2.0 Project Description

2.1 Introduction and Overview

Beacon Solar, LLC, a Delaware limited liability company (herein “Beacon Solar” or “Applicant”), is proposing to construct, own and operate the Beacon Solar Energy Project (herein “BSEP” or “Project”). The Project is a concentrated solar electric generating facility proposed on an approximately 2,012-acre site in Kern County, California. The Project will use well-established parabolic trough solar thermal technology to produce electrical power using a steam turbine generator (STG) fed from a solar steam generator (SSG). The SSG receives heated heat transfer fluid (HTF) from solar thermal equipment comprised of arrays of parabolic mirrors that collect energy from the sun.

The Project will have a nominal electrical output of 250 megawatts (MW) and commercial operation is planned to commence by the third quarter of 2011, subject to timing of regulatory approvals and Applicant achievement of project equipment procurement and construction milestones. The solar thermal technology will provide 100 percent of the power generated by the plant; no supplementary energy source (e.g., natural gas to generate electricity at night) is proposed to be used for electric energy production. The Project will utilize two auxiliary boilers fueled by natural gas to reduce startup time and for HTF freeze protection. The auxiliary boilers will supply steam to the HTF freeze protection heat exchangers during nighttime hours to keep the HTF in a liquid state when ambient temperatures are not sufficient to keep the temperature of the HTF above its relatively high freezing point (54 degrees Fahrenheit [°F]). In order to fuel the boilers, a new 17.6-mile, eight-inch gas pipeline will be constructed to connect the Project to an existing Southern California Gas Company (SCG) pipeline in the California City area. The Project will also have a diesel-fueled firewater pump for fire protection.

The Los Angeles Department of Water and Power’s (LADWP) 230 kilovolt (kV) Barren Ridge Switching Station is located across California State Route 14 (SR-14) approximately 1.5 miles southwest of the BSEP plant site. As discussed in detail in Section 2.7 and shown in Figure 2-4, Beacon Solar is seeking approval of the following two similar options for interconnecting the Project to LADWP’s transmission system, only one of which would eventually be built. Beacon Solar needs the flexibility of having both options approved because a decision on which option will be selected cannot be made until the Facilities Study is completed by the participating transmission system owner, a more a detailed design is completed, and the associated transmission line route easements are secured by the Applicant.

> **Option 1** Construction of a new, approximately 3.5-mile 230 kV transmission line (of which approximately 1.6 miles will be within the 2,012-acre plant site boundary), that would run west from the power block across SR-14 and south across private property to the Barren Ridge Switching Station.
>
> **Option 2** Construction of a new, approximately 2.3-mile 230 kV transmission line (of which approximately 1.6 miles will be within the plant site boundary), that would run west across SR-14 to a new switching station to be constructed at the location where the Project’s transmission line

first meets LADWP's existing transmission ROW. A second, 230 kV transmission line slightly over one mile long would then be constructed east of and adjacent to the existing LADWP ROW from the new switching station down to the Barren Ridge Switching Station.

LADWP is currently evaluating the potential need for any downstream, regional transmission system upgrades that would be required as a result of the Project, but as discussed in Section 2.7.2, LADWP is developing a major transmission upgrade project explicitly designed to bring power to their customers from renewable energy projects in the general vicinity of the BSEP site. Accordingly, it is not expected that any physical downstream upgrades will be required solely as a result of interconnecting the proposed Project. The System Impact Study (SIS) currently being prepared by LADWP is expected to confirm this finding.

The Project proposes to use a wet cooling tower for power plant cooling. Water for cooling tower makeup, process water makeup, and other industrial uses such as mirror washing will be supplied from onsite groundwater wells, which also will be used to supply water for employee use (e.g., drinking, showers, sinks, and toilets). A package water treatment system will be used to treat the water to meet potable standards. A sanitary septic system and onsite leach field will be used to dispose of sanitary wastewater.

Project cooling water blowdown will be piped to lined, onsite evaporation ponds. The ponds will be sized to retain all solids generated during the life of the plant. However, if required for maintenance, dewatered residues from the ponds will be sent to an appropriate offsite landfill as non-hazardous waste. No offsite backup cooling water supply is planned at this time; the use of multiple onsite water supply wells and redundancy in the well equipment will provide an inherent backup in the event of outages affecting one of the onsite supply wells.

2.2 Project Objectives

The Project is being developed to supply renewable electric energy (as an alternative to new fossil fuel generation resources) to serve the electrical load requirements in California. Beacon Solar's specific objectives for the proposed project are the following:

- To construct, operate and maintain an efficient, economic, reliable, safe and environmentally sound solar-powered generating facility that will help achieve: (i) the State of California objectives mandated by SB 1078 (California Renewable Portfolio Standard Program) (ii) AB 32 (California Global Warming Solutions Act of 2006) and (iii) other local mandates adopted by the State's municipal electric utilities to meet the requirements for the long term wholesale purchase of renewable electric energy for distribution to their customers.
- To develop a site with an excellent solar resource.
- To develop a previously disturbed site with close proximity to transmission infrastructure in order to minimize environmental impacts.
- To interconnect directly to the LADWP electrical transmission system.
- To develop a new utility-scale solar energy project using proven concentrated solar trough technology.
- To develop a site with available water resources to allow wet cooling in order to optimize power generation efficiency and reduce Project cost.

2.3 Location of Facilities

The Project plant site is located in eastern Kern County along the California SR-14 corridor, approximately four miles north-northwest of California City's northern boundary, approximately 15 miles north of the Town of Mojave, and approximately 24 miles northeast of the City of Tehachapi (Figure 1-1). Koehn Lake (usually dry) is located approximately five miles to the east-northeast and Red Rock Canyon State Park is located approximately four miles to the north. The Honda Proving Center, an automotive test track facility, is located approximately 0.8 mile to the east (Figure 1-2).

The BSEP plant site is located in Township 31 South, Range 37 East, Mount Diablo Base and Meridian; a summary legal description is provided in Table 2-1. The legal description identifies the Assessor's Parcel Numbers (APN) of the 21 parcels within the plant site boundary. The BSEP power block and solar arrays will occupy approximately 1,266 acres of the 2,012-acre site. Additionally, a rerouted drainage channel, evaporation ponds, access road, administration buildings and other support facilities, bioremediation areas, and some open areas will be fenced, for a total "plant site" of approximately 2,012 acres. As shown on Figure 2-1, the plant site would be located east of SR-14 and except for a short portion of the access road, also east of an existing Union Pacific rail line that extends roughly north-south. Access to the site will be from SR-14.

The proposed route of the new 17.6-mile natural gas pipeline between the plant site and the existing SCG line west of California City area is shown on Figure 2-1, as are the two transmission line route options identified above. Ownership information for the properties surrounding the plant site and linear facilities is provided in AFC Appendix A.

Table 2-1 Summary Legal Description

APN 469-050-01, -02, -05, -06, -09, -17, -18 and 469-060-01, -02, -12, -13, -16, -17	APN 469-021-02
APN 469-022-09	APN 469-082-14
APN 469-140-11	APN 469-082-26
APN 469-022-02, -03, -06	APN 469-022-01
APN 469-022-09	APN 469-021-05
APN 469-021-10	APN 469-021-01

2.4 Site Description

2.4.1 Existing Site Conditions

The approximately 2,012-acre plant site is largely vacant and significantly disturbed from past agricultural activities that occurred up to the early 1980's. There are several abandoned structures in a small area east of SR-14 near the site access point from the highway; these structures are located outside of the plant site boundary and are expected to be removed by the Applicant in the near future. Demolition and disposal of the structures and associated materials will be performed in accordance with existing regulations.

Photographs of the site in its current condition are presented in Figure 2-2. The site is relatively flat, with elevations ranging from approximately 2,220 feet above mean sea level (amsl) in the southwest to 2,025 feet amsl in the northeast. Pine Tree Creek, a dry desert wash, trends south-southwest to north-northeast through the center of the site. There is also a fault zone crossing the site from southwest to northwest resulting in up to a ten-foot step change in elevation across the fault zone. The fault zone is described in more detail in Section 2.4.2 below and in Section 5.5, Geologic Hazards and Resources.

2.4.2 Site Surveys and Engineering Design Criteria

Detailed land and topographic surveys were performed to establish local benchmarks and site boundaries and to understand grading and drainage-related requirements and issues. A preliminary geotechnical study of the Project plant site was performed to evaluate general subsurface conditions, seismicity and other geologic hazards and to provide recommendations for design and construction of the foundations for Project structures. A copy of the study report is included as AFC Appendix B.2. Overall, the study found the site geotechnically feasible for construction of the proposed solar plant.

There is a mapped, State-designated Alquist-Priolo Earthquake Fault Zone (AP zone) that crosses through the site and a second AP zone a short distance west of the site, with a finger extending onto the northwestern portions of the site (see Section 5.5, Geologic Hazards and Resources). The fault mapped as crossing the site is the Cantil Valley fault (also known as the Garlock West fault because it is part of the Garlock fault system), and the fault mapped as extending into the northwestern site area is the Garlock East fault. Sensitive Project facilities (power block, administrative/warehouse facilities, and evaporation ponds) are located outside the mapped AP zone areas to minimize any seismic related risks. A portion of the solar field and associated piping will be located within the AP zone. 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 AFC Appendix C.

2.5 Generating Facility Description

The following sections describe the Project plant site arrangement and the processes, systems, and equipment that constitute the power plant. 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 from an oblique angle that shows a current view of the plant site and surrounding area; Figure 2-3b is the same photograph with the simulated plant facilities added. Note that the generating facilities described in this section, along with the associated construction/operating footprint, all occur within the approximately 2,012-acre plant site boundary depicted in Figure 2-1. Project-related linear facilities (natural gas pipeline and transmission line) outside the plant site boundary are described in Sections 2.6 and 2.7, respectively.

2.5.1 Site Arrangement

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

- Overall plant area and facilities footprint,
- Power block,

- Control room and local warehouse location,
- Administration building,
- Solar collector field arrangement,
- Evaporation ponds,
- Bioremediation/landfarm areas,
- Onsite transmission facilities,
- Onsite gas pipeline facilities,
- Dry wash realignment,
- Existing groundwater wells used for water supply, and
- Access road from SR-14.

Figure 2-5 is a plot plan of the Project's power block. As shown on Figure 2-5, major components of the Project include:

- Solar steam generator (SSG) heat exchangers,
- One steam turbine-generator (STG) and condenser,
- One wet cooling tower,
- Two natural gas-fired auxiliary boilers,
- Steam-fed HTF freeze protection heat exchangers,
- HTF surge volume tanks,
- Firewater pump and pump house with associated diesel fuel tank,
- One raw water storage tank,
- One treated water storage tank,
- Demineralized water storage tank, and
- Ancillary equipment.

Elevation drawings of plant facilities are provided in Figure 2-6, which includes views looking east (Section A-A) and looking north (Section B-B).

2.5.2 Process Description

This section describes the power generation process and thermodynamic cycle employed by the Project. The power plant consists of:

- One STG,
- Multiple SSG heat exchangers,
- One water-cooled condenser,

- Two feedwater pumps,
- One deaerator,
- Multiple feedwater heaters,
- One wet cooling tower,
- Two natural gas-fired auxiliary boilers, and
- Approximately 1,244-acre solar thermal collection field.

The plant's power cycle is the Rankine-with-reheat thermodynamic cycle. A preliminary heat balance diagram for the process is included in Figure 2-7. The thermal input is via heated HTF from the parabolic trough solar field at a temperature of approximately 740 °F.

Overall annual availability of the Project facilities is expected to be in the range of 96 percent excluding non-daylight hours. The plant's capacity factor will depend on the local solar insolation, and is estimated to be approximately 26.5 percent (approximately 600,000 megawatt hours (MWH) per year). Estimates for monthly production were performed using Solar Advisor Model software developed and maintained by the National Renewable Energy Laboratory.

The Project will use the Rankine thermodynamic cycle with reheat described as follows:

- Process 1: The working fluid (water) is pumped from low to high pressure; as the fluid is a liquid at this stage, the pump requires minimal input energy. During this process, steam extracted from the STG is used to preheat the water prior to entering the SSG system, which increases overall cycle efficiency.
- Process 2: The high pressure liquid enters the SSG system where it is heated theoretically at constant pressure by the HTF to become superheated steam.
- Process 3: The superheated steam expands through the high pressure section of the steam turbine turning the generator to produce electricity. This steam is then reheated in different vessels that are part of the SSG system and sent to the reheat section of the steam turbine. The reheat exhausts into the low pressure (LP) section of the steam turbine. All sections of the STG decrease the temperature and pressure of the steam with the LP section extracting the last available power from the steam.
- Process 4: The wet steam from the LP section then enters the condenser where it is cooled at a constant low pressure to become a saturated liquid. The condensed liquid returns to Process 1.

The solar field provides the heat input in Process 2. As the HTF is circulated from the SSG to the solar field, light from the sun reflects off the solar collector's parabolic troughs and is concentrated on the heat collection elements (HCEs). HTF flowing in HCEs at the focal point of the parabolic troughs absorbs the solar energy and provides a high temperature energy source for the Rankine cycle. The HTF planned for use is Therminol™ VP-1, an oil widely used in solar thermal and other high-temperature heat transfer applications.

Low quality waste heat is rejected in Process 4. As the turbine exhaust is condensed, the heat is transferred to the cool circulating water. The warm circulating water carries the heat to the wet, mechanical draft cooling tower where the heat is rejected via evaporation and convection and cooled water returns to the condenser.

Two nominal 24,000 pound per hour steam auxiliary boilers will also be included in order to provide steam as needed for the steam turbine seal steam system while the STG is offline overnight and during start-up. Sealing steam is used to prevent air from entering the steam turbine while the condenser is under vacuum. The startup time for the plant will be reduced compared to using solar-generated steam as a source of sealing steam. Unlike a gas-fired 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 will be delayed (and thus reduce total daily electrical generation) while seal steam is generated by heat produced from solar energy alone and vacuum is established in the condenser. It is estimated that using an auxiliary boiler for seal steam will reduce the daily start-up time by 30 to 60 minutes. Conservatively assuming that the STG is on-line 30 minutes sooner each day, at a minimum of 25 MW, 350 days per year yields an additional 4,500 Megawatt-hours (MWh) of renewable electrical generation each year. Once the plant commences generation of electricity for delivery to the electrical grid, the use of the natural gas-fired auxiliary boilers ceases and they are held in stand-by mode until auxiliary heat is again required for start-up or HTF freeze protection.

Feedwater for each of the auxiliary boilers will come from the main steam condenser via a dedicated boiler feed pump. Each boiler will require approximately 30 million British thermal units per hour (MMBtu/hr) of natural gas at full load. Additionally, the auxiliary boilers will provide freeze protection heat for the HTF by feeding steam to the HTF freeze protection heat exchangers, as discussed in Sections 2.5.3.1 and 2.5.5.8.

2.5.3 Energy Conversion Facilities Description

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

2.5.3.1 Solar Thermal Field

The following subsections describe the Project's solar thermal component.

Description of Technology

The collector field is made up of a large field of single-axis-tracking parabolic trough solar collectors. The solar field is modular in nature and comprises many parallel rows of solar collectors, aligned on a north-south axis (see Figures 2-9 and 2-10). Each solar collector has a linear parabolic-shaped reflector that focuses the sun's direct normal radiation on a linear receiver known as a heat collection element (HCE) located at the focus of the parabola.

The collectors track the sun from east to west during the diurnal cycle to ensure that the sun is continuously focused on the linear receiver. A more specific description of the HCE is provided below under "Solar Field Components." The HTF is heated up to approximately 740 °F as it circulates through the HCEs and returns to a series of heat exchangers where the fluid is used to generate high-pressure steam in the SSG at the power block, which provides steam to the Project's STG.

Parabolic trough solar technology is the most proven large-scale solar power technology available today, primarily because of the nine commercial-scale SEGS facilities that are operating in the Mojave Desert at Harper Lake, Kramer Junction, and Daggett. More than 2,000,000 square meters of parabolic trough collector technology have been operating daily for nearly 20 years, and in the aggregate have accumulated

nearly 200 “plant years” of operational experience. The parent company of Beacon Solar, LLC (FPL Energy, LLC or FPLE) is involved in the ownership and operation of most of the SEGS facilities and the addition of BSEP will reinforce FPLE’s commitment to supplying renewable energy to utility customers in California.

Significant advancements in collector and plant design have been made possible by the efforts of the SEGS operators, the parabolic trough industry, and solar research laboratories around the world. These improvements include advancements in mirror durability in high winds, receiver efficiency, structural design, cost reduction and system control.

Major Solar Equipment

The major pieces of equipment for the solar portion of the Project, each of which is discussed below, are as follows (see Figures 2-4 and 2-5):

- Heat collection element (HCE),
- Solar collector assembly (SCA),
- HTF,
- Mirrors,
- Connectors,
- SSG heat exchangers,
- HTF freeze protection heat exchangers,
- HTF surge tanks,
- HTF ullage system, and
- HTF piping headers.

The solar field will encompass approximately 1,244 acres and will utilize solar trough technology similar to the nine existing SEGS units, but with design improvements to improve performance. The solar trough design utilized at the SEGS plants has demonstrated excellent field reliability; the solar trough field at the Kramer Junction SEGS facilities has shown an average availability of approximately 99 percent in recent years. For this reason, similar reliability is expected for BSEP.

Heat collection elements. The HCE is the “heart” of the solar plant and is one of the primary reasons for the high efficiency of the parabolic trough collector design. The HCE consists of a steel tube with a selective surface, surrounded by an evacuated glass tube insulator. The coating gives it excellent selective heat transfer properties with a high absorptivity for direct beam solar radiation, and a low design emissivity. The HCE incorporates glass-to-metal seals and metal bellows to achieve the vacuum-tight enclosure. The vacuum enclosure serves primarily to protect the selective surface and to reduce heat losses by insulating it.

The outer glass cylinder has anti-reflective coating on the inner and outer surfaces to reduce reflective losses off the glass tube (increasing the transmissivity). Typically, getters (metallic substances that are designed to absorb gas molecules) are installed in the vacuum space to absorb hydrogen and other gases that permeate into the vacuum annulus over time to maintain its insulating properties.

Solar Collector Assemblies. The SCA rotate around the north/south axis to track the sun as it moves through the sky during the day. The axis of rotation is located at the collector center of mass to minimize the required tracking power. The drive system uses hydraulic rams or electric motors to position the collector. A closed-loop tracking system relies on a sun sensor or position feedback sensor for the precise alignment required to focus the sun on the HCE during operation. The tracking is controlled by a local controller on each SCA. The local controller also monitors the HTF temperature and reports operational status, alarms, and diagnostics to the main solar field control computer in the control room. It is expected the SCA will be designed for normal operation in winds up to 35 miles per hour (mph) and safe operation in winds up to 50 mph. The SCAs are designed to survive winds up to 90 mph when in their stowed position (the collector aimed approximately 10 degrees below eastern horizon).

***Heat Transfer Fluid*.** It is expected that Therminol™ (VP-1), manufactured by Monsanto, will be used as the HTF. Therminol is a special high-temperature oil that has an excellent operating history and is used in many heat transfer processes. The Material Safety Data Sheet (MSDS) for Therminol™ is provided in AFC Appendix E. Therminol™ VP-1 is an aromatic hydrocarbon, biphenyl-diphenyl oxide. The oil is regulated as a hazardous material by the State of California.

Mirrors. The current low-iron glass mirrors are one of the most reliable components in the solar collectors. There has been no long-term degradation in the reflective quality of the low-iron glass mirrors; ten year-old mirrors can be cleaned and brought back to like-new reflectivity. Long term endurance of the mirror, as measured by the experience at SEGS, indicates that mirror life of 30 years or more can be expected for the Project.

Development of an efficient and cost-effective program for monitoring mirror reflectivity and washing mirrors is critical. Differing seasonal soiling rates (higher in the summer) require flexible procedures. Operations and Maintenance (O&M) procedures at the SEGS plants are well established and are available for use on this Project. All methods use demineralized water for best effectiveness. The periodic monitoring of mirror reflectivity provides a valuable quality control tool for mirror washing and helps to optimize wash labor. As a general rule, the reflectivity of glass mirrors can be maintained near design levels with a good washing program.

Connectors. It is expected that a hard-piped assembly with ball joints will be used to connect the SCAs to the headers and SCAs to each other, similar to those being used at the SEGS plants at Harper Lake. The ball joint assembly has a number of advantages over previous designs using flexhoses, including lower cost, lower head loss, and reduced heat losses.

Solar Steam Generator System. The SSG system will be typical of the design used reliably in the SEGS units for over 20 years. SSGs are designed differently than conventional gas-fired boilers in that they are “fired” with hot oil instead of hot gasses. This design is similar to any “kettle boiler” shell and tube heat exchanger in that the hot HTF is circulated through tubes and the steam is produced on the shell side. The SSG system includes heat exchangers for preheating the condensate, superheating the steam, and reheating steam in addition to the boiler vessels.

HTF Freeze Protection Heat Exchanger. To eliminate the problem of HTF freezing, steam-fed shell and tube heat exchangers will be used to keep the HTF above 75 °F whenever the facility is offline. As discussed above, the auxiliary boilers will supply the heat for this process as well as performing the function of a startup boiler. This dual-use configuration reduces the number of individual emission sources.

HTF Surge Tank. To accommodate the volumetric change that occurs when heating the HTF to the operating temperature, surge tanks are required. Nitrogen will be used to provide a blanket on the headspace of the tank. The nitrogen purge prevents oxidation or contamination of the HTF by reducing its exposure to atmospheric air.

HTF Ullage System. 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.

HTF Piping Header. To transport the HTF throughout the site, supply and return piping is routed to allow for balanced flow through all the HCEs. Expansion loops will be located through the plant as required to maintain the composite pipe stress within ASME B31.1 Power Piping code allowable limits. The composite pipe stress includes seismic and thermal stresses. It is anticipated that the solar field will be divided into eight to ten sections with automatic or semiautomatic isolation valves. The isolation valves will either be triggered automatically, e.g., by ground acceleration in the event of an earthquake, or by the operator inside the control room. The sectional isolation valves will be located to control the maximum volume of HTF leakage during a pipe failure. The piping in the solar array will be designed and constructed to allow movement due to thermal expansion – the steel piping in the mirrored trough sections of the array will be connected to the HTF distribution headers with ball joints and the piping will not be rigidly mounted to foundations or other structures, structurally decoupling the system from seismic ground shaking in the event of an earthquake.

2.5.3.2 Steam Turbine-Generator (STG)

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. The Project's STG is expected to be a two casing reheat type with seven to eight feedwater heater extraction points and down flow LP exhaust. The STG is equipped with accessories required to provide efficient, safe, and reliable operation, including the following:

- Governor system,
- Steam admission system,
- Gland seal system,
- Lubrication oil system including oil coolers and filters,
- Generator coolers, and
- Metal enclosures designed for outdoor service for STG auxiliary systems.

2.5.4 Electrical System Description

This section describes the BSEP's major electrical systems and equipment. All of the net power produced by the facility is currently expected to be delivered to the LADWP transmission grid through the Project's interconnection with the existing Barren Ridge Switching Station located approximately 1.5 miles southwest of the southwest corner of the 2,012-acre plant site (see Section 2.7). Roughly 11 percent of

the Project's output will be used on site for plant auxiliaries such as pumps, control systems, and general facility loads including lighting and heating, ventilation, and air conditioning (HVAC). Some of the power needed for on-site uses will be converted from alternating current (AC) to direct current (DC) for power plant control systems and emergency backup systems such as lube oil pumps and STG turning gear. The descriptions of the major electrical systems and equipment provided in the following subsections reflect AC power unless otherwise noted. An overall one-line diagram of the major electrical systems is presented in Figure 2-10.

2.5.4.1 Major Electrical Equipment and Systems

Power will be generated by the STG at 18 kV (depending on the final generator selection) and stepped up by a fan-cooled generator step-up transformer to 230 kV for transmission to the grid. Auxiliary power will be back-fed through the 115 kV to 4.16 kV step-down transformer. Once the STG is running, it will supply the plant auxiliary power through a generator voltage tap and the unit auxiliary transformers (UAT). The plant stand-by electrical power requirements and the majority of the "house" power will be back-fed through the generator step-up transformer (GSU) and UAT from the interconnected participating transmission system owner electrical system. Emergency and some house power will be provided from an existing Southern California Edison Company (SCE) distribution line that crosses the Project site. Additional detail regarding this distribution line is included in Section 2.7.3.

2.5.4.2 Grounding

The electrical system is susceptible to ground faults and lightning and switching surges that can pose hazards to site personnel and electrical equipment. The station grounding system provides an adequate path to ground to permit the dissipation of current created by these events. The station-grounding grid will be designed for adequate capacity to dissipate heat from ground current under the most severe conditions in areas of high ground fault current concentration.

Bare conductors will be installed below-grade in a grid pattern throughout the power block area. Each junction of the grid will be bonded together by an exothermic weld or compression connection. Ground resistivity readings will be used to determine the necessary numbers of ground rods and grid spacing to ensure safe step and touch potentials under severe fault conditions. Grounding stingers will be brought from the ground grid to connect to building steel and non-energized metallic parts of electrical equipment.

2.5.4.3 Electrical Generation

The BSEP's STG will tie into a 230 kV onsite switchyard. The STG generates electricity at 18 kV that will connect to the switchyard at 230 kV via a generator circuit breaker and a GSU. The generator circuit breaker will be rated 12000 Amperes (A) at 25 kV and will include 12000/5 A current transformers and 18/0.12 kV voltage transformers for generator and bus duct protection. A disconnect switch will be included with the generator circuit breaker for generator disconnect and transformer maintenance. 25 kV, 12000-A isolated phase bus duct will connect the generator to the generator circuit breaker and the generator circuit breaker to the GSU. The GSU will be 200 megavolt-amps (MVA), 18/230 kV, two-winding, delta-wye grounded, and fan-cooled (using oil-immersed natural circulation, multi-stage, forced air cooling). The neutral point of high-voltage winding will be solidly grounded. The main step-up transformer will have metal oxide surge arrestors connected to the high-voltage terminals and will have manual de-energized ("no-load") tap changers located in high-voltage windings to allow for a nominal secondary voltage plus or minus five

percent with a 2.5 percent differential to allow for generator output voltage variations. The step-up transformer will rest on a concrete pad with a perimeter berm designed to contain the transformer non-PCB insulating oil in the event of a leak or spill and has a deluge-type fire protection system.

The plant site switchyard will be located near the GSU and will require an overhead 795 thousand circular mils (kcmil) size, steel-reinforced, aluminum conductor line for the connection to the GSU. The switchyard will consist of a 230 kV switchyard circuit breaker for the protection of the line to the grid, with 230 kV, 12000-A disconnect switches on each side of the breaker for breaker maintenance. The switchyard breaker will be of the dead tank design with 1200/5 multi-ratio current transformers on each bushing and 230/0.12 kV voltage transformers contained within the breaker control cabinet for protection of the line during normal operation or the GSU and the UATs during back-feed. The instrument transformers will also be used for generator synchronizing.

A disconnect switch will be located at the gen-tie line termination within the switchyard for line isolation. The switchyard will be equipped with sensitive 1200/5 current transformers and 230/0.12 kV capacitor controlled voltage transformers located on the 230 kV switchyard bus for net revenue metering. Lightning arresters will be provided in the area of the takeoff towers to protect against surges due to lightening strikes. Tubular aluminum alloy bus will be used in the switchyard. Cable connections between the tube bus and equipment will be aluminum or aluminum alloy type cable. Tube, cables, and support structures will meet electrical and mechanical design requirements.

Electrical faults will be detected, isolated, and cleared in a safe and coordinated manner as soon as practical to ensure the safety of equipment, personnel, and the public. Protective relaying will meet Institute of Electrical and Electronic Engineers (IEEE) requirements and will be coordinated with LADWP.

2.5.4.4 Electrical System for Plant Auxiliaries

Power for plant auxiliaries are supplied at 4.16 kV from two three-winding UATs for redundancy. The 18 kV bus duct of the STG is provided with a tap connection to the 18/4.16 kV oil-filled, step-down UAT's with high side base ratings of 30 MVA. Each winding of the 4.16 kV side of each transformer is connected to two separate main-tie-main 4.16 kV switchgear/ motor control centers (MCC) line-ups. The STG is provided with an 18 kV generator breaker located between the generator and the auxiliary bus tap. This configuration allows power for plant auxiliaries to be supplied from the plant switchyard through the GSU regardless of whether the STG is online or offline. The auxiliary transformers rest on concrete pads designed to contain the transformer oil in the event of a leak or spill.

The 4.16 kV switchgear/MCC distributes power to the plant's 4 kV motors and to various 4.16/0.48 kV unit substation transformers. The low voltage side of each of the unit substation transformers is connected to 480 Volt (V) switchgear. The 480 V switchgear distributes power to the plant's large 480 V loads and to the various 480 V MCCs supplying power to the small plant loads. The MCCs distribute power to the plant's intermediate 480 V loads and to power panels serving small 480 V loads.

2.5.4.5 DC Power Supply System

The plant's DC power supply system consists of a bank of 125-VDC batteries, a 125-VDC battery charger, metering, ground detectors, and distribution panels. Under normal operating conditions, the battery charger supplies DC power to the DC loads. The battery charger receives 480 V, three-phase AC power from the

electrical distribution system serving plant auxiliaries. The battery charger continuously charges the battery bank while supplying DC power to the DC loads. Under abnormal or emergency conditions when AC power is not available, the battery bank supplies DC power directly to the DC loads. The battery bank is sized to power the DC loads and essential service AC loads through an inverter for a sufficient amount of time to provide for safe and damage-free shut down of the power plant. Recharging the battery bank occurs whenever AC power becomes available.

The DC power supply system provides power for critical control circuits, power for control of the 18 kV, 4.16 kV and 480 V switchgear, and power for DC emergency backup systems. Emergency backup systems include DC lighting and DC lube oil and seal oil pumps for the STG.

2.5.4.6 Essential Service AC System

An essential service AC system (120 V, single-phase) provides power to essential instrumentation, critical equipment loads, safety systems, and equipment protection systems that require uninterruptible AC power. The essential service AC system and the DC power supply system are both designed to ensure that critical safety and equipment protection control circuits are always energized and able to function in the event of unit trip or loss of AC power.

The essential service AC system consists of an inverter, a solid-state transfer switch, a manual bypass switch, an alternate AC source transformer and voltage regulator, and AC panel boards. The DC power supply system is the normal source of power to the essential service AC system. Power flows from the DC power supply system through the inverter to the AC essential service panel boards. The solid-state transfer switch continuously monitors both the inverter output and the alternate AC source. Upon loss of the inverter output and without interruption of power, the transfer switch automatically transfers essential service AC loads from the inverter output to the alternate AC source. The manual bypass switch enables isolation of the inverter and transfer switch for testing and maintenance without interruption of power to the essential service AC loads.

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

As shown in Figure 2-1 and discussed in Section 2.6, the auxiliary boilers will be fueled by natural gas supplied from a new 17.6-mile, eight-inch pipeline connected to an existing SCG pipeline west of California City. Natural gas delivered to the Project site will flow through a revenue quality flow meter, pressure regulation station, and filtering equipment and will provide gas to the auxiliary boilers. Safety pressure relief valves are provided downstream of the pressure regulation valves. The estimated natural gas usage is 60 million British thermal units per hour (MMBtu/hr) for a maximum of 36,000 MMBtu/year. Table 2-2 shows the typical composition of the natural gas used to fuel the Project's auxiliary boilers.

Table 2-2 Typical Natural Gas Composition

Component	Molar Percent (%)	Component	Molar Percent (%)
Methane, CH_4	96.11	Butane, C_4H_{10}	0.10
Ethane, C_2H_6	1.80	Pentane, C_5H_{12}	0.00
Propane, C_3H_8	0.30	Hexane, C_6H_{12}	0.03
Carbon Dioxide, CO_2	1.24	Nitrogen, N_2	0.04
Total	**100.00**		
Sulfur (grains per 100 dry standard cubic feet (dscf))			0.20
Higher Heating Value (Btu/scf)			1,020

2.5.5.2 Water Supply and Use

The Project's various water uses include makeup for the circulating water system, makeup for the SSG, water for solar collector mirror washing, service water, potable water and fire protection water. Water balance diagrams corresponding to typical summer (107 °F dry bulb/67 °F wet bulb) and typical annual (80 °F dry bulb/57 °F wet bulb) operation of the power plant are presented in Figures 2-12 and 2-13 respectively.

Water Requirements

The estimated water requirements for the power plant are presented in Table 2-3. The average total annual water usage is estimated to be about 1,600 acre-feet per year, which corresponds to an average daily flow rate of about 990 gallons per minute (gpm). Usage rates will vary during the year and will be higher in the summer months when the peak maximum flow rate could be as high as about 4,054 gpm. Equipment sizing will be consistent with peak daily rates to ensure adequate design margin. Detail of the water uses is contained in Figures 2-12 and 2-13 including process water, cooling water, mirror washing, etc.

Water Source and Quality

Process and cooling water needs of the Project will be met by use of groundwater pumped from wells on the plant site. Water for domestic uses by Project employees will also be provided by onsite groundwater treated to potable water standards by a package treatment unit. As discussed in Section 5.17, Water Resources, there are 12 existing water supply wells that were previously used to support alfalfa farming on the Project site. Four of these wells (Nos. 41, 42, 49, and 63) will be used to support Project operational water requirements and are shown on Figure 2-4. Pumping test data has shown water supply wells on the plant site have the capacity to meet BSEP water demand requirements. Wells Nos. 49 and 63 will be used as the primary water supply wells, with Wells Nos. 41 and 42 in reserve. These wells were selected because of their location outside the solar array and their specific capacity. New water supply wells may need to be installed if the existing water supply wells do not meet performance requirements or are damaged or destroyed during construction.

Table 2-3 Water Use

Water Use	Annualized Average Rate [1] (gpm)	Peak Rate [2] (gpm)	Estimated Annual Use (Acre-Feet)
Plant Operation	990	4,054	1,599
Potable water	5	5	8

[1] The estimated groundwater usage in gallons per minute is based on an average daily consumption

[2] The "peak" rate is the instantaneous maximum for summer usage

The remaining wells will be used to monitor water levels during pumping and to evaluate groundwater quality. Those wells located within the solar array footprint will have their pump motors and bowls removed and cut down to near-surface grade elevations. Those in the solar array that are located within an area required for a solar array footing will be destroyed in a manner consistent with State of California requirements. No offsite backup cooling water source of supply is included as part of the Project; however, a potential source of supplemental make-up water supply is discussed in Section 4.4 in the AFC Alternatives section. The use of four existing onsite water supply wells in the central and southwestern portion of the BSEP plant site on a rotating basis will adequately serve the Project. These wells will provide redundancy, and an inherent backup in the event of outages or maintenance.

Onsite raw water and treated water storage tanks with capacities of 2,840,000 and 2,350,000 gallons, respectively, will provide enough storage capacity for an 18-hour interruption of water supply to the facility. A portion (360,000 gallons) of the raw water will be dedicated to the plant's fire protection water system. The quality of ground water that will be supplied by the wells is shown in Table 2-4.

2.5.5.3 Water Treatment

The peak load (summer) water balance diagram presented in Figure 2-12 shows the power plant's various water uses and water treatment processes. The raw water, circulating water, process water, and mirror washing water all require onsite treatment and this treatment varies according to the quality required for each of these uses.

<u>Groundwater</u>

The groundwater will be treated with a biocide (sodium hypochlorite) prior to storage in the 2,840,000-gallon onsite raw water storage tank, which will also contain a minimum of 360,000 gallons of water for fire protection capabilities. The water will be used as make-up water in the cooling towers and other site water requirements.

Table 2-4 Typical Water Quality Data in the Project Area

Analyte	Concentration[1]
Bicarbonates (HCO_3)	200-360 milligrams per liter (mg/L)
Boron (B)	0.14-0.24 mg/L
Calcium (Ca)	45-50 mg/L
Carbonates (CO_3)	0 mg/L
Chloride (Cl)	14-18 mg/L
Magnesium (Mg)	0.015-0.057 mg/L
Nitrogen (N)	1.05-1.5 mg/L
Nitrate (NO_3^-)	1.0-1.5 mg/L
Sodium (Na)	74-84 mg/L
Sulfate (SO_4^+)	110-124 mg/L
Total Hardness ($CaCO_3$)	160-170 mg/L
Total Dissolved Solids (TDS)	470-550 mg/L
pH	~8.0
[1] Concentrations based on 2007 laboratory analyses from existing onsite wells.	

Circulating Water Treatment

In order to reduce overall water consumption and sizing of evaporation ponds, raw water will be processed via ion exchange and stored in a 2,300,000-gallon treated water storage tank prior to feeding to the circulating water system. Water conditioning chemicals may be fed into the makeup water to minimize corrosion and to inhibit mineral scale formation and biofouling. Sulfuric acid is fed into the circulating water system for alkalinity reduction in order to control the mineral scaling tendency of the circulating water. The sulfuric acid is fed in an amount proportional to the circulating water makeup flow. The sulfuric acid feed equipment includes a bulk storage tank and two full-capacity metering pumps.

Makeup water will be treated via ion exchange to reduce scale forming species from entering the cooling water system. Chemical regeneration of resin in the demineralizers will likely take place on site, and accordingly the chemicals to perform that regeneration are described in the discussion of hazardous materials.

To further inhibit mineral scale formation, an organic phosphate inhibitor solution may be fed into the circulating water system in an amount proportional to the circulating water blowdown flow. The inhibitor solution feed equipment includes a bulk storage tank and two full-capacity metering pumps. To inhibit biofouling, sodium hypochlorite is shock-fed into the circulating water system as a biocide. The sodium hypochlorite feed equipment includes a bulk storage tank and two full capacity metering pumps.

Steam Cycle Process Water

Makeup water for the steam cycle must meet stringent specifications for suspended and dissolved solids. To meet these specifications, water is processed through a demineralized water makeup system. This system is anticipated to consist of multiple unit operations, concluding with mixed-bed demineralizers. Water produced by this system will also be used for the mirror washing described below.

Additional conditioning of the condensate and feedwater circulating in the steam cycle is provided by means of a chemical feed system. To minimize corrosion, an oxygen scavenger for dissolved oxygen control and an alkaline solution for pH control are fed into the condensate. To minimize scale formation in the SSG, a solution of disodium phosphate (DSP) and trisodium phosphate (TSP) may be fed into each feedwater system. The chemical feed systems include an oxygen scavenger feed tank, an alkaline solution (amine) feed tank, and a phosphate solution feed tank. The feed tanks are provided with two full-capacity metering pumps.

A steam cycle sampling and analysis system monitors the water quality at various points in the plant's steam cycle. The water quality data is used to guide adjustments in water treatment processes and to determine the need for other corrective operational or maintenance measures. Steam and water samples are routed to a sample panel where steam samples are condensed and the pressure and temperature of all samples are reduced as necessary. The samples are then directed to automatic analyzers for continuous monitoring of conductivity and pH. All monitored values are indicated at the sample panel and critical values are transmitted to the plant control room. Grab samples are periodically obtained at the sample panel for chemical analyses that provide information on a range of water quality parameters.

Solar Mirror Washing Water

To facilitate dust and contaminant removal, deionized (demineralized) water is used to spray clean the solar mirrors on a periodic basis, determined by the reflectivity monitoring program. This operation is generally done at night and involves a water truck spraying deionized water on the mirrors in a drive-by fashion. The deionized water production facilities, already in place for SSG makeup water, will be sized to accommodate the additional solar mirror washing demand of about two acre-feet per year and is shown on the water balance diagrams. Rinsate from the washing operation is expected to evaporate on the mirror surface with no appreciable runoff.

2.5.5.4 Cooling Systems

The power plant includes two cooling systems; 1) the steam cycle heat rejection system (e.g., cooling tower) and, 2) the closed cooling water system (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 surface condenser, circulating water system, and a wet cooling tower. The surface condenser receives exhaust steam from the LP section of the STG and condenses it to liquid for return to the SSG. The surface condenser is a shell-and-tube heat exchanger with wet, saturated steam condensing on the shell side and circulating water flowing through the tubes to provide cooling. The warmed circulating water exits the condenser and flows to the cooling tower to be cooled and reused.

The circulating water is distributed among multiple cells of the cooling tower, where it cascades downward through each cell and then collects in the cooling tower basin. The mechanical draft cooling tower employs electric motor-driven fans to move air through each cooling tower cell. The cascading circulating water is partially evaporated, and the evaporated water is dispersed to the atmosphere as part of the moist air leaving each cooling tower cell. As discussed in Section 5.15, Visual Resources, because of climatic conditions at the site, visible moisture plumes are expected to occur relatively infrequently and largely in winter months, and no need is expected for a plume-abated cooling tower.

The circulating water is cooled primarily through partial evaporation and secondarily through heat transfer with the air. The cooled circulating water is pumped from the cooling tower basin back to the surface condenser and auxiliary cooling water system.

Auxiliary Cooling Water System

The auxiliary cooling water system uses water from the cooling tower for the purpose of cooling 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.

2.5.5.5 Waste Generation and Management

Project wastes include wastewater, non-hazardous solid waste, hazardous solid waste, and hazardous liquid waste. Project waste streams and management details are discussed in AFC Section 5.16, Waste Management and Section 5.17, Water Resources.

Wastewater

The water balance diagrams show the power plant's wastewater streams and the disposition of wastewater. Wastewater is segregated in two separate collection systems, one for industrial streams (including the cooling tower blowdown and raw water treatment effluent) and the other for sanitary wastes. The industrial system collects wastewater from the SSG and demineralization system and delivers it to the cooling tower basin. As discussed below, the cooling tower blowdown will be piped to onsite evaporation pond(s) for dewatering and the residual solids will remain in the pond for the duration of the plant life. If necessary for pond maintenance reasons, any solids removed from the pond will be shipped to an appropriate offsite landfill.

Wastewater sources include the following:

- Circulating water system blowdown,
- SSG blowdown,
- Demineralization system wastewater,
- Chemical feed area drains, and
- General plant drains.

The Project's sanitary system will collect wastewater from sanitary facilities such as sinks and toilets. This waste stream will be sent to an onsite sanitary waste septic system.

Evaporation Ponds

It is expected that BSEP will have three double-lined evaporation ponds each with a nominal surface area of 8.3 acres for a total of 25 acres. The ponds will be designed in accordance with Lahontan Regional Water Quality Control Board (RWQCB) requirements. Multiple ponds are planned to allow plant operations to continue in event that a pond needs to be taken out of service for some reason, e.g., needed maintenance. Each pond will have enough surface area so that the evaporation rate exceeds the cooling tower blowdown rate at maximum design conditions and at annual average conditions. Pond depth will be selected so that the ponds will not need to have residual solids removed during the life of the plant.

The pond liner system is expected to consist of a 60 mil high density polyethylene (HDPE) inner liner and a 50 mil HDPE outer liner. Between the liners is a synthetic drainage net that is used as part of the leachate collection and removal system (LCRS). A sand layer will cover the liner system on the pond basin. The sloped sections of the pond will have the sand layer plus a riprap layer covering the liner. Monitoring of the evaporation ponds will be required to detect the presence of liquid and/or constituents of concern. The LCRS will be monitored; several existing onsite wells also will be used as monitoring wells for the evaporation ponds. Based on the experience of the existing SEGS plants, it is expected that the constituents of concern for this monitoring will include chloride, sodium, sulfate, TDS, biphenyl, diphenyl oxide, potassium, selenium, and phosphate. The detection monitoring program for the facility consists of monitoring the LCRS, lysimeters, and monitoring wells for the presence of liquid and/or constituents of concern.

On-Site Bioremediation/Landfarm System

The BSEP will include a bioremediation/land farm unit to treat soil contaminated with HTF. The unit will be designed in accordance with Lahontan RWQCB requirements. The bioremediation and land farm facilities will cover an area of approximately 400 feet by 800 feet. Bioremediation will be used for soils with concentrations less than 10,000 milligrams per kilogram (mg/kg) and land farming for soils with concentrations below 1,000 mg/kg. Based on the experience at the existing SEGS facilities, the California Department of Toxics Substances Control (DTSC) has determined that soil contaminated with HTF is classified as a non-hazardous waste.

The bioremediation area will include multiple HDPE liners and LCRS. Treatment in the bioremediation unit will involve the addition of nitrogen and phosphorous (i.e., fertilizers) as nutrients to the HTF-contaminated soil to stimulate consumption of HTF by the indigenous bacteria. The soil will remain in the bioremediation unit until concentrations are reduced to less than an average concentration of 100 mg/kg; the remediated soil is expected to be used as fill material on the site. The land farm area will be located next to the bioremediation area. Soils with initial HTF concentrations less than 1,000 mg/kg will be brought to the unlined land farm and stored there until concentrations are below 100 mg/kg, at which point it can be used as fill material on the site. Natural attenuation is the only “treatment” that occurs at the land farm; no additives (e.g., fertilizer, water) are used.

Other Non-Hazardous Solid Waste

Construction, operation and maintenance of the Project will generate non-hazardous solid wastes typical of power generation or other industrial facilities (see Section 5.16, Waste Management). These wastes include scrap metal and plastic, insulation material, paper, glass, empty containers, and other miscellaneous solid wastes. These materials will be disposed of by means of contracted refuse collection and recycling services.

Hazardous Solid and Liquid Waste

Small quantities of hazardous wastes will be generated during Project construction and operation. Hazardous wastes generated during the construction phase will include substances such as paint and primer, thinners, and solvents. Hazardous solid and liquid waste streams generated during Project operations include substances such as used hydraulic fluids, oils, greases, filters, etc., as well as spent cleaning solutions and spent batteries. To the extent possible, both construction and operation-phase hazardous wastes will be recycled. Tables 5.16-5 (construction phase) and 5.16-6 (operations phase) in Section 5.16, Waste Management' summarize Project hazardous waste streams in terms of quantities, origin and composition, and management method(s).

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.

Carbon steel tanks also will be used to store sodium hydroxide solution (7,500-gallon capacity), sulfuric acid (10,000-gallon capacity), lube oil and diesel fuel (largest tank is 1,200 gallons). Secondary containment will be provided for these tanks.

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). 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 and portable fire extinguishers.

The Project's fire protection water system will be supplied from a dedicated 360,000-gallon portion of the 2,840,000-gallon raw water storage tank located on the plant site. One electric and one diesel-fueled backup firewater pump, each with a capacity of 3,000 gallons per minute, will deliver water to the fire protection water-piping network. A smaller electric motor-driven pump jockey pump will maintain pressure in the piping network. If the jockey pump is unable to maintain a set operating pressure in the piping network, the diesel fire pump starts automatically.

The piping network will be configured in a loop so that a piping failure can be isolated with shutoff valves without interrupting the supply of water to a majority of the loop. The piping network will supply fire hydrants located at intervals throughout the power plant site, a sprinkler deluge system at each unit transformer, HTF expansion tank and circulating pump area and sprinkler systems at the STG and in the operations and administration buildings. Portable fire extinguishers of appropriate sizes and types will be located throughout the plant site.

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 fire. As vegetation or other combustible materials will not be allowed in the solar field, the HTF will be allowed to extinguish itself naturally, since the remainder of the field is of nonflammable material (aluminum, steel, and glass).

2.5.5.8 Plant Auxiliary Systems

The following plant auxiliary systems control, protect, and support the power plant and its operation.

Distributed Control System

The Distributed Control System (DCS) provides control, monitoring, alarm, and data storage functions for power plant systems. These include:

- Control of the STG, SSG System and balance-of-plant 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 will 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 datalinks provide STG control, monitoring, alarm, and data storage functions via the control operator interface and control technician workstation of the DCS.

Lighting System

The Project's lighting system will provide operations and maintenance personnel with illumination in both normal and emergency conditions. The system will consist primarily of AC lighting, but will include DC lighting for activities or emergency egress required during an outage of the plant's AC electrical system. The lighting system will also provide AC convenience outlets for portable lamps and tools. Lighting will be designed to provide the minimum illumination needed to achieve safety and security objectives and will be shielded and oriented to focus illumination on the desired areas and minimize additional nighttime illumination in the site vicinity.

Cathodic and Freeze Protection Systems

Cathodic protection systems protect against electrochemical corrosion of underground metal piping and structures. Underground metal structures will have cathodic protection as necessary based on soil conditions.

Freeze protection systems (heat tracing) will be employed to protect small water and condensate piping systems that cannot be easily drained. Also due to the high freezing temperature of the solar field's HTF (54°F), steam-fed HTF freeze protection heat exchangers will be provided to protect the system during the night hours and colder months. Overall natural gas fuel usage is included in Section 2.5.5.1.

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.

Telemetry

The BSEP will utilize electronic systems to control equipment and facilities operations over a large site. Because of the presence of various important Department of Defense (DOD) facilities/activities in the general area (e.g., Edwards Air Force Base, China Lake Naval Weapons Center and associated ranges), Beacon Solar is sensitive to the need to ensure that use of the electronic spectrum by the BSEP does not interfere with DOD activities. Detailed information on BSEP use of the electronic spectrum has not yet been developed at the current stage of the Project engineering design process. However, Beacon Solar has met with DOD representatives and the parties have agreed on a process that will avoid potential electronic interference issues, as shown in a February 19, 2008 letter from A. M. Parisi, Complex Sustainability Officer for the R-2508 Complex Sustainability Office, Naval Air Systems Command Weapons Division to Gary Palo of Beacon Solar that is provided in AFC Appendix K. Based on this correspondence, Beacon Solar is willing to accept the following as a Condition of Certification:

Beacon Solar will provide information on planned use of the electronic spectrum at project facilities to Department of Defense (DOD) representatives at least 30 days prior to the start of project construction. The information provided will be in sufficient detail for DOD agencies to evaluate whether project use of specific radio frequencies would cause interference with DOD activities. As needed, based on the feedback provided by DOD, Beacon Solar will modify the facility's planned frequency use, provide data on these modifications to DOD, and obtain written confirmation from DOD of the acceptability of Project frequency usage with respect to avoiding interference with DOD activities. Beacon Solar will provide documentation to the CEC Compliance Project Manager (CPM) of the DOD's confirmation of the acceptability of the Project's planned use of radio frequencies spectrum prior to the installation of electronic systems that potentially could affect DOD activities.

HTF Leak Detection

Leak detection of HTF will be accomplished in a combination of ways. Small leaks, possible at ball joints or other connections, will be located based on daily inspection of the solar field. Those small leaks can then be corrected via repacking of joints or valves or by minor repairs if needed. The ability to isolate loops and sections of the field will allow for quick repairs. Larger sudden leaks are a greater concern. In order to identify and react to such leaks quickly, the Project is considering a combination of remote pressure sensing equipment and remote operating valves that would allow for isolation of large areas of the field, or possibly the entire field. Such features will be developed as part of the detail design process.

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 will be designed in conformance with Uniform Building Code and California Building Code criteria for Seismic Zone 4. As noted earlier, sensitive Project facilities (e.g., power block, evaporation pond) will be placed at specific onsite locations that avoid the mapped AP fault zones.

2.5.6.1 SSG System, STG and Associated Equipment

The SSG System, STG and condenser will be located outdoors and supported on reinforced concrete mat foundations. The STG foundation will include a reinforced concrete pedestal that supports the STG above the surface condenser. The one step-up transformer and GSU will be supported on reinforced concrete mat foundations. Balance-of-plant (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 Array Support Structures

Each solar collector array 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 40 feet along the array. Foundation design will be based on site-specific geotechnical conditions to ensure that the solar array 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 administration building and warehouse adjacent to the solar field and a control building located in the power block. The design and construction of the administration 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 are supported on reinforced concrete mat foundations or individual spread footings and the structures rest on reinforced concrete slabs. The total square footage of the various Project buildings and pre-engineered enclosures (e.g., control room, administration building, warehouse, electrical equipment enclosures) is approximately 31,000 square feet.

2.5.6.4 Water Storage Tanks

There will be a number of covered water tanks on site including a 2,840,000-gallon raw water storage tank for short-term backup cooling water supply, with a portion (360,000 gallons) dedicated to the plant's fire protection water system and a 2,350,000-gallon treated water storage tank. There also will be a 150,000-gallon storage tank for storage of demineralized water and an 80,000-gallon storage tank for neutralization. The neutralization tank is used to neutralize the pH of chemicals used in the water treatment process. 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, Railroad Crossing, Fencing, and Security

As noted earlier, access to the plant site will be from SR-14. As discussed in Section 5.13, Traffic and Transportation, BSEP is in discussion with Caltrans to finalize plans for site access/egress to and from the highway. Use of an existing access point from SR-14 at the northwest corner of the plant site is expected. Necessary improvements to the SR-14 intersection include acceleration and deceleration lanes both northbound and southbound, (southbound deceleration improvements will involve extending the existing southbound left turn pocket). Again, subject to more formal review of Project design information, Caltrans staff indicated preliminarily that acceleration/deceleration lanes 1,500 feet in length would appear to be appropriate.

A Union Pacific (UP) Railroad line referred to as the Lone Pine Branch runs roughly north-south along the western BSEP site boundary. Discussions with UP categorized this rail line as lightly traveled with four trains per day on average. Beacon Solar plans to upgrade the existing at-grade railroad crossing such that the at-grade crossing is acceptable for use during Project construction and operations. The detailed design of the modified at-grade crossing will be developed per UP standards per UP and California Public Utilities Commission approval of information prepared and filed by the Applicant with UP.

Only a small portion of the overall plant site will be paved, primarily the site access road 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 23 acres with approximately six acres of paved area. The solar field 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 field and support facilities perimeter will be secured with chain link metal-fabric security fencing, eight feet tall, with one-foot barbed wire or razor wire on top (see Figure 2-4). Controlled access gates will be located at the site entrance. Desert tortoise exclusion fencing and tortoise-proof gates will be installed at the base of the chain link fence. Chain-link security fencing and desert tortoise fencing will also be installed around the new switchyard adjacent to the LADWP transmission line. As discussed below, a dry desert wash that currently traverses the site will be rerouted around the site to the east; the rerouted wash will be outside the security/tortoise fencing, but will be enclosed with a low maintenance fence, such as a single or double strand barbed wire.

2.5.6.6 Site Drainage and Earthwork

The Project site is located in the arid Mojave (average annual rainfall in the site vicinity reported as less than seven inches). The existing topographic conditions of the BSEP plant site show an average slope of one to three percent toward the northeast. The present undeveloped property has sheet drainage/run-off and during infrequent large precipitation events, run-off from the site may reach Koehn Lake (usually dry), approximately six miles to the northeast. The site currently is traversed in a diagonal southwest to northeast direction by an existing shallow dry wash known as Pine Tree Creek which will be rerouted around the solar field to the east. The portion of the existing channel to be rerouted is about 8,150 feet long and varies in width from 600 to more than 1,000 feet wide and about 10 feet deep on average for the 100-year flood event. The rerouted and reshaped channel will follow the plant site's southern and eastern boundaries to ultimately match the original sheet flow drainage path at the northeast corner of the site (see Figure 2.4). The rerouted channel segment will be approximately 14,000 feet long, designed to meet Kern County requirements, and also revegetated with native vegetation to minimize habitat disturbance. An overall conceptual drainage study and plan is contained in Appendix L.

The rerouted and reshaped channel will be sized to convey storm water discharge for a 100-year event with a minimum of one foot of freeboard above the water surface elevation. The realigned dry wash will be a 3:1 trapezoidal channel, with a minimum bottom width of 345 feet (to a maximum of about 2,900 feet at the end of the transition back to sheet flow at the northeast of the site). The proposed average channel depth is approximately eight feet. Dirt berms on the sides of the channel will be used to accomplish the transition from the new channel bottom back to the existing ground surface/flow patterns at the northeast corner of the plant site.

An existing railroad drainage crossing is located west of the plant site. The flow from this crossing will be rerouted in a swale to convey the flow from this drainage crossing east across the plant site to the rerouted dry wash discussed above. The swale will be approximately 9,000 feet long with an average depth of one foot and a minimum bottom width of 15 feet.

The Project's power block area is centrally located within the solar field. The power block will drain via sheet flow away from equipment foundations to the solar field. The runoff will then flow through ditches to the relocated dry wash channel to the east. Local area containments will be provided around certain locations, such as oil-filled transformers and chemical storage areas. The water from these areas and from other plant drains will be sent to an onsite oil-water separator, which is designed to remove free floating oil, grease, and settleable oily coated solids from oil/water discharges associated with plant processes. The oil free water is then added to the plant cooling water.

The solar field will be graded generally following the existing contours of the site. Runoff from the solar field area will drain by sheet flow to shallow diversion swales running in the east-west direction to the dry wash channel and a detention area (see Appendix L) in the northeast section of the solar field.

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

- Employee Training Program,
- Erosion and Sediment Control,
- Good Housekeeping Programs,
- Preventive Maintenance Programs,
- Structural BMPs,
    - Temporary containments 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.

The Project's power block and solar field areas will be graded to allow for a balanced distribution of material, so there is no requirement to truck large quantities of earth materials to or from the site. The preliminary grading plan assumes seven percent soil shrinkage to achieve the balance of cut and fill material. The cut and fill grading necessary to create suitable conditions for Project construction will result in an elevation of approximately 2,050-2,250 feet amsl. Adjustments will be made to provide engineered fill as required for stabilization under equipment and structure foundations per the Project geotechnical report. Only soil materials approved by a geotechnical engineer for structural fill will be used. Additionally, specialized granular materials may need to be imported to the proposed site for road base and possible use below foundations.

Existing site elevations range from approximately 2,050 to 2,260 feet amsl. Mass grading of the site will occur at the beginning of the Project construction period. The grading will result in a slope of 1 to 1.5 percent downward from the southwest to the northeast of the site. The total earth movement required will be approximately 5,160,000 cubic yards. The preliminary site grading plan is designed to be balanced; no import or export of soil is expected for general earthwork. Earthwork associated with the proposed Project will include excavation for foundations and underground systems.

2.5.7 Construction of Generating Facilities

Major milestones of the planned BSEP construction schedule are as follows:

- Begin construction: third quarter 2009
- Startup and test: second quarter 2011
- Commercial operation: third quarter 2011

Project construction is expected to occur over a total of 25 months. Project construction will require an average of 477 employees over the entire 25-month construction period, with manpower requirements peaking at approximately 836 workers in Month 15 of construction. The construction workforce will consist of laborers, craftsmen, supervisory personnel, support personnel, and construction management personnel. Table 5.11-9 in Section 5.11, Socioeconomics, provides a breakdown of the construction workforce by skill over the entire construction period.

Temporary construction laydown and parking areas will be provided within the power plant site (see Figure 2-4). Due to the size of the plant site, the solar field laydown area will be relocated periodically as the solar field is built out. 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 rerouted wash will be completed during the first nine months of the construction schedule.
- *Foundations:* this includes excavations for large equipment (STG, SSG, GSU, cooling tower, 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 be piping, electrical, and smaller component installations.
- *Testing and Commissioning:* testing of subsystems will be done as they are completed. Major equipment will be tested once all supporting subsystems are installed and tested.

Equipment and materials will be delivered to the BSEP plant site by truck; large components (e.g., STG) will be brought by rail to a rail siding in the town of Mojave and then are expected to be trucked to the site on SR-14.

2.5.8 Project Operation

The Project will have a moderate sized workforce during operation; an estimated total workforce of 66 full time equivalent personnel will be needed to staff the facility 24 hours per day/seven days per week. When the plant is not operating (generating electricity), personnel will be present as necessary for maintenance, to prepare the plant for startup, and/or for site security.

2.6 Natural Gas Pipeline

2.6.1 Pipeline Description

A new eight-inch, 17.6-mile natural gas pipeline will be constructed by Southern California Gas (SCG) to connect the Project to the existing SCG pipeline situated west of California City (see correspondence in Appendix K.3). Approximately 1.2 miles will be within the plant site boundary and 16.4 miles will be outside the plant site boundary. The line will be buried four to 10 feet below ground surface depending on location.

As shown on Figure 2-1, the Project's gas line route takes off from an existing SCG line in the rail line ROW west of California City and follows the street ROW of California City Boulevard east approximately five miles to Neuralia Road. The route then turns north on Neuralia Road and will be installed in disturbed road shoulders of the roadway for approximately 11 miles. From Neuralia Road, the route turns west into the Project site along a corridor previously disturbed by the installation of existing SCE power distribution lines.

2.6.2 Pipeline Construction

Construction of the gas pipeline will be the responsibility of SCG and is expected to take three to six months with a peak workforce of approximately 240 workers. Provisions for construction contractor employee parking for the pipeline construction will be accommodated by the Applicant at the plant site, except for those supervisory contractor employee and agency inspection vehicles which must be temporarily parked along the route while construction takes place. Most major pieces of pipeline construction equipment will remain along the pipeline ROW during construction with storage and staging of equipment and supplies located at the Project plant site or other acceptable site selected by SCG at the time construction is underway. Excavated earth material would be stored within the construction ROW. During nonworking hours, any open trench will be covered with wood or other material of sufficient strength to support wildlife.

The Applicant has entered into a Collective Work Agreement with SCG pursuant to which SCG is to perform detailed engineering and construction cost estimating for the gas line extension. Prior to additional information being provided by SCG in accordance with the provisions of the agreement, the Applicant anticipates that the construction of the natural gas pipeline will generally consist of the following elements, subject to SCG providing further information.

- Trenching: The optimal trench will be approximately 48 inches wide and four to 10 feet deep. With loose soil, a trench up to eight feet wide at the top and three feet wide at the bottom may be required. The trench depth will provide a minimum cover of 36 inches.
- Stringing: The pipeline components will be staged along the trench on wooden skids in preparation for installation.
- Installation: Installation consists of bending, welding, and coating the weld-joint areas of the pipe after it has been strung, padding the ditch with sand or fine spoil, and lowering the pipe string into the trench following non-destructive testing of all wells.
- Backfilling: consists of returning spoil back into the trench around and on top of the pipe, ensuring that the surface is returned to its original grade or level. The backfill will be compacted to protect the stability of the pipe and to minimize subsequent subsidence.

Trenchless construction methods may be used for short crossings under existing water lines or other buried pipelines. Boring pits will be dug on each side of the crossing to accommodate the process. Cleanup consists of restoring the surface of the roadway or ROW by removing any construction debris, grading to the original grade and contour, and revegetating or repairing where required.

The pipeline will undergo hydrostatic testing which involves filling the line with water, venting all air, increasing the pressure to the specified code requirements, and holding the pressure for a period of time. After hydrostatic testing, the test water will be chemically analyzed for contaminants and discharged to the surrounding area pursuant to the Project Construction Stormwater Permit unless the analysis shows that the

water is contaminated; in which case, the water would be trucked to an appropriate disposal facility. Following hydrostatic testing the pipeline will be cleaned and dried, purged of air and filled with natural gas for operation.

2.7 Transmission System

2.7.1 Transmission System Description

The western boundary of the 2,012-acre BSEP plant site is located approximately one mile east of two existing LADWP transmission lines: 1) the Celilo-Sylmar 500 kV DC intertie line, and 2) the Inyo-Barren Ridge 230 kV line (see Figure 2.4). Both lines run within the same approximately 250-foot wide, north-south LADWP ROW. This ROW is located approximately 1,900 feet west of SR-14 with the 500 kV DC Celilo-Sylmar line located west of the 230 kV Inyo-Barren Ridge line. The 230 kV Barren Ridge Switching Station on the Inyo-Rinaldi line is situated approximately 1.5 miles southwest of the southwest corner of the plant site.

The BSEP will be connected to the LADWP transmission system by constructing a single-circuit three-phase 230 kV transmission line that would interconnect to the 230 kV system. The nominal 250 MW Project output produces 772A at 230 kV and the proposed GSU maximum fan-cooled rating is 330 MVA for a maximum current capacity of 877A. The conductor proposed for the gen-tie is 795-kcmil “Drake” capable of carrying 1014.9 A. LADWP utilizes the nominal voltage of 230 kV. The use of 230 kV as the targeted design voltage in this AFC is consistent with the industry use of the 230 kV term to describe the nominal voltage for this class of system. Each circuit will be supported by mono-pole structures at appropriate intervals with final heights as indicated in Section 2.7.1.4 below. The lines will be insulated from the poles using porcelain insulators engineered for safe and reliable operation at a worst-case voltage of 241.5 kV (nominal, plus five percent). Shield wires will be included along the length of the lines to protect against lightening strikes (see Figure 5.14-2 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.

Beacon Solar is seeking approval of the following two similar options for interconnecting the Project to LADWP’s transmission system, only one of which will eventually be built (see Figure 2-1). Beacon Solar needs the flexibility of having both options approved because a decision on which option will be selected cannot be made until a Facilities Study is performed, a detailed design is completed, and transmission line route easements are secured. Both options are included in the work scope for the System Impact Study (SIS) in preparation by LADWP.

2.7.1.1 Transmission Line Route Option 1

Option 1 would involve a route directly from the plant site power block to the Barren Ridge Switching Station. The direct Barren Ridge interconnection option would require approximately 3.5 miles of overhead 230 kV transmission line, approximately 1.6 miles of which would be within the plant site boundary. The line would exit a pull-off structure within a new Project switchyard in the plant site power block and head northerly. It will follow the Project access road for approximately 1.2 miles on monopole steel/concrete

structures, turning southwest to cross the existing UP rail line and SR-14. These crossings require increased conductor ground clearance above the tracks and the highway surface as required by California Public Utilities Commission General Order 95 (GO-95). An increase in conductor ground clearance is achieved either by an increase in pole height or by an increase in line tension. During preliminary transmission line design, a conservative approach was taken in the pole design height in order to ensure ground clearance in accordance with GO-95, but final design will be based on actual field conditions and site requirements. After crossing SR-14, the line will continue in a southwesterly direction for approximately 0.3 mile until it reaches the Barren Ridge Switching Station.

2.7.1.2 Transmission Line Route Option 2

Option 2 would include a new switching station adjacent to the existing LADWP ROW west of SR-14 on Beacon Solar-owned property and would require a total of approximately 2.3 miles of overhead 230 kV transmission line from the power block west to a new switchyard next to the LADWP ROW. Like Option 1, approximately 1.6 miles of the new line would be within the plant site boundary. Also like Option 1, the line would exit a pull-off structure within a new Project switchyard within the plant site power block and head northerly following the Project access road for approximately 1.2 miles on monopole steel/concrete structures and turn southwest to cross the existing Union Pacific railroad and SR-14. After crossing SR-14, the line will terminate on a pull-off structure within the new switching station.

From the new switching station, a new approximately 1.1-mile 230 kV line would be routed to the south parallel to the existing Inyo-Barren Ridge 230 kV line to the Barren Ridge switching station. This line would require approximately 150 feet of new ROW east of the existing LADWP ROW between the Inyo-Barren Ridge line and SR-14. Approximately 1,500 feet of this new ROW would cross Beacon Solar-owned property and an additional 3,800 feet would cross land owned by other private parties.

2.7.1.3 Power Poles

Because the total lengths of the two transmission line options are very similar, under either Option 1 or Option 2, the Project transmission line(s) will be installed on 36 new steel/concrete mono-poles. The poles are expected to average approximately 79 feet in height (maximum pole height of 110 feet), with a span length expected to average approximately 500 feet.

Access by vehicle to the Project transmission line route will be by existing dirt roads associated with the existing LADWP line to the maximum extent feasible. However, a new access road will be required (approximately one mile long for Option 1 and 1.9 miles long for Option 2), for access to the transmission ROW, and there also will be new stub access roads (approximately 100 feet long each) to provide access to each Project transmission structure. Installation of the transmission structures and conductors will require disturbance of small additional areas totaling less than one acre in the aggregate. These include several pull sites (from which the new conductors are actually installed on the new structures and strung between them) and a few splicing sites.

Representative photographs of existing conditions along the transmission line route and at the switchyard location and simulations that show these locations with the addition of Project transmission facilities are provided as Figures 2-14a through 2-14b.

2.7.1.4 Switching Station

Interconnection into the Barren Ridge Switching Station would require that the existing facility be prepared to accept the generation from the BSEP. As set forth in the Joint Committee Workshop before the CEC on May 14, 2007 addressing regional transmission issues, LADWP designed the Barren Ridge Switching Station to include provisions for additional renewable power projects in the region. LADWP's eventual goal is to have 1,100 MW of additional capacity into the Los Angeles area out of this region. Therefore, modification of the Barren Ridge switching station should be minimal. This will be confirmed during the licensing process. It is proposed that existing bus work within the breaker-and-a-half Barren Ridge Switching Station will be utilized for BSEP interconnection with the addition of two new 3000A, 230 kV circuit breakers and a 230-115 kV capacitor-controlled voltage transformer for line protection and four new 230 kV, 3000A disconnect switches for line and circuit breaker disconnect. Plan view and one-line drawings of the Barren Ridge Switching Station are shown in Figures 2-15 and 2-16. The proposed line labeled "Future Expansion Line 4" in Figure 2-17 will be the BSEP interconnection line.

As noted above, Option 2 for interconnection into Barren Ridge would require the construction of a new approximately 400 ft. by 240 ft. BSEP switching station over one mile northeast of the Barren Ridge Switching Station on Beacon Solar-owned property. A plan view drawing of this new switching station is shown in Figure 2-17. The BSEP switching station would be of a three breaker ring bus configuration for added reliability and flexibility. Requirements at the Barren Ridge Switching Station would be the same regardless of which of the two transmission options is selected for the BSEP. As stated earlier, a major reason for this interconnection option is LADWP's expressed interest in possibly utilizing this switchyard for potential future upstream upgrades of their Inyo-Barren Ridge line. The ring bus configuration of the new switchyard would leave room for a loop-in of the Inyo-Barren Ridge line in the future.

The switching station will utilize tubular aluminum alloy 1200A bus. Cable connections between the tube bus and equipment will be ACSR, AAAC, or AAC795-kcmil cable. Tube, cables, and support structures will meet all electrical and mechanical design requirements. Instrument transformers (current and capacitive voltage transformers) will be included for protection. Shield wires and lightening arrestors will be included to protect switching station equipment and personnel against lightening strikes. Final switchyard and/or substation equipment will be determined during final engineering of the proposed interconnection.

2.7.2 Construction of Transmission Facilities

The transmission line will be constructed 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 power poles (and for one of the two options discussed above, a new switching station) and involve 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 will be cleared for access along the transmission line route to provide access to the tower 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, welded together, 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 eight pulling sites required to install the conductors along this segment of the transmission line. Most sites will be on existing access roads or access roads that will be installed as part of the transmission line installation.
- *Communication System:* The overhead ground/fiber optic communications cable will be installed using the same pulling sites as were used for the conductor installation.

2.7.3 Interconnection Study

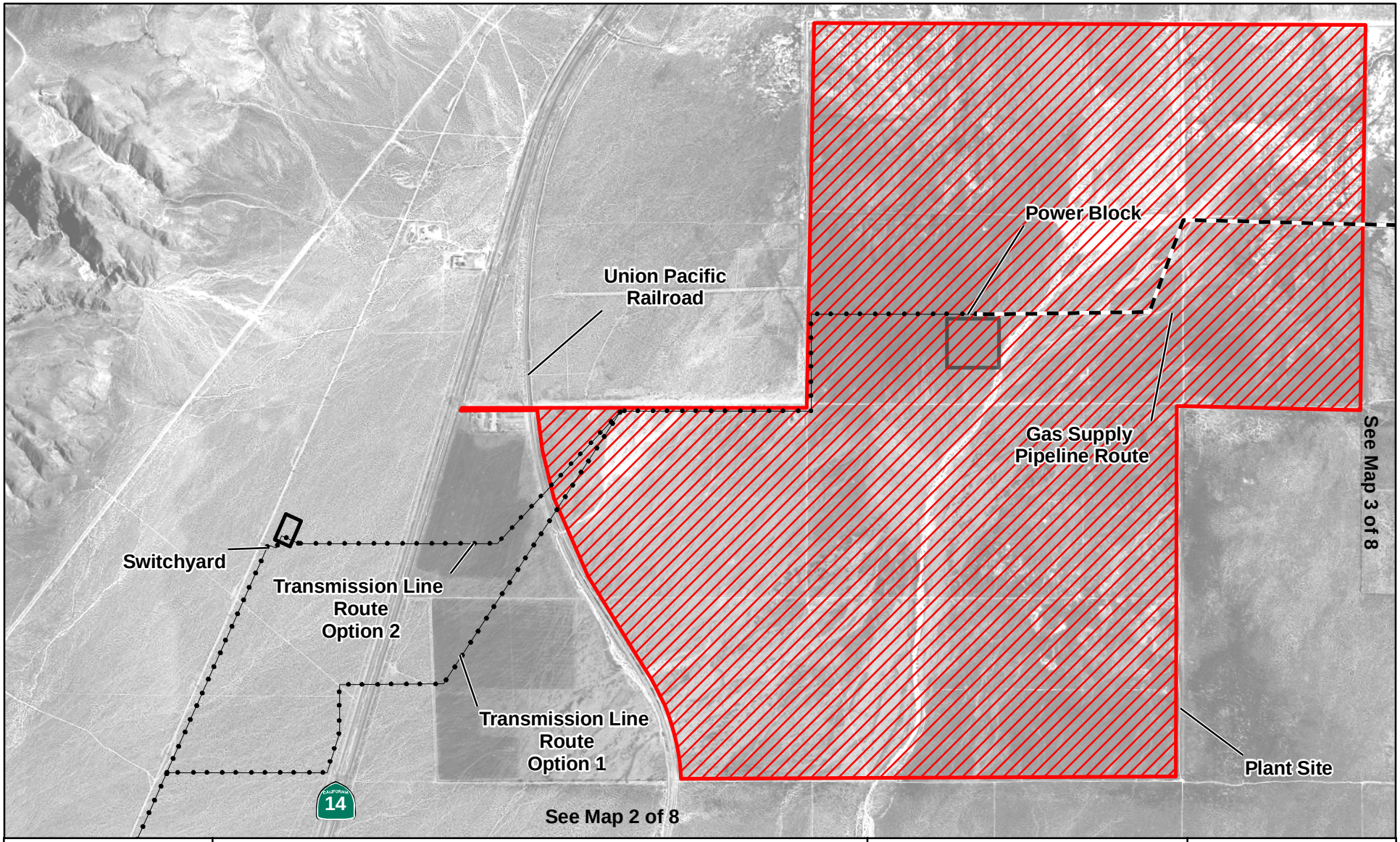
LADWP is currently preparing an interconnection SIS under an agreement with the Applicant. This study will define the impacts on the LADWP system of the Project's interconnection and is expected to confirm that no physical downstream upgrades would be required to accommodate the Project. It is important to note that LADWP is already planning transmission system upgrades (the Barren Ridge-Castaic Transmission Project) explicitly intended to maximize the amount of renewable energy from renewable projects (solar, wind, etc.) in the general vicinity of the BSEP site that it can provide to its customer base.

LADWP is proposing to upgrade and build new transmission capacity from the Barren Ridge Switching Station approximately 1.5 miles southwest of the BSEP site to the Castaic Power Plant near Lake Castaic/Santa Clarita in Los Angeles County. As described on the LADWP website, the upgraded transmission system will "improve reliability and capacity of renewable energy from the Mojave Desert and Tehachapi Mountain areas" to serve LADWP's customers. The Barren Ridge-Castaic project is designed to tie into LADWP's Pine Tree Wind Project, and as stated on the website "to access several other wind and solar projects in various stages" of development.

The Barren Ridge-Castaic project is designed in multiple phases, beginning with construction of a new 230 kV line from the Barren Ridge Switching Station to the Castaic Power Plant. The second phase of the project involves upgrading an existing 230 kV line (the Barren Ridge-Rinaldi line) to provide further increased transmission capacity for renewable energy projects, with a third phase involving construction of a new substation near Santa Clarita to maximize operational flexibility. The environmental review process for this project is in its early stages at the beginning of 2008.

2.7.4 Existing SCE Distribution Line

There is an existing SCE distribution line that presently runs east-west across the northern portion of the plant site. The rerouting of the SCE distribution line will be as shown in Figure 2-4 to follow BSEP plant site boundaries around the northern portion of the site. However, this rerouting will be done in conjunction with present LADWP efforts to serve the Barren Ridge Switching Station with the same line and therefore, will be finalized as LADWP completes the Barren Ridge Switching Station. The rerouting of the SCE line will occur completely within BSEP plant site boundaries to minimize potential impacts.



Map Location

Legend

- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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N W E S

Beacon Solar Energy Project

Figure 2-1
Project Site and Linear Facilities

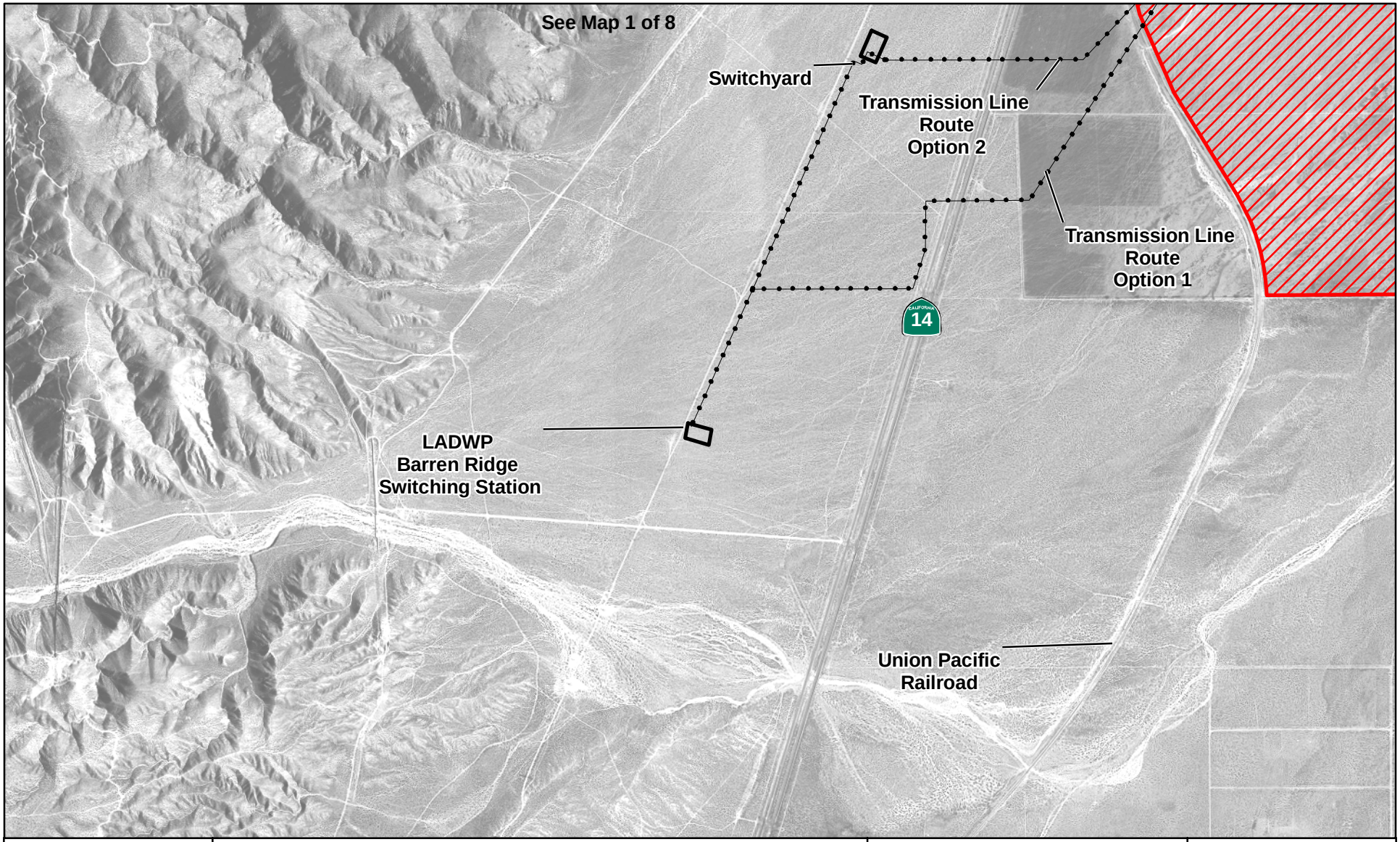
Mapsheet 1 of 8

Source:2006 NAIP;
WorleyParsons 2007;

Beacon Solar

ENSR | AECOM

Project: 10056-014
Date: March 2008



Map Location

Legend

- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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N W E S

Beacon Solar Energy Project

Figure 2-1
Project Site and Linear Facilities

Mapsheet 2 of 8

Source:2006 NAIP;
WorleyParsons 2007;

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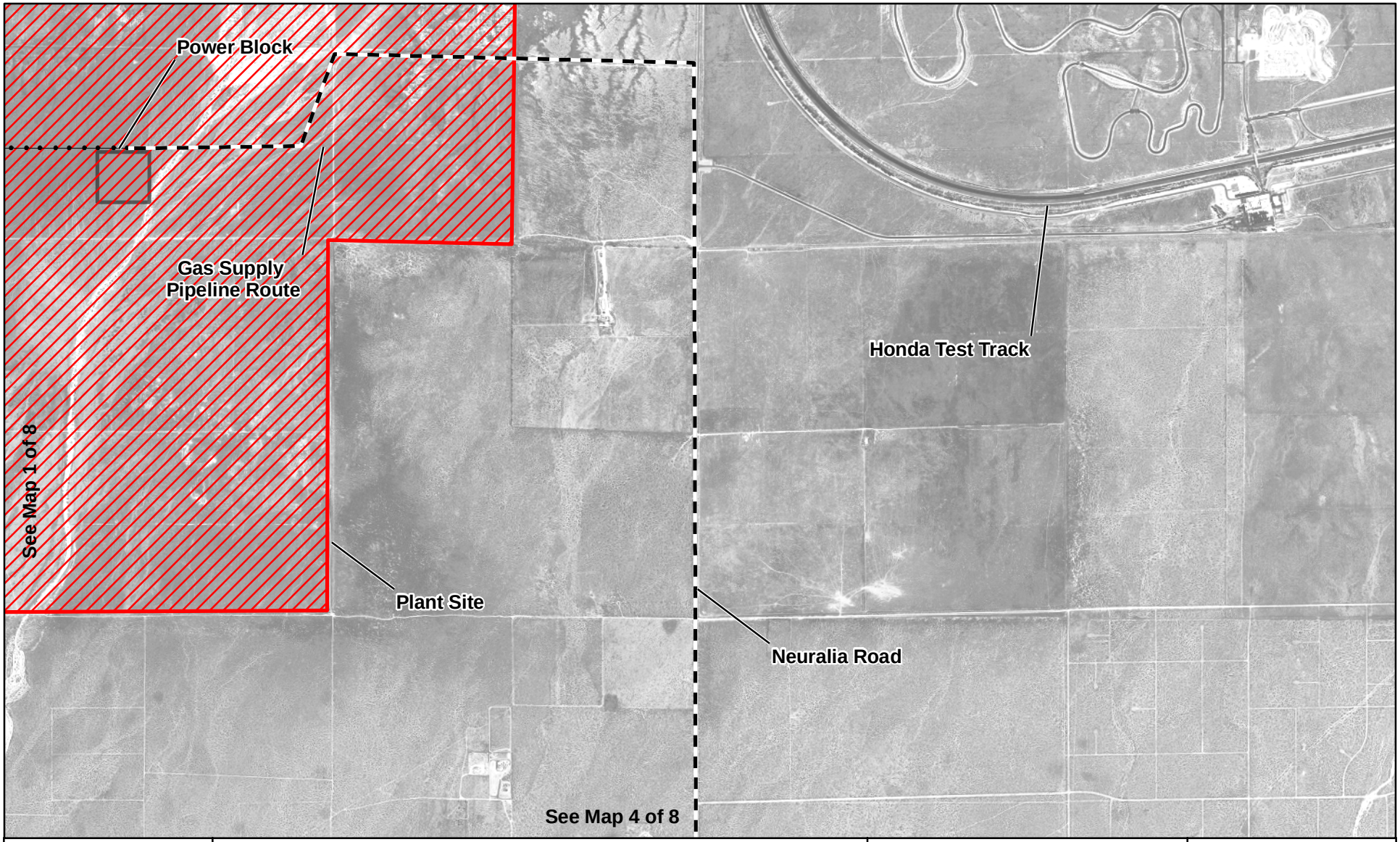
ENSR | AECOM

Project: 10056-014
Date: March 2008



Map Location

Legend

- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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N W E S

Beacon Solar Energy Project

Figure 2-1
Project Site and
Linear Facilities

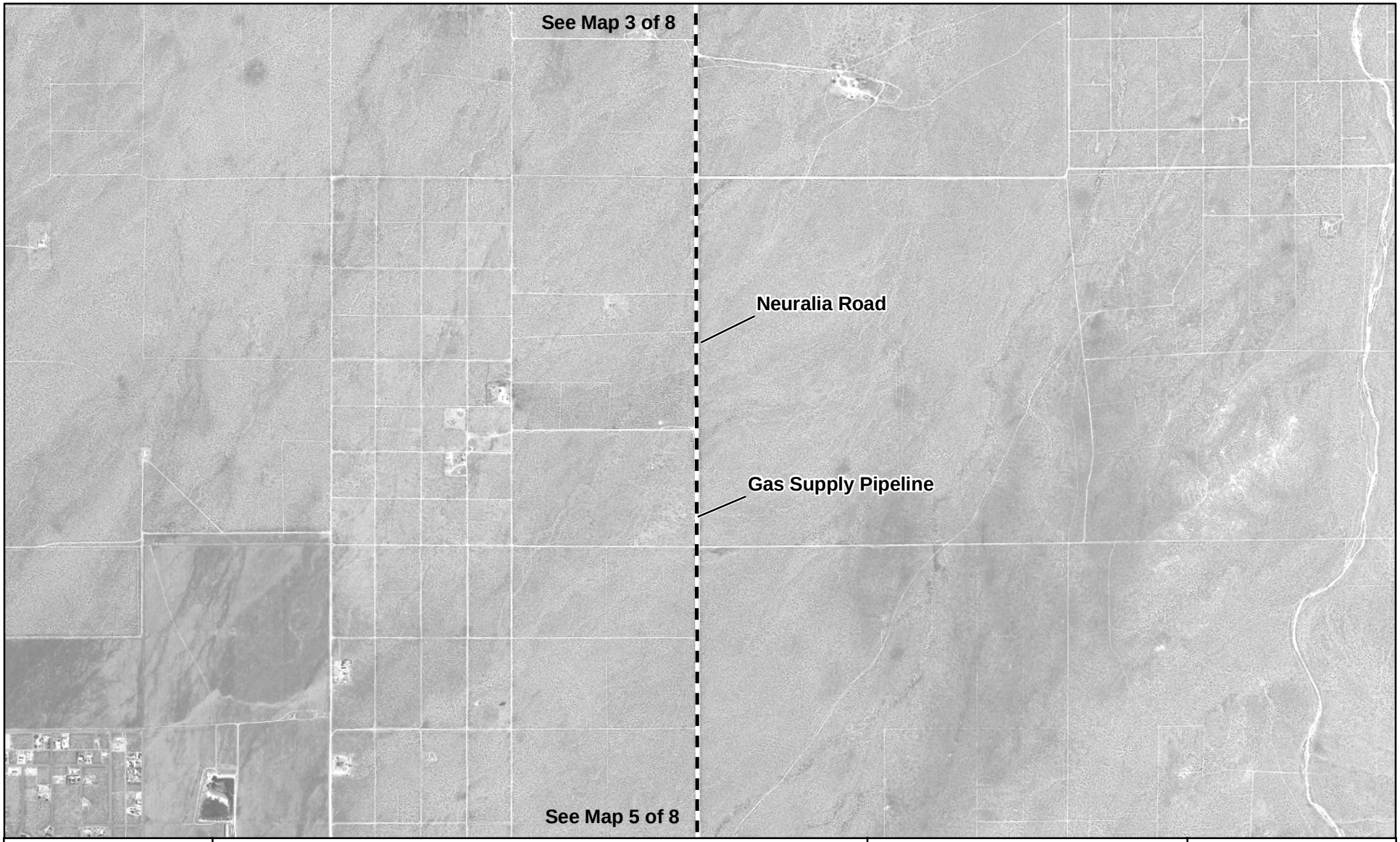
Mapsheet 3 of 8

Source:2006 NAIP;
WorleyParsons 2007;

Beacon Solar

ENSR | AECOM

Project: 10056-014
Date: March 2008



Map Location

Legend

- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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N W E S

Beacon Solar Energy Project

Figure 2-1
Project Site and
Linear Facilities

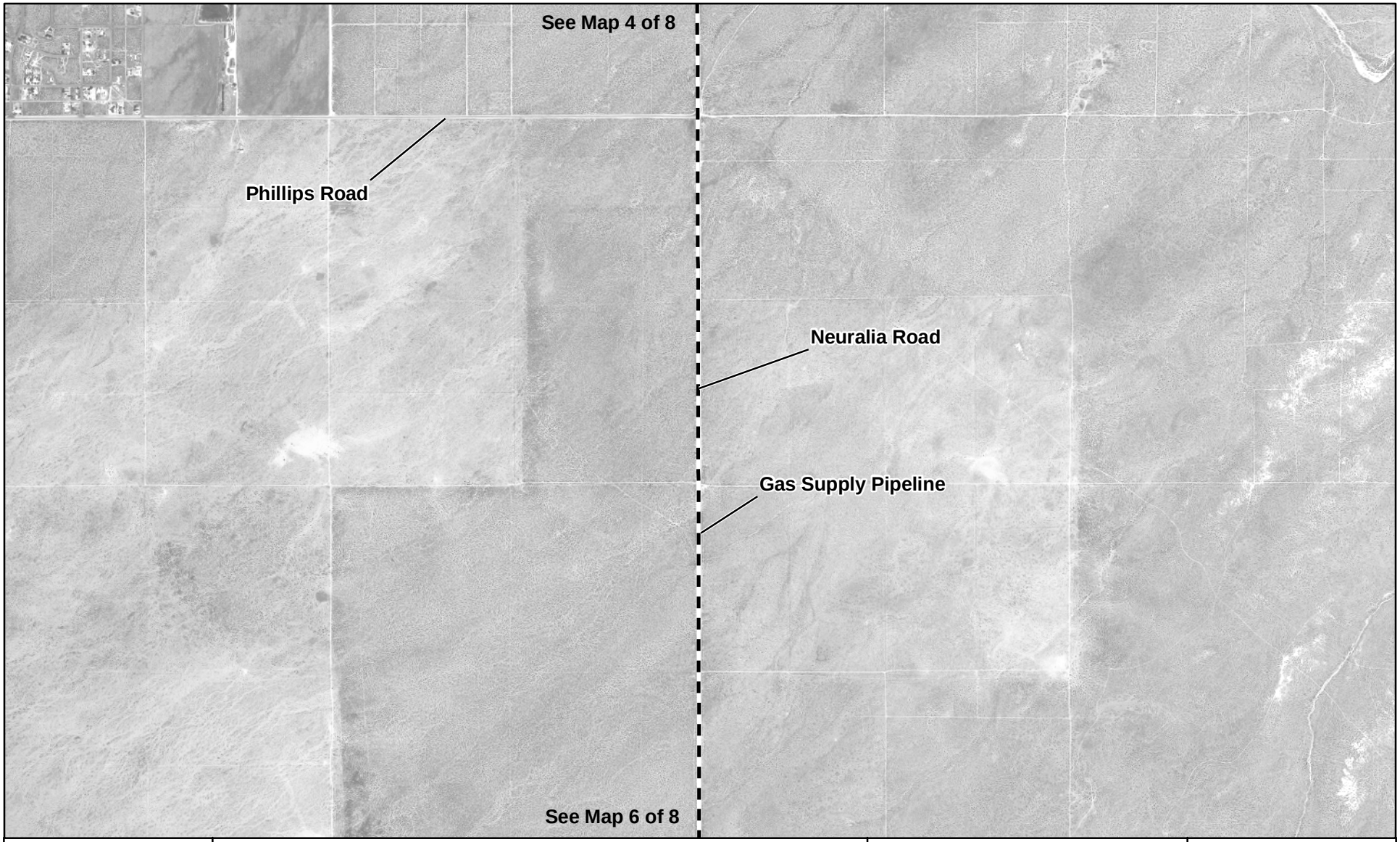
Mapsheet 4 of 8

Source:2006 NAIP;
WorleyParsons 2007;

Beacon Solar

ENSR | AECOM

Project: 10056-014
Date: March 2008



Map Location

Legend

- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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Beacon Solar Energy Project

Figure 2-1
Project Site and
Linear Facilities

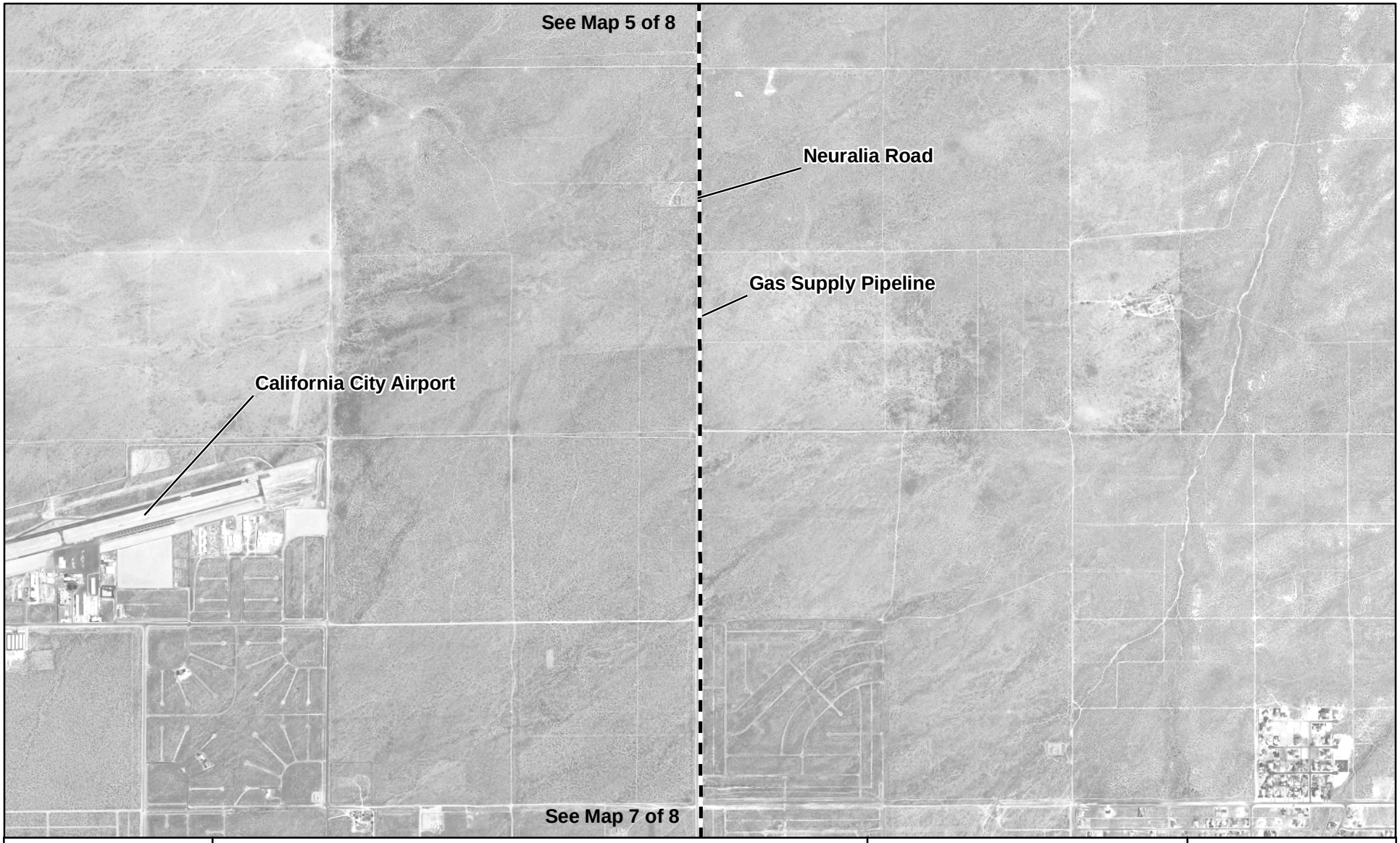
Mapsheet 5 of 8

Source:2006 NAIP;
WorleyParsons 2007;

Beacon Solar

ENSR | AECOM

Project: 10056-014
Date: March 2008



Map Location

Legend

- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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N W E S

Beacon Solar Energy Project

Figure 2-1
Project Site and Linear Facilities

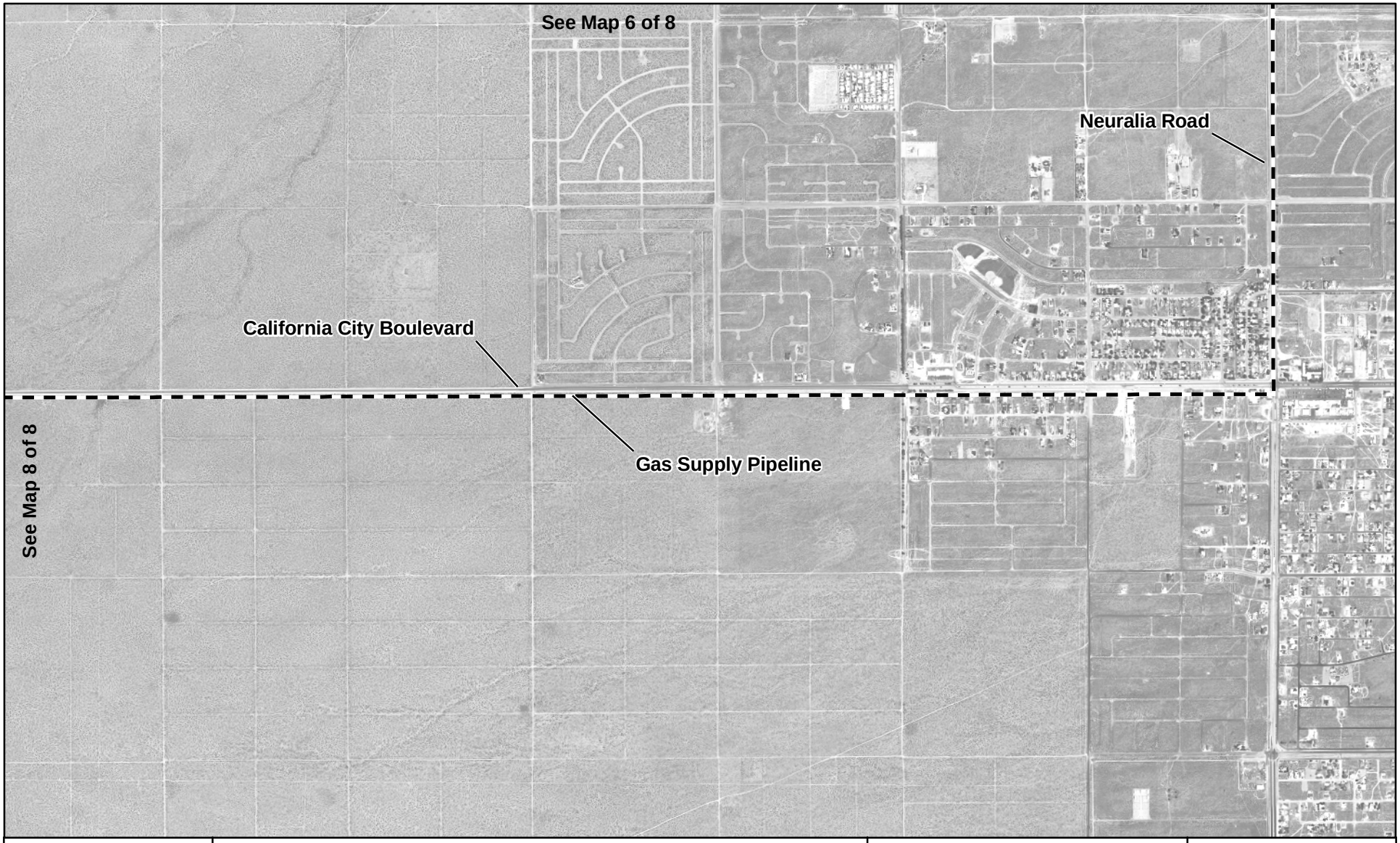
Mapsheet 6 of 8

Source:2006 NAIP;
WorleyParsons 2007;

Beacon Solar

ENSR | AECOM

Project: 10056-014
Date: March 2008



Map Location

Legend

- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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N W E S

Beacon Solar Energy Project

Figure 2-1
Project Site and
Linear Facilities

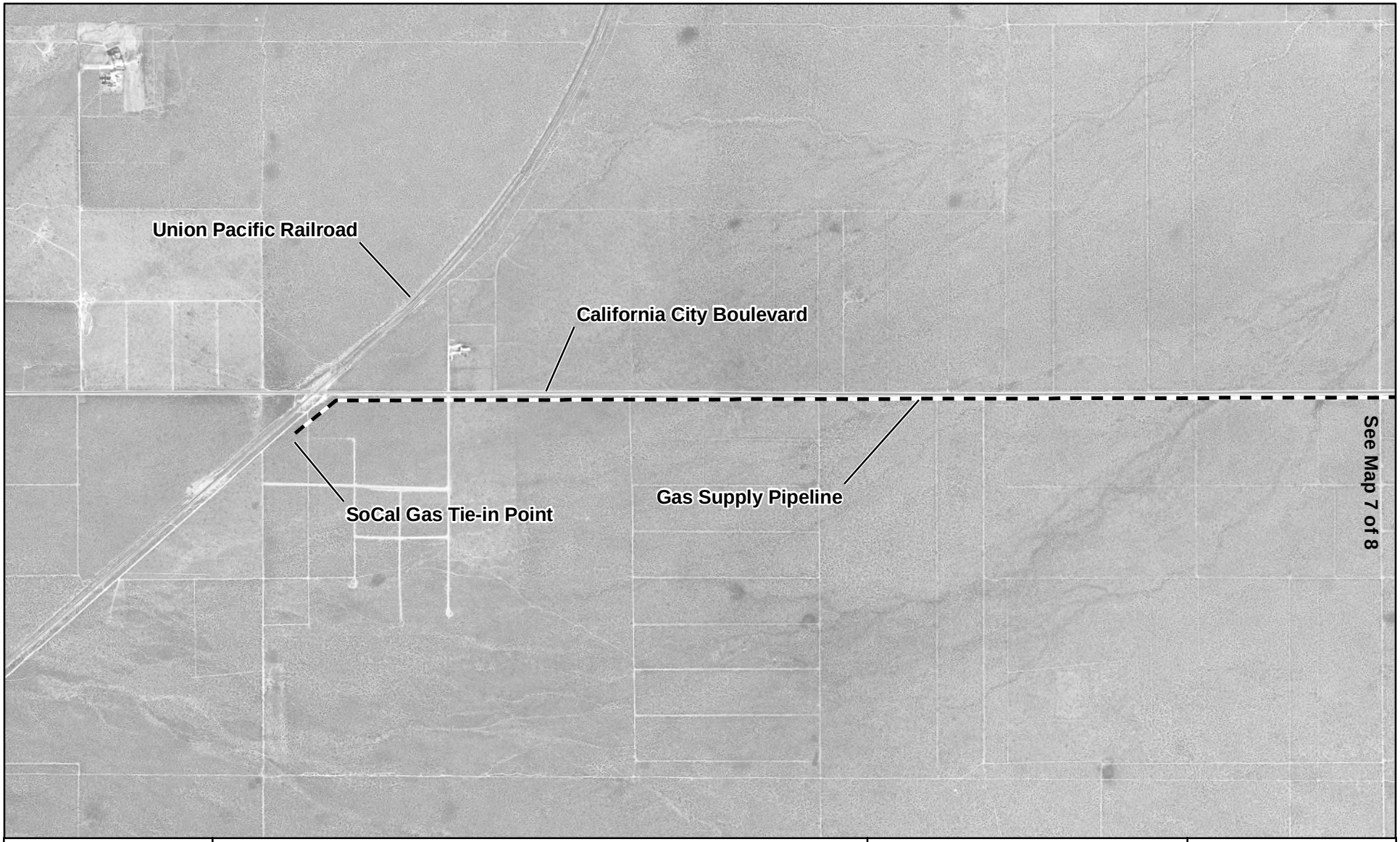
Mapsheet 7 of 8

Source:2006 NAIP;
WorleyParsons 2007;

Beacon Solar

ENSR | AECOM

Project: 10056-014
Date: March 2008



Map Location

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- Gas Supply Pipeline
- Transmission Lines
- Plant Site
- Power Block

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Beacon Solar Energy Project

Figure 2-1
Project Site and
Linear Facilities

Mapsheet 8 of 8

Source:2006 NAIP;
WorleyParsons 2007;

Beacon Solar

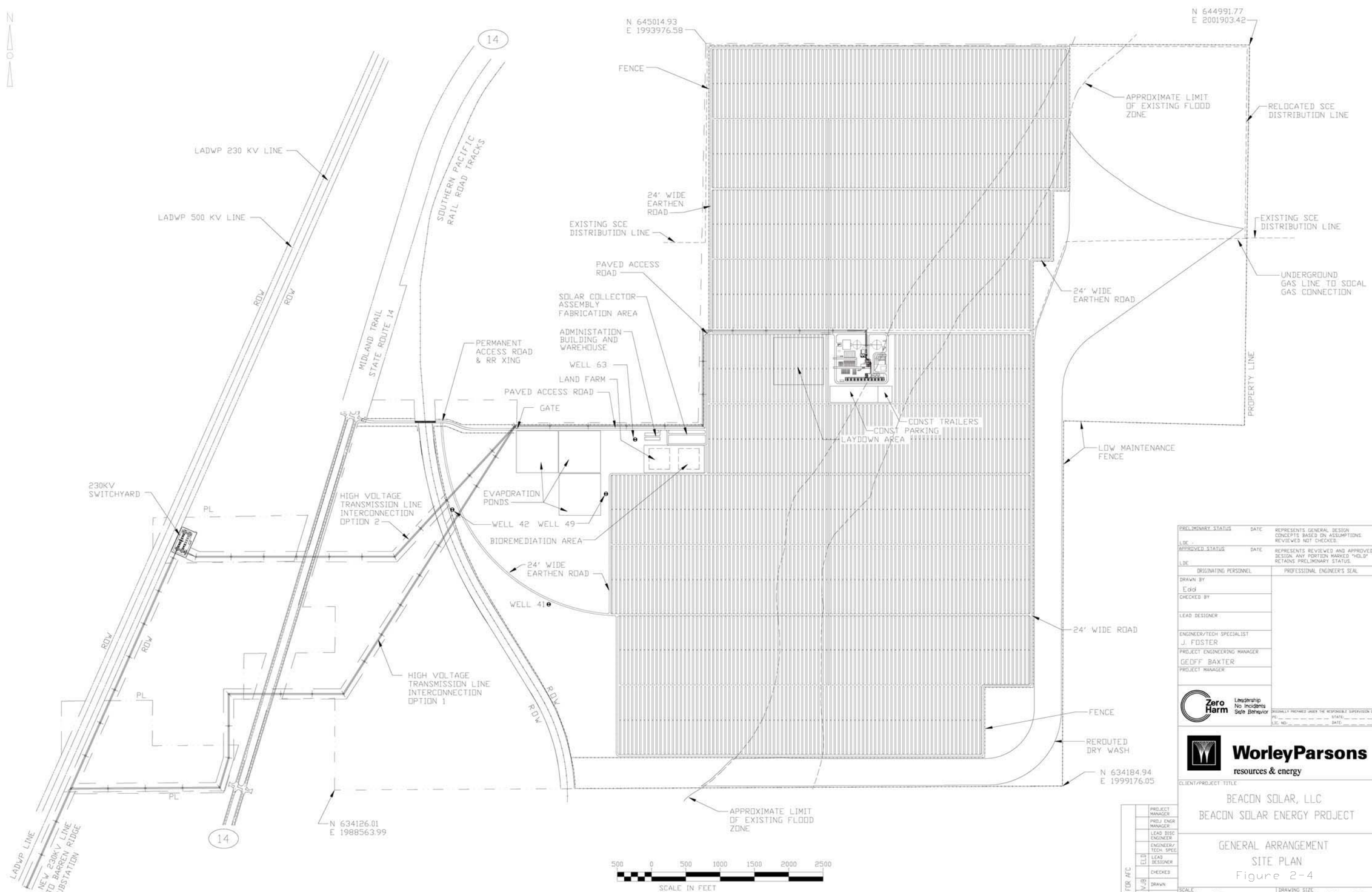
ENSR | AECOM

Project: 10056-014
Date: March 2008

Figure 2-2 Plant Site Photographs – Existing Conditions

Figure 2-3a Plant Site without Simulated Project Facilities

Figure 2-3b Plant Site with Simulated Project Facilities (Transmission Line Option 1)



PRELIMINARY STATUS	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE		
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE		

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: Edd	
CHECKED BY	
LEAD DESIGNER	
ENGINEER/TECH SPECIALIST: J. FOSTER	
PROJECT ENGINEERING MANAGER: GEOFF BAXTER	
PROJECT MANAGER	

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: STATE:
LIC. NO.: DATE:

WorleyParsons resources & energy

CLIENT/PROJECT TITLE

BEACON SOLAR, LLC
BEACON SOLAR ENERGY PROJECT

GENERAL ARRANGEMENT
SITE PLAN
Figure 2-4

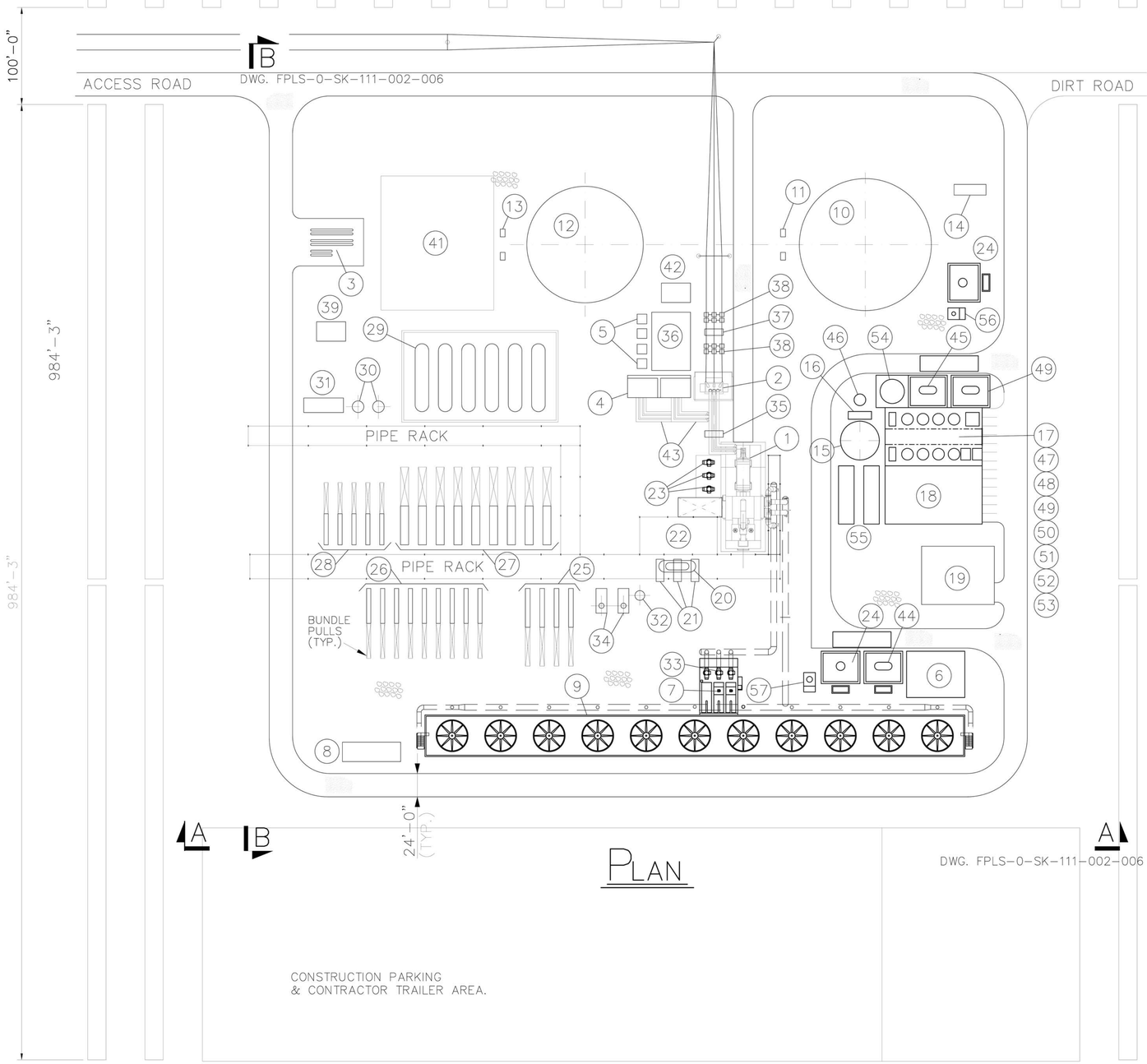
REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
G	02/21/08	VJB		ELD				

ISSUED FOR AFC

SCALE: 1' = 600'
DRAWING SIZE: ARCH D (24" x 36")
WORLEYPARSONS DWG. NO.: FPLS-0-SK-111-002-001
REV: G

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

DWG-FILE: FPLS-0-SK-111-002-001.dwg
DWG-DATE: 21-Feb-08



PLAN

EQUIPMENT DESCRIPTIONS

1 STEAM TURBINE/GENERATOR
2 GSU TRANSFORMER
3 GAS STORAGE AREA (NITROGEN, HYDROGEN AND CO2)
4 UNIT AUXILIARY TRANSFORMERS
5 SUS TRANSFORMERS
6 COOLING TOWER CHEMICAL FEED/STORAGE
7 COOLING TOWER AUXILIARY PUMPS
8 COOLING TOWER ELECTRICAL EQUIPMENT
9 COOLING TOWER
10 RAW & FIRE WATER STORAGE TANK (2,840,000 GALLONS)
11 PROCESS WATER PUMP SKID
12 PROCESS WATER STORAGE TANK (2,350,000 GALLONS)
13 PROCESS WATER PUMP SKID
14 FIREWATER PUMP HOUSE
15 DEMIN WATER STORAGE TANK (150,000 GALLONS)
16 DEMIN WATER PUMP SKID
17 WATER TREATMENT BUILDING
18 CONTROL ROOM/ADMIN BUILDING
19 WAREHOUSE
20 DEAERATOR/STORAGE TANK
21 FEEDWATER PUMPS
22 FEEDWATER HEATERS (AREA)
23 CONDENSATE PUMPS
24 SODIUM HYPOCHLORITE
25 ECONOMIZERS (4)
26 REHEATERS (18) STACKED TWO HIGH
27 EVAPORATORS (9)
28 SUPERHEATERS (5)
29 EXPANSION STORAGE TANKS (6)
30 HTF FREEZE PROTECTION HEAT EXCHANGERS (2)
31 HTF CIRCULATING PUMPS (6)
32 STEAM BLOWDOWN TANK
33 CIRCULATING WATER PUMPS
34 START-UP BOILERS (20,000 LB/HR) (2)
35 GENERATOR CIRCUIT BREAKER
36 MAIN ELECTRICAL BUILDING
37 MAIN CIRCUIT BREAKER
38 MAIN DISCONNECT
39 HTF PUMP PDC
40 CHEMICAL & HAZARDOUS MATERIAL STORAGE
41 RESERVED FOR MECHANICAL EQUIPMENT
42 SCE STEP-DOWN TRANSFORMER (IF REQ'D)
43 ISOLATED PHASE BUS DUCT
44 SULFURIC ACID STORAGE TANK
45 SODIUM HYDROXIDE STORAGE TANK
46 DEGASIFIER
47 CAUSTIC CHEMICAL FEED SKID
48 CATION MIX BED
49 ACID CHEMICAL FEED SKID
50 BACKWASH & REGENERATION PUMPS
51 ANION MIX BED
52 WATER TREATMENT CONTROL PANEL
53 WATER TREATMENT POWER PANEL
54 NEUTRALIZATION STORAGE TANK (80,000 GALLONS)
55 DEMINERALIZED WATER TREATMENT TRAILERS
56 BISULFITE STORAGE TANK
57 SCALE INHIBITOR STORAGE TANK

STACK LOCATIONS	N	E
START-UP BOILER 1	640246.86	1996198.53
START-UP BOILER 2	640246.86	1996221.22
DIESEL FIRE PUMP	640675.45	1996578.25

PLANT NORTH

LEGEND:
GRAVEL
ASPHALT
CONCRETE

60 0 60 120 180
SCALE: 1" = 60'

PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE
APPROVED STATUS — DATE — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE

ORIGINATING PERSONNEL
DRAWN BY: SED
CHECKED BY: JLF
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER
PROJECT MANAGER: GRB

PROFESSIONAL ENGINEER'S SEAL

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: STATE:
LIC. NO.: DATE:

WorleyParsons resources & energy

CLIENT/PROJECT TITLE
BEACON SOLAR LLC
BEACON SOLAR ENERGY PROJECT
Figure 2-5

GENERAL ARRANGEMENT
POWER BLOCK
EQUIPMENT LAYOUT

SCALE: 1" = 60'
DRAWING SIZE: ARCH D (24" x 36")
WORLEYPARSONS DWG. NO.: FPLS-0-SK-111-002-003
REV: C

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
C	12/06/07	ELD	JLF					GRB

ISSUED FOR REVIEW

FAC	PIPING	I & C	ELECT	MECH	CIVIL	STRUC

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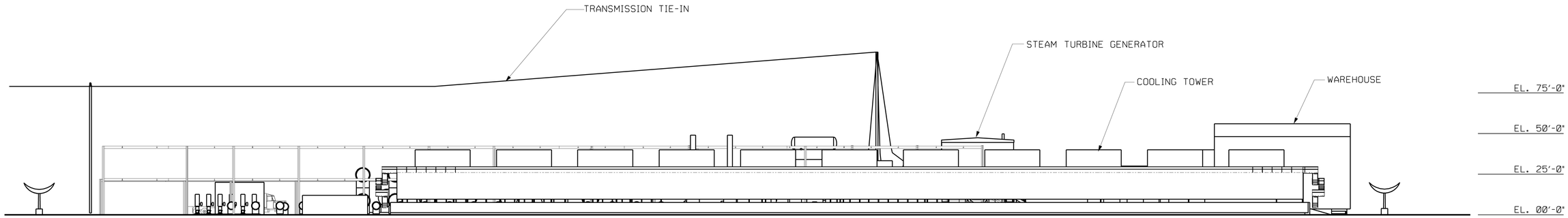
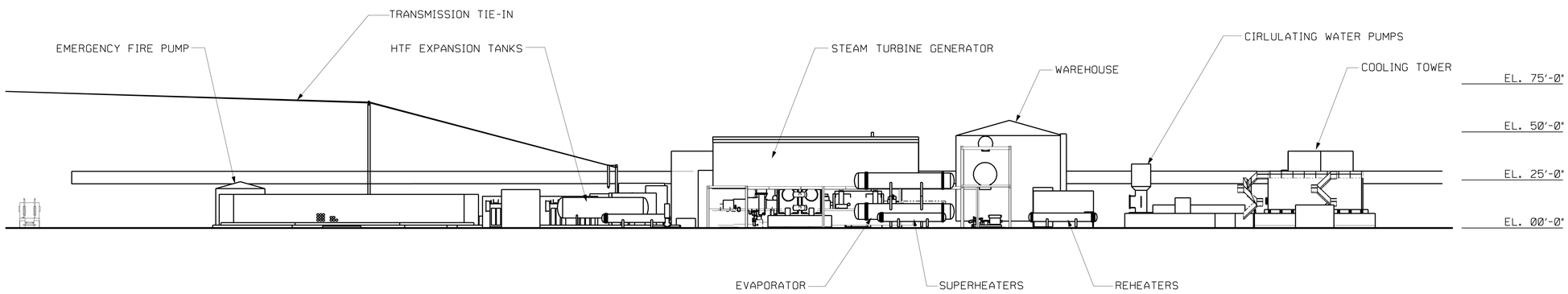
DWG-DATE: 30-Nov-07 08:30



SECTION "A-A"
FROM DWG. FPLS-0-SK-111-002-003
LOOKING NORTH



SECTION "B-B"
FROM DWG. FPLS-0-SK-111-002-003
LOOKING EAST

30 0 30 60 90
SCALE IN FEET

PRELIMINARY STATUS LDE	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS LDE	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED 'HOLD' RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: SED	
CHECKED BY: JLF	
LEAD DESIGNER	
ENGINEER/TECH SPECIALIST	
PROJECT ENGINEERING MANAGER	
PROJECT MANAGER: GRB	

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE#: STATE:
LIC. NO.: DATE:

WorleyParsons
resources & energy

CLIENT/PROJECT TITLE
BEACON SOLAR LLC
BEACON SOLAR ENERGY PROJECT

Figure 2-6

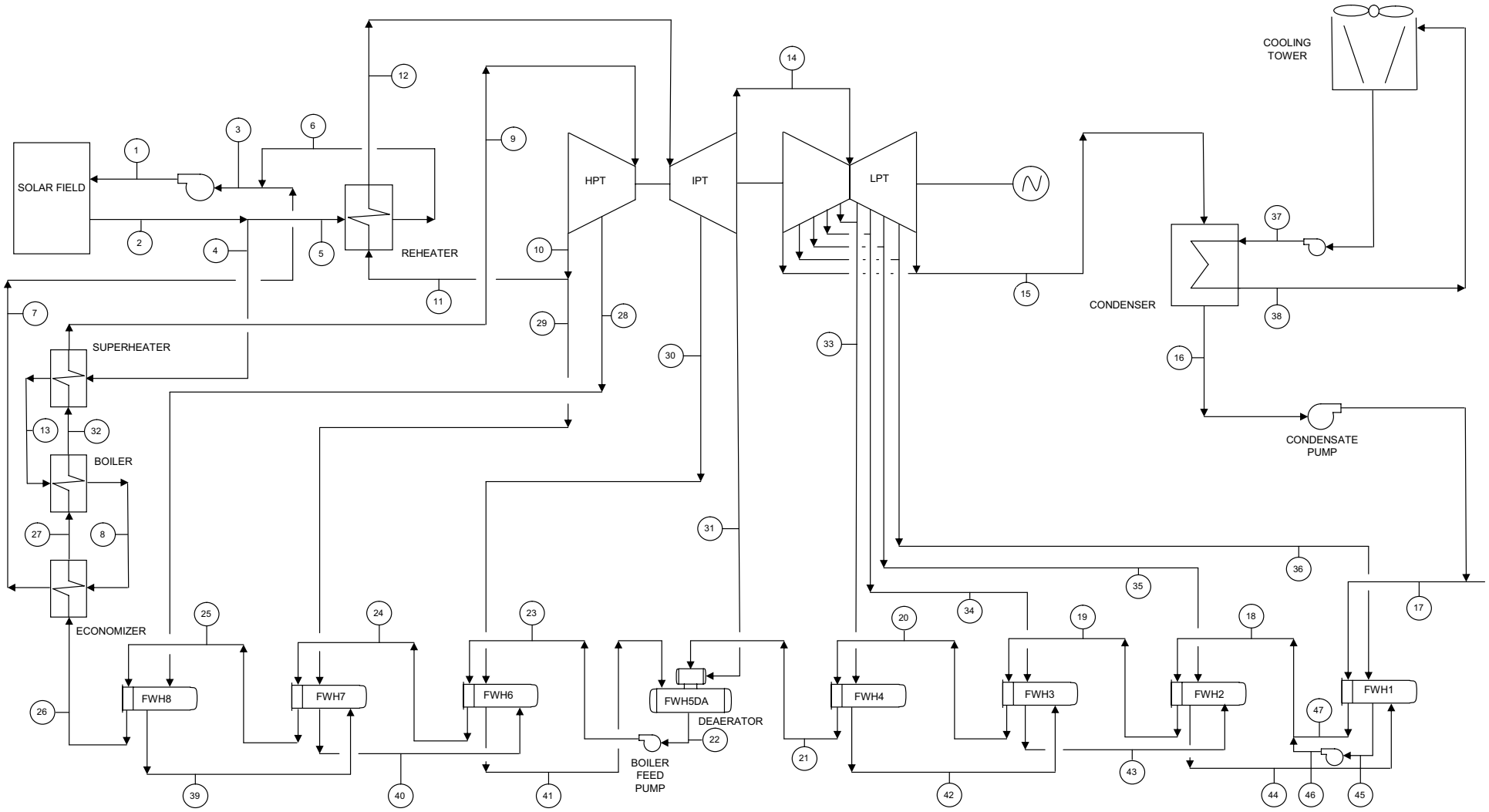
GENERAL ARRANGEMENT
POWER BLOCK
ELEVATION VIEWS

SCALE: 1" = 30'
DRAWING SIZE: ARCH D (24" x 36")
WORLEYPARSONS DWG. NO.: FPLS-0-SK-111-002-006
REV: B

REV	DATE	VJB	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
B	02/22/08	VJB							GRB

FAC PIPING I & C ELECT MECH CIVIL STRUC

DWG-FILE: FPLS-0-SK-111-002-006.dgn
DWG-DATE: 21-Feb-08 17:10



Issued for AFC	JLF	02/08/08
Preliminary	BJR	11/09/07
Description	By	Date

Figure 2-7

Page 1 of 6

Name		Signature	Date
Engineer:	BJR		
Checked:	GHP		
Approved:	GRB		

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HEAT BALANCE DIAGRAM

Beacon Solar Energy Project

Rev B.

Figure 2-7

WorleyParsons
resources & energy

Rev B
2/12/2008

Beacon Energy, LLC
Beacon Solar Energy Project

Heat Balance Data

#	Description		Case #1 - Hot Day Design Point	Case #2 - Annual Average
-	Ambient Conditions	Ambient DB Temperature (F)	104	71
-	Ambient Conditions	Relative Humidity	16%	27%
-	System Performance	Gross Power Output (kW)	280,000	280,004
-	System Performance	Aux Loads (kW)	30,000	30,000
-	System Performance	Net Output (MW)	250	250
-	System Performance	Steam Cycle Efficiency	34.7%	35.2%
1	HTF to Solar Field	Flow (lb/hr)	21,876,200	21,232,835
		Temp (F)	554	550
		Press (psia)	-	-
		Enthalpy (BTU/lb)	229	227
2	HTF from Solar Field	Flow (lb/hr)	21,876,200	21,232,835
		Temp (F)	743	743
		Press (psia)	-	-
		Enthalpy (BTU/lb)	339	339
3	HTF Return to Pump	Flow (lb/hr)	21,876,200	21,232,835
		Temp (F)	554	550
		Press (psia)	-	-
		Enthalpy (BTU/lb)	229	227
4	HTF to Superheater	Flow (lb/hr)	19,538,923	18,953,643
		Temp (F)	740	740
		Press (psia)	-	-
		Enthalpy (BTU/lb)	337	337
5	HTF to Reheater	Flow (lb/hr)	2,337,277	2,279,192
		Temp (F)	740	740
		Press (psia)	-	-
		Enthalpy (BTU/lb)	337	337
6	HTF from Reheater	Flow (lb/hr)	2,337,277	2,279,192
		Temp (F)	439	437
		Press (psia)	-	-
		Enthalpy (BTU/lb)	158	157
7	HTF from Economizer	Flow (lb/hr)	19,538,923	18,953,643
		Temp (F)	568	564
		Press (psia)	-	-
		Enthalpy (BTU/lb)	236	234
8	HTF to Economizer	Flow (lb/hr)	19,538,923	18,953,643
		Temp (F)	612	611
		Press (psia)	-	-
		Enthalpy (BTU/lb)	261	260
9	HP Steam to STG	Flow (lb/hr)	2,400,727	2,366,111
		Temp (F)	699	699
		Press (psia)	1,540	1,521
		Enthalpy (BTU/lb)	1,283	1,285
10	CRH from STG	Flow (lb/hr)	2,204,274	2,173,546
		Temp (F)	421	419
		Press (psia)	311	307
		Enthalpy (BTU/lb)	1,163	1,164

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2/12/2008

Beacon Energy, LLC
Beacon Solar Energy Project

Heat Balance Data

#	Description		Case #1 - Hot Day Design Point	Case #2 - Annual Average
11	CRH to Reheater	Flow (lb/hr)	2,076,503	2,048,199
		Temp (F)	419	417
		Press (psia)	304	300
		Enthalpy (BTU/lb)	1,162	1,163
12	HRH to STG	Flow (lb/hr)	2,076,502	2,048,200
		Temp (F)	700	700
		Press (psia)	291	287
		Enthalpy (BTU/lb)	1,370	1,370
13	HTF Supply to Boiler	Flow (lb/hr)	19,538,923	18,953,643
		Temp (F)	717	716
		Press (psia)	-	-
		Enthalpy (BTU/lb)	323	322
14	Crossover Steam	Flow (lb/hr)	1,960,195	1,934,011
		Temp (F)	469	469
		Press (psia)	100	99
		Enthalpy (BTU/lb)	1,264	1,264
15	STG Exhaust	Flow (lb/hr)	1,619,978	1,584,226
		Temp (F)	103	93
		Press (psia)	1.04	0.77
		Enthalpy (BTU/lb)	992	983
16	Condenser Hotwell	Flow (lb/hr)	1,619,978	1,584,226
		Temp (F)	103	93
		Press (psia)	1.04	0.77
		Enthalpy (BTU/lb)	71	61
17	Condensate Pump Discharge to FWH1	Flow (lb/hr)	1,619,978	1,584,226
		Temp (F)	103	93
		Press (psia)	200	200
		Enthalpy (BTU/lb)	72	62
18	Condensate to FWH2	Flow (lb/hr)	1,960,197	1,934,010
		Temp (F)	145	143
		Press (psia)	178	179
		Enthalpy (BTU/lb)	114	111
19	Condensate to FWH3	Flow (lb/hr)	1,960,197	1,934,010
		Temp (F)	197	196
		Press (psia)	155	157
		Enthalpy (BTU/lb)	165	164
20	Condensate to FWH4	Flow (lb/hr)	1,960,197	1,934,010
		Temp (F)	246	245
		Press (psia)	132	135
		Enthalpy (BTU/lb)	215	214
21	Condensate to FWH5/Deaerator	Flow (lb/hr)	1,960,197	1,934,010
		Temp (F)	287	287
		Press (psia)	107	111
		Enthalpy (BTU/lb)	257	256

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2/12/2008

Beacon Energy, LLC
Beacon Solar Energy Project

Heat Balance Data

#	Description		Case #1 - Hot Day Design Point	Case #2 - Annual Average
22	Boiler Feed Pump Suction	Flow (lb/hr)	2,400,725	2,366,109
		Temp (F)	323	322
		Press (psia)	93	92
		Enthalpy (BTU/lb)	293	292
23	Feedwater to FWH6	Flow (lb/hr)	2,400,724	2,366,110
		Temp (F)	326	326
		Press (psia)	1,800	1,800
		Enthalpy (BTU/lb)	300	299
24	FW to FWH7	Flow (lb/hr)	2,400,724	2,366,110
		Temp (F)	367	366
		Press (psia)	1,780	1,781
		Enthalpy (BTU/lb)	342	341
25	Feedwater to FWH8	Flow (lb/hr)	2,400,724	2,366,110
		Temp (F)	410	409
		Press (psia)	1,760	1,761
		Enthalpy (BTU/lb)	388	386
26	FW to Economizer	Flow (lb/hr)	2,400,724	2,366,110
		Temp (F)	458	457
		Press (psia)	1,600	1,580
		Enthalpy (BTU/lb)	440	438
27	Feedwater to Boiler	Flow (lb/hr)	2,400,724	2,366,110
		Temp (F)	604	602
		Press (psia)	1,590	1,570
		Enthalpy (BTU/lb)	645	649
28	Extraction Steam to FWH8	Flow (lb/hr)	158,039	154,707
		Temp (F)	467	466
		Press (psia)	500	493
		Enthalpy (BTU/lb)	1,196	1,198
29	Extraction Steam to FWH7	Flow (lb/hr)	127,772	125,347
		Temp (F)	421	419
		Press (psia)	311	307
		Enthalpy (BTU/lb)	1,163	1,164
30	Extraction Steam to FWH6	Flow (lb/hr)	86,905	85,460
		Temp (F)	604	604
		Press (psia)	190	187
		Enthalpy (BTU/lb)	1,325	1,325
31	Pegging Steam to DA	Flow (lb/hr)	67,813	66,585
		Temp (F)	468	468
		Press (psia)	93	92
		Enthalpy (BTU/lb)	1,264	1,264
32	HP Steam to Superheater	Flow (lb/hr)	2,400,727	2,366,111
		Temp (F)	601	600
		Press (psia)	1,560	1,540
		Enthalpy (BTU/lb)	1,167	1,168

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2/12/2008

Beacon Energy, LLC
Beacon Solar Energy Project

Heat Balance Data

#	Description		Case #1 - Hot Day Design Point	Case #2 - Annual Average
33	LP Steam Extraction #1 to FWH4	Flow (lb/hr)	83,128	81,892
		Temp (F)	392	393
		Press (psia)	65	64
		Enthalpy (BTU/lb)	1,229	1,229
34	LP Steam Extraction #2 to FWH3	Flow (lb/hr)	93,568	92,809
		Temp (F)	282	283
		Press (psia)	33	33
		Enthalpy (BTU/lb)	1,179	1,180
35	LP Steam Extraction #3 to FWH2	Flow (lb/hr)	92,830	94,377
		Temp (F)	206	205
		Press (psia)	13	13
		Enthalpy (BTU/lb)	1,119	1,120
36	LP Steam Extraction #4 to FWH1	Flow (lb/hr)	70,692	80,706
		Temp (F)	153	152
		Press (psia)	4	4
		Enthalpy (BTU/lb)	1,052	1,052
37	Circ Water to Condenser	Flow (lb/hr)	74,806,576	74,806,576
		Temp (F)	78	68
		Press (psia)	45	45
		Enthalpy (BTU/lb)	46	36
38	Circ Water from Condenser	Flow (lb/hr)	74,806,576	74,806,576
		Temp (F)	98	88
		Press (psia)	37	37
		Enthalpy (BTU/lb)	66	56
39	Drain from FWH8	Flow (lb/hr)	158,039	154,707
		Temp (F)	419	418
		Press (psia)	480	474
		Enthalpy (BTU/lb)	396	395
40	Drain from FWH7	Flow (lb/hr)	285,810	280,053
		Temp (F)	376	374
		Press (psia)	292	289
		Enthalpy (BTU/lb)	349	348
41	Drain from FWH6	Flow (lb/hr)	372,716	365,515
		Temp (F)	335	334
		Press (psia)	177	174
		Enthalpy (BTU/lb)	307	305
42	Drain from FWH4	Flow (lb/hr)	83,128	81,892
		Temp (F)	255	254
		Press (psia)	60	59
		Enthalpy (BTU/lb)	224	223
43	Drain from FWH3	Flow (lb/hr)	176,696	174,701
		Temp (F)	206	205
		Press (psia)	30	30
		Enthalpy (BTU/lb)	174	173

Figure 2-7

WorleyParsons
resources & energy

Rev B
2/12/2008

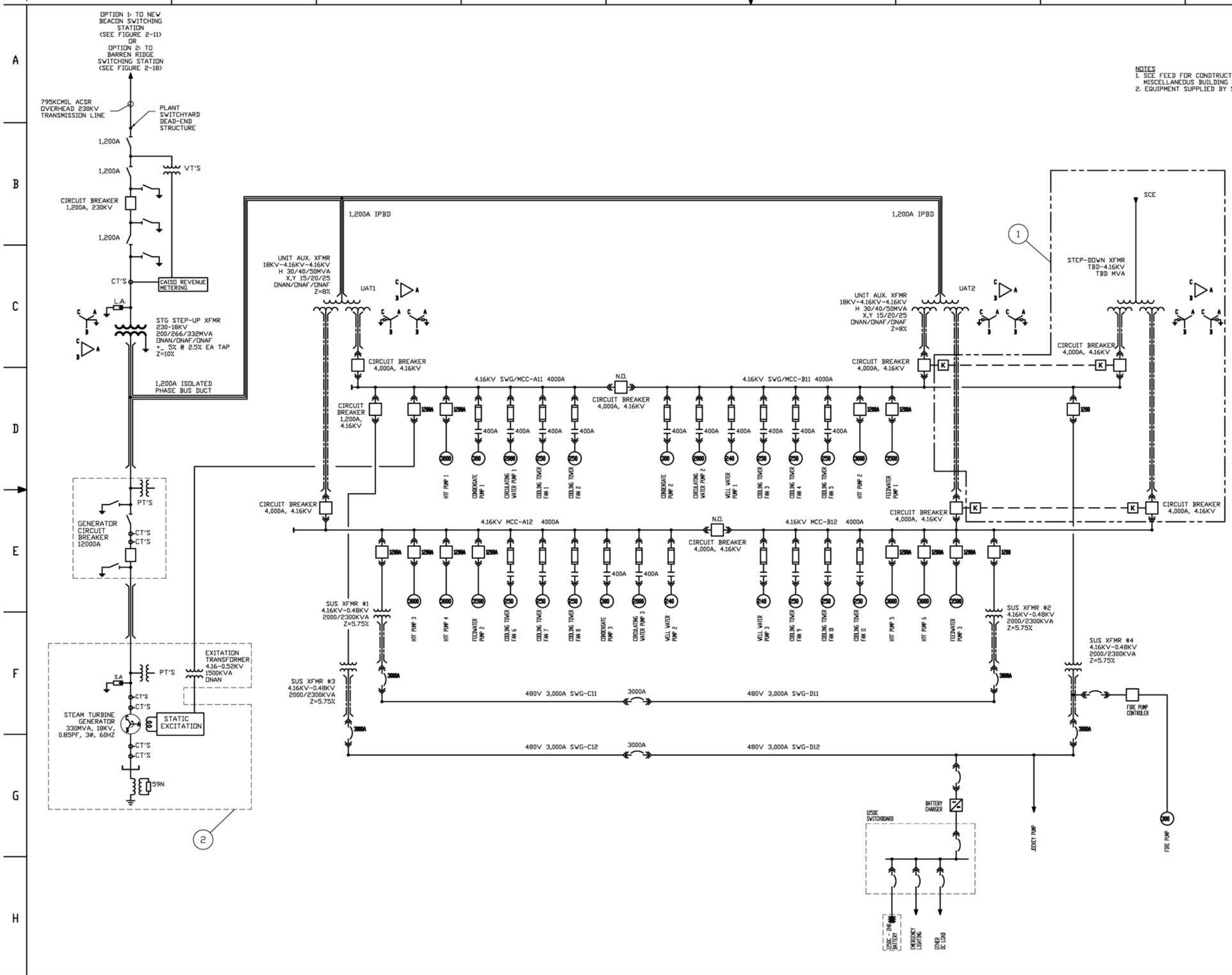
Beacon Energy, LLC
Beacon Solar Energy Project

Heat Balance Data

#	Description		Case #1 - Hot Day Design Point	Case #2 - Annual Average
44	Drain from FWH2	Flow (lb/hr)	269,526	269,078
		Temp (F)	154	152
		Press (psia)	12	12
		Enthalpy (BTU/lb)	122	120
45	Drain from FWH1	Flow (lb/hr)	340,218	349,784
		Temp (F)	150	147
		Press (psia)	4	3
		Enthalpy (BTU/lb)	118	115
46	Drain from FHW1 after pump	Flow (lb/hr)	340,218	349,784
		Temp (F)	150	148
		Press (psia)	200	200
		Enthalpy (BTU/lb)	118	116
47	Condensate from FWH1	Flow (lb/hr)	1,619,978	1,584,226
		Temp (F)	144	142
		Press (psia)	178	179
		Enthalpy (BTU/lb)	113	110

Figure 2-8 Typical Trough Solar Collector

Figure 2-9 Aerial Photograph of Kramer Junction SEGS Site



NOTES
1. SCE FEED FOR CONDTRUCTION POWER AND MISCELLANEOUS BUILDING LOADS.
2. EQUIPMENT SUPPLIED BY STG MANUFACTURER.

REV	DATE	DESCRIPTION	DRAWN	DESIGNED	LEAD DESIGNER	ENGINEER/TECH SPECIALIST	PROJECT ENGINEERING MANAGER	LEAD DISC. ENGINEER	PROJECT MANAGER	PROFESSIONAL ENGINEER	PROJECT DIRECTOR
D	05 04 10	FOR AFC		SR	GB		SR	SR			GB
C	05 14 10	FOR REVIEW		SR	GB		JS	SR			GB
B	05 18 10	FOR REVIEW		EDD		JPZ	JS			GB	
A	11 05 09	FOR REVIEW							JS		

PRELIMINARY STATUS — DATE — LDE
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS — DATE — LDE
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL
DRAWN BY: EDD
CHECKED BY:
LEAD DESIGNER: JPZ
ENGINEER/TECH SPECIALIST: JOE STANLEY
PROJECT ENGINEERING MANAGER: GEOFF BAXTER
PROJECT MANAGER:

PROFESSIONAL ENGINEER'S SEAL

Zero Harm — Leadership, No Incidents, Safe Behavior

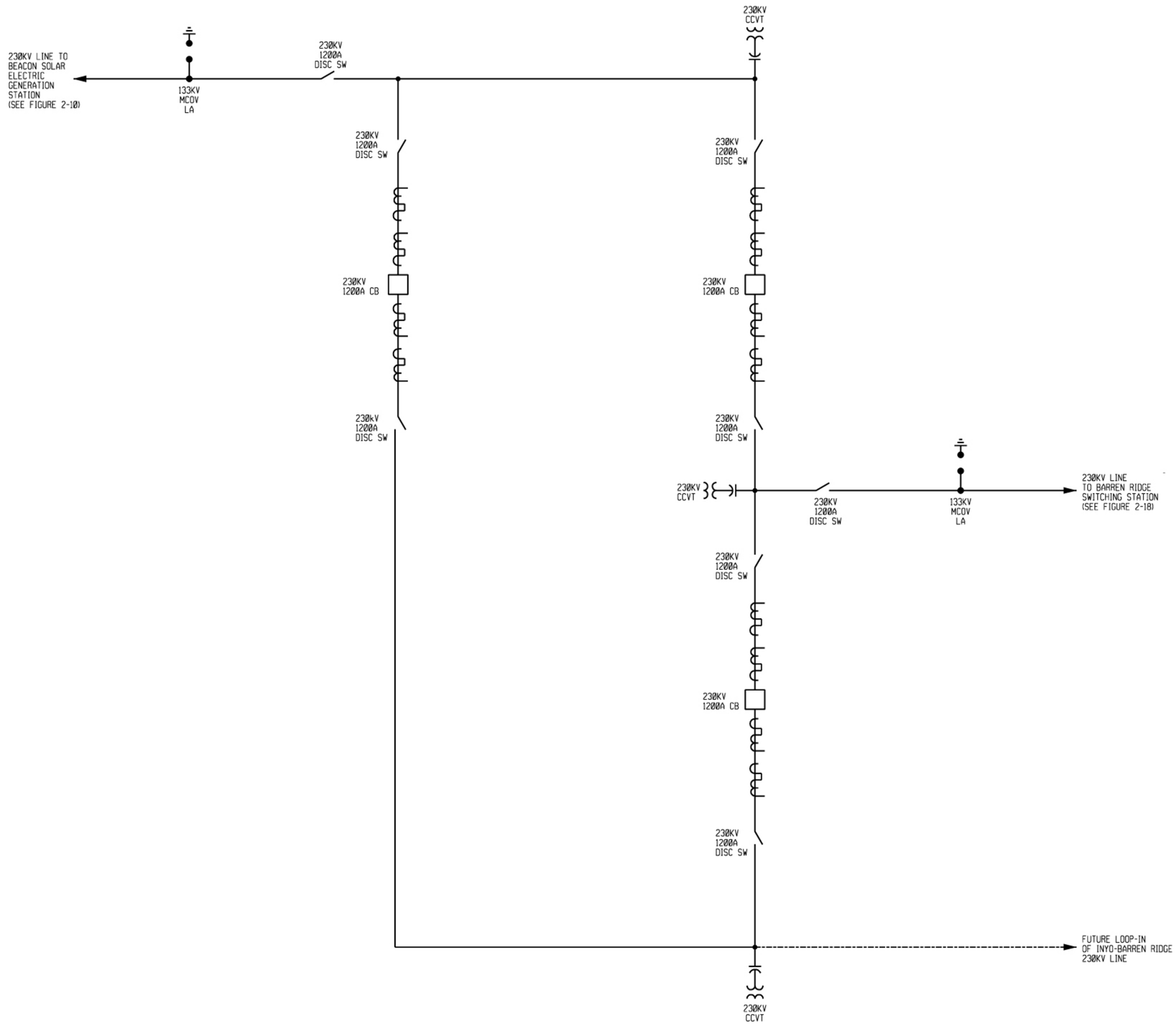
WorleyParsons resources & energy

CLIENT/PROJECT TITLE
BEACON SOLAR, LLC
BEACON SOLAR ENERGY PROJECT

CONCEPTUAL
KEY ONE LINE DIAGRAM
Figure 2-10

SCALE: SR
DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: FPLS-0-SK-623-206-001
REV: D

FPLS-0-SK-623-206-001 REV.D.dwg 26-Feb-2009 - 11:03



REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH SPEC	LEAD ENGR	PROJ ENGR MANAGER	PROJECT MANAGER
B	02 26 08	REVISED AS INDICATED 4 PLACES	RLH	SR	JS		SR	GB	GB
A	02 18 08	ISSUED FOR AFC	RLH	SR	JS		SR	GB	GB

PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE J STANLEY 02/14/08

APPROVED STATUS — DATE — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE

ORIGINATING PERSONNEL

DRAWN BY: RLH
CHECKED BY: J STANLEY
LEAD DESIGNER: SCR
ENGINEER/TECH SPECIALIST: SCR
PROJECT ENGINEERING MANAGER: GEOFF BAXTER
PROJECT MANAGER:

PROFESSIONAL ENGINEER'S SEAL

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PEG ____ STATE ____
LIC. NO. ____ DATE ____

WorleyParsons
resources & energy

CLIENT/PROJECT TITLE
BEACON SOLAR, LLC
BEACON SOLAR ENERGY PROJECT
Figure 2-11

CONCEPTUAL
ONE LINE DIAGRAM
230KV BSEP SWITCHING STATION

SCALE: NONE
DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: FPLS-1-SK-662-206-001
REV: B

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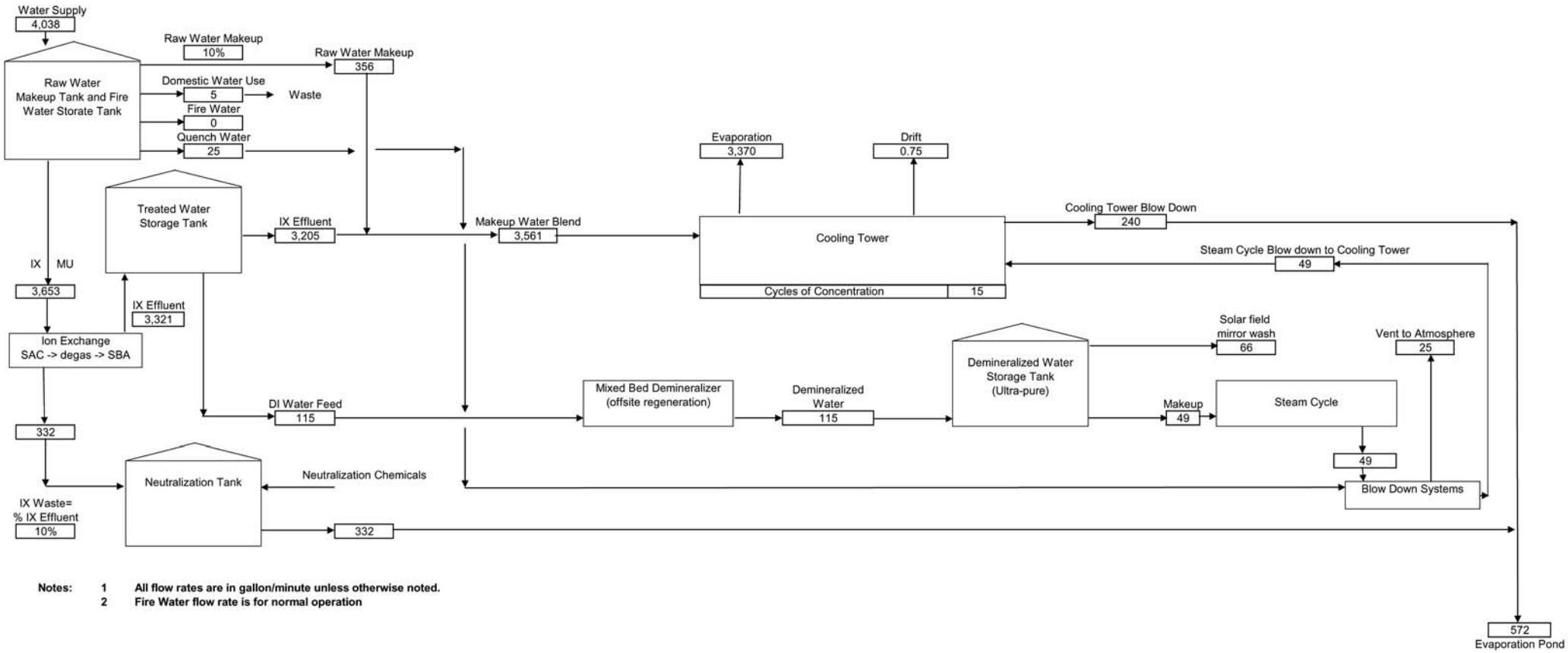

Notes:
1. **All flow rates are in gallon/minute unless otherwise noted.**
2. **Fire Water flow rate is for normal operation**

Rev.	Description	By	Date
C	Issued for AFC	SDS	02/07/08
B	Water Balance with pre-treatment (Opt 2)	SDS	10/31/07
A	Initial format and calculations	MRP	05/03/07

Figure 2-12

Design Case:

Net Output	250 MW	
Dry bulb Temp	104	Deg F
Wet Bulb Temp	68	Deg F
Amb Pressure	13.51	psia

WorleyParsons
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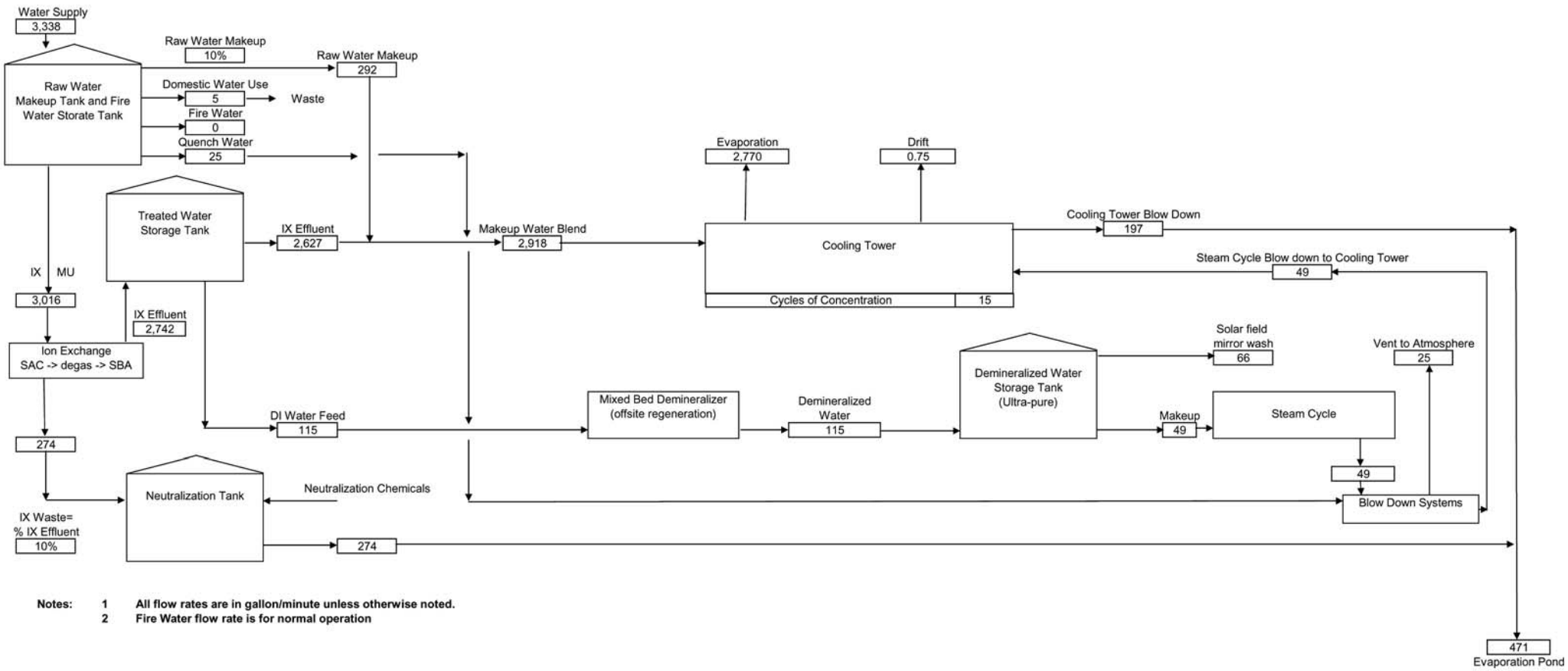
Water Balance, Summer Typical

Beacon Solar Energy Project

Rev. C



Notes:
1. **All flow rates are in gallon/minute unless otherwise noted.**
2. **Fire Water flow rate is for normal operation**

Rev.	Description	By	Date
C	Issued for AFC	SDS	02/07/08
B	Water Balance with pre-treatment (Opt 2)	SDS	10/31/07
A	Initial format and calculations	MRP	05/03/07

Figure 2-13

Design Case:

Net Output	250 MW	
Dry bulb Temp	71	Deg F
Wet Bulb Temp	52	Deg F
Amb Pressure	13.51	psia

WorleyParsons
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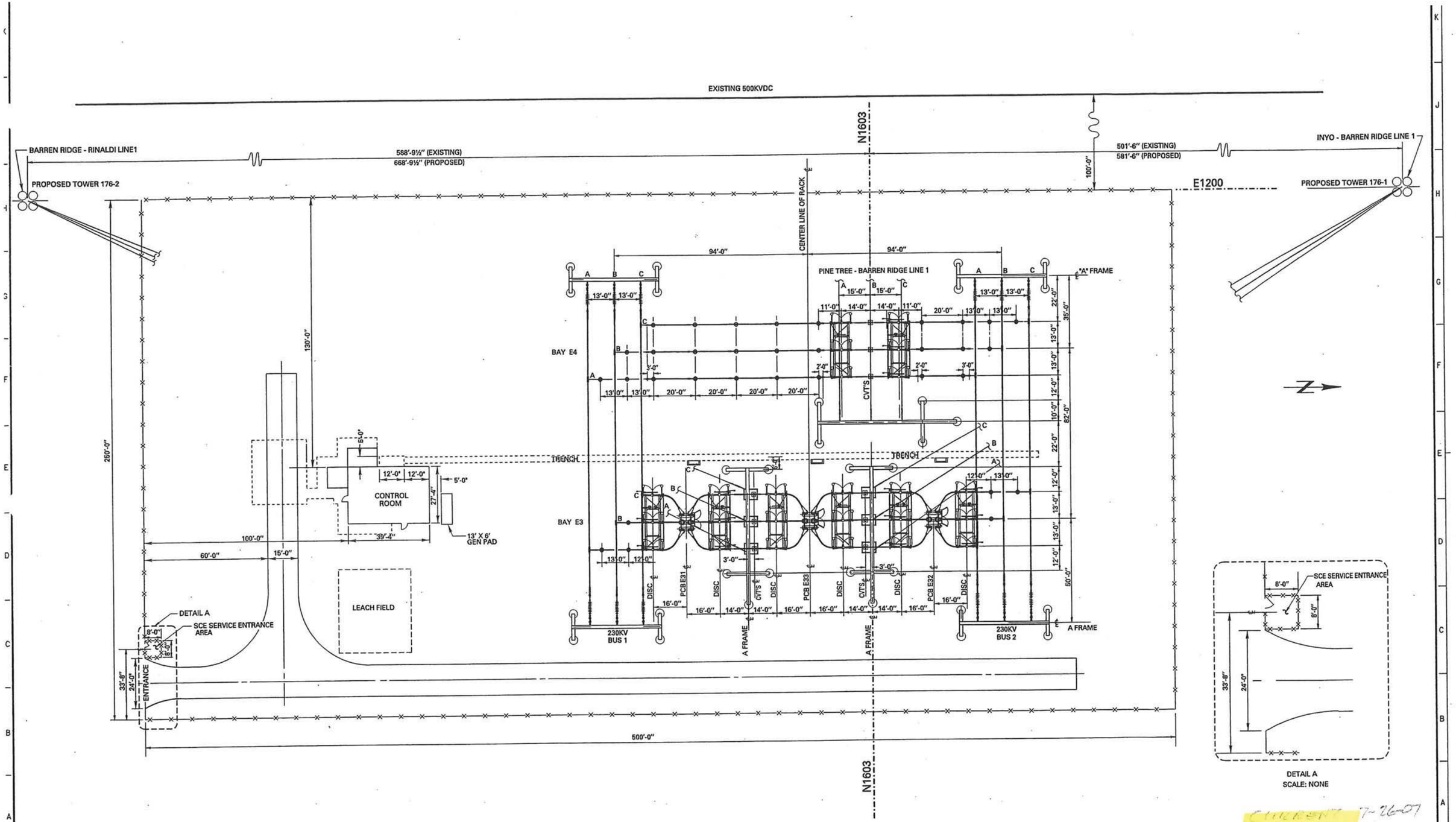
Water Balance, Annual Typical

Beacon Solar Energy Project

Rev. C

Figure 2-14a Transmission Line Route – Existing Conditions

Figure 2-14b Transmission Line Route With Simulated BSEP Facilities



CURRENT 7-26-07
DRAFTING

EQUIPMENT PLAN EA6

Figure 2-15

REVISIONS	
NO.	DESCRIPTION

Revision Number
DRAFTING RELEASE
DRAWN BY
CHECKED BY
ENGINEERING APPROVAL

OWNER/AGENT APPROVAL
DRAWING REVISION RELEASE APPROVAL
FINAL APPROVAL RELEASE SIGNATURE — DATE 3/9/06

SCALE: (UNLESS NOTED) 1"=20'-0"
DRAFTING RELEASE
DRAWN BY JBI
CHECKED BY JBI
ENGINEERING APPROVAL 3/9/06

OWNER/AGENT APPROVAL
DRAWING RELEASE APPROVAL
FINAL APPROVAL RELEASE SIGNATURE — DATE

DESIGN EQUIPMENT PLAN
BARREN RIDGE SWITCHING STATION

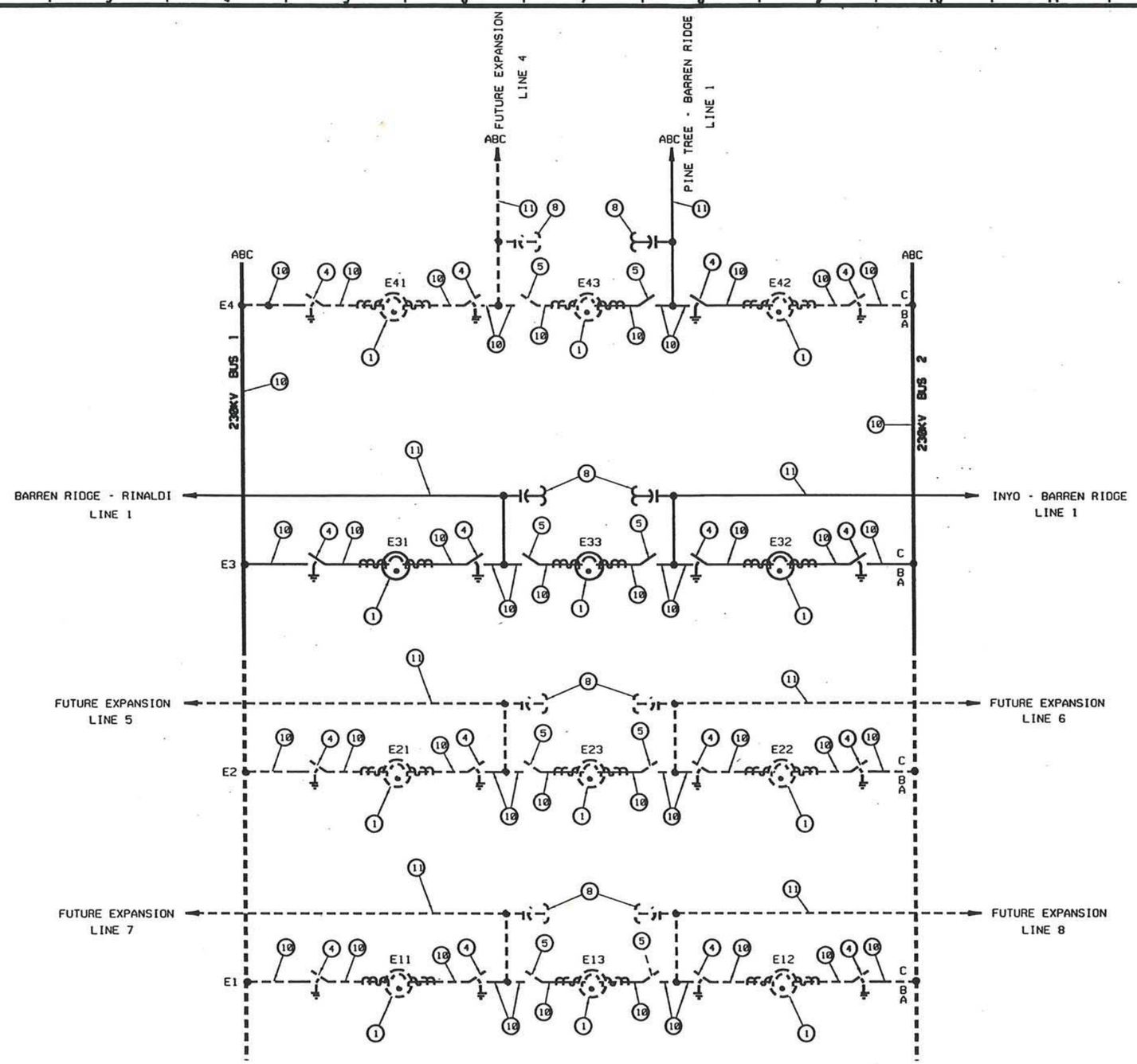
POWER SYSTEM
DEPARTMENT OF WATER AND POWER
CITY OF LOS ANGELES

DRAWING NUMBER
J43-EA3
REV. 0

DES. ENGR. IF I
SUP. ENGR. B. VATANPOUR

DRA E050020
J43EA3.DGN
2-10-06

PART NO.	PARTS LIST DESCRIPTION
1	PCB. 230KV. 3000A. 40KA. SF6
2	
3	
4	SW. DISC. 230KV. 3000A. 3P W/ GND
5	SW. DISC. 230KV. 3000A. 3P
6	
7	
8	XFMR. COUPLING CAP VOLTAGE. 230KV-115V. (3)
9	
10	CABLE. ALUMINUM. 2500KCMIL. BARE
11	CABLE. ALUMINUM. 1272KCMIL. BARE. ACS/AW
12	
13	
14	
15	
16	
17	
18	
19	
20	



FOR FUTURE USE

NOTE:
1. CONTROL AND OPERATING VOLTAGE: 125VDC.
2. SUPERVISORY VOLTAGE: 125VDC.

RELAY AND METERING SCHEMATIC EA2

Figure 2-16

Revision Number 1
DRAWN BY J B IGNACIO
CHECKED BY
SCALE: (UNLESS NOTED) NONE
DRAWN BY ASHKAN NASSIRI/JB
CHECKED BY

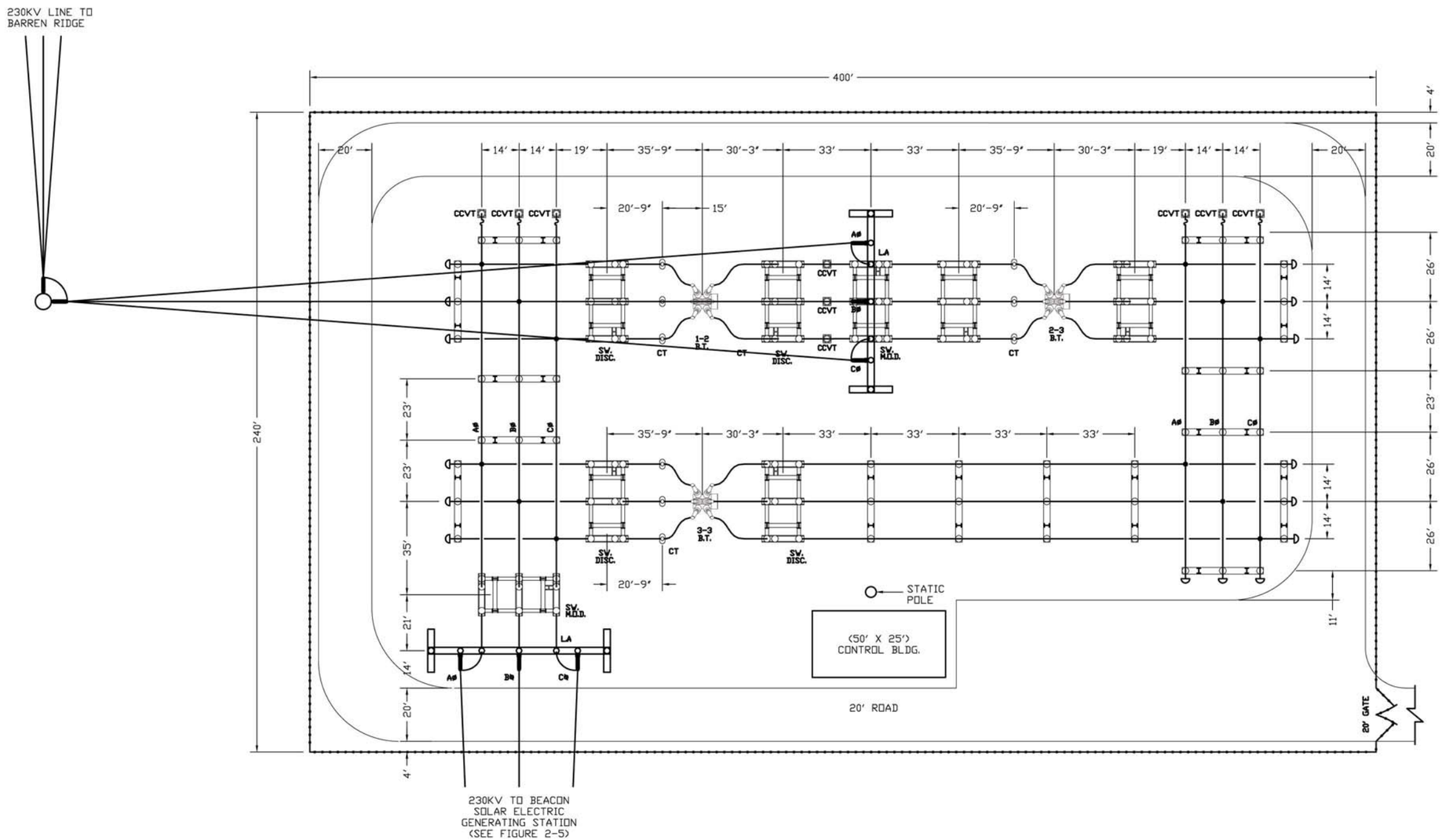
ONE LINE DIAGRAM
BARREN RIDGE SWITCHING STATION

POWER SYSTEM
DEPARTMENT OF WATER AND POWER
CITY OF LOS ANGELES

DRAWING NUMBER J43-EA1

J43EA1.DGN

j43ea1_Revised.dgn 7/24/2007 2:34:05 PM



REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPECIALIST	PROJECT ENGINEERING MANAGER	PROJECT MANAGER
C	15/4/08	FOR AFC	SR	JS		SR	JS	GB GB
B	15/4/08	FOR REVIEW	SR	VH	KBB	SR	SR	GB GB
A	15/4/07	FOR REVIEW	SR	SR	KBB	SR	SR	GB GB

PRELIMINARY STATUS — DATE — LINE
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS — DATE — LINE
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

DESIGNATING PERSONNEL

DRAWN BY: STEVEN RICHARDS
CHECKED BY: JOE STANLEY
LEAD DESIGNER:
ENGINEER/TECH SPECIALIST: STEVEN RICHARDS
PROJECT ENGINEERING MANAGER: GEOFF BAXTER
PROJECT MANAGER: GOEFF BAXTER

PROFESSIONAL ENGINEER'S SEAL

Zero Harm — Leadership, No Incidents, Safe Behavior

PERSONALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE ____ STATE ____ LIC. NO. ____ DATED ____

WorleyParsons resources & energy

CLIENT/PROJECT TITLE
BEACON SOLAR, LLC
BEACON SOLAR ENERGY PROJECT

CONCEPTUAL LAYOUT
230KV BSEP SWITCHING STATION
Figure 2-17

SCALE 1" =20'-0" | DRAWING SIZE ARCH D (36" x 24")

WORLEYPARSONS DWG. NO. FPLS-0-SK-595-201-001 | REV C

FPLS-0-SK-595-201-001 rev.dwg
14-Feb-2008 - 13:29