FACT SHEET	
Project Name	**Ridgecrest Solar Power Project (RSPP or Project)**
General site location State County Location Description (access road entrance)	 California Kern 35° 33’ 29” North latitude, 117° 45’ 14” West longitude The site access road is from Brown Road, about 2.25 miles west of the intersection of Brown Road and U.S. Highway 395, approximately 5 miles southwest of Ridgecrest, California
Solar technology	Solar thermal (utilizing parabolic troughs)
Nominal power output, per unit/total	250 megawatts (MW)/250 MW
Number of units	1
Annual expected net electrical energy delivered to the grid	Approximately 500 gigawatt-hours (GWh)
Type of turbine exhaust steam condensing	Air-Cooled Condenser (ACC) (i.e., dry cooling)
Source of water approximate tie-in location size and length of water pipeline	Indian Wells Valley Water District (IWVWD) Ridgecrest Heights Booster Station 35° 35’ 12” North latitude, 117° 42’ 19” West longitude 12” diameter, ~5.0 miles long
Water consumption, total	150 acre-feet per year (afy)
Primary energy source	Radiant solar energy
Supplemental fuel	Propane (for quick startup and heat transfer fluid freeze protection only, not energy generation)
Project ROW area	~3,920 acres
Facility footprint	~1,440 acres
Northern solar field – area within the fence line, which includes the solar field and bioremediation area	~755 acres
Southern solar field – area within the fence line, which includes the power block, solar field and switchyard, plus the unfenced office area	~685 acres
Total disturbance area	~1,760 acres
Transmission Line Tie-in ownership entity name approximate tie-in location line voltage length of gen-tie line	 Southern California Edison (SCE) Inyo-Kern/Kramer Junction transmission line 35° 33’ 24” North latitude, 117° 45’ 37” West longitude 230 kilovolts (Kv) 2,610 linear feet (LF), all on site

2.0 Project Description

2.1 Introduction and Overview

Solar Millennium LLC (Applicant) is proposing to construct a utility-scale solar thermal electric power generating facility named the Ridgecrest Solar Power Project (RSPP or Project). The Project will have a nominal output of 250 megawatts (MW), consisting of a single power plant utilizing two solar fields. The Project will be located in the high northern Mojave Desert in northeastern Kern County, California, about five miles southwest of the City of Ridgecrest, California. The Project right-of-way (ROW), for which a ROW grant sought by the Applicant from the Bureau of Land Management (BLM), will extend across approximately 3,920 acres of public lands owned by the Federal government. The Project facilities will occupy 1,440 acres of the 3,920-acre site, and there will be a total disturbance area (including areas outside the facility fenceline), of approximately 1,760 acres.

The Project will utilize solar parabolic trough technology to generate electricity. With this technology, arrays of parabolic mirrors collect heat energy from the sun and refocus the radiation on a receiver tube located at the focal point of the parabola. A heat transfer fluid (HTF) is heated to high temperatures (750 degrees Fahrenheit [°F]) as it circulates through the receiver tubes. The heated HTF is then piped through a series of heat exchangers where it releases its stored heat to generate high pressure steam. The steam is then fed to a traditional steam turbine generator where electricity is produced.

Construction is scheduled to begin in late 2010 and continue into 2013. Commercial operation is expected to begin in mid-2013.

The power plant will have two solar fields, each occupying roughly 700 acres and composed of solar collector piping loops arranged in parallel groups connected to supply and return header piping. The northern solar field will be located north of Brown Road and the southern solar field will be located south of Brown Road. The power block will be located south of Brown Road, just north of the southern solar field. The power block will be composed of its own administration, control, warehouse, maintenance, and lab buildings; the HTF pumping and freeze protection system; solar steam generator (SSG); a propane-fired auxiliary boiler; one steam turbine generator (STG); an air-cooled condenser (ACC); generator step-up (GSU) transformer, transmission lines and related electrical system; potable and treated water tanks; and auxiliary equipment (i.e., water treatment system, diesel-powered emergency generator, and firewater system).

In addition to the main power generating facility, The site will include a main office building and parking lot, a main warehouse with laydown area, onsite access roads, a tie-in switchyard, and a land treatment unit (LTU) for bioremediation or land farming of HTF-contaminated soil.

The Project will generate electric power solely via solar energy. Propane will be used to fire an auxiliary boiler overnight to support startup operations until the HTF system is up to operating temperature, at which time the generation of electricity can commence. A second fired heater will be used as needed, mostly during the winter, to prevent freezing of the HTF. The plant will utilize a new 5-mile water pipeline from the municipal water supply district. A new 230-kilovolt (kV) transmission line from the turbine generator to a new nearby switchyard will interconnect with Southern California Edison's (SCE) existing 230 kV InyoKern/Kramer Junction transmission line passing west of the Project site. Figure 2-1 shows the overall layout of Project facilities.

Studies of the regional electrical transmission system will be performed to determine whether additional downstream upgrades to the system will be required as a result of the Project. However, this issue is not part of the California Energy Commission or BLM review process. The California Independent System Operator (CAISO) and SCE initiated a Phase I Cluster Study in the fall of 2008. The Phase I Cluster Study was released on July 28, 2009. The Applicant will provide this document under confidential cover.

All thermal power plants (including solar) that utilize a steam cycle to generate electricity require cooling, which typically involves considerable amounts of cooling water. The Project is located in the arid desert of southern California where water consumption is a concern. Consistent with State policy, the Project will drastically reduce water use by utilizing an ACC in an alternative cooling method commonly referred to as dry cooling. Water will be used for solar mirror washing, feedwater makeup, firewater supply, dust control, and onsite domestic use. Total consumption for the facility is estimated at 150 acre-feet per year (afy), to be supplied by the local municipal water district via a new pipeline.

2.2 Project Objectives, Purpose and Need

2.2.1 Project Objectives and Purpose

The specific objectives and purpose of the Project are:

- To develop a utility-scale solar energy project utilizing parabolic trough technology.
- To construct and operate an environmentally friendly, economically sound, and operationally reliable solar power generation facility that would contribute over 500,000 MW hours (MWh) of clean, renewable solar energy per year to the State of California's renewable energy goals.
- To locate the Project in an area with high solar insolation (i.e., high intensity of solar energy).
- To interconnect directly to the CAISO Grid through the SCE electrical transmission system while minimizing additions to electrical infrastructure (e.g., avoiding lengthy new transmission lines).
- To commence construction in 2010 to qualify for the American Recovery and Reinvestment Act (ARRA) of 2009's Renewable Energy Grant Program.

2.2.2 Project Need

The Federal government and the State of California have clearly established the need for the nation and State to increase the development and use of renewable energy in order to enhance energy independence, meet environmental goals, and create new economic and employment growth opportunities. The Project will help meet these societal needs.

More specifically, the Project will further the development of renewable energy and thereby:

- Assist California in meeting its Renewable Portfolio Standard (RPS) goal of 33 percent of electrical power retail sales by 2020 under pending legislation.
- Support United States (U.S.) Secretary of the Interior Salazar's Order 3285 making the production, development and delivery of renewable energy top priorities for the U.S.
- Support Governor Schwarzenegger's Executive Order S-14-08 to streamline California's renewable energy project approval process and to increase the State's RPS to 33 percent renewable power by 2020.
- Sustain and stimulate the economy of Kern County in southern California by helping to ensure an adequate supply of renewable electrical energy, while creating additional construction and operations employment and increased expenditures in many local businesses.
- Generate electricity without significant emissions of greenhouse gases, thereby meeting the statewide reduction goals of Assembly Bill (AB) 32.

Two integral goals of the ARRA of 2009's Renewable Energy Grant Program are to enhance America's energy independence and create near-term employment opportunities for Americans. As noted above, the Project will help meet these vital societal needs.

2.3 Location of Facilities

The Project site is located southwest of U.S. Highway 395 and approximately 4.5 miles southwest of the City of Ridgecrest, California in northeastern Kern County (Figure 2-1). Ridgecrest is at the southern boundary of the northernmost of two discrete sections of China Lake Naval Air Weapons Station (NAWS).

The Applicant-owned facilities will be entirely on public land, BLM ROW # CACA 49016, in Township 28 South, Range 39 East and Township 27 South, Range 39 East. A legal description is provided in Table 2-1. Ownership information for the properties surrounding the plant site and linear facilities is provided in Appendix A. The associated water pipeline, to be owned and operated by the Indian Wells Valley Water District (IWVWD), will be installed entirely within public road ROWs. The water pipeline will be located in Kern County.

Table 2-1 Summary Legal Description of Parcels within the Plant Site Boundary

Assessor Parcel Numbers		
341-091-08	341-091-10	341-091-11
341-110-01	341-110-02	341-110-03
341-110-05	341-110-06	097-070-02
Source: Kern County Assessor's Office		

The BLM ROW application covers 3,920 acres of high flat desert. The main office, parking lot and area inside the Project's security fence, within which all Project operational facilities will be located, will occupy approximately 1,440 acres of the ROW. The total area disturbed during construction and operation is approximately 1,760 acres. Access to the site will be provided by a new 700-foot long, 24-foot wide paved access road from Brown Road, approximately 2.25 miles west of the intersection of Brown Road with U.S. Highway 395. A new 12-inch diameter, approximately five-mile long water pipeline will be installed within the Brown Road and China Lake Boulevard ROWs to a point of connection with the IWVWD. The onsite portion of the new electrical transmission gen-tie line route will be approximately 0.5 mile long, running from the GSU transformer in the power block to the new Project switchyard, which will be in close proximity to the point of interconnection with the regional electrical grid which will be approximately 300 feet outside the plant site boundaries (see Figure 2-1).

2.4 Site Description

2.4.1 Existing Site Conditions

The 3,920-acre Project site is composed of undeveloped desert with naturally-vegetated areas. Figure 2-2 is a representative photograph of the site in its present condition. The entire proposed ROW is on BLM land. There are no existing structures that would need to be demolished, but existing 115 and 230 kV SCE transmission lines that traverse the southwestern portion of the site will require relocation. The Applicant is working with SCE in an effort to accommodate both uses within the BLM ROW. A linear corridor within the ROW but outside the plant fence line, approximately 160 feet in width and 7,500 feet in length and just west of the southern solar field, is reserved for the relocated transmission lines. It is anticipated that this corridor will be assigned to SCE as part of the transmission line relocation process. Brown Road, a two-lane road, traverses the middle of the site diagonally from a northwesterly to southeasterly direction, dividing the site into northern and southern sections.

The site is mostly flat, with elevation ranging on United States Geological Survey (USGS) topographical maps from a low of about 2,630 feet above sea level at the western limits of the northern solar field to a high of about 2,770 feet above sea level along the southern and eastern reaches of the site boundary. There are two large ephemeral washes that traverse the plant site, and smaller dry desert washes traverse the site generally from the southeast to the northwest. A former Southern Pacific Rail Road ROW is located in the western portion of the Project site. The railroad ties and tracks have been removed, but the ROW remains, and includes raised berms, bridges, and stormwater conveyances.

Detail on historical use of the site is provided in the Phase I Environmental Site Assessment provided in Appendix B.

2.4.2 Site Surveys and Engineering Design Criteria

Light Detection and Ranging (LiDAR) mapping of the site has been performed to obtain preliminary topographic information on the site to establish local benchmarks and site boundaries and to understand grading- and drainage-related requirements and issues. Detailed land and topographic surveys will be performed during the final design of the Project. A preliminary geotechnical study of the plant site is currently in progress to evaluate general subsurface conditions, seismicity, and other geologic hazards and to provide recommendations for design and construction of the foundations for Project structures. Results of the study will be submitted for agency and stakeholder review when they are available. It is anticipated that the study will find that the site is geotechnically feasible for construction of the proposed Project.

Additional geotechnical investigations (e.g., additional soil borings at specific equipment locations), will be performed as part of the detailed facility design. Engineering design criteria for the Project, including seismic design criteria, are provided in Appendix C.

2.5 Generating Facility Description

The following sections describe the Project site arrangement and the processes, systems, and equipment that constitute the generation facilities. All plant facilities will be designed, constructed and operated in accordance with applicable laws, ordinances, regulations and standards (LORS). Figure 2-3a is a photograph that shows a current view of the Project site and surrounding area; Figure 2-3b is the same photograph with the proposed plant facilities added. All generating facilities described in this section will be located within the fenceline of the 1,440-acre facility footprint. Project-related linear facilities located outside the Project fenceline are limited to very short segments of the new 230-kV transmission line entering and exiting the fenced switchyard and the five-mile long water pipeline shown on Figure 2-1. A linear corridor within the ROW but outside the plant fence line, approximately 160 feet in width and 7,500 feet in length and just west of the southern solar field, is reserved for the relocated transmission lines. It is anticipated that this corridor will be assigned to SCE as part of the transmission line relocation process. The transmission system is described in Section 2.6, Transmission System, below.

2.5.1 Site Arrangement

Figure 2-4 shows the layout of Project facilities on the plant site which include:

- Northern and southern solar fields,
- Power block,
- Access road from Brown Road to onsite office,
- Office and parking,
- LTU for bioremediation/land farming of HTF-contaminated soil,
- Warehouse/maintenance building and laydown area,

- Onsite transmission facilities including switchyard,
- Dry wash rerouting,
- Water pipeline, and
- SCE transmission corridor relocation area.

A plot plan of the Project power block is included as Figure 2-5. As shown in this figure, major components of the power block include:

- SSG, including steam generation heat exchangers,
- HTF expansion and overflow vessels,
- One HTF freeze protection heat exchanger,
- One auxiliary boiler,
- One STG,
- One GSU transformer,
- ACC,
- One small wet cooling tower for ancillary equipment (no evaporation pond),
- Reverse osmosis (RO) concentrate/dust control water storage tank,
- Potable water storage tank,
- Treated water tank,
- Water treatment system,
- Operations and maintenance buildings, and
- Transmission lines and communication lines exiting the power block.

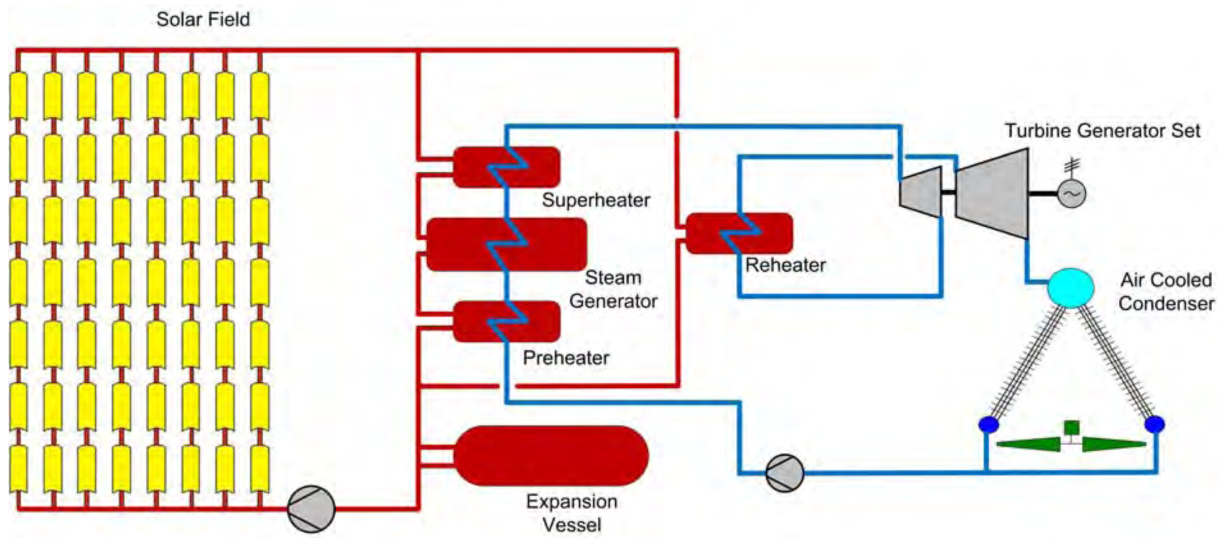
Elevation and three dimensional views of the power block facilities are provided in Figure 2-6a and 2-6b, respectively.

2.5.2 Process Description

This section describes the power generation process and thermodynamic cycle employed by the Project. The power generating facility is composed of the following major components:

- Deaerator,
- Feedwater pumps,
- Feedwater heaters,
- SSG,
- Steam superheater,
- Steam reheater,
- STG,
- ACC,
- Approximately 1,400 total acres of parabolic trough solar collection fields, and
- HTF piping, pumping, and conditioning system.

The thermodynamic cycle is illustrated in the diagram below and described in the steps that follow:



Red lines on the diagram represent HTF piping. Hot HTF flows from top to bottom in the figure, arriving from the solar fields and transferring heat in the superheater and reheater, then to the steam generator, and lastly in the preheater before returning to the solar fields to be heated again. The blue lines represent steam and water piping. Feedwater, the portion of the blue line between the ACC and the preheater, is heated in a series of feedwater heaters by steam turbine extractions (not shown here; see Figure 2-7) at various pressure levels.

Step 1: The power cycle working fluid (water) from the deaerator and feedwater heaters is pumped from low to high pressure and piped to the solar preheater. HTF provides heat to the preheater which heats the feedwater to its saturation temperature.

Step 2: The high pressure saturated water enters the steam generator where it is heated by warmer HTF. The water changes phase (i.e., boils) and exits as saturated steam.

Step 3: The saturated steam flows through to the superheater where hot HTF takes the saturated steam at constant pressure up to higher temperature prior to being fed to the high pressure section of the steam turbine.

Step 4: The superheated steam expands through the high-pressure section of the steam turbine turning the generator to produce electricity.

Step 5: The steam let down from the turbine's high-pressure section is then reheated in a solar reheater which is fed with hot HTF. The reheated steam is then fed to the intermediate-pressure section of the steam turbine.

Step 6: The intermediate-pressure steam exhausts into the low-pressure section of the steam turbine. All sections of the STG decrease the temperature and pressure of the steam with the low-pressure section extracting the last available power from the steam.

Step 7: The wet steam from the low-pressure section then enters the ACC where it is cooled at a constant low pressure to become a saturated liquid. The condensed liquid returns to the feedwater heater train and the beginning of the steam cycle to begin the process again.

A propane-fired auxiliary boiler with a capacity of 25,000 pounds per hour steam provides steam for maintaining steam cycle equipment vacuum over night and for startup. Sealing steam is used to prevent air from entering the steam turbine while the condenser is under vacuum. This method reduces startup time for the plant compared to relying on solar-generated steam as the sealing steam source. Unlike a gas-fired power plant, a solar thermal plant must wait for the sun to rise in the morning to start generating steam and has a finite time to generate electricity (i.e., the number of sunlight hours). If the plant does not have a secondary source of steam, plant startup is delayed (and thus total daily electrical generation reduced), while solar heat alone generates sealing steam and vacuum is established in the condenser.

Once the plant begins generating electricity for delivery to the electrical grid, the fired auxiliary boiler is no longer needed and is held in stand-by mode until auxiliary heat is again required after plant shutdown. The auxiliary boiler requires approximately 36.7 million British thermal units per hour (MMBtu/hr) of fuel at full load (design load is 34.4 MMBtu/hr). A heat balance diagram for the plant's steam cycle is provided as Figure 2-7.

2.5.3 Energy Conversion Facilities Description

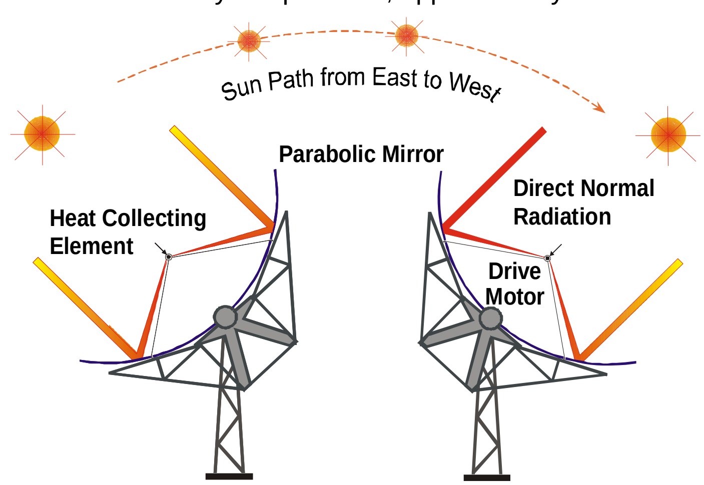
This section describes the major energy conversion components of the Project including the solar collection system, SSG, STG, auxiliary boilers, and HTF freeze protection heat exchanger.

The Project will be a single-unit parabolic trough solar power plant having a nominal output of 250 MW. The plant will consist of a conventional steam Rankine-cycle power block, a parabolic trough solar field, an HTF and steam generation system, as well as a variety of ancillary facilities (sometimes referred to collectively as "balance-of-plant" [BOP]), such as conventional water treatment, electrical switchgear, administration, warehouse, and maintenance facilities, etc.

The electric output of the plant will be provided entirely by solar energy. No electricity will be generated by the use of fossil fuel. A propane-fired HTF heater will be used for freeze protection of the HTF in the solar fields. The HTF is a synthetic hydrocarbon liquid mixture of diphenyl ether and biphenyl. Similar formulations are marketed by different manufacturers under the names of Therminol or Dowtherm. The HTF is not classified as a hazardous material by the U.S. Department of Transportation, and is not listed under U.S. Environmental Protection Agency Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) regulations; however, it is regulated as a hazardous material by the State of California. It has a crystallizing (i.e., freezing) point of 12 degrees Celsius (°C) (about 54°F). Freeze protection is routinely accomplished by circulating HTF at a very low flow rate through the solar field using hot HTF from the vessel as a source. Performance model results indicate that the HTF heater may be required on very cold nights in the winter. See Appendix D for the HTF Material Safety Data Sheet.

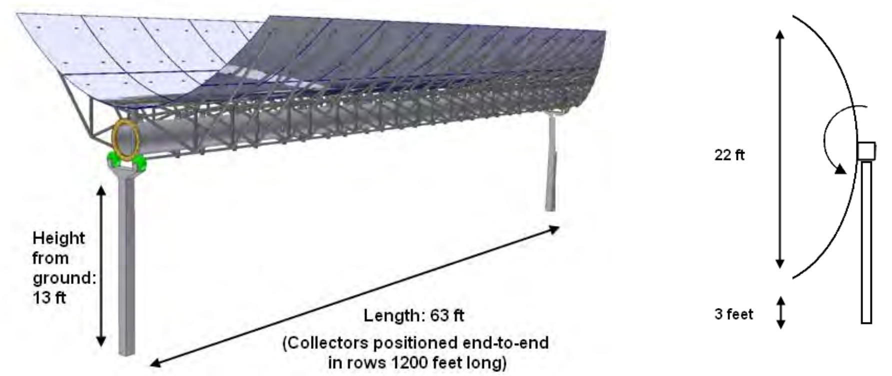
A propane-fired auxiliary boiler will be used to support rapid startup each morning, i.e., maintaining steam seals. Steam generated by the auxiliary boiler will be at a relatively low pressure, approximately 165 pounds per square inch gauge (psig).

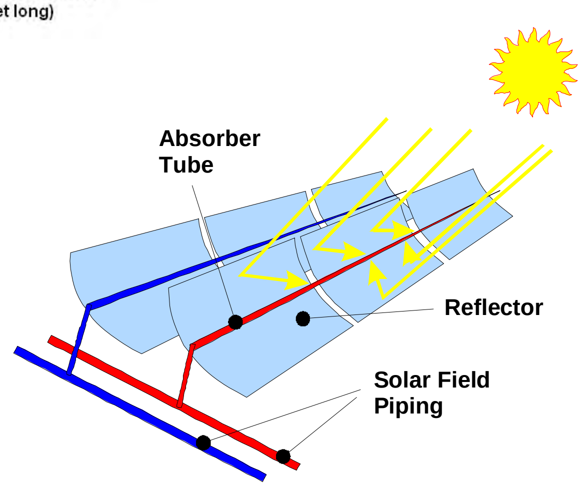
The solar field will be a modular, distributed system of solar collector assemblies (SCAs) connected in a series-parallel arrangement via a system of insulated pipes. The collectors will be equipped with a sun tracking mechanism that moves the reflecting collectors toward the sun to the optimum angle for solar energy collection. The collectors will be aligned north-south to track the sun from east to west.



HTF will flow from the HTF pumping area in the power block to the cold HTF header that distributes it to the collector loops of SCAs in the solar fields.

Parabolic Trough Collector Loop. Each of the collector loops consist of two adjacent rows of SCAs, each row about 1,300 feet long. The two rows are connected by a crossover pipe. HTF is heated in the loop and enters the hot header, which returns hot HTF from all loops to the power block where the power generating equipment is located.





Solar Collector Assemblies. The SCAs will be oriented north-south to rotate east-west to track the sun as they move across the sky throughout the day. The SCAs collect heat by means of linear troughs of parabolic reflectors, which focus sunlight onto a straight line of Heat Collection Elements (HCEs) welded along the focus of the parabolic "trough." The HCE is mounted on a mechanical support system that includes steel, pylons and bearings. Each SCA includes local measurement instrumentation, a hydraulic drive system, and a controller which independently tracks the sun to maintain mirror focus on the HCEs and protects the HCEs from overheating.

Mirrors. The parabolic mirrors to be used in the Project are low-iron glass mirrors and are known to be one of the most reliable components in the SCAs. No long-term degradation of the mirrors has been observed, and older mirrors can be brought back to nearly full reflectivity with simple cleaning. Typical life spans of the reflective mirrors are expected to be 30 years or more. The HCEs of the solar plant are composed of a steel tube surrounded by an evacuated glass tube insulator. The steel tube has a coated surface, which enhances its heat transfer properties with a high absorptivity for direct solar radiation, accompanied by low emissivity. Glass to metal seals and metal bellows are incorporated into the HCE to ensure a vacuum-tight enclosure. The enclosure protects the coated surface and reduces heat losses by acting as an insulator.

The glass tube cylinder has anti-reflective coating on both the inner and outer surfaces to reduce reflective losses off the glass tube, thereby increasing the transmissivity. Usually, to maintain the tube's insulating properties, getters, or scavengers, are installed in the vacuum space to absorb hydrogen and other gases that may permeate into the vacuum cylinder over time.

HTF System. In addition to the HTF piping in the solar field, the HTF system includes three elements: 1) the HTF heater, 2) the HTF expansion and overflow vessels, and 3) the HTF ullage system. To eliminate the problem of HTF freezing, an HTF heater will be installed and used to ensure system temperature stays above 54°F whenever the unit is offline. An expansion vessel is required to accommodate the volumetric change that occurs when heating the HTF to the operating temperature.

During plant operation, HTF will degrade into components of high and low boilers (substances with high and low boiling points). The low boilers are removed from the process through the ullage system. HTF is removed from the HTF surge tank and flashed, leaving behind high boilers and residual HTF. The flashed vapors are condensed and collected in the ullage system.

Solar Steam Generator System. The SSG system transfers the sensible heat from the HTF to the feedwater. The steam generated in the SSG is piped to a Rankine-cycle reheat steam turbine. Heat exchangers are included as part of the SSG system to preheat and boil the condensate, superheat the steam, and reheat the steam. Refer to the process schematic diagram above in Section 2.5.2, Process Description.

2.5.3.1 Steam Turbine Generator

As described earlier, steam from the SSG is sent to the STG. The steam expands through the STG turbine blades to drive the steam turbine, which in turn drives the generator, converting mechanical energy to electrical energy. The Project's STG is expected to be a three-stage casing type with high pressure, intermediate pressure, and low pressure steam sections.

The STG is equipped with accessories required to provide efficient, safe, and reliable operation, including the following:

- Steam stop and control valves,
- Gland seal system,
- Lubricating and jacking oil systems,
- Thermal insulation, and
- Control instrumentation.

2.5.3.2 Process Control of the Solar Field

The solar field system operates under the control of the Field Supervisor Controller (FSC), a computer located in the central control room that communicates with each SCA and with the plant's distributed control system. The FSC collects information from each SCA and from the distributed control system and issues instructions to the field as a whole, and/or modular instructions to SCA loops or individual SCAs. It deploys the solar field during the day when weather and plant availability permit and stows it at night and during high winds.

A weather station located in the power block area provides real-time measurements of weather conditions that affect the solar field operation. Radiation data are used to determine the performance of the solar field. Wind speed data are needed since under high wind conditions the solar field must be stowed. The FSC communicates with the plant's distributed control system (DCS), which coordinates and integrates power block, HTF system, and solar field operation.

The solar power plant cycle basically consists of two separate, coupled systems – the HTF loop and the power block steam loop. The HTF loop transfers accumulated solar heat from the parabolic trough solar field as described above in the previous section for steam generation to drive the turbine generator.

The HTF cycle is driven by two parallel pump stations. Cold HTF returning from the power block is heated to the design temperature in the solar field. The hot HTF flows to parallel steam generation trains. Each train includes a preheater, steam generator, superheater, and reheater. In normal operation the hot HTF stream is split between the trains. It is also possible to remove each train from the loop via motor control valves.

At the basic level, the system distributes cold HTF from the power block to solar field collector loops, collects hot HTF from the solar field, and inputs the collected heat to the feedwater/steam cycle. Due to the characteristics of HTF, several auxiliary systems are required to keep the HTF loop functioning. A system of reclamation and ullage vessels removes sludge and low boiler and high boiler distillates that develop over time in the HTF system.

As the solar field begins tracking the sun and the HTF heats up, its thermal expansion is accommodated in an expansion vessel. If the HTF in this vessel reaches its design working level, it overflows into overflow vessels. If thermal input to the HTF stops, HTF begins to contract. The HTF level in the expansion vessel falls, and overflow return pumps transfer HTF from the overflow vessels back into the expansion vessel to maintain sufficient content there.

2.5.3.3 Operational Modes of the Solar Field

A DCS containing several automation units controls the HTF and steam loops and all auxiliary plant systems, and determines the appropriate operating sequences for them. It also monitors and records the primary operating parameters and functions as the primary interface for system control. The DCS communicates with all subsystem controls, including electrical system equipment, steam cycle controllers, variable frequency drives, and BOP system controllers via serial data communication. It receives analog and digital inputs/outputs (I/O) from all instruments and equipment not served directly by dedicated local controllers. The DCS controls both the steam and HTF cycles directly, operating rotating equipment via relevant electrical panels. It includes a graphical user interface at an operator console in the main control room.

Day-to-day, the following operation modes are usually passed in the HTF system:

- Warm up,
- Solar field mode (heat transfer from solar field to power block),
- Shutdown, and
- Freeze protection.

Warm up

Usually in the morning, this mode brings the HTF flow rate and temperatures up to their steady-state operating conditions by positioning all required valves, starting the required numbers of HTF main pumps for establishing a minimum flow within the solar field and tracking the solar field collectors into the sun.

At the beginning of warm up, HTF is circulated through a bypass around the power block heat exchangers until the outlet temperature reaches the residual steam temperature in the heat exchangers. HTF is then circulated through the heat exchangers and the bypass is closed. As the HTF temperature at the solar field outlet continues to rise, steam pressure builds up in the heat exchangers until the minimum turbine inlet conditions are reached, upon which the turbine can be started and run up to speed. The turbine is synchronized and loaded according to the design specification until its power output matches the full steady-state solar field thermal output.

Solar Field Control Mode

The DCS enters solar field control mode automatically after completing warm-up mode. It regulates the flow by controlling the HTF main pump speeds to maintain the design solar field outlet temperature. Several HTF pumps will generally be operated in parallel, at the speed required to provide the required flow in the field. If the thermal output of the solar fields is higher than the design capacity of the steam generation system, collectors within the solar fields are de-focused to maintain design operating temperatures.

Shutdown

If the minimal thermal input to the turbine required by the operating strategy cannot be met under the prevalent weather conditions, then shutdown is indicated.

Operators will track all solar collectors into the stow position, reduce the number of HTF main pumps to a minimum, and stop the HTF flow to the power block heat exchangers.

Freeze Protection

During periods when the solar power generating facility is shutdown, HTF is circulated through the piping in the solar fields at low flow rate. For most of the year, under typical weather conditions, no supplemental heat is required to keep the HTF flowing freely. However, it is anticipated that on colder winter nights supplemental heat will be required to ensure the HTF doesn't freeze in the piping. A propane-fired HTF heater, with a rated capacity of 35 MMBtu/hr, will be provided as part of the HTF system. It is expected the HTF heater will need to operate approximately 100 hours per year to keep the HTF from freezing.

2.5.4 Electrical System Description

This section describes the Project's major electrical systems and equipment. All power produced by the Project is expected to be delivered to the SCE transmission grid through interconnection with SCE's 230 kV Inyokern/Kramer Junction transmission line, as described in greater detail in Section 2.6.1, Transmission System Description.

Descriptions of major electrical systems and equipment provided in the following subsections refer to alternating current (AC) power unless otherwise noted. A single-line diagram of the major electrical components of the power block is presented as Figure 2-8. A single-line diagram of the interconnection between the Project and the SCE transmission system, including the Project's switchyard, is presented as Figure 2-9.

2.5.4.1 Electrical Generation

The STG will generate electricity at 18 kV and will connect to the Project switchyard described in the above paragraph. An oil-filled GSU transformer will step up the voltage to 230 kV. Generator parameters are listed in Table 2-2 below.

Table 2-2 Generator Specification

Generator main data (rating)	Value
Rated apparent power	321 million volt amperes
Rated active power	273 MW
Rated terminal voltage (± 5.0%)	21,000 volts
Rated phase current	8,824 amperes (A)
Rated power factor	0.85 per unit
Rated frequency (± 2.0%)	60 hertz (Hz)
Rated speed	3,600 revolutions per minute (rpm)
Cooling air inlet temperature	90°F
Air overpressure	2.9 psig
Generator output with one cooler out of service	67%

2.5.4.2 Electrical System for Plant Auxiliaries

In addition to the text immediately below, please see the single-line diagram in Figure 2-8.

2.5.4.3 DC Power Supply System

An uninterruptible power system (UPS) will be provided in the plant. The UPS will service emergency lighting, the DCS, electrical breakers, and relays. This direct current (DC) power system will serve as a temporary bridge to the more robust emergency diesel AC power supply in the event external power is suddenly lost.

2.5.4.4 Essential Service AC System

A 120 volt essential service AC power distribution system serves critical equipment loads, lighting and alarms, and loads that protect equipment from potential damage in the event of sudden loss of station service. This system is served through an inverter that receives power from the DC power supply system.

2.5.5 Plant Auxiliary Systems

The following subsections describe the various power plant auxiliary systems (fuel supply, water supply, water treatment, cooling systems, waste management, etc.) associated with the Project.

2.5.5.1 Fuel Supply and Use

The auxiliary boiler and HTF heater will be fueled by propane. Propane will be delivered to the site via truck from a local distributor and stored in an 18,000 gallon aboveground tank. The estimated propane usage for normal operations is 8 MMBtu/hr overnight and 34 MMBtu/hr for ½ hour during startup each morning. The estimated peak propane usage is approximately 70 MMBtu/hr when the HTF heater is in use during the winter when the plant is in startup mode, i.e., while the auxiliary boiler is simultaneously operating at capacity.

2.5.5.2 Water Supply and Use

The Project will be dry cooled. The Project's various water uses include water for solar collector mirror washing, makeup for the SSG feedwater, dust control, water for cooling plant ancillary equipment, potable water, and fire protection water. A water balance diagram is presented in Figure 2-10.

The estimated operational water requirements for the Project are presented below in Table 2-3. The total annual water usage is estimated to be about 150 afy, which corresponds to an average flow rate of about 90 gallons per minute (gpm) under an assumption of continuous usage over the year. Usage rates will vary during the year and will be higher in the summer months when the peak flow rate could be as much as about 50 percent higher (about 132 gpm). Equipment sizing will be consistent with peak daily rates to ensure adequate design margin.

Table 2-3 Summary of Operational Water Usage

Service	Annual (acre-feet)
Power Cycle Makeup Water *	38
Mirror Wash Water	53
Domestic Potable Water	3
Dust Suppression Water	10
Cooling of Ancillary Equipment	40
Total (rounded)	**144 (150)**
* Power cycle makeup water will be recycled to offset about 25 percent of annual consumptive use. The minimum monthly (January) volume will be about 1.25 million gallons (3.8 acre-feet). The peak monthly (June) volume will be about 5.7million gallons (17.5 acre-feet).	

<u>Water Source and Quality</u>

The water source for the Project is groundwater provided through the IWVWD. Power cycle makeup and other water needs for the Project will be met by treating the water supply. While the proposed Project lies outside the IWVWD service area, it is within about four miles of the District boundary. The Project will be required to provide a new pipeline to bring IWVWD water from the Ridgecrest Heights storage tank to the RSPP. The Project may also be responsible for modifying pumping equipment at the IWVWD Ridgecrest Heights Booster Station ensure adequate pressure and delivery to the Project site (modifications could include the construction of a new pump station). The Project demands will amount to about 1.6 percent of the existing IWVWD demand. Quality of water from IWVWD is given in Table 2-4. No data is available for silica. No offsite backup water source is included as part of the Project.

Table 2-4 Water Quality (IWVWD Supply)

Constituent	Concentration
Total Dissolved Solids, mg/L	200 - 700
Specific Conductance, µS/cm	150 - 590
Alkalinity, mg/L as CaCO3	84 - 140
Hardness, mg/L as CaCO3	10 - 190
Chloride, mg/L	24 - 280
Sodium, mg/L	42 - 190
Boron, µg/L	150 - 1,400
pH	7.9 - 8.8
Source: IWVWD 2007 Annual Water Quality Report	

2.5.5.3 Water Treatment

Water received from IWVWD will meet the requirements of the California Department of Health Services for potable water supplies and will not require further treatment for this purpose. Power cycle makeup, mirror washing water, and cooling of ancillary equipment will require onsite treatment for reduction of dissolved solids, and this treatment varies according to the quality required for each of these uses.

Water will be received via pipeline and stored in a 1.5 million-gallon potable water storage tank. This tank will also serve as storage for firewater supply. Excluding any use for firefighting, this volume of potable water would provide enough storage capacity for five days interruption of water supply to the facility.

The treatment process for reduction of dissolved solids is known as desalination, and can be accomplished by either thermal processes (evaporation/condensation) or membrane processes such as RO or electrodialysis reversal (EDR). Considering the relatively good quality of the source water, it is unlikely that thermal processes would be cost effective. Accordingly, only membrane processes are considered here. The proposed treatment process for the various water uses is presented schematically in Figure 2-10. Since RO and EDR produce similar product water quality and waste streams, further discussion will reference only RO for simplicity. Selection of the process to be used at the Project will be made during the final design process.

Membrane desalination processes split the feed stream into two streams: 1) a product water stream (permeate) with reduced salinity and 2) a concentrate stream containing the majority of the salts that were in the feed stream. Desalination processes are usually designed to operate with the highest safe recovery (recovery is the fraction of feedwater recovered as permeate) in order to minimize water loss, since the concentrate would normally be considered a waste stream. In this case, it appears that the highest safe recovery is about 93 percent. The permeate stream will be directed to a 600,000-gallon treated water tank storage tank. This tank will provide three days storage for these uses, which will extend the amount of time available for operation during potable water supply outages. The RO concentrate stream, which will be utilized onsite for dust control, will be directed to a 100,000-gallon storage tank.

The requirements for steam purity are given in Table 2-5. In order to provide the demineralized water quality needed for power cycle makeup it will be necessary to provide ion exchange demineralization as a final treatment step after RO. Ion exchange demineralization can be done using either permanently installed equipment or portable demineralizers. Permanently installed equipment requires regeneration on site, which can require storage and disposal of significant quantities of sulfuric acid and sodium hydroxide (caustic).

Alternatively, portable demineralizers are taken off site for regeneration at the supplier's facility, so no onsite storage of chemicals and disposal of regeneration wastes is required. Offsite regeneration is proposed for the Project. This will eliminate the need to store regeneration chemicals on site and minimize onsite production of hazardous wastes. These demineralizers will be provided as forklift-moveable fiberglass "bottles" that will be traded out when exhausted and returned to the supplier for regeneration.

Table 2-5 Steam Purity Requirements

Parameter	Unit	Normal operation	Startup
Conductivity after cation exchanger @ 25 °C [(1)]	µS/cm [(3)]	<0.20	<1
Sodium (as Na) Boiler water PO4 0 -2 mg/kg [(2)]	µg/kg	<5	<10
Sodium (as Na) Boiler water PO4 > 2 mg/kg	µg/kg	<10	<20
Silica (as SiO_2)	µg/kg	<20	<100
Iron (as Fe)	µg/kg	<20	<100
Copper (as Cu) 150 bar	µg/kg	<3	<10
Copper (as Cu) > 150 bar	µg/kg	<1	<10

(1) Additional tolerance of maximum 2 µS/cm is given for carbon dioxide.

(2) In case of boiler water phosphate treatment > 2mg/kg PO4 a higher Na content in steam is tolerated as phosphates are considered as being non-corrosive to the turbine. For all other boiler water treatments, the lower limit is applicable.

(3) µS/cm = microSiemens per centimeter (Siemens is a unit of the electrical conductivity).

The steam purity specification is based on VGB's "Guidelines for Feed Water, Boiler Water, and Steam Quality for Power Plants/Industrial Plants" R450Le, issued 2004.

It is anticipated that all of the power cycle makeup water will be recycled and reused as feed to the RO system. This will reduce the salinity of the RO feed and improve the RO recovery. Because of the very low total dissolved solids (TDS) of the makeup to the ancillary equipment heat rejection cooling tower, it is expected that blowdown will not be required. Rather, drift (windblown mist) will provide the necessary salt removal. If blowdown is required, it will be recycled to the RO system.

It may be more advantageous to recycle the power cycle makeup water to the ion exchange demineralizer rather than to the RO. This modification will be evaluated during final design.

Solar Mirror Washing Water

To facilitate dust and contaminant removal, water from the primary desalination process, RO water, will be used to spray clean the solar collectors on a weekly or as-needed basis, determined by the reflectivity monitoring program. This mirror washing operation is done at night and involves a water truck spraying treated water on the mirrors in a drive-by fashion. Mirror washing equipment utilizes brushes to reduce the amount of water use. It is expected that the mirrors will be washed weekly in winter and twice weekly from mid- spring through mid-fall. The mirrors are angled down for washing therefore water doesn't accumulate on the mirrors. Wash water falls from the mirrors to the ground and, due to the small volume, soaks in with no appreciable runoff. Remaining rinse water from the washing operation is expected to evaporate on the mirror surface with no appreciable runoff. The treated water production facilities will be sized to accommodate the solar mirror washing demand of about 53 afy and is shown on Figure 2-10, Water Balance Diagram.

2.5.5.4 Cooling Systems

The power plant includes two cooling systems; 1) the air-cooled steam cycle heat rejection system, and 2) the closed cooling water system for ancillary equipment cooling, each of which is discussed below.

Steam Cycle Heat Rejection System

The cooling system for heat rejection from the steam cycle consists of a forced draft ACC, or dry cooling, system. The dry cooling system receives exhaust steam from the low-pressure section of the STG and condenses it to liquid for return to the SSG.

Auxiliary Cooling Water System

The auxiliary cooling water system uses a wet cooling tower for cooling ancillary plant equipment, including the STG lubrication oil cooler, the STG generator cooler, steam cycle sample coolers, large pumps, etc. The water picks up heat from the various equipment items being cooled and rejects the heat to the cooling tower. This auxiliary cooling system will allow critical equipment such as the generator and HTF pumps to operate at their design ratings during hot summer months when the Project's power output is most valuable. An average of 40 afy will be consumed by the auxiliary cooling water system; the maximum rate of consumption is 63 afy in summer.

2.5.5.5 Waste Generation and Management

Project wastes will be composed of non-hazardous wastes including solids and liquids and lesser amounts of hazardous wastes and universal wastes. The non-hazardous solid waste will primarily consist of construction and office wastes, as well as liquid and solid wastes from the water treatment system. The non-hazardous solid wastes will be trucked to the nearest Class II or III landfill as discussed in Section 5.16, Waste Management. Non-hazardous liquid wastes will consist primarily of domestic sewage, and reusable water streams such as RO system reject water, boiler blowdown, and auxiliary cooling tower blowdown. To manage the non recyclable non-hazardous domestic sewage wastes, a septic tank and leach field will be installed.

Wastewater

The Project will produce two primary wastewater streams:

- Non reusable sanitary wastewater produced from administrative centers and operator stations.
- Reusable streams including: blowdown from the small ancillary equipment cooling tower for the ancillary equipment heat rejection system; RO reject water; and boiler blowdown.

As noted above, the power generation cycle will not produce cooling tower blowdown because the plant will be dry cooled. A small auxiliary cooling tower will generate a small amount of blowdown which will be reused on site.

Sanitary wastewater production will consist of domestic water use. Maximum domestic water use is expected to be less than 83,000 gallons per month (2,700 gallons per day [gpd]). It is anticipated that the wastewater will be consistent with domestic sanitary wastewater and will have Biological Oxygen Demand and Total Suspended Solids in the range of 150 to 250 milligrams per liter (mg/L).

Wastewater Treatment

Sanitary wastes will be collected for treatment in septic tanks and disposed via leach fields located at the power block as well as at the administration and warehouse areas. Smaller septic systems will be provided for the control room buildings to receive sanitary wastes at those locations. Based on the current estimate of 2,700 gpd of sanitary wastewater production per day, a total leach field area of approximately 5,500 square feet will be required spread out among three locations.

Construction Wastewater

Sanitary wastes produced during construction will be held in chemical toilets and transported off site for disposal by a commercial chemical toilet service. Any other wastewater produced during construction such as equipment rinse water will be collected by the construction contractor in Baker tanks and transported off site for disposal in a manner consistent with applicable regulatory requirements.

Onsite Land Treatment Unit (LTU)

The two solar fields to be installed at the Project will share the same LTU to bioremediate or land farm soil contaminated from releases of HTF. The LTU will be designed in accordance with Lahontan Regional Water Quality Control Board (RWQCB) requirements and is expected to comprise an area of about 8 acres. The bioremediation facility will utilize indigenous bacteria to metabolize hydrocarbons contained in non-hazardous HTF-contaminated soil. A combination of nutrients, water, and aeration facilitates the bacterial activity where microbes restore contaminated soil within 2 to 4 months. The California Department of Toxic Substances Control (DTSC) has determined for a similar thermal solar power plant that soil contaminated with up to 10,000 milligrams per kilogram (mg/kg) of HTF is classified as a non-hazardous waste[1]. However, the DTSC has further indicated that site-specific data will be required to provide a classification of the waste. Initially, in addition to sampling for HTF, samples will be analyzed for ignitability and toxicity using appropriate State and Federal methods to verify generator knowledge and characterize the waste as hazardous or non-hazardous. These data will be obtained to provide site-specific information and verify this classification, as discussed in Section 5.16, Waste Management.

The LTU will be constructed with a clay liner at least five feet in thickness in accordance with Title 27 requirements. Unsaturated zone monitoring and/or groundwater monitoring will be used to evaluate liner integrity. Nutrients including nitrogen and phosphorus will be added to the contaminated soil to encourage consumption of the HTF by the indigenous bacteria. The soil will remain in the remediation unit until concentrations are reduced to an average concentration of less than 100 mg/kg HTF. Soil contaminated with HTF levels of between 100 and 1,000 mg/kg will be land farmed at the LTU, meaning that the soil will be aerated but no nutrients will be added.

Other Non-Hazardous Solid Waste

Non-hazardous solid wastes may be generated by construction, operation, and maintenance of the Project which are typical of power generation facilities. These wastes may include scrap metal, plastic, insulation material, glass, paper, empty containers, and other solid wastes. Disposal of these wastes will be accomplished by contracted solid refuse collection and recycling services.

Hazardous Solid and Liquid Waste

Hazardous wastes will also be generated during Project construction and operation. During construction, these wastes may include substances such as paint and paint related wastes (e.g., primer, paint thinner, and other solvents), equipment cleaning wastes, and spent batteries. During Project operation, these wastes may include used oils, hydraulic fluids, greases, filters, spent cleaning solutions, spent batteries, and spent activated carbon. Section 5.16, Waste Management, provides greater detail of the anticipated hazardous waste streams in terms of quantities of waste, origin and composition, and waste management method. Both construction and operation-phase hazardous waste will be recycled and reused to the maximum extent possible.

---

[1] DTSC 1995. Letter to Mr. David Rib, KJC Operating Company, re: Request for Reclassification of Therminol Contaminated Soil as Nonhazardous Pursuant to Section 66260.200(f), Title 22, California Code of Regulations – Waste Evaluation Unit (WEU) File # F143, April 4.

2.5.5.6 Hazardous Materials Management

There will be a variety of hazardous materials used and stored during construction and operation of the Project, as summarized below. Section 5.6, Hazardous Materials Handling, provides additional data on the hazardous materials that will be used during construction and operation, including quantities, associated hazards and permissible exposure limits, storage methods, and special handling precautions.

Hazardous materials that will be used during construction include gasoline, diesel fuel, oil, lubricants, and small quantities of solvents and paints. All hazardous materials used during construction and operation will be stored on site in storage tanks/vessels/containers that are specifically designed for the characteristics of the materials to be stored; as appropriate, the storage facilities will include the needed secondary containment in case of tank/vessel failure. An aboveground carbon steel tank with secondary containment also will be used to store diesel fuel (300 gallons).

A variety of safety-related plans and programs will be developed and implemented to ensure safe handling, storage, and use of hazardous materials (e.g., Hazardous Material Business Plan [HMBP]). Plant personnel will be supplied with appropriate Personal Protective Equipment (PPE) and will be properly trained in the use of PPE and the handling, use, and cleanup of hazardous materials used at the facility, as well as procedures to be followed in the event of a leak or spill. Adequate supplies of appropriate cleanup materials will be stored on site.

2.5.5.7 Fire Protection

Fire protection systems are provided to limit personnel injury, property loss, and Project downtime resulting from a fire. The systems include a fire protection water system, foam generators, carbon dioxide (CO_2) fire protection systems, and portable fire extinguishers.

The location of the Project is such that it will fall under the jurisdiction of the Kern County Fire Department. It is expected that the Project will be classified as an industrial facility under the Kern County Development Standards, and as such, the minimum required fire flow would be 1,500 gpm for four hours. This calls for a minimum fire water storage volume of 360,000 gallons. Firewater will be supplied from the 1.5 million-gallon potable water storage tank located at the power block on the plant site. One electric and one diesel-fueled backup firewater pump, each with a capacity of 1,500 gpm, will deliver water to the fire protection piping network.

The piping network will be configured in a loop so that a piping failure can be quickly isolated with shutoff valves without interrupting water supply to other areas in the loop. Fire hydrants will be placed at intervals throughout the plant site that will be supplied with water from the supply loop. The water supply loop will also supply firewater to a sprinkler deluge system at each unit transformer, HTF expansion tank, and circulating pump area and sprinkler systems at the steam turbine generator and in the administration building.

Fire protection for the solar field will be provided by zoned isolation of the HTF lines in the event of a rupture that results in a fire.

2.5.5.8 Distributed Control System

The DCS provides control, monitoring, alarm, and data storage functions for power plant systems. These include:

- Control of the STG, SSG System, and BOP systems in a coordinated manner,
- Monitoring of operating parameters from plant systems and equipment,
- Visual display of the associated operating data to control operators and technicians,

- Detection of abnormal operating parameters and parameter trends,
- Provision of visual and audible alarms to apprise control operators of such conditions, and
- Storage and retrieval of historical operating data.

The DCS is a microprocessor-based system. Redundant capability is provided for critical DCS components such that no single component failure would cause a plant outage. The DCS consists of the following major components:

- Computer monitor-based control operator interface (redundant),
- Computer monitor-based control engineering work station,
- Multi-function processors (redundant),
- Input/output processors (redundant for critical control parameters),
- Field sensors and distributed processors (redundant for critical control parameters),
- Historical data archive, and
- Printers, data highways, data links, control cabling, and cable trays.

The DCS is linked to the control systems furnished by the STG supplier and to the solar field controls. These data links provide STG control, monitoring, alarm, and data storage functions via the control operator interface and control technician workstation of the DCS.

2.5.5.9 Telecommunications and Telemetry

The Project will have telecommunications service from providers who serve the Ridgecrest area. Voice and data communications will be supported by a fiber optic system. This will be augmented with wireless telecom equipment, particularly to support communication with Project staff dispersed throughout the large Project site.

With respect to telemetry, the Project will utilize electronic systems to control equipment and facilities operations over a large site. While detailed information on Project use of the electronic spectrum has yet to be developed, because of the presence of various important Department of Defense (DoD) facilities/activities in the general area, e.g., China Lake NAWS and associated ranges, the Applicant is sensitive to the need to ensure that use of the electronic spectrum by the Project will not interfere with DoD activities.

2.5.5.10 Lighting System

The Project's lighting system will provide operations and maintenance personnel with illumination in normal and emergency conditions. AC lighting will be the primary form of illumination, but DC lighting will be included for activities or emergency egress required during an outage of the plant's AC system. AC convenience outlets will also be provided for portable lamps and tools. The lighting fixtures will be hooded to minimize night time glare in deference to the "dark skies" initiatives that strive to protect views of night skies. The minimum illumination required to ensure safety and security objectives will be provided and will be oriented to minimize additional illumination in areas not pertinent to the facility.

2.5.5.11 HTF Freeze Protection System

A freeze protection system will be used to prevent freezing of the HTF piping systems during cooler winter nights. Since the HTF freezes at a relatively high temperature (54°F), HTF will be routinely circulated at low flow rates throughout the two solar fields using hot HTF from the storage vessel as a source. During winter, a fired HTF heater may be used when weather conditions dictate.

2.5.5.12 HTF Leak Detection

Leak detection of HTF will be accomplished in various ways. Visual inspection throughout the solar fields on a daily basis will detect small leaks occurring at ball joints or other connections. Such leaks can be corrected via minor repairs or repacking of joints and valves. The configuration of the looped system, allowing different sections of the field to be isolated, will facilitate the repair of small leaks. Since larger leaks are of a greater concern, detection of large leaks is being proposed by using remote pressure sensing equipment and remote operating valves to allow for isolation of large areas of the loops in the solar fields. Details of the design will be developed in the design detail process.

2.5.5.13 Service Air and Instrument Air Systems

The service air system supplies compressed air to hose connections located at intervals throughout the power plant. Compressors deliver compressed air at a regulated pressure to the service air-piping network.

The instrument air system provides dry, filtered air to pneumatic operators and devices throughout the power plant. Air from the service air system is dried, filtered, and pressure regulated prior to delivery to the instrument air-piping network.

2.5.6 Project Civil/Structural Features

The following subsections describe civil/structural features of the Project, as illustrated in the site arrangement presented in Figure 2-4. The power plant has been designed in conformance with Uniform Building Code (UBC) and California Building Code (CBC) criteria for Seismic Zone 4, the zone of highest seismic risk. The assumptions on structural and foundation designs outlined below are to be confirmed or modified as appropriate during the detailed design phase of the Project, with final design based on the results of the geotechnical investigation.

2.5.6.1 SSG System, STG and Associated Equipment

The SSG system, STG, and ACC will be located outdoors and supported on reinforced concrete mat foundations. The STG foundation will include a reinforced concrete pedestal. The GSU transformer will be supported on a reinforced concrete mat foundation. BOP mechanical and electrical equipment will be supported on individual reinforced concrete pads. BOP components/materials include piping, valves, cables, switches, etc., that are not included with major equipment and are generally installed or erected onsite.

2.5.6.2 Solar Collector Assembly Support Structures

Each SCA will be supported by structures (stands) that connect the parabolic troughs to the drive mechanism. Each array will be supported by multiple individual foundations with a foundation located approximately every 63 feet along the assembly. Foundation design will be based on site-specific geotechnical conditions to ensure that the SCA stands are able to support all loading conditions (including wind loading) at the Project site.

2.5.6.3 Buildings

The Project will include an office building and warehouse outside the power block. The power block will include a number of buildings including a control building, maintenance shop, water treatment lab, electrical building, and office building. The design and construction of the office building and warehouse will be consistent with normal building standards. Other plant site buildings will include the water treatment building, as well as a number of pre-engineered enclosures for mechanical and electrical equipment. Building columns will be supported on reinforced concrete mat foundations or individual spread footings and the structures will rest on reinforced concrete slabs. The total footprint area of the buildings outside the power block is 122,000 square feet, and the footprint area of the buildings within the power block is approximately 31,200 square feet.

2.5.6.4 Water Storage Tanks

There will be three covered water tanks on site: one 1.5 million-gallon potable water storage tank, one 100,000-gallon RO concentrate/dust control storage tank, and one 600,000-gallon treated water storage tank. Water storage tanks will be vertical, cylindrical, field-erected steel tanks supported on foundations consisting of either a reinforced concrete mat or a reinforced concrete ring wall with an interior bearing layer of compacted sand supporting the tank bottom.

2.5.6.5 Roads, Fencing, and Security

Access to the plant site will be from Brown Road via a new 700-foot long, 24-foot wide paved road. To provide safe ingress and egress at the new access road, two 1,500-foot long acceleration and two 1,000-foot long deceleration lanes will be required on Brown Road to accommodate eastbound and westbound ingress/egress.

Only a small portion of the overall plant site will be paved, primarily the site access road to the main office and power block and portions of the power block (paved parking lot and roads encircling the STG and SSG areas). The remaining portions of the power block will be gravel surfaced. In total, the power block will be approximately 18 acres with approximately six acres of paved area. The solar fields will remain unpaved and without a gravel surface in order to prevent rock damage from mirror wash vehicle traffic; an approved dust suppression coating will be used on the dirt roadways within and around the solar field. Roads and parking areas located within the power block area and adjacent to the administration building and warehouse will be paved with asphalt.

The Project solar fields and support facilities perimeter will be secured with a combination of chain link and wind fencing. Chain link metal-fabric security fencing, 8 feet tall, with one-foot barbed wire or razor wire on top will be installed along the north and south sides of the facilities. Thirty-foot tall wind fencing, composed of A-frames and wire mesh, will be installed along the east and west sides of each solar field. Tortoise exclusion fencing will be included. Controlled access gates will be located at the site entrances. As discussed below, the drainage channels will be outside the plant facilities and the security fencing but still within the Project ROW.

2.5.6.6 Site Drainage and Earthwork

The Project site is located 4.5 miles southwest of Ridgecrest in Kern County, California on the southern edge of Indian Wells Valley north of the El Paso Mountains. The main site entrance will be from Brown Road about 2.25 miles due west of the intersection of U.S. Highway 395 and Brown Road. The existing topographic conditions of the proposed site show an average slope of approximately two feet in 100 feet (two percent) toward the northwest north of Brown Road and toward the north south of Brown Road. Cross slopes vary from nearly flat to as much as four percent. Steeper slopes occur at transitions into washes. At present, onsite stormwater runs overland and collects in concentrated flows that eventually confluence with El Paso Wash.

<u>Offsite Drainage</u>

The offsite (outside the plant site) drainage area consists of distinct watersheds totaling approximately 35 square miles, which generally drain from elevated areas two to three miles south of the solar fields northward to relatively more gradually-sloped areas at the approach to the solar fields. Natural vegetation within the watersheds can be described as sporadic scrub brush typical of local high desert conditions. There are three existing incised channels that currently pass through one or both of the proposed solar field sites. These channels vary in size and have been incised beyond their annual flows due to long term erosion. Each of these channels will require minor diversions to direct watershed flow from existing natural channels around the solar fields and back into the same natural channels down-slope of the solar fields. These diversions will not substantially add or subtract flow amounts. They simply route natural drainage around the fields. Although the original large solar field, which overlays the El Paso Wash, split into two smaller solar fields in order to accommodate the flow of the El Paso Wash through the site, the technical design of the solar field mirrors, heat collection system, pumps and control systems precludes the option of breaking solar fields into smaller distinct components that would allow the current drainage channels to remain entirely in place.

The western-most offsite channel, which accepts water from a five-square mile watershed, currently passes through the southwest corner of the southern solar field. The proposed design will divert runoff around the west side of the southern solar field and back into the natural channel at a point approximately 0.25 mile north of the southern limit of the southwest corner of the field.

The middle channel accepts drainage water from El Paso Wash (a 20-square mile watershed) and impacts the east side of the southern solar field approximately 0.25 mile south of Brown Road. This channel also impacts the southwest corner of the northern solar field. The proposed design will intercept the existing channel at the east edge of the southern solar field and direct flow northerly along the east side of the field; westerly south of Brown Road; northerly through a proposed culvert under Brown Road; northerly along the western boundary of the northern solar field and back to El Paso Wash near the northwest corner of the northern solar field.

The east channel is formed by flows from the 10-square mile watershed located south of the site, on the east and west side of U.S. Highway 395. Due to existing roadway improvements, some of the water is diverted away from the site. The proposed design will intercept this water near the southeast corner of the northern solar field and direct it northerly in an improved channel along the east side of the field to the northern edge, then northwesterly to rejoin the aforementioned ephemeral creek that eventually rejoins El Paso Wash.

Each of the proposed offsite diversion channels is being sized to contain the 100-year, 24-hour storm event as defined in the Kern County Hydrology Manual and will include necessary earth compaction and riprap side-slope protection along key reaches (e.g., directional transitions, natural-to-proposed channel transitions, proposed-to-natural channel transitions, and reaches with significant design velocities).

Onsite Drainage

Onsite stormwater from the proposed southern and northern solar fields is drained by a collection of onsite interior channels parallel to the solar collectors that direct stormwater sheet flow from the solar fields to increasing larger interior channels westerly then northerly to points of direct discharge into the creeks through best management practice erosion control facilities. The discharge from the southern solar field will be directed to the culvert under Brown Road so that flow originating from that field will not cause erosion to existing road crossings.

Both proposed solar fields will be terraced into multiple relatively flat south-to-north plains that will generally slope east-to-west from nearly level to as steep as two percent. Permeability of natural onsite soils[2] is being considered for estimation of stormwater sheet flow infiltration and modeling of onsite storm runoff. The ground located beneath proposed solar mirrors is currently assumed to maintain permeability of existing soil inasmuch as this area will not be paved.

---

[2] The predominant onsite soil is classified as “s1024” Wasco-Rosamond-Cajon or U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) hydrologic soils groups A and B, characterized as soil with moderate to excellent permeability. The offsite upland soils to the east and west of the site are classified as hydrologic soils groups C and D, characterized as soil with low levels of permeability. See Section 5.12, Soils.

The onsite interior channels for each field include north-south-oriented swales that will collect and direct stormwater sheet flow to two main westward-sloped channels located at the terraces, to be located approximately 0.25 mile and 0.75 mile north of the southern limit of each field. The channels convey water directly to existing creeks as previously mentioned. Culverts will be provided across the channels for essential onsite roads.

The power block area will have its own detention/water quality basin. The power block will generally drain by sheet flow or swales to the basin. The basin will be designed to mitigate the 25-year storm flow and to provide water quality mitigation. Oil and chemical storage areas within the power block will have their own containment features. The basin will also be designed to retain for a short duration prior to outfall to the nearest downstream channel.

The preliminary site grading plan is designed to be balanced; no import or export of soil is expected for general earthwork. The grading plan does not contemplate any soil shrinkage or other losses. When the geotechnical investigation report is available for the site, the grading plan will be adjusted to account for any loss in elevation that could occur. Engineered fill will be provided as required for equipment and structure foundations as/if recommended by the geotechnical report. Only soil material approved by the geotechnical engineer will be used for structural fill. Additionally, granular material may need to be imported for the use as road base and possible use below foundations. Grading of the site will commence at the beginning of the construction period and will last over a period of approximately 24 months. Such an extended grading period will require less water on a daily basis for grading operations as well as for dust control over a smaller area. The total earth movement required is estimated at 7.5 million cubic yards.

As summarized in Section 5.17, Water Resources, and described in the preliminary construction Storm Water Pollution Prevention Plan (SWPPP) and Drainage, Erosion and Sediment Control Plan (DESCP) provided in Appendix L, the Project will employ a comprehensive system of management controls, including site-specific Best Management Practices (BMPs), to minimize stormwater contact with contaminants and thus pollutants in the stormwater. These management controls may include:

- Erosion and sediment control,
- Employee training program,
- Good housekeeping programs,
- Preventive maintenance programs,
- Structural BMPs:
  - Temporary containment during maintenance activities
  - Permanent secondary containment structures at chemical storage and process areas
- Materials, equipment and vehicle management practices,
- Spill prevention and response programs, and
- Inspection programs.

2.5.7 Construction of Generating Facilities

Major milestones of the planned construction schedule are as follows:

- Begin construction: fourth quarter 2010
- Start of commercial operations: mid-2013

2.5.7.1 Construction Schedule, Manpower, and Sequencing

Project construction is expected to occur over a total of 28 months. Project construction will require an average of 405 employees over the entire 28-month construction period, with manpower requirements peaking at approximately 633 workers in Month 11 of construction. The construction workforce will consist of a range of laborers, craftsmen, supervisory personnel, support personnel, and management personnel. Section 5.11, Socioeconomics, provides a breakdown of the construction workforce by skill over the entire construction period.

Temporary construction parking areas will be provided within the power plant site adjacent to the laydown area. The plant laydown area will be utilized throughout the build out of the two solar fields. The construction sequence for power plant construction includes the following general steps:

- *Site Preparation:* This includes detailed construction surveys, mobilization of construction staff, grading, and preparation of drainage features. Grading for the solar field, power block, and drainage channels will be completed during the first 18 months of the construction schedule.
- *Linears:* This includes the site access road, telecommunication line, transmission line, and water pipeline. The site access road and telecommunication line will be constructed during the first 6 months of the construction schedule in conjunction with plant site preparation activities. The onsite transmission line, telecommunications line, and water line will be constructed during the first 18 months of the construction schedule. The re-alignment of the existing SCE line is proposed to begin in the 18th month and be complete in the 27th month.
- *Foundations:* This includes excavations for large equipment (STG, SSG, GSU transformer, etc.), footings for the solar field, and ancillary foundations in the power block.
- *Major Equipment Installation:* Once the foundations are complete the larger equipment will be installed. The solar field components will be assembled in an onsite erection facility and installed on their foundations.
- *BOP:* With the major equipment in place, the remaining field work will include piping, electrical, and smaller component installations.
- *Testing and Commissioning:* Testing of subsystems will be conducted as they are completed. Major equipment will be tested once all supporting subsystems are installed and tested.

2.5.7.2 Deliveries

Equipment and materials will be delivered to the Project site by truck.

2.5.7.3 Fire Protection

A Construction Fire Protection and Prevention Plan will be developed and followed throughout all phases of construction. The permanent facility fire protection system will be put into use during construction as soon as is practicable. Prior to the availability of this system, fire extinguishers and other portable fire fighting equipment will be available on site. All equipment will be California Occupational Safety and Health Administration (Cal/OSHA) compliant. Locations of portable fire fighting equipment may include portable office spaces, welding areas, flammable chemical areas, and vehicles and other mobile equipment.

2.5.7.4 Construction Water

To meet Project construction water needs involves providing water for all construction related activities. These activities include:

- Dust control for areas experiencing construction work as well as mobilization and demobilization,
- Dust control for roadways,
- Water for grading activities associated with both cut and fill work,
- Water for soil compaction in the utility and infrastructure trenches,
- Water for soil compaction of the site grading activities,
- Water for soil stockpile sites,
- Water for the various building pads, and
- Water for concrete pours on site.

The predominant use of water will be for grading activities, which will have a steady rate of work each month. The grading schedule for the site has been spread to cover the total construction period. This will mean that water use will be steady and without definable peaks. Average water use at the site is estimated to be about 561,000 gallons (1.7 acre-feet) per working day. Total construction water use for the duration of Project construction is estimated to be about 478 million gallons (1,470 acre-feet). Construction water will be sourced from IWVWD. Potable water during construction will be brought on site in trucks and held in day tanks.

2.5.8 Project Operation

While electrical power is to be generated only during daylight hours, the Project will be staffed 24 hours a day, 7 days per week. A total estimated workforce of 84 full time employees will be needed to staff the Project. A breakdown of operational staff is provided in Section 5.11, Socioeconomics.

2.6 Transmission System

2.6.1 Transmission System Description

Two existing transmission lines owned and operated by SCE that currently traverse the plant site will be re-routed around and to the west of the site.

The Project will be connected to the SCE transmission system by constructing a single-circuit three-phase onsite 230 kV transmission line that will interconnect at a new Project switchyard immediately adjacent to the facility. This new switchyard will also be located in close proximity to the SCE 230 kV transmission line that is being rerouted around the Project site. The new switchyard will be owned by the Applicant and include the design and construction features required for an interconnection to an SCE transmission line. The nominal 250 MW Project output produces 630A at 230 kV. The conductor proposed for the gen-tie is 795-thousand circular mils (kcmil) “Drake” conductor capable of carrying 907 amperes (A) at 75°C. SCE utilizes the nominal voltage of 230 kV. The use of 230 kV as the targeted design voltage in this application for certification (AFC) is consistent with the industry use of the 230 kV term to describe the nominal voltage for this class of system.

The circuit will be supported by mono-pole structures at appropriate intervals with final heights as indicated below in Section 2.6.1.2, Transmission Structures. The lines will be insulated from the poles using porcelain insulators engineered for safe and reliable operation at a maximum operating voltage of 253-kV (nominal, plus 10 percent). A shield wire will be included on the line to protect against lightning strikes (see Figure 5.14-1 in Section 5.14, Transmission Line Safety and Nuisance). These pole designs were engineered to provide conceptual design limits for purposes of the electric and magnetic field (EMF) studies. Final transmission structure design including tangent, angle, dead end, and pull-off structures and associated hardware will be determined during the final engineering of the proposed interconnection.

2.6.1.1 Transmission Line Route

The proposed gen-tie route is approximately 0.5 mile long and proceeds directly west from the power block, then turns northwest into the Project's planned 230-kV switchyard, which will be located due west of the power block and adjacent to the existing SCE transmission lines. Plant site construction will require the relocation of approximately 1.5 miles of existing overhead 115-kV and 230-kV transmission lines that currently traverse the Project site. The new gen-tie line will exit a pull-off structure in the power block and head westerly along the south edge of the power block on monopole steel structures. The proposed 230-kV line will be designed to meet the requirements of California Public Utilities Commission General Order 95 (GO-95). During preliminary transmission line design, a conservative approach was taken in the pole design height in order to ensure ground clearance is in accordance with GO-95, but final design will be based on actual field conditions and site requirements.

2.6.1.2 Transmission Structures

The Project's monopole transmission structures are expected to average approximately 75 feet in height with a maximum height of 120 feet and an average span length of in the range of 400 to 800 feet.

Access by vehicle will be required along the proposed Project transmission line route, a section of which crosses a new drainage ditch. Vehicle access for construction and regular operations between the power block and proposed switchyard will require new 15-foot wide unpaved roads. Two roads will be required: south of the drainage ditch an 800-foot long unpaved road between the power block and the drainage ditch, and north of the drainage ditch a second new 1,000-foot long unpaved road between the main office building and switchyard. Installation of the transmission structures and conductors will require disturbance of small additional areas totaling less than one acre in the aggregate.

2.6.2 Construction of Transmission Facilities

The transmission line will be constructed in accordance with the guidelines of the Institute of Electrical and Electronics Engineers Guide 524 "Guide to the Installation of Overhead Transmission Line Conductors" with crews working continuously along the ROW, with construction of the entire transmission line requiring a peak workforce of approximately 20 workers. Transmission line construction will include the installation of tubular steel poles involving the following sequence of activities:

- *Marshalling Yards:* Staging areas for trailers, office personnel, equipment, material staging, laydown and employee parking for the Project will be established in an approved area.
- *Road Work:* As needed, dirt roads for access along the transmission line route to provide access to the structure locations. These access roads will be installed in locations that avoid sensitive environmental resources identified in Project environmental surveys.
- *Pole Erection*: Each pole will be assembled on site and dressed out with insulators and conductor hardware.
- *Conductors:* From pulling sites, the conductors will be installed, sagged and permanently connected to the insulators.
- *Pulling Sites:* There will be approximately three pulling sites required to install the conductors.
- *Communication System:* The overhead ground/fiber optic communications cable will be installed using the same pulling sites as were used for the conductor installation.

The transmission lines for this site will be 230 kV lines and will be placed on steel monopoles up to 120 feet in height. The lines and monopoles will be placed entirely within the Project ROW. The poles have a base width of 5 to 6 feet and a top width of 1 to 2 feet, depending on local conditions. The construction corridor is also entirely within the Project ROW.

Using cranes, the towers will be installed using cranes to place the towers on concrete foundations buried in the ground. The construction footprint at the tower locations is approximately 20 feet x 20 feet. The laydown area is contained within the construction corridor along the full alignment. Fifteen-foot wide access roads will be constructed adjacent to the towers for the full length of the alignment as described above under Transmissions Structures. Pull sites are the same general locations as the tower sites. The pull will originate from the end of the alignment and will progress from tower to tower for the full alignment using pulley rigs and cables.

2.6.3 Interconnection Study

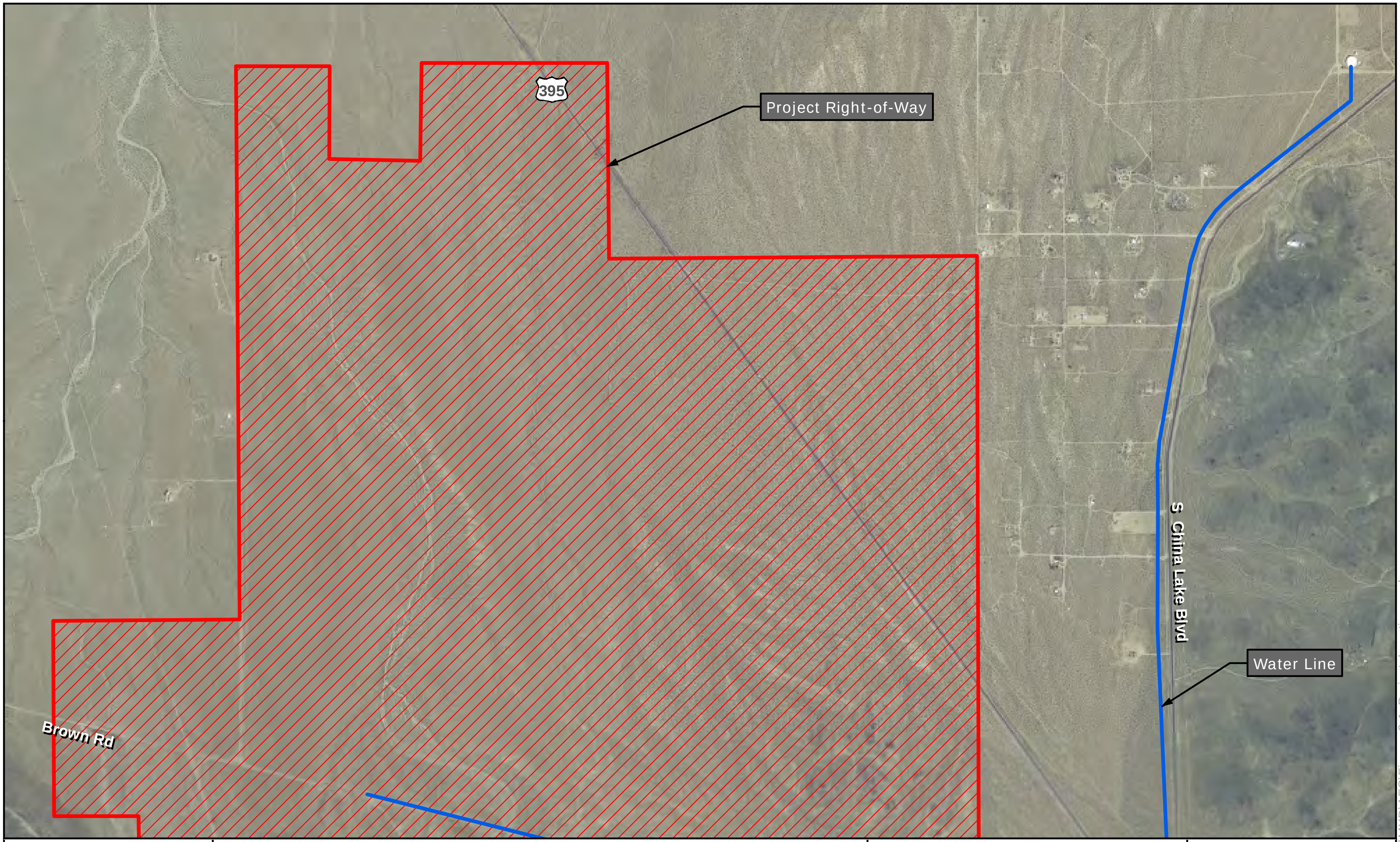
The CAISO and SCE initiated a Phase 1 Cluster Study in the fall of 2008. The Phase I Cluster Study was released on July 28, 2009. The Applicant will provide this document under confidential cover.

The final Phase 2 Study will commence in November 2009 and will be completed in 2010. An Interconnection Agreement for the Project is expected to be concluded in the fourth quarter of 2010.

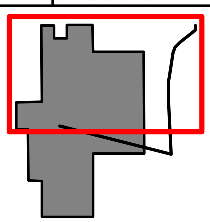
2.6.4 Existing SCE Distribution Line

There is an existing 115-kV transmission line and a 230-kV transmission line located on the site. The Applicant is working with SCE to try to accommodate both the solar facilities and the SCE line within the BLM ROW. The rerouting of these SCE distribution lines is proposed as shown in Figure 2-1 to follow Project site boundaries around the southwest portion of the site. The rerouting of the SCE lines would occur adjacent to the Project site boundaries and entirely within the Project ROW.

The existing lines are on steel towers generally 80 to 120 feet in height. The re-aligned transmission lines would use towers similar in type and would be placed at the same height and spacing as the existing lines. The construction corridor would generally be 160 feet wide. The towers would be placed using concrete foundations. The construction footprint at the tower locations would be approximately 40 feet x 40 feet square. The laydown area would be contained within the construction corridor of 160 feet along the full alignment. A 15-foot wide access road would be constructed adjacent to the towers for the full length of the alignment. Pull sites would be the same general locations as the tower sites. The pull would originate from the end of the alignment and would progress from tower to tower for the full alignment using pulley rigs and cables.



Map Location



Legend

- Plant Site
- City Limits
- Water Line

1 inch = 2,000 feet
0 2,000 4,000 Feet

Ridgecrest Solar Power Project

Figure 2-1
Project Location

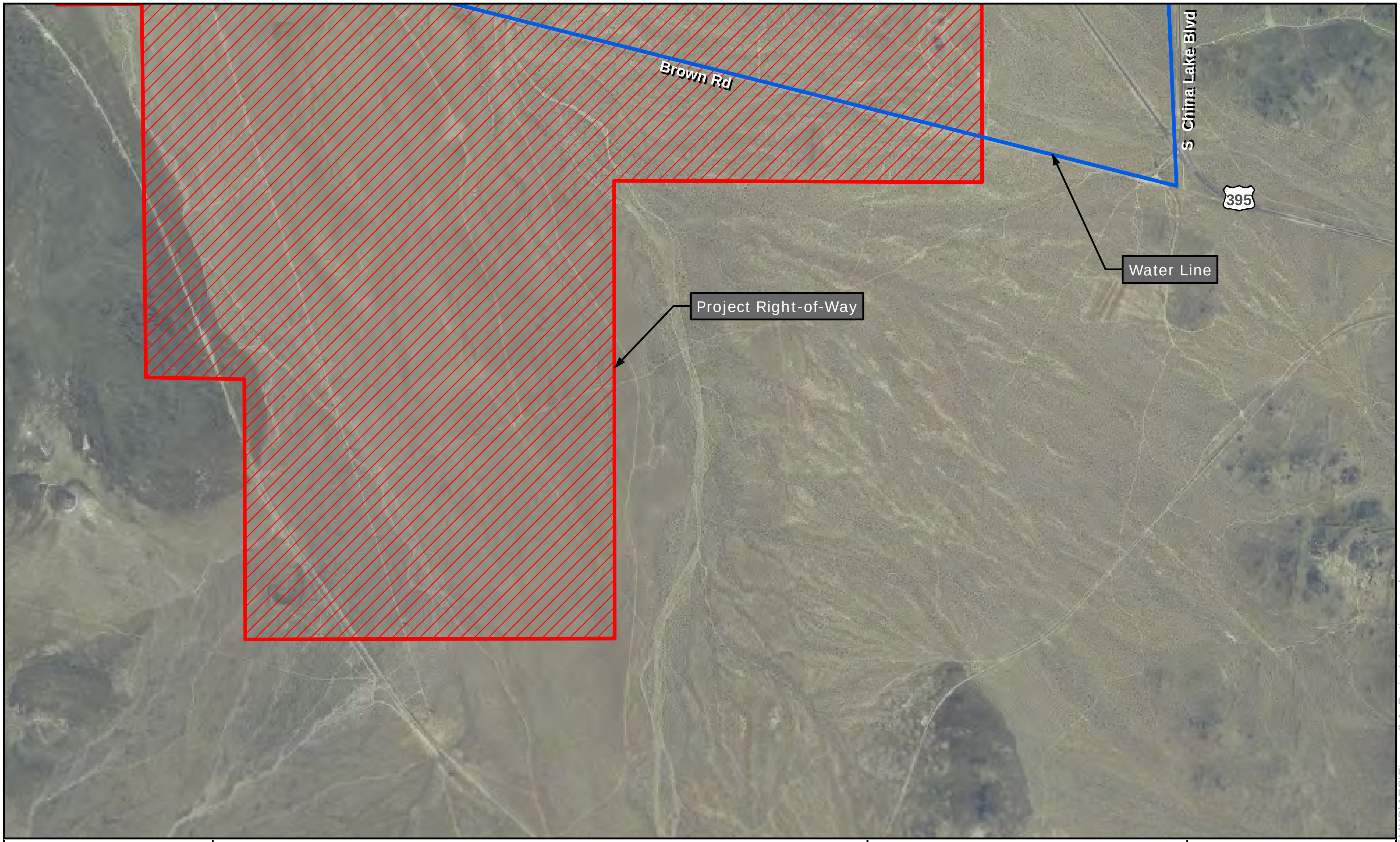
1 of 2

Solar Millennium

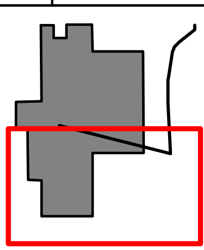
AECOM

Date: September 2009

Y:\Projects\Solar_Millennium\RSPP\MXD\AFC\Figure_2-1_Project_Location.mxd



Map Location



Legend

Plant Site
City Limits
Water Line

1 inch = 2,000 feet

0 2,000 4,000 Feet

N S E W

Ridgecrest Solar Power Project

Figure 2-1
Project Location

2 of 2

Solar Millennium

AECOM

Date: September 2009

Y:\Projects\Solar_Millennium\RSPP\MXD\AFC\Figure_2-1_Project_Location.mxd

Figure 2-2 - Photo Showing Representative Existing RSPP Site Conditions

Figure 2-3a - RSPP Site without Simulated Facilities

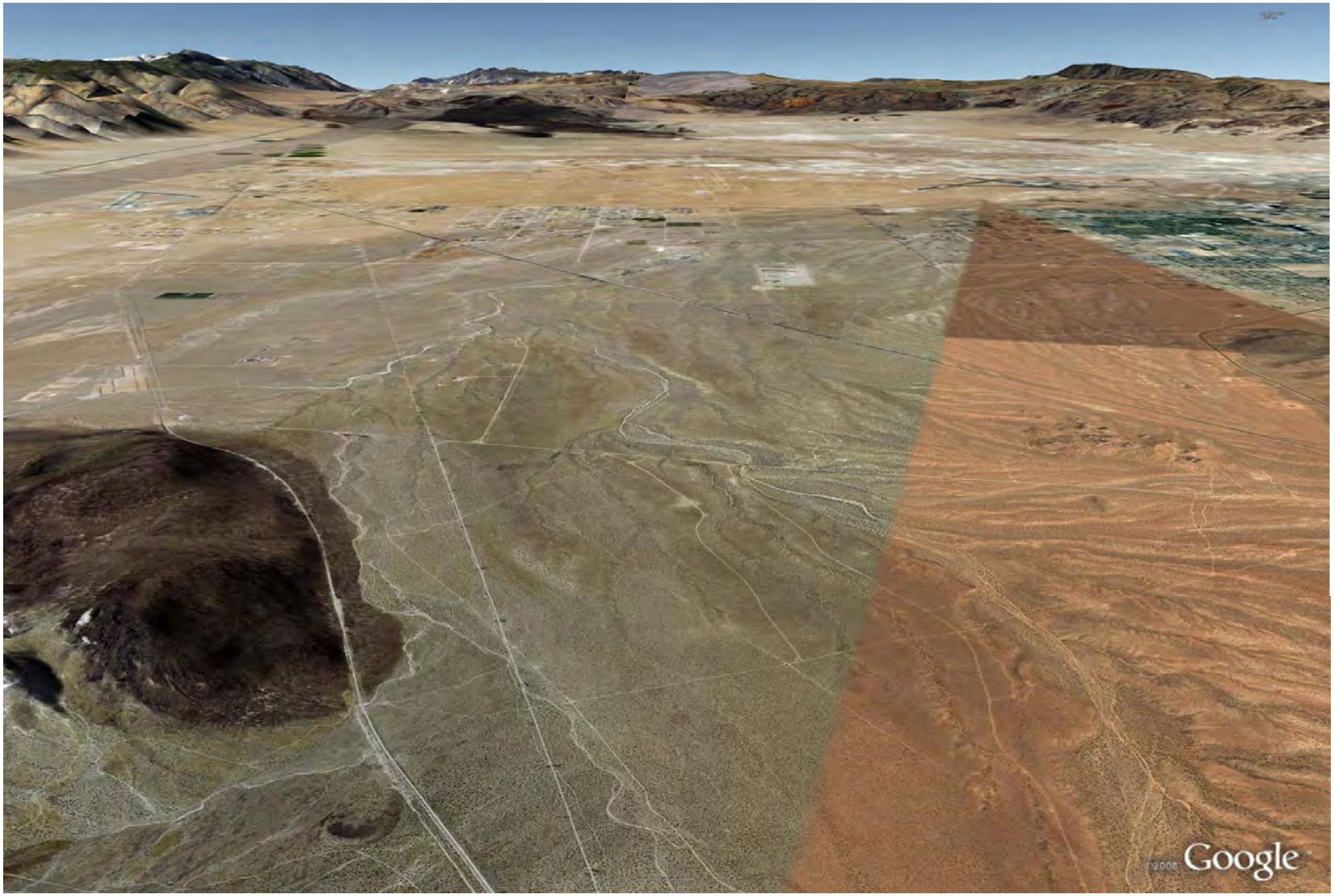
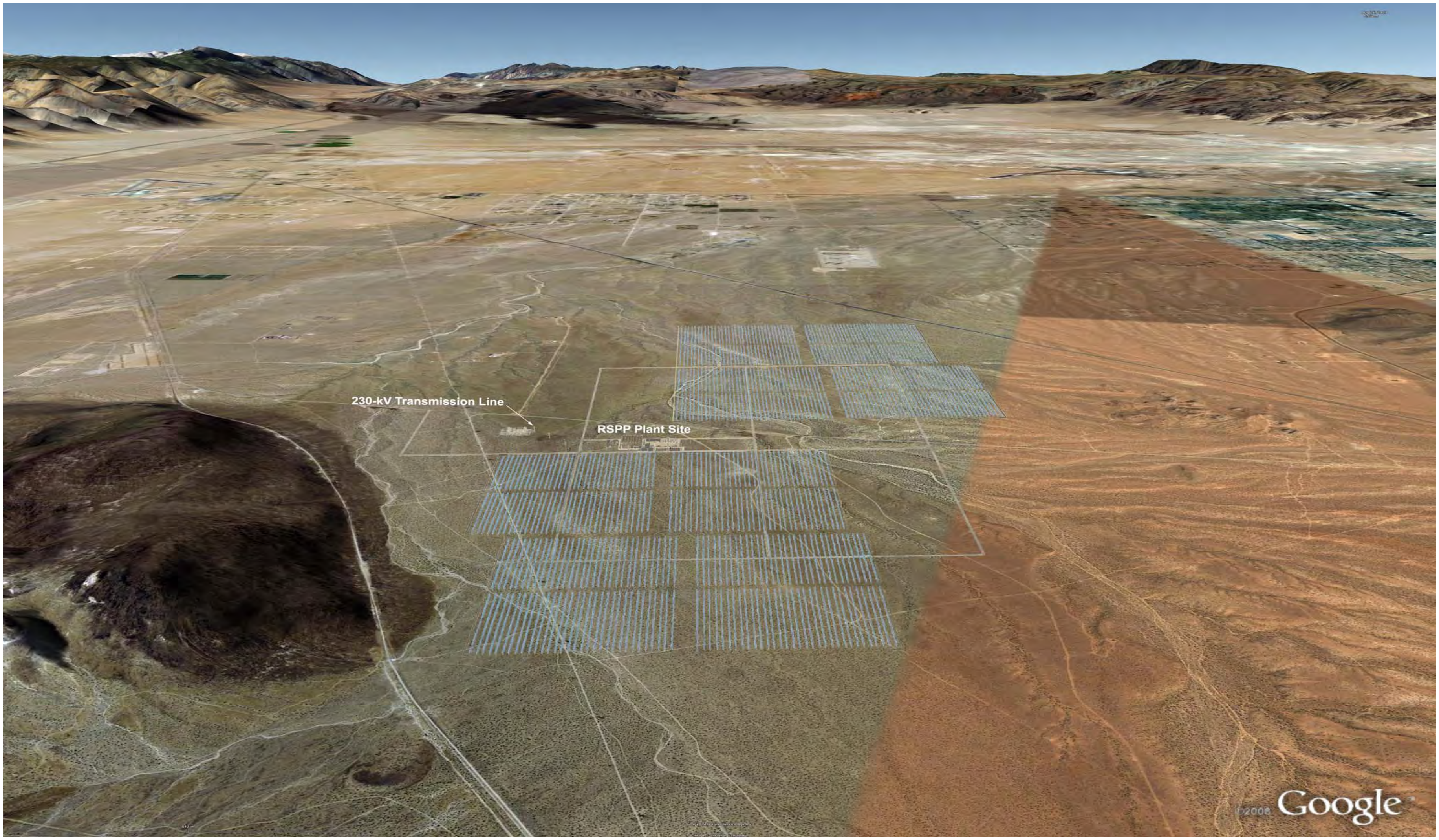
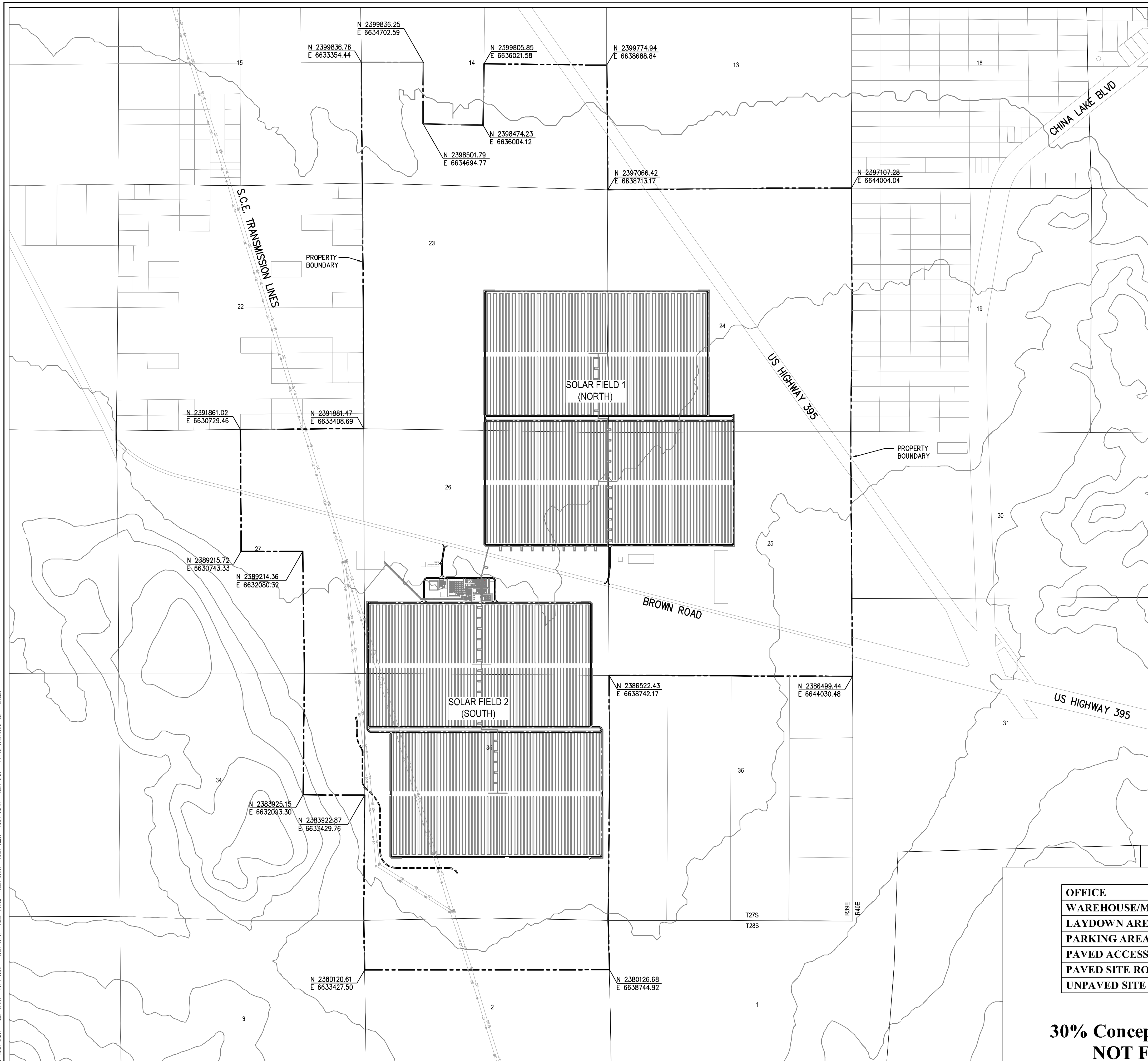


Figure 2-3b - RSPP Site with Simulated Facilities





OFFICE	10,000 SF
WAREHOUSE/MAINTENANCE BLDG	112,200 SF
LAYDOWN AREA	45 AC
PARKING AREA (75 VEHICLES)	21,000 SF
PAVED ACCESS ROAD (24' WIDE)	700 LF
PAVED SITE ROAD (24' WIDE)	6,000 LF
UNPAVED SITE ROAD (24' WIDE)	61,300 LF

30% Conceptual Engineering Plans
NOT FOR CONSTRUCTION

AECOM

AECOM
5001 E. Commercenter Dr.
Bakersfield, Ca 93309
Phone 661.325.7253
www.aecom.com

Designed: W. BLACK
Checked: W. BLACK
Drawn: K. S. BEDFORD
Record Drawing by/date:

Revisions:
#	DATE	DESCRIPTION

Prepared for:

Solar Millennium LLC

LEGEND:

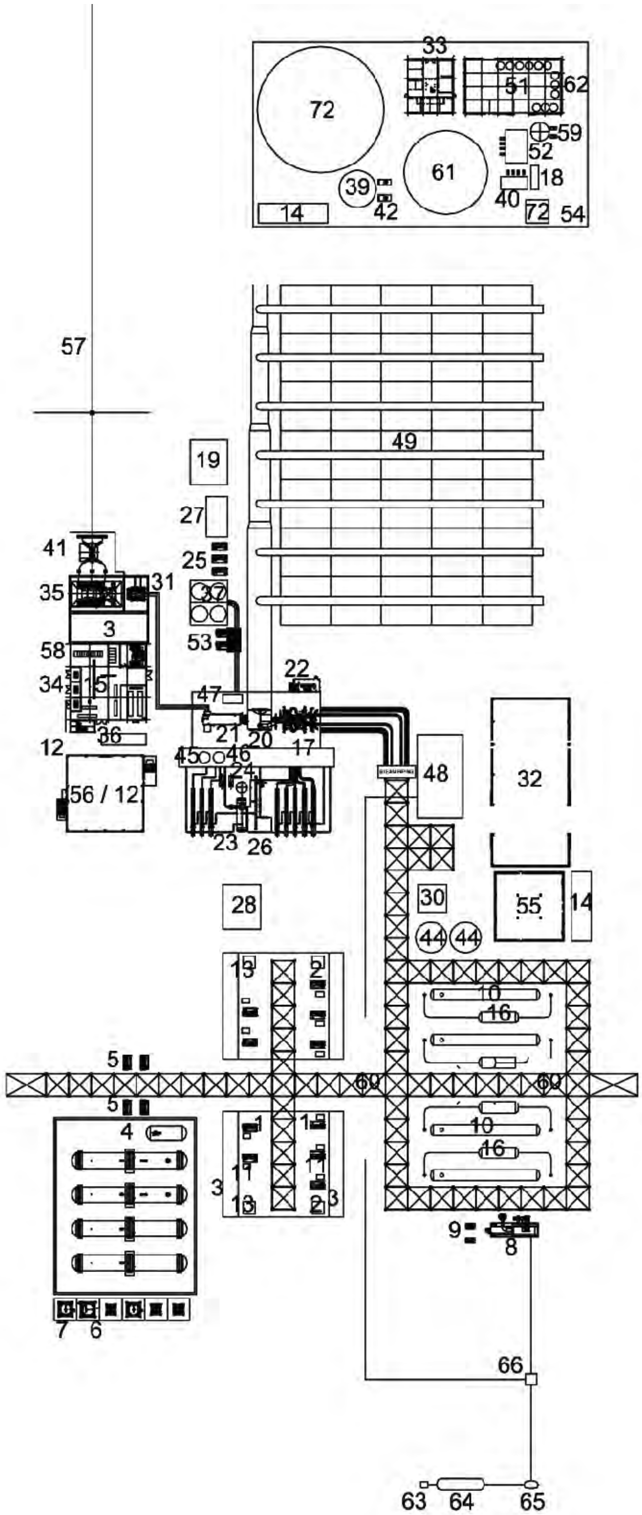
- SOLAR FIELD PARABOLIC TROUGH
- BALANCE OF PLANT FACILITIES
- PROPOSED ACCESS ROAD (PAVED)
- PROPOSED ACCESS ROAD (GRAVEL)
- RAILROAD
- PROPOSED GAS
- PROPOSED WATER
- PROPOSED TELEPHONE
- PROPOSED ELECTRIC
- EXISTING ELECTRIC
- PROPOSED SECURITY FENCE
- PROPOSED WIND FENCE
- EXISTING CONTOURS (10 FOOT INTERVALS)
- PROPOSED DRAINAGE CHANNEL/FLOW DIRECTION
- EXISTING INTERMITTENT DRAINAGE CHANNEL
- SITE BOUNDARY
- DISTURBANCE LIMITS
- HEADER PIPING

Ridgecrest Solar Power Project

Kern County, California

Figure 2-4
General Arrangement

Date: 06/10/09
Sheet: 2 OF 13



#	LEGEND / NAME	DIMENSIONS (LxWxH) / CAPACITY	FTPRINT (S
1	HTF MAIN PUMPS	INCIDENTAL	
2	HTF PUMPS SEAL OIL UNIT	INCIDENTAL	
3	SWITCH YARD	13' X 92'	1200SF
4	OVERFLOW VESSEL AND EXPANSION VESSEL	124' X 154'	19KSF EA
5	OVERFLOW RETURN PUMPS	INCIDENTAL	
6	ULLAGE COOLERS AND VESSEL	59' X 20'	1200SF
7	NITROGEN SYSTEM	INCIDENTAL	800SF
8	HTF HEATER	50' X 22' X 80' STACK	1100SF
9	FREEZE PROTECTION PUMPS	INCIDENTAL	
10	STEAM GENERATORS	90' X 10' X 24' EA	900SF
11	VARIABLE FREQUENCY DRIVE SYSTEM	INCIDENTAL	
12	WEATHER STATION BUILDING	68' X 68' X 24' (TWO LEVEL BLDG)	4600SF
13	HTF PUMPS LUBE OIL UNIT	INCIDENTAL	
14	PARKING	18' X 60'	1080SF
15	BALANCE OF PLANT ELECTRICAL BUILDING	67' X 67' X 24' (TWO LEVEL BLDG)	4500SF
16	REHEATERS	32' X 10' EA	320SF
17	EXCITATION TRANSFORMER	NOT FOUND	
18	WATER TREATMENT MCCS	INCIDENTAL	
19	MCC COOLING TOWER	33' X 40' X 32' HIGH	1320
20	STEAM TURBINE	111' X 50' X 40' HIGH	5500SF
21	GLAND CONDENSER	INCIDENTAL	
22	LUBE OIL CONSOLE	INCIDENTAL	
23	DEAERATOR	125' X 57'	7100SF
24	FEEDWATER PUMPS	INCIDENTAL	
25	CONDENSATE PUMPS	INCIDENTAL	
26	LP/HP PRE-HEATERS	INCIDENTAL	
27	VACUUM SYSTEM	19' X 35' X 24' HIGH	665
28	DIRTY WASTE WATER SUMP, OIL WATER SEPARATOR	INCIDENTAL	
29	FREE FOR USE		
30	COMPRESSED AIR SYSTEM	25' X 25' X 24' HIGH	625 SF
31	GENERATOR CIRCUIT BREAKER	20' X 30' X 20'	600 SF
32	WAREHOUSE	68' X 146' X 30'	10K SF
33	CHEMICAL INJECTION SKID	46' X47' X 24'	2K SF
34	MAIN AUXILIARY TRANSFORMERS	INCIDENTAL	
35	GENERATOR STEP-UP TRANSFORMERS	48' X 32' X 24'	1,500 SF
36	EMERGENCY DIESEL GENERATOR	40' X 10' X 20'	400 SF
37	COOLING TOWER	33' X 40' X 32' HIGH	1,300 SF
38	FREE FOR USE		
39	WATER TANK (RO CONCENTRATE)	33' DIA X 24' HIGH / 100,000 GAL	850 SF
40	SERVICE WATER PUMPS	23' X 12' X 16'	275 SF
41	TAKE OFF TOWER	30' X 35' X 50'	1,000 SF
42	FIRE PROTECTION PUMPS	INCIDENTAL	
43	FREE FOR USE		
44	BLOWDOWN TANKS	28' DIA EA	570 SF
45	TURBINE DRAINS TANK	INCIDENTAL	
46	CONDENSATE TANK	INCIDENTAL	
47	STG PACKAGED ELECTRONIC AND ELECTRICAL CONTROL COMPARTMENT	INCIDENTAL	
48	AUXILIARY BOILER	40' X 73' X 32'	2900 SF
49	AIR COOLED CONDENSER	245' X 296' 120' HIGH	73K SF
50	HTF PIPING CONNECTION TO SOLAR FIELD	INCIDENTAL	
51	SAMPLE PANEL & LAB BUILDING	84' X 48' X 24' HIGH	4,000 SF
52	DEMINERALIZED WATER TANK	16' DIA X 24' HIGH	200 SF
53	AUXILIARY COOLING WATER PUMPS	INCIDENTAL	
54	WATER TREATMENT AREA	192' X 148'	28K SF
55	ADMINISTRATON BUILDING	60' X 60' 24' HIGH	3,600 SF
56	CONTROL BUILDING	68' X 68' 24' HIGH	4,600 SF
57	HIGH VOLTAGE LINE	4' DIA 120' HIGH POLES	
58	SUS TRANSFORMER & 480 V BUS	INCIDENTAL	
59	DEMINERALIZED WATER PUMPS	INCIDENTAL	
60	PIPE RACK	40' HIGH MISC.	
61	TREATED WATER TANK	73' DIA X 24' HIGH / 600,000 GAL	4,500 SF
62	CHEMICAL FEED CANOPY	NOT FOUND	
63	LPG TRUCK UNLOADING STATION	INCIDENTAL	
64	LPG STORAGE TANK	9' 4-3/4" DIA X 40' 9-3/8" X" LONG / 18,000 GAL	400SF
65	LPG PUMPS	6' DIA. X 12'-0" LONG	64SF
66	LPG VAPORIZER	10'-0" X 10'-0"	100SF
70	NOT USED		
71	NOT USED		
72	POTABLE WATER TANK (ALSO FIREWATER STORAGE)	110' DIA X 24' HIGH 1.5M GAL	9,500SF

Project Location

Ridgecrest Solar Power Project

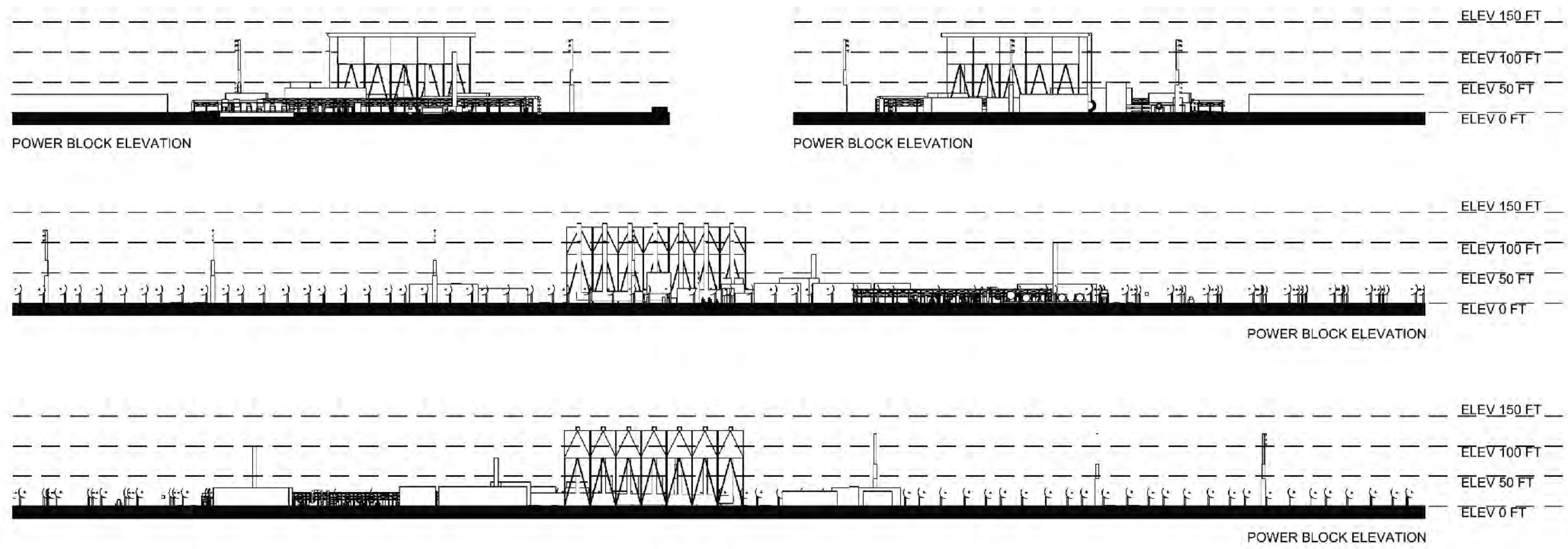
Figure 2-5
General Arrangement
Power Block

Solar Millennium

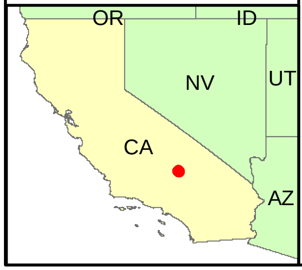
AECOM

Project: 12944-003
Date: September 2009

J:\2009 Projects\12944-Solar Millennium\Figures for Engineering\ridgecrest-powerblock.mxd



Project Location



Ridgecrest Solar Power Project

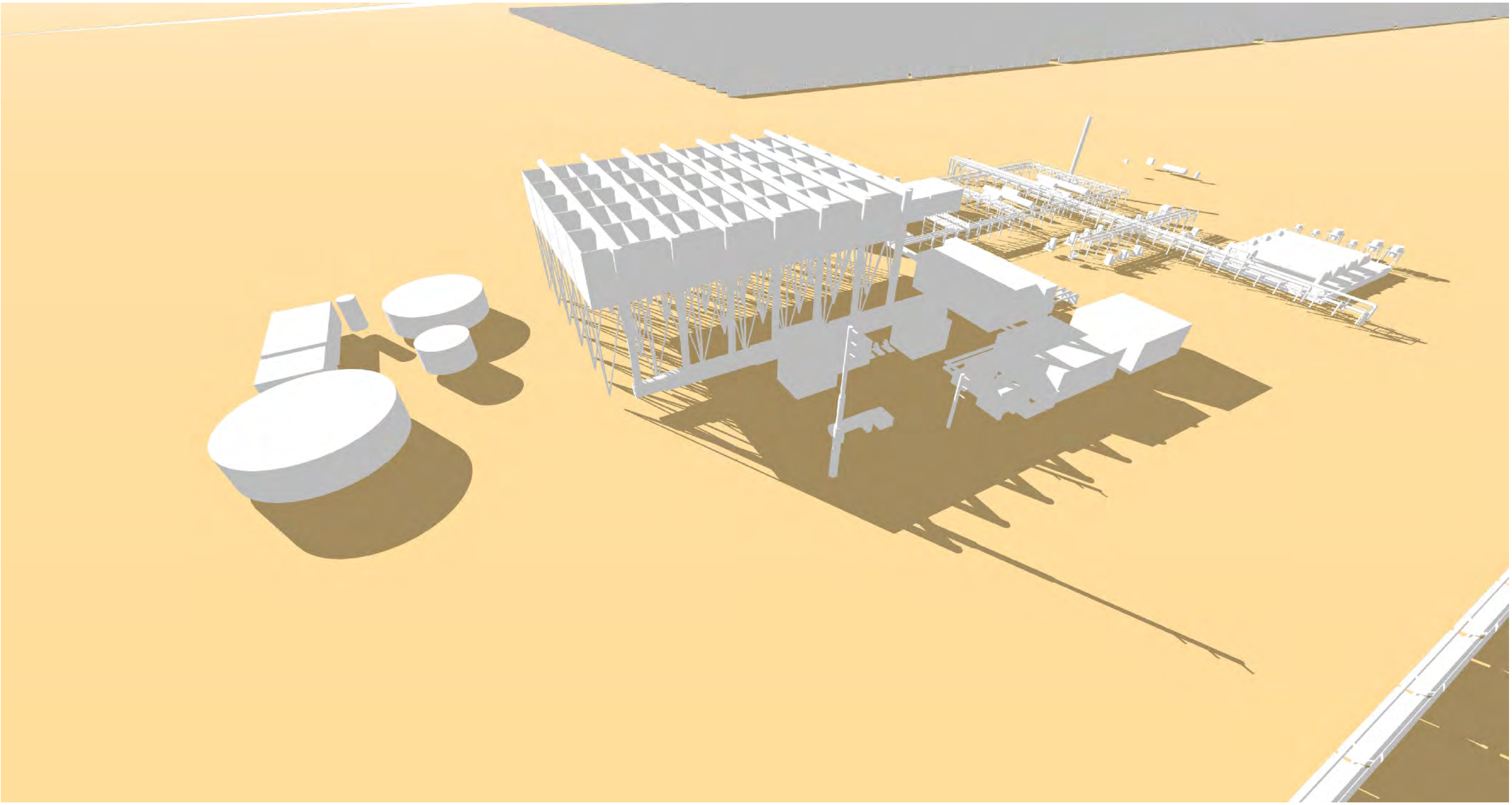
Figure 2-6a
Elevation View of
Project Facilities

Solar Millennium

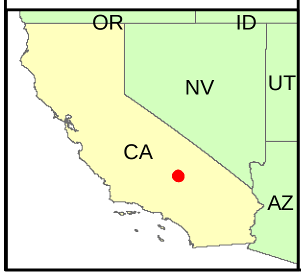
AECOM

Project: 12944-003
Date: September 2009

J:\2009 Projects\12944-Solar Millennium\Figures for Engineering\Ridgecrest-Elevation View.mxd



Project Location



Ridgecrest Solar Power Project

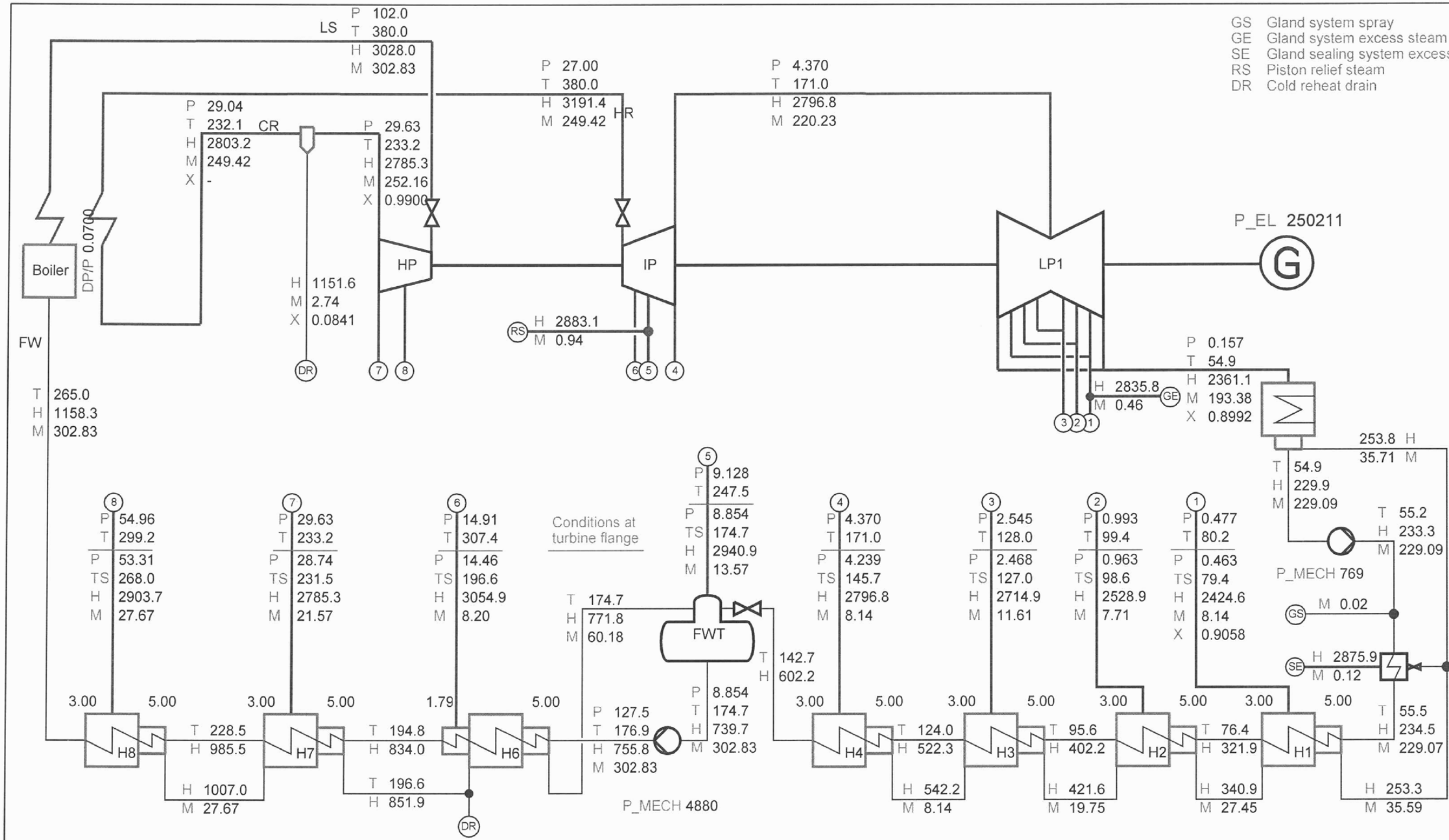
Figure 2-6b
Three Dimensional View of Project Facilities

Solar Millennium

AECOM

Project: 12944-003
Date: September 2009

J:\2009 Projects\12944-Solar Millennium\Figures for Engineering\ridgecrest-3d View.mxd



WinAlpro - Version: 2008-09-30

R:\PROJEKTE\Ridgecrest 2-2008\Dry_cooled\2008-12-05_GMD306RevA_HL\HBD_306_RevA_Lo.alg

P	Pressure	bar
T	Temperature	°C
H	Enthalpy	kJ/kg
M	Mass flow	kg/s
TS	Saturation temperature	°C
X	Mass fraction of vapor	-
P_MECH	Mechanical power	kW
P_EL	Electrical power	kW

HR = (Q.LS + Q.HR - Q.CR - Q.FW) / (P_EL.Gen)
= 9539 kJ/(kW*h)

Q_Solar 663000.0

Drawn: 2008-12-08
Checked:
Approved:
Doc F L E Sh.No. 1 N.o.Sh. 1

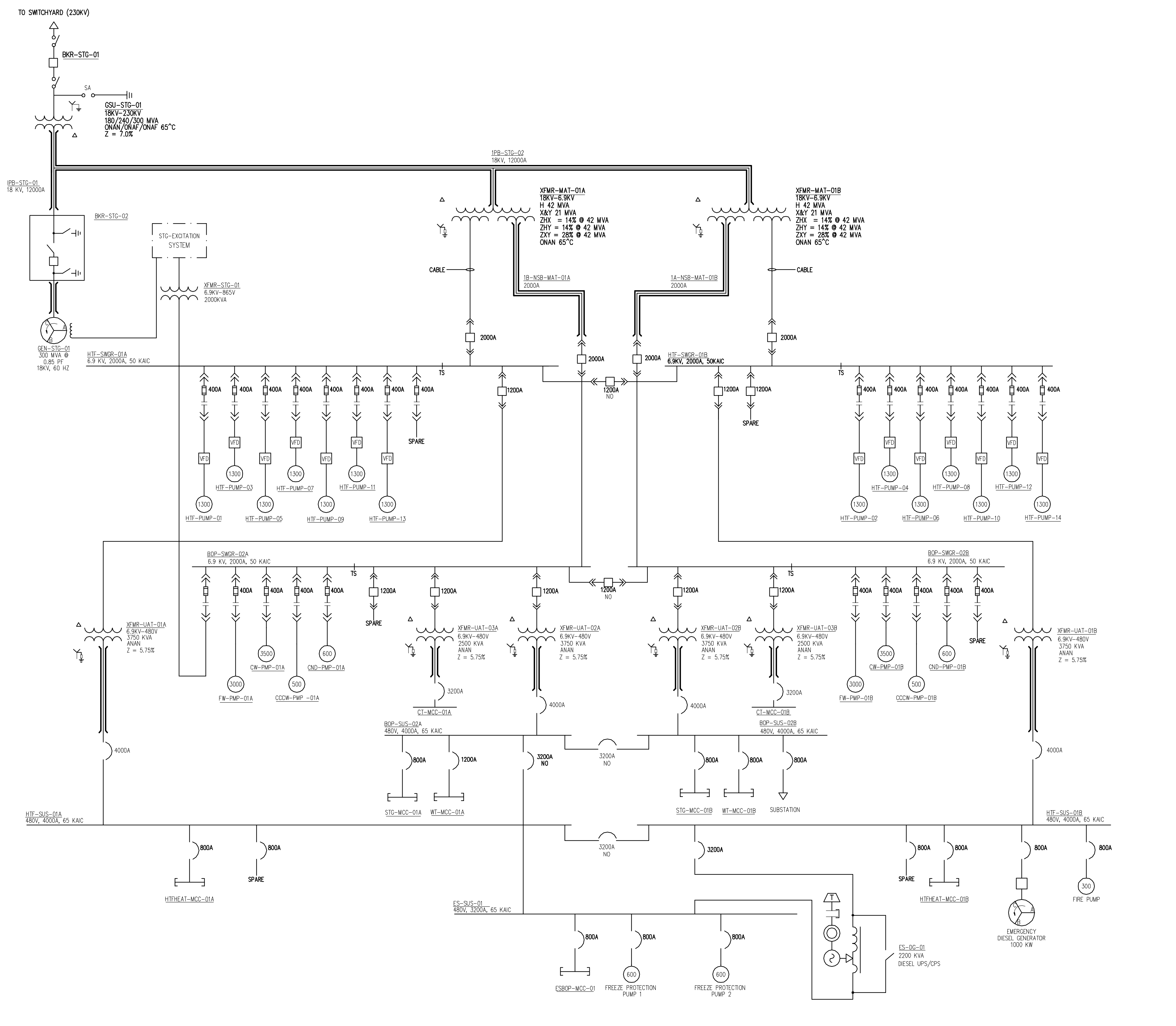
ALSTOM

HEAT BALANCE DIAGRAM
2 - ACC variant
100% Load

Figure 2-7

3600 rpm
cos phi = 0.9

Lohse
TSNSD-T1
2008-12-08/10:06
GMD 6 021306 - Rev.A



NOTES:

1. MAIN AUXILIARY TRANSFORMERS ARE ONLY SIZED FOR ½ THE FULL LOAD.

— PRELIMINARY —
NOT FOR CONSTRUCTION

CONFIDENTIAL

THESE DRAWINGS ARE CONFIDENTIAL IN NATURE. ANY MISUSE OR UNAUTHORIZED DISTRIBUTION OF THE DRAWINGS CONTAINED HEREIN WILL BE A VIOLATION OF THIS CONFIDENTIALITY REQUIREMENT AND SUBJECT THE VIOLATOR TO LIABILITY. REVIEW OF THESE MATERIALS BY RECIPIENT SHALL CONSTITUTE AN ACCEPTANCE OF THESE TERMS AND THE TERMS OF ANY UNDERLYING CONFIDENTIALITY AGREEMENT WE MAY HAVE EXECUTED IN OBTAINING THIS INFORMATION FROM A THIRD PARTY. IF THE RECIPIENT IS NOT IN AGREEMENT WITH THE OBLIGATION OF CONFIDENTIALITY THEN THE DRAWINGS SHALL BE RETURNED TO THE ORIGINATOR.

REV	DESCRIPTION	DWN	CHK	APP	DATE
D	ADDED EMER DIESEL GEN; RELOCATED FREEZE PROT, FIRE PUMP; DELETED ESHTF-MCC-01; REVISED STG TO 12000A, 1A-NSB-MAT-01A, 1B-NSB-MAT-01B TO CABLE				02-26-09
C	ADDED EMERGENCY BUS				01-30-09
B	MODIFIED TO 3-WINDING XFMRS AND OWNER'S COMMENTS				12-10-08
A	PRELIMINARY				10-28-08

KIEWIT-MSM JOINT VENTURE

SOLAR MILLENNIUM

RIDGECREST SOLAR POWER PLANT

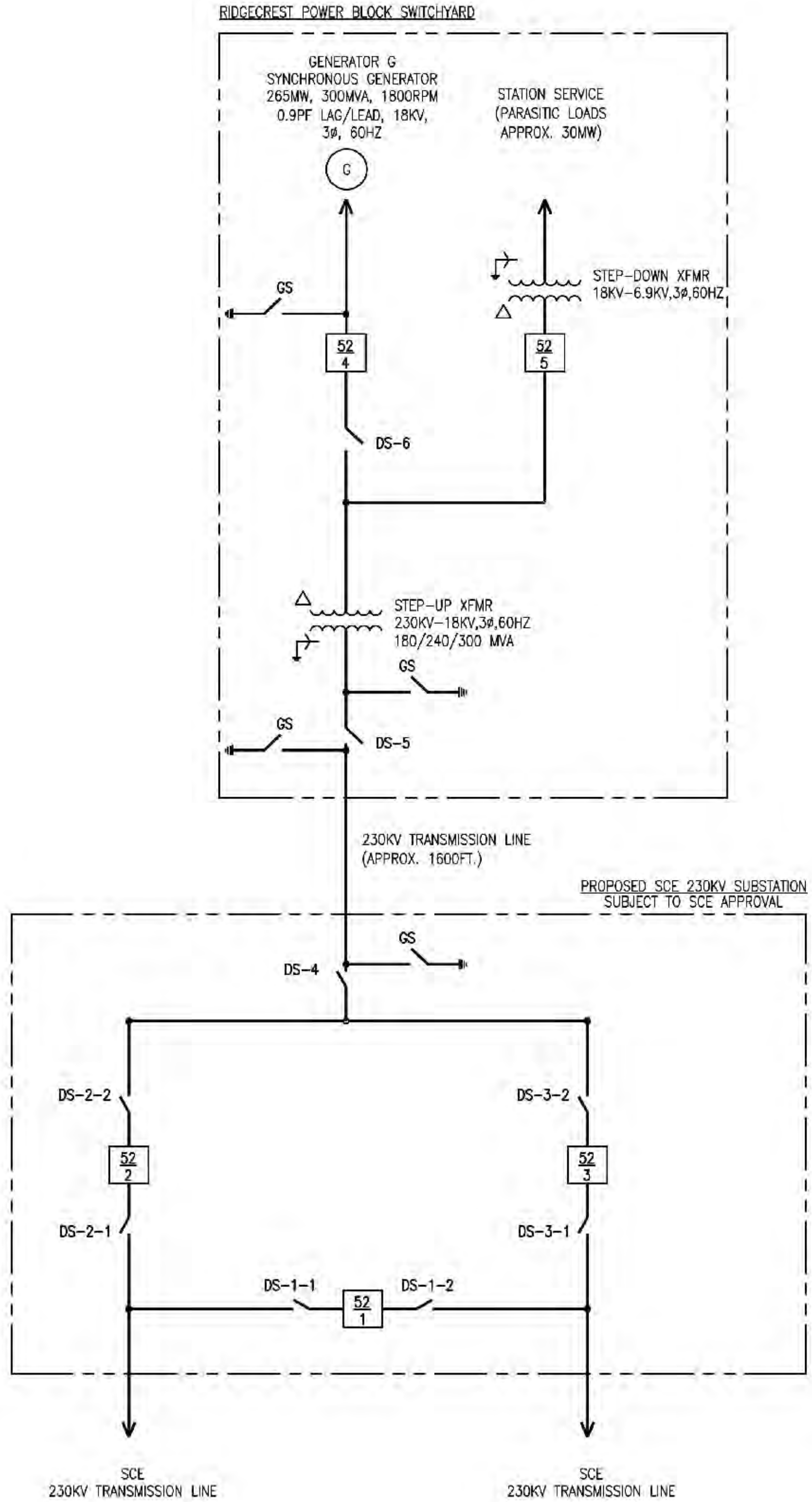
FIGURE 2-8
CONCEPTUAL ONE LINE DIAGRAM
POWER PLANT

ELECTRICAL ONE LINE DIAGRAM

	by	date
DESIGNED		
DRAWN		
CHECKED		
APPROVED		

DRAWING NUMBER

2008-045E-E0-001



ABBREVIATIONS:

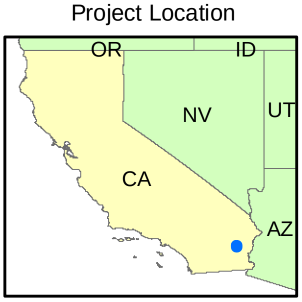
A	AMPERES
APPROX.	APPROXIMATELY
DS	DISCONNECT SWITCH
FT.	FEET
G	GENERATOR
GS	GROUND SWITCH
HZ	HERTZ
IC	INTERRUPTING CURRENT
KV	KILOVOLTS
KVA	KILO VOLTAMPERE
LA	LIGHTNING ARRESTER
MVA	MEGA VOLTAMPERE
MW	MEGA WATTS
NEUT,N	NEUTRAL
PF	POWER FACTOR
RES	RESISTOR
V	VOLTS
XFMR	TRANSFORMER

NOTE: ABBREVIATION MAY OR MAY NOT INCLUDE PERIOD/S, OR LETTER S FOR PLURAL FORM.

SYMBOLS	DESCRIPTION
52 X	CIRCUIT BREAKER X
	POWER TRANSFORMER
G	STEAM TURBINE GENERATOR SYNCHRONOUS GENERATOR 265MW, 300MVA, 1800RPM 0.9PF LAG/LEAD, 18KV, 3ø, 60HZ
	DISCONNECT SWITCH THREE POLE GANG OPERATED
GS	GROUND SWITCH

NOT FOR CONSTRUCTION

Project Location



Ridgecrest Solar Power Project

Figure 2-9
Project Interconnection
One Line Diagram

Solar Millennium

AECOM

Project: 12944-003
Date: September 2009

J:\2009 Projects\12944-Solar Millennium\Figures for Engineering\ridgecrest_fig2-9-interconnection_1line.mxd

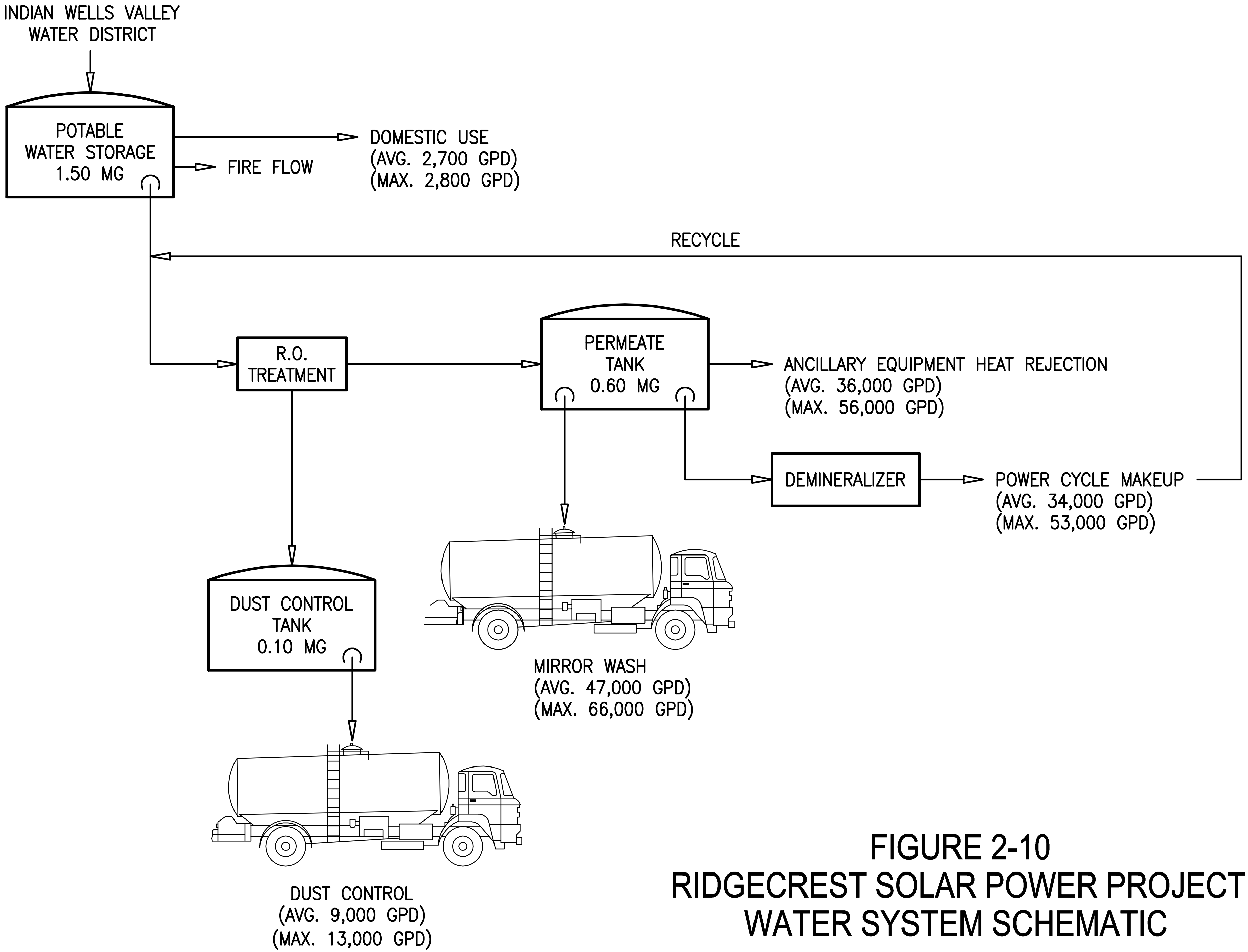


FIGURE 2-10
RIDGECREST SOLAR POWER PROJECT
WATER SYSTEM SCHEMATIC