3.1 INTRODUCTION

This section describes Stirling Energy Systems (SES) Solar One (Solar One or Project) and its ancillary facilities and systems. The Project will be one of the world's largest solar power projects. It will be owned and operated by SES Solar Three, LLC and SES Solar Six, LLC (Solar One or Applicant). The Project will consist of approximately 34,000 solar dish Stirling systems (referred to as SunCatchers), their associated equipment and systems, and their support infrastructure. The nominal design electric capacity of the Project is approximately 850 megawatts (MW). The Project Site is approximately 8,230 acres and is located in San Bernardino County, California (see Figures 1-1, and 1-2, in Section 1).

For the Project, the Applicant will deploy SES's SunCatcher proprietary technology, which consists of solar concentrating dishes coupled with Solar Stirling Engine Power Conversion Units (PCUs). The SunCatcher technology has been developed, optimized, and matured during the past 20 years. It offers a number of distinct and unique benefits in the production of utility-scale electric power. These advantages include the items listed below.

Performance

- **High Peak Efficiency:** The SunCatcher technology is the world's most efficient solar power to grid-quality electricity system. The SES technology has had one of the world's records for efficiency since 1984 and in January 2008, SunCatcher broke its own record, achieving a conversion efficiency rating of 31.25 percent.
- **High Part-Load Efficiency:** The Solar Stirling Engine integrated into the SunCatcher delivers high part-load efficiency. Thus, little degradation of conversion efficiency occurs in suboptimal solar conditions, resulting in high annual performance.
- **Durability/Long Life:** This technology has been in operation since 1984 with no appreciable loss in any of the key performance criteria (reflectivity, electrical output, structural integrity, or efficiency). In fact, prototypes have been built and moved to various locations in the 24-year lifetime of the technology with no appreciable degradation in performance.

Modularity Design

Each SunCatcher is a highly efficient, modular, self-contained electricity generator. This leads to the advantages listed below.

- **Immediate Power Production:** This technology allows immediate power production from units or groups of units as they are installed. A key result of this is that the overall cost of the Project is reduced due to the combined impacts of higher efficiencies and earlier generation of electricity during the installation period.
- **High Availability:** The modularity of the Project facilities provides a high degree of redundancy which benefits overall availability. The failure of any specific unit or group of units will not have an adverse effect on the performance of the overall Project.
- **Terrain Tolerance:** The modularity allows the units to be installed on sloping land with up to a 10 percent grade. This significantly reduces the requirements for grading of sites, thereby minimizing the ground disturbance.

- **Mass Production:** Modularity allows high volume and low cost automotive-style mass production. This type of mass production also provides the opportunity for high-precision, highly consistent quality of manufacturing, which translates into higher reliability of system performance. Another advantage of mass production processing is the ability to work in controlled factory environments that are designed and operated based on lean manufacturing principles. The result is considerably lower levels of waste generation throughout the process, both in manufacturing and site deployment. Furthermore, modularity facilitates recycling and management of the waste generated. An additional benefit is that manufacturing at off-site factories will result in reduced disturbance of the Project Site during installation.

Environmental

- **Water Usage:** The SunCatcher[1] technology does not employ steam in its generation process. In fact, the only water consumption specific to the SunCatcher technology is that required for mirror washing.
- **Emissions:** SunCatchers do not consume fossil fuels; therefore, no combustion emissions are specifically associated with the operation of this technology.

3.1.1 Technology

The Solar One technology is the most efficient solar-powered electricity-generating technology currently deployed in the world. The SunCatcher electric power generation profile aligns well with utility peak demand requirements and has a predictable "time-of-day" output. Solar insolation, the amount of incoming solar radiation, varies annually from summer to winter, which causes a similar variation in the daily output power of the Project.

Each SunCatcher consists of a PCU and a mirrored-surface dish assembly operating as a solar concentrator that automatically tracks the sun. The dish assembly collects and focuses solar energy onto the PCU to generate electricity. Each PCU consists of a solar receiver heat exchanger and a closed-cycle, high-efficiency Solar Stirling Engine specifically designed to convert solar power to rotary power via a thermal conversion process. The engine drives an electrical generator to produce grid-quality electricity. Power generated by the 1.5MW groups of 60 SunCatchers per group will be collected through a 600-volt underground power collection system. This collection system will combine the output from the units and connect each 1.5MW group to a generator step-up unit (GSU) transformer with an output voltage of 34.5 kilovolt (kV). The output from the GSUs will be grouped into 3-, 6-, and 9MW groups, which will be connected via 34.5kV underground collection circuits to 48- or 51MW, 34.5kV overhead collection circuits, each of which will be connected directly to the on-site collection substation. The on-site collection substation will be connected via a 220kV, single-circuit overhead interconnection transmission line for delivery of generated electricity to the Southern California Edison (SCE) Pisgah Substation, where the interconnect to the California Independent System Operator (CAISO)-controlled grid will take place.

[1] These references are for the SunCatcher systems. Limited water and fuel consumption and vehicle emissions associated with operation and maintenance activities for a utility-scale power plant will still be required.

3.1.2 Project Summary

The Project will include the construction of a new 220kV substation approximately in the center of the Project Site. The Project design will minimize land disturbance, and the Project will operate with no fossil-fuel emissions from the electric generation process. Well water will be stored on-site for all operational needs. The drainage swales will be constructed to intercept and convey the surface low-flows from undisturbed natural areas to debris basins. Rainfall runoff will be collected and percolated into the ground. Main roads will be constructed with a combination of roadway dips and elevated sections across the drainage features. A stem pipe concept may be used at some of these crossings; the stem pipes will retain a small amount of water, which will be percolated into the ground. The sanitary system will consist of a buried septic tank system with a dual sanitary leach field.

The Project will be constructed in two phases. As shown on Figure 3-1, Solar One – Site Plan – Phase I – During Construction, Phase I of the Project will consist of up to 20,000 SunCatchers configured in 333 (1.5MW) solar groups of 60 SunCatchers per group that will have a net nominal generating capacity of 500MW. As shown on Figure 3-2, Solar One – Site Plan – Phase II – During Construction, and Figure 3-3, Solar One– Site Plan – Post-Construction, Phase II will expand the Project to 34,000 SunCatchers configured in 567 (1.5MW) solar groups with a total net generating capacity of 850MW. The Project will be connected to the SCE Pisgah Substation via an approximate 2-mile, single-circuit, 220kV transmission line. The Project will require the proposed SCE expansion and upgrade of the 220kV SCE Pisgah Substation, increasing the voltage to 500kV, looping the Eldorado-Lugo 500kV line into the SCE Pisgah Substation and removing 65 miles of the of the existing Lugo-Pisgah No 2 220kV Transmission Line and reinstalling a new 500kV transmission line from the SCE Pisgah Substation to the Lugo Substation. In addition, modifications within the SCE Eldorado and Lugo substations will be required. See Appendix EE, Lugo-Pisgah No. 2 500kV Transmission Line and Substation Siting Study, for more details regarding these upgrades.

Within the Project boundary, Phase I requires approximately 5,838 acres of BLM land and Phase II requires approximately 2,392 acres of BLM land. The total area of BLM land, within the Project boundary, required for both phases, including the area for the operation and administration building, the maintenance building, and the substation, is approximately 8,230 acres. A portion of the 220kV transmission line that will be built for the Project will parallel the Burlington Northern Santa Fe (BNSF) Railroad Right-of-Way (ROW) and the remaining portion will parallel the SCE transmission line within the Project boundary, as shown on Figure 3-5. The Applicant has applied for a ROW grant for the Project Site from the Bureau of Land Management (BLM) California Desert District (CDD). Although the Project is phased, it is being analyzed in this Application for Certification as if all phases will be operational at the same time.

The main entry for traffic to the Project Site during construction will be from Interstate 40 (I-40) via a proposed temporary half interchange approximately 3 miles east of the Project Site. The proposed interchange will accommodate west bound traffic and will be constructed on the north side of I-40. A proposed temporary two-lane off-site access road will be constructed from this interchange back to the Project Site.

During Project operation, the main access (entry and exit) to the site will be from Hector Road. The portion of the Project north of the BNSF Railroad will be accessed via a proposed overpass

over the railroad that will be constructed on the Project Site. During Project operation, the secondary and emergency access will be from the existing road network.

3.2 LOCATION OF THE PROJECT

The Project Site is located in San Bernardino County in an undeveloped area of the Mojave Desert located approximately 115 miles east of Los Angeles, California, and 37 miles east of Barstow, California along I-40. The following sections or portions of sections in Townships 8 and 9 of the San Bernardino Meridian identify the Project Site and the planned boundary for development of the Project.

Within Township 8 North, Range 5 East of the San Bernardino Meridian defined by:

- the eastern half of Section 2,
- the portion of the northeast and northwest quarter sections and the northeast and southeast quarter-quarter sections of the south east quarter section of Section 8 south of the railroad ROW and north of the I-40 ROW,
- the southwest, northeast, and southeast quarter of Section 10,
- the portion of Section 11 south of the railroad ROW and the portion of the northeast quarter section of Section 11 north of the railroad ROW,
- the portion of Section 12 north and south of the railroad ROW,
- the portion of Section 14 north of the I-40 ROW,
- the portion of Section 16 north of the I-40 ROW, and
- the portion of the northeast quarter-quarter section of the northeast quarter section of Section 17 north of the I-40 ROW.

Township 8 North, Range 6 East defined by:

- the portion of Section 4 west of the SCE Transmission ROW,
- all of Sections 5 and 6,
- the portions of Section 7 north and south of the railroad ROW,
- the portion of Section 8 west of the SCE Transmission ROW,
- the portion of Section 9 west of the SCE Transmission ROW,
- the portions of Section 17 west of the SCE Transmission ROW and north and south of the railroad ROW, and
- the portions of Section 18 west of the SCE Transmission ROW, south of the railroad ROW and north of the I-40 ROW.

Township 9 North, Range 5 East defined by:

- the eastern half of Section 35,

Township 9 North, Range 6 East defined by:

- all of Sections 31 and 32, and
- the northwest and southwest quarter sections and the northwest and southwest quarter-quarter sections of the northeast and southeast quarter sections of Section 33.

The area where the Project would be constructed is primarily open, undeveloped land within the Mojave Desert. The Cady Mountain Wilderness Study Area (WSA) is located north of the Solar One site. The Pisgah Crater, located within the BLM-designated Pisgah Area of Critical Environmental Concern (ACEC), is located south of the Project. Several underground and aboveground utilities traverse the area.

An off-site single-circuit generation interconnection transmission line will be constructed a distance of approximately 0.14 miles to connect the Project to the SCE Pisgah Substation as shown on the following figures:

- Figure 3-5, Solar One 220kV Transmission Line,
- Figure 3-6, Solar One and Solar Three Transmissions Lines,
- Figure 3-7, 500kV Transmission Line Under Crossing Detail, and
- Figure 3-8, 220kV Transmission Line Under Crossing Detail.

The single-circuit transmission line will be defined by a linear survey and will be routed through portions of Township 8 North, Range 6 East, Section 18.

Electric and communications utility services for the Main Services Complex will be constructed in Township 8 North, Range 5 East in Section 15 to the overhead utility lines located on the south side of National Trails Highway. These utility ROWs will be defined by linear surveys and are shown in the Figure 3-9, Utility Plan – On-Site Utility Service.

A temporary site access road will be constructed from I-40 to the eastern boundary of the Project Site, as shown on Figure 3-3, Solar One – Site Plan – Post Construction. The temporary site access road will generally follow an existing road and will include new off-and-on ramps to the westbound lanes of I-40. The temporary site access road will be defined by a linear survey, and will be routed through portions of Township 8 North, Range 6 East, Sections 17, 20 and 21.

3.3 PROJECT SITE DESCRIPTION

3.3.1 Existing Site Conditions

The Project is located in San Bernardino County, California. The Project will be located on approximately 8,230 acres of land requested to be authorized under a ROW permit from the BLM. There are approximately 2,246 acres of private land within the Project boundary.

Currently, the Project Site consists primarily of mostly undisturbed desert alluvial sands and desert flora and includes some parcels of private land.

In addition to the natural desert areas, the site also contains numerous improvements including:

• BNSF Railroad - the BNSF railroad bisects the site from west to east. The BNSF Hector siding is located adjacent to the Project and is within the BNSF ROW.

- Gas Pipelines - Several underground high pressure gas pipelines cross the site, generally parallel to the highway and the railroad. There are several valve and gasline control installations also located within the gasline easement on the Project Site.
- Electric Transmission - An existing SCE electrical overhead powerline forms part of the boundary of the site. In addition the SCE Pisgah Substation is located adjacent to the site.
- I-40 – the interstate highway forms the southern boundary of the Project Site
- Hector Road – enters the site from I-40 for approximately 0.5 mile.

Topography

The northern part of the site (Phase I) is flanked by the Cady Mountains which are rugged, weathered mountains sloping down to a moderately sloped plain, typical of the basin and range province. The ground surface at the site generally slopes from the northeast to the southwest from an approximate high point elevation of 2,860 feet above mean sea level (msl) to the southwestern side of the site with an elevation of approximately 1,800 feet. Slopes range from approximately 2 percent to 6 percent across the site. The southern boundary of the site is formed by I-40.

Hydrologic Setting

The Project Site lies within the Mojave Desert, which is part of the Great Basin. The topography is typical of the Basin and Range Province. The site lies at the foot of the Cady Mountains. As is typical with basin and range system, the basin is bounded by the Pisgah and Lavic Lake Faults. Weathering and erosion from the mountain ranges has created vast amounts of sediment which has collected in the valley, mostly burying the bedrock.

The site is located northwest of the Pisgah Crater, also known as Pisgah Volcano. The volcano is the youngest vent in the Lavic Lake volcanic field. It is speculated that there may have been activity at this site as recent as 2,000 years ago, though more likely 20,000 to 50,000 years ago. The lava flows extend over 10 miles from the cone and are visible at the ground surface at some locations within the Project boundary.

The Project Site is located generally on a gently sloping alluvial surface. On the north side of the railroad tracks, slopes vary from about 2 percent to 6 percent and exhibit the characteristics of an alluvial fan or plain. Slopes within the mountainous watershed north of the site are much steeper. These slopes promote rapid runoff of floodwater when the precipitation rate exceeds the infiltration rate of the soil.

Climate

The Mojave Desert is one of the hottest and most arid regions in North America. The Project Site lies approximately 80 miles south of Death Valley. This region is one of the more arid parts of the Mojave Desert with an average annual precipitation of approximately 5 inches (measured in Barstow). Maximum recorded 24-hour precipitation is 1.57 inches (measured in Barstow). February is the wettest month with a mean rainfall of 0.99 inch and a maximum of 4.22 inches. June is the driest month with a mean rainfall of 0.06 inch and maximum of 0.60 inch. Average annual maximum and minimum temperatures are 80º F and 50º Fahrenheit (F). Daily maximum and minimum temperatures are 115º F and 8º F. Average annual pan evaporation is over 140 inches.

Soils

Site soils are generally of four different types. Within wash areas, soils vary from silty to gravelly fine sands which are loose, un-compacted and exhibit little cohesion. Soils in these areas are deposited by fluvial action and are often uniformly graded (sorted). In higher areas, which are not subject to concentrated water flows, soils are more densely compacted and contain larger gravels, cobbles, and boulders. Soils in these areas exhibit relatively little desert varnish but do appear to be armored. In some areas, bedrock outcrops are observed which appear to be either exposed bedrock or lava flows. The entire area is littered with pyroclastic material presumably from the Pisgah Crater that is several miles southeast of the Project Site. The mountainous off-site watershed area includes massive outcrops of bedrock. The bedrock is highly fractured and weathered.

Surface Water

There are no perennial streams within the Project Site or in the area. The nearest major ephemeral stream is the Mojave River which is approximately 15 miles northwest of the site and does not pose a flooding hazard to the project. The site is traversed by a number of discontinuous ephemeral drainage features. No floodplains have been delineated by the Federal Emergency Management Agency (FEMA); however, additional delineation will be undertaken to identify flood paths within the Project Site that pose a hazard.

3.3.2 Site Surveys

USGS maps have been used to preliminary establish local benchmarks, Project Site boundaries, and topography. The USGS topographic maps were used to establish the site's grading and drainage plans and to determine preliminary placement of SunCatchers, roadways, and other Project features. A preliminary geotechnical report was performed for a portion of the Project to evaluate general surface conditions; basic subsurface conditions, seismicity, and the other geological information necessary to develop preliminary recommendations for the design and construction of foundations, aboveground structures, and equipment (see Section 5.3, Geologic Hazards and Resources, and Appendix E, Solar One Pilot Project Preliminary Geotechnical and Geologic Hazards Evaluation).

3.4 PROJECT DESCRIPTION

This section describes the Project Site arrangement, the Project conceptual design, Project processes, and the operation of the Project. Project facilities will be designed, constructed, and operated in accordance with applicable laws, ordinances, regulations, and standards (LORS). Computer-generated photo simulations of the Project are shown on Figures 3-10A through 3-10C. Figure 3-10A is a full-page color photographic reproduction depicting the visual appearance of the existing Project Site. Figure 3-10B is a color simulation depicting the Project Site and ancillary features after construction. Figure 3-10C provides a simulation of a portion of the Project Site.

3.4.1 Project Site Arrangement

The site plan for the Project is shown on Figure 3-3, Solar One – Site Plan – Post Construction. The basic building block for the Project is a 1.5MW solar group consisting of 60 SunCatchers, as shown on Figure 3-11, Solar One 1.5MW Solar Group Plan. The 1.5MW groups will be connected in series to create 3-, 6-, and 9MW solar groups. A typical 9MW group is shown on Figure 3-12, Solar One 9MW Solar Group Plan. The 3-, 6-, and 9MW groups will be connected to overhead collection lines rated at 48MW or 51MW. A typical 18MW solar group showing two 9MW groups connected to the overhead collection lines is shown on Figure 3-13, Solar One 18MW Solar Group Plan. Typical elevation views of a 6MW portion of the solar field are provided on Figure 3-14, Solar One Typical Elevation View. The typical solar groups will be arranged as necessary to fit the contours of the site. These figures illustrate the location, equipment arrangement, and size of the generation equipment for the Project.

The entire working Project will be fenced while still protecting sensitive ecological areas. The Project will have four laydown areas, two for each Phase. The southeast corner of Phase I will have a laydown area on approximately 26 acres and the other laydown area will be located on approximately 14 acres adjacent to the Main Services Complex. Phase II will have a laydown area on approximately 26 acres located just north of I-40 and immediately east of Hector Road and the other laydown area will be located on approximately 11 acres adjacent to the Satellite Services Complex.

The boundary of the Project will encompass approximately 8,230 acres of land, not including the private parcels of land designated as not a part of the Project. Access to the federal land managed by the BLM will be authorized under a ROW permit. Appendix C, Property Owners Within 1,000 Feet of Project Site, contains a list of the current assessor parcel numbers and the owners' names and addresses for all parcels within 1,000 feet of the Project and its ancillary facilities.

During Project construction, the main entry and exit to Phase I will be from the east, from the temporary access road. The main entry and exit to Phase II will be from Hector Road. During Project operation, main site access (entry and exit) will be from Hector Road. The temporary access road to be constructed from I-40 may be utilized as a permanent secondary emergency access route after construction.

The following roadways will be constructed on the Project Site: paved arterial roads, unpaved perimeter roads, and unpaved access routes. The paved arterial roads will reduce fugitive dust while allowing full access to dishes and infrastructure. Polymeric stabilizers may be used in lieu of traditional road construction materials for paved roads and/or to stabilize unpaved roads. Access to the Project Site will be through controlled gates. See Table 3-17 for more details on these roadways.

3.4.2 Major Equipment

Table 3-1, Major Equipment List, and Table 3-2, Significant Structures and Equipment, list the major equipment and significant structures required for the Project, respectively.

Table 3-1
Major Equipment List

Description	Quantity	Size/Capacity	Remarks
SunCatcher power generating system	34,000	2 kWe	Focuses solar energy onto a Power Conversion Unit to generate 25kWe of electricity
Generator collection junction box	2,834	400A, 600V	Collects the output from 12 Stirling dish assemblies.
Generator collection power center, distribution switchboard with six 400A circuit breakers	567	2,000A Bus, 600V	Collects five 1.5MW solar groups and connects one power factor correction capacitor group.
Collector group generator step-up unit (GSU) transformer, with taps	567	1,7kVA, 57V to 34.kV	Step up power from 1.5MW solar group (60 Stirling dishes assemblies).
Power factor correction capacitor, switched in five each 200kVAR steps	567	1,000kVAR, 6 V	Provides power factor correction at the 1.5MW solar group level.
Open bus switch rack, five 1,200A feeder breakers, 40kA INT, with switches, insulators, and bus work	6	34.5kV, 3,00A	Five of each switch rack lineup collects 150MW at 34.5kV, one lineup collects 100MW at 34.5kV.
Shunt capacitor bank, switched in six 15MVAR steps	6	34.5kV, 90 MVAR	Provides power factor correction at the 150MW solar group level.
Dynamic VAR (DVAR) compensation system in coordination with shunt capacitor banks; size to be determined by studies (Check with Tom, may be 6)	6	34.kV, size to be determined	Provides active VAR compensation to maintain required power factor profile and to aid in meeting low-voltage ride-through requirements.
Disconnect switch, 35kV, 200kVBIL, group-operated	6	35kV, 3,000A	Provides capability to isolate power transformer from the 34.5kV collection system.
Power transformer, three-phase, oil filled	6	100/133/166.7MVA, 220/127 to 34.5/19.9kV, 750kV BIL	Step up power from 34.5kV collection voltage to 220kV transmission voltage.
Power circuit breaker	7	242kV, 2,000A, 40kA interrupting capacity	Transformer and line protection.
Coupling capacitor voltage transformer	6	242kV, 90kV BIL, 60Hz, PT Ratio 1,200/2,000:1	Voltage source for protection and control.
Disconnect switch, 242kV, 900kV BIL, group operated	9	24kV, 2,000A	For isolation of the power transformers, breakers and for isolating the substation from the interconnect transmission lines.

Table 3-1
Major Equipment List

Description	Quantity	Size/Capacity	Remarks
Diesel power generator set	1	250kW, 480V	Installed at Main Services Complex
Fire water pump, diesel or electric	1	26HP	Installed at Main Services Complex
Water Treatment	1	64,000gpd	Automatic reverse osmosis and/or demineralized system(s)

Source: Stirling Energy Systems, 2008.

Notes:

A	=	ampere (amp)
BIL	=	basic impulse level
gpd	=	gallons per day
HP	=	horsepower
Hz	=	hertz
INT	=	international
kA	=	kilo amps
kV	=	kilovolt
kVA	=	kilovolt amps
kVAR	=	kilovolt amp reactive
kW	=	kilowatt
kWe	=	kilowatt-electric
MVA	=	mega volt amps
MVAR	=	mega volt amp reactive
MW	=	megawatts
V	=	volts
VAR	=	volt amp reactive
W	=	watts

Table 3-2
Significant Structures and Equipment

Description	Quantity	Length (feet)	Width (feet)	Height (feet)
SunCatcher power generating system	34,000	38	40	38
Main Services Complex administration building	1	200	150	14
Main Services Complex maintenance building	1	180	250	44
Main SunCatcher assembly building[2]	3	211	170	78
Satellite Services Complex maintenance building		120	250	44
Well water storage tank, 175,000 gallons	1	40 diameter		20
Demineralized water tank, 17,000 gallons	2	18 diameter		10
Potable/Fire Water Tank, 175,000 gallons	1	40 diameter		20
220kV transmission line towers, double-circuit with upswept arms	12 to 15	--	32	90 to 110

[2] Assembly building may be relocated from the Main Services Complex to the Satellite Services Complex during Phase II

Table 3-2
Significant Structures and Equipment

Description	Quantity	Length (feet)	Width (feet)	Height (feet)
Generator collection sub-panel; distribution panel, 42 circuit, 400A, 600V, with circuit breakers in a weatherproof enclosure	2,834	1	2.67	5
Generator collection power center, 2,000-A distribution panels with six 400-A circuit breakers	567	2	3.33	7.5
Collector group generator step-up unit transformer (GSU), 1,750kVA, 575 V to 34.5kV, with taps	567	6.67	7.5	6.67
Power factor correction capacitor, 600V, 1,000kVAR, switched in five, each 200kVAR steps	567	2.5	6.67	7.5
Open bus switch rack, 35kV, 7 bay with five 35kV, 1,200-A, 40kVA INT, circuit breakers, insulators, switches, and bus work	6	105	20	30
Shunt capacitor bank, 34.5kV, 90 MVAR switched in six each 15 MVAR steps	6	15	8	20**
Dynamic VAR (DVAR) compensation system in coordination with shunt capacitor banks – size to be determined by studies	1	60	12	16
Disconnect switch, 35kV, 3,000 A, 200kV BIL, group-operated	6	3	11	16**
Power transformer, three phase, 100/133/167 mega volt amp, 230/132.8-34.5/19.9kV, 750kV BIL, oil filled	6	15	35	23
Power circuit breaker, 242kV, 2000A, 40 kilo amp interrupting capacity	7	12	20	16
Coupling capacitor voltage transformer for metering, 242kV, 900kV BIL, 60 Hertz, Potential Transformer ratio 1,200/2,000:1	6	1	1	25**
Disconnect switch, 242kV, 2000A	9	10	25	25**

Source: Stirling Energy Systems, Inc., 2008.
Notes:
**Includes structure height to provide electrical safety clearances to ground.
-- = not applicable
A = ampere (amp)
BIL = basic impulse level
INT = international
kV = kilovolt
kVA = kilovolt amp
kVAR = kilovolt amp reactive
MVAR = mega volt amp reactive
v = volts

3.4.3 Power Process Description

The Project will consist of approximately 34,000 SunCatchers. Each SunCatcher will produce up to 25 kW net of grid-quality electricity at 575 volts alternating current. The Project will be electrically designed as 567 1.5MW, three-phase, 60-hertz, solar groups. Each complete solar group will consist of 60 SunCatchers, which correlates to a 1.5MW power block with a corresponding generator step-up unit (GSU) transformer (see Figure 3-15, 1.5MW Solar Group Electrical One-Line Diagram, Sheet 1, and Figure 3-16, 1.5MW Solar Group Electrical One-Line Diagram, Sheet 2). The GSU transformer will step the voltage up to 34.5kV.

The 1.5MW solar groups will be connected by underground electrical cables to create the 3-, 6-, and 9MW solar groups. Two typical 9MW groups are shown on Figure 3-17, Solar One – 18MW Feeder Group General Arrangement. Five 9MW groups and one 3MW group will be connected by underground electrical cables and a pole riser to an overhead collector line rated for 48MW. Five 9MW groups and one 6MW solar group will be connected by underground electrical cables and a pole riser to an overhead collector line rated for 51MW (Figure 3-18, Solar One – 51MW Feeder Group General Arrangement). The overhead collector groups will deliver the solar electric–generated power to the Solar One Substation.

The solar groups will operate daily from sunrise to sunset; they will come out of the stowed position after sunrise once the solar insolation reaches a minimum of 250 watts per square meter (W/m^2). Full power output is achieved when solar insolation reaches $1{,}000W/m^2$. The solar field will operate until dusk unless adverse weather events occur (e.g., storms, periods of sustained clouds, or sustained wind conditions greater than approximately 35 miles per hour).

At dusk or when clouds reduce solar insolation to below a minimum of $250W/m^2$, the SunCatchers will be moved into the night-stow position. During periods of sustained high winds (exceeding 35 miles per hour), the SunCatchers will be moved into the wind stow position.

Each SunCatcher has an on-board control system that utilizes proprietary control systems to control the PCU and the dish. The on-board controllers will be supervised by a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system will include central processors and an operator interface located in the central control room, communications, and data logging servers and dish-group servers located throughout the solar field. The various components of the SCADA system and the on-board controllers on each SunCatcher will be interconnected with a system of underground and overhead fiber optic cables that will generally be routed together with the electrical collection system cables.

3.4.4 Description of Technology

The solar dish Stirling technology is well beyond the research and development phase, with more than 20 years of recorded operating history. The equipment is well characterized with over 45,000 hours of on-sun time. Since 1984, the solar dish Stirling equipment has held one of the world's efficiency record for converting solar energy into grid-quality electricity. This record was achieved when the technology was installed in Huntington Beach, California. Solar One coordinated with the U.S. Department of Energy and Sun-Labs (National Renewable Energy Laboratory and Sandia National Laboratories) to conduct an endurance test of the solar dish Stirling system and to bring the technology to market.

The history of the development of the Solar Stirling Engine is provided in Appendix B, Solar Stirling Engine.

3.4.4.1 SunCatcher Technology

The SunCatcher is a 25-kilowatt-electrical (kWe) solar dish Stirling system designed to automatically track the sun and collect and focus solar energy onto a PCU, which generates electricity. The system consists of a 38-foot-high by 40-foot-wide solar concentrator in a dish structure that supports an array of curved glass mirror facets. These mirrors collect and concentrate solar energy onto the solar receiver of the PCU.

The PCU converts the focused solar thermal energy into grid-quality electricity. The conversion process in the PCU involves a closed-cycle, high-efficiency four-cylinder, 35-horsepower reciprocating Solar Stirling Engine utilizing an internal working fluid of hydrogen gas that is recycled through the engine. The Solar Stirling Engine operates with heat input from the sun that is focused by the SunCatcher's dish assembly mirrors onto the PCU's solar receiver tubes, which contain hydrogen gas. The PCU solar receiver is an external heat exchanger that absorbs the incoming solar thermal energy. This heats and pressurizes the hydrogen gas in the heat exchanger tubing, and this gas in turn powers the Solar Stirling Engine.

A generator is connected to the Solar Stirling Engine; this generator produces the electrical output of the SunCatcher. Each generator is capable of producing 25kWe at 575 volts alternating current (VAC/60 hertz [Hz]) of grid-quality electricity when operating with rated solar input. Waste heat from the engine is transferred to the ambient air via a radiator system similar to those used in automobiles.

The hydrogen gas is cooled by a standard glycol-water radiator system and is continually recycled within the engine during the power cycle. The conversion process does not consume water, as is required by most thermal-powered generating systems. The only water consumed by the SunCatcher is for washing of the mirrors to remove accumulated dust and replenishing small losses to the cooling system radiator in a 50-50 glycol-water coolant.

Thousands of SunCatchers constitute a single power plant, making the Project modular and scalable. Installed units will produce power while the remainder of the Project is under construction. Maintenance will be done on individual units while the vast majority of the units remain online; the result is high overall availability.

The SunCatcher technology uses no fuel other than heat from the sun, is emissions free, and uses a tiny fraction of the water required by traditional power plants. For this reason, the Project will have less impact on the environment than traditional generation technologies while providing a clean, efficient, reliable source of energy to SCE customers.

3.4.4.2 SunCatcher Components

The SunCatcher has three major components: the foundation/pedestal, the dish assembly, and the PCU.

Foundation/Pedestal

The solar dish will typically be mounted on a foundation consisting of a metal fin-pipe that is hydraulically driven into the ground. This foundation is preferred because no concrete is required, no spoils are generated, and the foundations can be completely removed when the Project is decommissioned. The metal fin-pipe foundation creates minimal disturbance to the environment. When conditions are not conducive to the use of the metal fin-pipe foundation, the foundation will consist of rebar-reinforced concrete constructed below grade. Figure 3-19, Integrated Metal Fin Pipe Foundation/Pedestal, illustrates the metal fin-pipe foundation.

Both of these foundation designs meet applicable structural design requirements and applicable LORS.

The SunCatcher pedestal on which the SunCatcher Dish Assembly is secured is up to 18 feet 6 inches in height and will be an integrated part of the metal fin-pipe foundation or will be a separate structure fastened to the rebar-reinforced concrete foundation at ground level.

Dish Assembly

The SunCatcher Dish Assembly is fitted with a trunnion that attaches to the pedestal. Each Dish Assembly consists of a 38-foot by 40-foot steel structure that supports an array of curved glass mirror facets. These mirrors form a curved shape engineered to concentrate solar energy onto the solar receiver portion of the PCU. The Dish Assembly includes azimuth and elevation drives for tracking the sun and a PCU support boom.

The SunCatcher Dish Positioning Control System employs proprietary algorithms to track the sun. This system focuses the solar energy onto the solar receiver by controlling elevation and azimuth drives, and executes startup, shutdown, and de-track procedures. These procedures allow the dish to "wake up" from the night-stow position in the morning to focus the dish mirror facets on the solar receiver of the PCU, and then to track the sun during the daylight operating time of the Project. The dish control system also communicates with and receives instructions from the central control room via the SCADA system. The system is designed to place the dish into a "wind stow" position when sustained winds exceed 35 miles per hour to protect the system from wind damage. The system also places the dish into "wind stow" position on loss of communications with the central control room or on receipt of a fault signal from the PCU control system.

Power Conversion Unit

The SunCatcher PCU converts the solar energy into grid-quality electricity. Hydrogen gas is used in a closed-cycle heating/expansion – cooling/compression cycle to drive a high-efficiency, 380-cubic-centimeter displacement, four-cylinder reciprocating Solar Stirling Engine. The Solar Stirling Engine powers an electrical generator that produces 25kWe net output after accounting for on-board parasitic loads at 575V alternating current, 60Hz of grid-quality electricity. The PCU attaches to the end of the PCU boom.

The dimensions of the PCU are approximately 88 inches (7 feet) long by 63 inches (5 feet) wide by 37 inches (3 feet) high. The PCU weighs approximately 1,400 pounds.

The PCU consists of six subsystems: solar receiver, Solar Stirling Engine, generator; cooling system, gas management system, and the PCU control system. Each subsystem is described below.

- **Solar Receiver:** The SunCatcher solar receiver consists of an insulated cavity with an aperture that allows the solar energy to enter. Within the cavity are four heater heads. Each heater head forms a tube network for one quadrant of the engine. The solar flux, radio energy from the sun, heats the metal tubes and the heat is then transferred through the tubes to the working hydrogen gas. The heat absorbed at the solar receiver drives the Solar Stirling Engine.
- **Solar Stirling Engine:** The kinematic Solar Stirling Engine has evolved from the design used as a propulsion source for submarines to its present Solar One design to convert solar

energy into electricity. The engine is highly reliable, low maintenance, and highly efficient. SES has further developed and improved the engine design specifically for use in the SunCatcher.

- **Generator:** A generator is coupled to the Solar Stirling Engine to produce the electrical output of the SunCatcher. The PCU generator attached to each Solar Stirling Engine is capable of producing up to 25kWe at 575VAC, 60Hz of grid-quality electricity when operating with a solar input of 250W/m^2 and above. The generator output is connected to the power collection system.
- **Cooling System:** Waste heat from the hydrogen gas within the engine is transferred to the ambient air via a radiator system similar to the type used in automobiles. The system is used to cool the hydrogen gas before the compression phase of the cycle. The SunCatcher cooling system is made up of ethylene-glycol fluid, a cooler in the gas circuit, a radiator, a fluid circulation pump, and a cooling fan.

  The pump circulates the cooling fluid through the gas cooler and radiator. Waste heat from the hydrogen gas is transferred to the ethylene-glycol fluid in the cooler. The coolant flows through the radiator where the fan forces ambient air over the cooling fins to remove heat. The heat is transferred to the atmosphere via the airflow over the radiator.
- **Gas Management System:** The gas management system controls the working pressure to ensure high efficiencies of the Stirling engine. The hydrogen gas is contained within a closed and sealed cycle, yet a very small amount of the hydrogen working fluid does leak (less than 200 cubic feet per dish per year) by the rod seals and is lost to the atmosphere. This hydrogen will be replenished by means of a local and/or distributed hydrogen system.
- **Control System:** The SunCatcher PCU control system monitors, controls, and communicates PCU performance. Thermal detectors are monitored by the PCU control system and the data are used to control the thermal balancing of the PCU. Alarms and faults monitored by the PCU control system are communicated to the Dish Positioning Control System and the Project SCADA system.

3.4.5 Electrical System Description

This section describes the major electrical systems and equipment for the Project. A small amount (less than 3 percent) of the Project output will be lost to electrical losses in the collection system. A very small amount (less than 0.1 percent) will be used in the Project substation for instrumentation, controls, lighting and heating, ventilating, and air-conditioning. Most of the output will be delivered to the regional electric grid through the interconnection with the SCE transmission system. The 25kWe rated net output of the SunCatchers takes into account the on-board auxiliary loads such as the azimuth and elevation drives, the cooling fan, and the controls systems. The Project buildings and auxiliary structures may receive electrical power via separate electrical services from SCE.

3.4.5.1 Major Electrical Equipment and Systems

The Project includes construction of a substation, which will include transformers, circuit breakers, metering, and other protection required to connect the Project to the SCE Pisgah Substation. The Project interconnect transmission system will require construction of approximately 2 miles of single-circuit 220kV transmission line.

Up to 34,000 SunCatchers will produce electrical power at 575 volts (V). Power will be collected at the 575V level in groups of 60 SunCatchers by an underground collection system. The voltage will be stepped up to 34.5kV by a GSU transformer.

Power will be collected at the 34.5kV level by a combination of underground cables and overhead collection lines and will be delivered to the Project substation, where the voltage will be stepped up to 220kV for transmission to the SCE Pisgah Substation and connection to the grid.

3.4.5.2 Electrical Collection System

This section describes the electrical collections system that collects power from the distributed generators and delivers it to the on-site substation for transmission to the SCE Pisgah Substation.

The following single-line diagrams illustrate the overall generation and distribution system for the Project:

- Figure 3-15, 1.5MW Solar Group Electrical One-Line Diagram, Sheet 1,
- Figure 3-16, 1.5MW Solar Group Electrical One-Line Diagram, Sheet 2,
- Figure 3-17, Solar One – 18MW Feeder Group General Arrangement, and
- Figure 3-18, Solar One – 51MW Feeder Group General Arrangement.

Power will be produced at 575 V by the PCU generators. The output from 12 SunCatcher PCU generators will be collected at a local 600 VAC, terminal cabinet via underground cables. Five local terminal cabinets will be wired to a 600-VAC, 2,000-A collector switchboard via underground cables to constitute a complete 60-unit, 1.5MW solar group. Local capacitor banks may be connected at each 1.5MW, 2,000-A solar group collector switchboard for volts-amps reactive control and power factor correction.

Each local collector switchboard described above will be connected to the low-voltage side of a 1,750kVA GSU transformer that steps voltage up to 34.5kV. GSUs will be connected together at 34.5kV via underground cables in strings of two to create a 3MW group, strings of four to create a 6MW group, and strings of six to create a 9MW group. Two typical 9MW groups are shown in Figure 3-17, Solar One – 18MW Feeder Group General Arrangement. Five 9MW groups and one 3MW group will be wired via underground cables and a pole riser to a 34.5kV overhead collection line rated for 48MW. Five 9MW groups and one 6MW group will be wired via underground cables and a pole rise to a 34.5kV overhead collection line rated for 51MW.

A total of six 48MW collection lines and eleven 51MW collection lines will be constructed. Overhead pole lines will be configured with one to four circuits. These pole lines will be routed to the 34.5kV to 220kV collector substation. Power step-up transformers at the Solar One Substation convert the 34.5kV collection voltage to the 220kV interconnection voltage in 150MW groups.

The electrical equipment described above will be specified for operation in a 55 degree Celsius ambient temperature to ensure reliability and longevity.

An elevation view of a 6MW solar group is shown in the Figure 3-14, Solar One Typical Elevation View.

3.4.5.3 Direct Current Power Supply System

SunCatcher controls and drive motors will be powered at 48 volts direct current (VDC) from battery/battery charger systems. The localized DC systems will each support multiple SunCatchers. The backup direct current (DC) power supply will maintain control power and provide the ability to slew the SunCatcher to a safe stow position in the event of a grid outage.

Each 220kV substation will have 125-VDC systems to feed the 220kV breaker controls, the step-up transformer controls, and the substation metering and relay circuits. The substation DC systems will consist of one battery, one charger, and one DC panel-board in each of the 34.5kV switchgear prefabricated metal buildings.

The battery chargers will each receive 240 VAC, three-phase power from the substation station service 34.5kV bus. They will supply power to the DC loads while continuously charging the batteries. The 125-VDC systems will be ungrounded and each will include a ground detector to detect ground faults.

3.4.5.4 Uninterruptible Power Supply System

The SCADA, control rooms, and other critical and related technical equipment support areas will be powered from uninterruptible power supply (UPS) systems backed up by diesel-powered standby generating systems to provide reliable, continuous, and uninterrupted power to the control rooms. The UPS units will be 120-VAC, solid-state converter/inverter technology with gel-cell batteries that require minimal ventilation for the charging gases.

3.4.5.5 Standby

The diesel-powered standby power generator will be sized to provide continuous power for the UPS system for the Project control rooms and other critical process loads through three-pole automatic transfer switches and downstream power distribution equipment. The estimated size of the diesel generator for the Main Services Complex is 250 kW, 480 VAC, three-phase service. Assuming a fuel consumption rate of 19.1 gallons/hour at 100 percent load, a 24-hour run time capability is a 480-gallon belly tank. A monthly 15-minute generator exercise program would consume 57.3 gallons of fuel per year.

3.4.5.6 Electrical Service for Buildings and Auxiliary Structures

Electrical service for the Main Services Complex, the water treatment structure, the water pumping stations, and other auxiliary structures will be provided separately from the Project power generation system and will be provided from SCE electrical distribution by means of overhead service lines to be constructed by SCE.

3.5 PROJECT AUXILIARIES

3.5.1 Lighting

Project building lighting will be a minimum 50 foot-candle illumination from combined day lighting and high-intensity discharge, high-efficiency lighting in the assembly and maintenance facility. Day lighting will supplement energy-efficient fluorescent lighting in the operation and administration and water treatment buildings. Emergency egress identification and path lighting will be provided per building code requirements.

Parking and site parking lighting will be designed to minimum traffic flow safety standards for personnel safety. Roadway lighting utilizing luminaries powered by photovoltaic arrays and batteries will be provided at the intersections and corners of internal site maintenance roads to provide minimal safety illumination from sunset to sunrise. Full-cut-off lighting fixtures will be used to control night sky light pollution. Project building exterior and support area lighting design will incorporate minimum personnel safety and security lighting levels while utilizing full-cut-off lighting fixtures to control light pollution. Photometric studies will be completed for the Main Services Complex, Satellite Services Complex and a typical roadway intersection. Preliminary photometric studies have been completed for the Main Services Complex and are illustrated for each of these areas on the following figures:

- Figure 3-20, Main Services Complex Lighting Site Plan – Part A,
- Figure 3-21, Main Services Complex Lighting Site Plan – Part B,
- Figure 3-22, Main Services Complex Lighting Site Plan – Part C, and
- Figure 3-23, Typical Roadway Lighting and Photometric Details.

Aviation obstruction lighting will be provided as required by the Federal Aviation Administration (FAA).

Reflective warning signage will be included on perimeter fencing.

3.5.2 Electrical Grounding

The electrical system may experience unit ground potential rise due to ground fault, lightning strike, or switching surges. A grounding system will be installed to permit dissipation of ground fault currents and minimize ground potential rise.

The substation-grounding grid will consist of bare conductors installed below grade in a grid pattern. Each junction of the grid will be bonded together by an exothermic welding process or mechanical connectors.

The grounding grid will be designed with adequate capacity to dissipate heat produced by ground current under the most severe fault conditions. Grid spacing will be designed to maintain safe voltage gradients. Ground resistivity testing and calculations will be performed during detailed design to determine the number and type of grounding electrodes and the grid spacing necessary to ensure safe step and touch potentials under fault conditions.

Each SunCatcher within the solar field will be bonded to the foundation to provide localized grounding of each machine.

Within Project buildings, grounding conductors will bond building structural steel, metallic piping, and non-energized metallic parts of electrical equipment to the building grounding systems. Isolated grounding conductors will connect sensitive control systems to the building grounding systems.

3.5.3 Cathodic and Lightning Protection

The cathodic protection system will be designed and installed to control electrochemical corrosion of exterior surfaces of underground carbon steel, copper, aluminum, and stainless steel. Bottoms of soil- or sand-pad-mounted steel tanks and exterior surfaces of underground ductile or cast-iron pipe will be protected against corrosion. The type of cathodic protection system (galvanic or impressed current) will be based on soil characteristics, the amount of material to be protected, and the interference effects of any nearby cathodic protection systems.

Lightning protection will follow the National Fire Protection Association (NFPA) 780 guidelines and will be provided where required for Project structures and pumps. A lightning protection study will be conducted to determine the specific equipment to protect.

3.5.4 Heating, Ventilation, and Air-Conditioning

Heating, ventilation, and air-conditioning (HVAC) will consist of heat pump rooftop units with code-required fresh make-up air capabilities for the Main and Satellite Services Complex. Mechanical ventilation with evaporative cooling and/or heat pumps will be utilized for maintenance buildings. Mechanical ventilation will be provided for the assembly buildings. Design will be performed in accordance with the Uniform Building Code (UBC)/International Building Code (IBC), California Energy and Buildings Codes, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, and Sheet Metal and Air-Conditioning Contractors National Association standards and guides, and applicable LORS. These are listed in Appendix F, Mechanical and Fire Protection Engineering Design Criteria.

Temperature control will be provided for both personnel and equipment areas, and humidity control will be provided in the control and communications equipment rooms. Electric and/or propane bottle radiant heaters will be provided at local workstations in the assembly buildings.

3.5.5 Buildings

Buildings will be constructed in accordance with the appropriate edition of the California Building Code (CBC) and other applicable LORS.

The site layout of the Main Services Complex is depicted on Figure 3-24, Main Services Complex Site Plan – Part A, and Figure 3-25, Main Services Complex Site Plan – Part B. The Main Services Complex elevation view is illustrated in Figure 3-26, Main Services Complex Elevation View.

The Main Services Complex will be located within the in a central location that provides for efficient access routes for maintenance vehicles servicing the SunCatcher solar field. The main control room, SCADA, and UPS will be located at the Main Services Complex.

Warehouse and shop spaces will provide work areas and storage for spare parts for Project maintenance. The Main Services Complex will contain meeting and training rooms, maintenance and engineering offices, and administrative offices.

The Project administration offices and personnel facilities will be located in a one-story operation and administration building. The operation and administration building will measure approximately 200 feet long by 150 feet wide by 14 feet high. This building will also contain meeting and training rooms, engineering offices, a visitor's room, and support services.

The Project maintenance facilities, shop, and warehouse storage will be located adjacent to the operation and administration building. The maintenance building will measure 180 feet wide by 250 feet long by 44 feet in height. This building will contain maintenance shops and offices, PCU rebuild areas, maintenance vehicle servicing bays, chemical storage rooms, the main electrical room, and warehouse storage for maintenance parts to service the SunCatchers.

A water treatment shade structure will be located within the Main Services Complex. The water treatment structure will house water treatment equipment and safe storage areas for water treatment chemicals. A motor control center for the water treatment equipment and pumps will be located within this structure. Two wastewater evaporative ponds designed for water treatment wastewater containment will be located adjacent to the water treatment structure.

The Satellite Services Complex will be located south of the Solar One Substation in Phase II of the Project. The Satellite Services Complex will include a shade structure for maintenance of equipment and parts. An 18 foot diameter by 10 foot high aboveground demineralized water tank will be located adjacent to this structure for SunCatcher mirror washing. Two of the three temporary assembly buildings located in Phase I will be relocated to this complex during Phase II construction. Temporary buildings will be removed from the Satellite Services Complex at the end of Phase II construction.

A control building will be located near the Solar One Substation. This building will contain relay and control systems for the substation in one room and the Project operations control room in another room or rooms.

A diesel-powered or electric fire water pump and a diesel operated standby power generator will be located adjacent to the operation and administration building

On-site electric service will be obtained from SCE. Communications service will be provided. See Figure 3-9, Utility Plan – On-Site Utility Service, illustrates the routing of the site electrical, communications and water utilities. See Figure 3-4, Utility Plan – Off-Site Utility Service,.

SunCatcher assembly will be performed on-site in temporary structures. The assembly buildings are shown on Figure 3-24, Main Services Complex Site Plan – Part A, with an elevation shown on Figure 3-26, Main Services Complex Elevation View. The three assembly buildings will be located beside the Main Services Complex. Two of three buildings may be relocated to the Satellite Services Complex during construction of Phase II. Assembly buildings will be decommissioned after the Project's SunCatchers are assembled and installed.

Each assembly building will be 170 feet wide by 211 feet long by 78 feet in height and will contain two assembly lines. Each assembly building will be located on a concrete pad for the storage of SunCatcher components and assembled SunCatcher staging before field installation.

The primary purpose of the SunCatcher assembly buildings will be the assembly of the SunCatcher superstructure, the main beam assembly and trusses, the pedestal trunnion, mirrors, wire harnesses, control systems, drive position motors, and the calibration of the mirrors and control systems before field installation. Each assembly bay will be equipped with an automated platform on locating rails to move the SunCatcher through the assembly process.

The exterior material for the assembly buildings will be a fire retardant vinyl fluoride film with ultraviolet blocking characteristics and will be chemical and weather resistant.

A concrete pad with the dimensions 50 feet by 510 feet will be located adjacent to the assembly buildings for staging the assembled SunCatchers before field installation.

Transport trailer storage will be located next to the assembly bays. This storage facility will accommodate approximately 75 to 100 trailers, maintaining a supply of 3 to 5 days of inventory of SunCatchers parts during the assembly phase of construction.

3.5.6 Yard Tanks

The Project yard tanks will be at-grade steel tank reservoirs and/or polyethylene tanks. Conceptually, it is envisioned that the water treatment system will consist of a well water tank with a permanent booster pump station, a potable water treatment system, ground-set steel or polyethylene potable water and a fire water storage tank, a booster pump station to accommodate potable water needs and fire-flow requirements, a disinfection system, a demineralized water treatment system for mirror washing water, a polyethylene storage tank for demineralized water storage, chemical storage, reject water and sludge disposal and evaporation ponds, and various support piping, valves, and miscellaneous equipment to support the system. Conceptual tank sizing for water and other uses is as follows:

- one approximately 175,000-gallon well water storage tank,
- two approximately 17,000-gallon demineralized polyethylene water storage tanks to contain SunCatcher mirror washing water,
- one approximately 175,000-gallon potable water storage tank, to contain both fire suppression water and domestic water,

- two approximately 5,000-gallon double-walled fuel storage tanks mounted horizontally within a containment pad , and
- one approximately 10,000-gallon underground septic holding tank for off-site sanitary sewer off-site disposal or a smaller septic tank with dual leach fields.

The steel water storage tanks, if selected, will be vertical, round, field-erected steel tanks with suitable stem wall foundations and interior reinforced-concrete mats with coatings and grounding corrosion control. Tanks, foundations, and piping connections will be designed and constructed to the appropriate standards for contents and seismic zone considerations. Anchor bolts will be used as required.

Chemical storage tanks will be of shop-fabricated, double-walled construction that meets all applicable LORS. These tanks, as well as any portable drums, will be provided with appropriate anchors or cradles and placed within spill containment basins.

3.5.7 Roads and Railroads

The Project Site is located north and south of the Burlington Northern Santa Fe (BNSF) railway and north of I-40 within San Bernardino County, approximately 37 miles east of Barstow. Currently, there are three interchanges within the vicinity of the Project, I-40/Hector Road Interchange, I-40/Crucero Road Interchange, and I-40/Fort Cady Road Interchange. Construction vehicles, delivery trucks with materials, SunCatcher transport vehicles, employees, and visitors need off road conveyance routes to the on-site Main Services Complex and to the SunCatcher field arrays. The proposed roadway circulation system includes a Main and Secondary Project Site Access Roadways, main arterials, perimeter roadways, service roadways, and SunCatcher local roadways. Transport of equipment and/or materials to the Project Site may be via the BNSF Railroad.

Railroad Delivery Option

In addition to the existing Hector Road interchange and the proposed I-40 temporary off-ramp and access road, a potential railroad delivery option is under consideration. The railroad option would require coordination with BNSF to construct a railroad siding specifically designed to off-load construction materials in a safe and efficient manner with minimal disruption to current BNSF rail traffic operations. When implemented, the rail delivery option will reduce project construction related truck traffic along I-40, at the proposed I-40 temporary off-ramp and at the Hector Road interchange. It is anticipated that the proposed the rail delivery option under consideration would significantly reduce the traffic loadings and further improve the forecast LOS C conditions at the study intersections during project construction.

Off-site Roadways

Site access during the construction phase will be provided by constructing a temporary off-ramp and on-ramp from I-40 freeway (westbound) with a two-way paved temporary construction access road east of the Lugo-Pisgah Transmission Line from I-40, traversing a BLM ACEC. This access roadway includes the construction of a deceleration and acceleration interchange (westbound) and two way roadway from I-40 to the Project Site along an existing unimproved road located north of the BNSF ROW, across a BLM ACEC approximately 3 miles in length. The proposed temporary construction access road will be 30 feet wide to allow for two lanes and

shoulders, one 12-foot lane in each direction and 3-foot shoulders, minimizing the disturbance to the BLM ACEC. This roadway will be the primary construction roadway for the Project Site.

A permanent Project Site access roadway will be provided upon Project built-out via construction of the Hector Road access with bridge over the BNSF railway, utilizing I-40/Hector Road interchange. The proposed permanent access roadway, as shown on Figure 3-3, Solar One – Site Plan – Post Construction, will connect to the existing county maintained paved portion of Hector Road. The proposed roadway will be located at an off-set between ¼ mile and ½ mile to the east of the existing Hector Road alignment, crossing the BNSF railway with the construction of a private overhead grade separation (bridge). With the permanent site access roadway, vehicles will utilize I-40/Hector Road interchange and travel north on Hector Road, crossing the BNSF railway over a proposed bridge into the northern side of the Project Site. The bridge approach is anticipated to be placed on BLM land where the BNSF ROW is reduced from 200-feet to 100-feet in width (approximately ¼ mile east of the existing Hector Road alignment). It is anticipated that the proposed bridge will consist of a 220-foot long, 125-foot clear span, and 36-foot wide PC/PS girder bridge carrying two 12-foot lanes of traffic and a 6-foot pedestrian/bicycle pathway per BNSF Clearances for Highway and Pedestrian Overpass. The permanent access roadway will be the primary operations and maintenance roadway for the Project Site.

On-site Roadways

The Project Site arrangement is illustrated in the following figures:

Figure 3-1, Solar One – Site Plan – Phase I – During Construction,

Figure 3-2, Solar One – Site Plan – Phase II – During Construction, and

Figure 3-3, Solar One – Site Plan – Post Construction.

The figures illustrate a network of four types of roadways proposed for servicing the Project:

- paved arterial roadways,
- unpaved solar field access routes,
- unpaved perimeter roadways, and
- paved Main Services Complex roadways and parking areas.

Polymeric stabilizers are proposed to be used in lieu of traditional road construction materials (e.g., asphalt) for paved roads or to stabilize unpaved roads. The paved arterial roadways may be designed with one 12-foot lane in each direction or as one-way roadways with one 12-foot lane, as illustrated on the above-referenced figures and Figure 3-27, Paved Arterial Roads. These paved arterial roadways will allow for a looped access to the Main Services Complex, unpaved solar field access routes, access to private properties within the site, and access to the electrical substation. Paving will be placed on arterial roadways to provide for improved solar field access and to minimize fugitive dust generation. The looped roadways will provide for redundancy in the event that a roadway is blocked because of local SunCatcher maintenance, construction traffic, or other local disruption.

Perimeter roadways are proposed along the perimeter fence. In some instances the paved arterial roadways will serve as the perimeter roadways. Where paved arterial roadways are not located

adjacent to the perimeter fence, 15-foot unpaved one-way roadways will be provided to allow for patrolling of the Project Site by the security personnel and for maintenance of the perimeter fence. Unpaved perimeter roadways will be constructed with polymeric stabilizers or with base material consisting of crushed aggregate over compacted natural ground. Fugitive dust control will be added to the perimeter roadways as needed to minimize dust generation.

The unpaved solar field access routes will be designed for minimum roadway blading to allow for individual SunCatcher access for installation and maintenance. The unpaved solar field access routes will allow for localized access for maintenance service vehicles, and will be constructed per the recommendations of the Soils Engineer based on the expected construction and maintenance traffic loads. To minimize site disturbance, the construction of unpaved north-south access routes will be located along the center of a 144-foot area along every other row of SunCatchers. Between rows, a 40-foot area will be left intact and generally undisturbed except for brush trimming as may be required to reduce fire hazard and shading of SunCatchers. Unpaved east-west access routes will be limited to the alignments, or projection thereof, where electrical cables have been installed in an east-west direction. Temporary site stabilization measures such as metal plates or soil reinforcement mats, and/or polymeric stabilizers may be used to access SunCatchers.

The Main Services Complex parking lot, trailer storage areas, and the roadways circling SunCatcher assembly bays will also be paved using asphalt or polymeric stabilizers. Concrete paving may be utilized in loading and storage areas.

3.5.8 Site Security

An on-site security system will be installed as part of the. Controlled access gates will be maintained at the entrances to the site, on the east side of the Project, north of the SCE Pisgah Substation and on the south side of the Project, at Hector Road. The Hector Road access will also serve as the main entry and exit gate during Project operations. Twenty-four hour site security monitoring will be provided in the control room via closed-circuit television and intercom system.

Perimeter security fencing and access gates will be provided for the Project Site, including additional fencing and gates around the main buildings, the electrical substation, and construction laydown areas. The security fencing will be provided with warning reflective signage. Site security monitoring will be able to be displayed on a real-time as well as a recorded basis. Security monitoring cameras and active detection systems will be provided for Project buildings, support areas, and the entire site perimeter. Regular site security vehicular patrols will be conducted to provide additional site security. Site access will be provided to off-site emergency response teams that respond in the event of an "after-hours emergency." Entry into the Project Site by fire department or emergency units will be handled on a manual override basis by 24-hour security officers stationed at both entrances.

3.5.9 Site Grading and Drainage

The Project Site will be developed utilizing the existing land features without major grading operations. Off-site flows will be accepted and conveyed throughout the site, with discharge following the existing drainage patterns. The Project Site preparation is based on minimizing surface-disturbing activities. Areas of sensitive habitat and cultural resource will be avoided wherever possible.

Brush trimming will be conducted between alternating rows as illustrated in Figure 3-17, Solar One – 18MW Feeder Group General Arrangement. Brush trimming consists of cutting the top of the existing brush while leaving the existing native plant root system in place to minimize soil erosion. Brush trimming will minimize shading on SunCatchers and prevent potential brush fire hazards.

After brush has been trimmed, blading for roadways and foundations will be conducted between alternating rows, as illustrated on Figure 3-28, 1.5MW Solar One Construction Disturbance Plan, to provide access to individual SunCatchers. Blading will consist of limited removal of terrain undulations to maintain a 10% maximum slope grade. Localized rises or depressions within the individual 1.5MW solar groups will be removed to provide for proper alignment and operation of the individual SunCatchers. Ground disturbance will be minimized wherever possible. The blading operations will generally keep native soils within 100 feet of the pre-development location, with no hauling of soils across the site.

To minimize site disturbance, the construction for unpaved north-south access routes will be located along the center of a 144-foot area along every other north-south column of SunCatchers. To protect the bladed areas from surface erosion, drainage swales will be constructed to intercept and convey the surface low-flows from undisturbed natural areas to debris basins. The debris basins are generally located upstream of paved arterial roadways. This approach is consistent with the BMP to minimize site erosion.

Debris basins are also proposed along the northern Project Site boundary to intercept the off-site flows from the Cady Mountains. In addition to intercepting debris from the mountains, the proposed debris basins will also provide for peak runoff attenuation of the surface flows, thus protecting the Project Site from flooding, sediment deposition, and scour.

Paved roadways will be constructed as close to the existing topography as possible, with limited cut-and-fill operations to maintain roadway design slope to within a maximum of 10 percent. (Project Site slope and gradient are shown in Appendix G, USGS Project Maps.)

To minimize shading on SunCatchers and prevent potential brush fire hazards, natural vegetation trimmings will be cleared in the area of each SunCatcher as well as on either side of the paved arterial roadways.

Grading operations will also be required for building foundations and pads and parking areas in the Main Services Complex, Satellite Services Complex, and substation areas. The clearing, blading, and grading operations will be undertaken using standard contractor heavy equipment. The equipment consists of, but is not be limited to, motor graders, bulldozers, elevating scrapers, hydraulic excavators, rubber tire loaders, compacting rollers, and dump trucks.

The Project Site layout will maintain the local pre-development drainage patterns where feasible, and water discharge from the Project Site will remain at the western boundary. The paved

roadways will have a low-flow, unpaved swale or roadway dip as needed to convey nuisance runoff to existing and/or proposed drainage channels/swales, as shown on Figure 3-29, Arizona Crossing, and utilize low-flow culverts, as shown on Figure 3-30, Low Flow Culverts. It is expected that storm water runoff will flow over the crown of the paved roadways, which are typically less than 6 inches from swale flow line to crown at centerline of roadway, thus maintaining existing local drainage patterns during storms. No crown is anticipated if polymeric stabilizers are used, further reducing drainage conveyance impacts. Where needed, unpaved roads will utilize low-flow culverts, as shown on Figure 3-31, Low Flow Culverts Under Solar Field Access Routes. Debris basins will be added throughout the Project Site for low-flow surface runoff retention in lieu of culverts. The design of the drainage facilities will be based on BMP for erosion and sediment control.

Localized channel grading will take place on a limited basis to improve channel hydraulics in the vicinity of BNSF railway right-of-way to control the surface runoff. In addition, the Main Services Complex will be protected from a 100-year flood by berms and/or channels that will direct the flow around the perimeter of the building site, if required.

Arizona Crossings (roadway dips) will be placed along the roadways or low-flow culverts consisting of a small-diameter storm drain with a perforated stem pipe, as needed to cross the minor or major channels/swales.

The proposed east-west on-site paved arterial roadway section between the Main Services Complex and I-40 will be designed as a designated evacuation route. As such, the culverts for the temporary construction access and the permanent access roadways will be designed such that the roadway section shall have its driving surface constructed above the projected profile of a 25-year storm event. In addition, overflow from the 100-year storm event will be limited to an over-flow depth not to exceed 7 inches.

It is anticipated that roadway maintenance will be required after rainfall events. For minor storm events, it is anticipated that the unpaved roadway sections may need to be bladed to remove soil deposition, along with sediment removal from debris basins and stem pipe risers at the culvert locations. For major storm events, in addition to the aforementioned maintenance, roadway repairs may be required due to possible damage to pavement where the roadways cross the channels and where the flows exceed the culvert capacity.

Soft bottom storm water retention basins will be constructed to mitigate the increase in runoff from the proposed building sites. Rainfall from paved areas and building roofs will be collected and directed to the storm water retention basins. Retention basins will be sized based on storing the entire 100-year, 24-hours storm volume from the proposed building sites. A 3.8-inch precipitation covering the entire site with no C reduction (coefficient of runoff) factor will be used. The retention volume may be considered by a combination of basin size and additional volume provided within paving and/or landscaping areas.

The retention basin will be designed so that the retained flows will empty within 72 hours after the storm to provide mosquito abatement. This design can be accomplished by draining, evaporation, infiltration, or a combination thereof.

The post-development flow rates released from the Project Site are expected to be less than the pre-development flow rates, thus complying with BMP. The expected flow reduction is based on the following factors.

- Except for the building sites, the majority of the Project Site will remain pervious, as only a negligible portion of the site will be affected by pavement and SunCatchers foundations.
- The increased runoff expected from the building sites will be over-mitigated by capturing 100 percent of the runoff in a retention basin, where the storm runoff will be infiltrated and/or evaporated to the atmosphere.
- The proposed debris basins and perforated risers to be constructed upstream of the roadway culverts will provide for additional retention/detention.

3.5.10 Well Water Supply Line

As discussed in Section 3.7.1, Water Supply Source, a proposed primary water well will be located in a Water Treatment Facility within the Main Services Complex per Figure 3-3, Solar One – Site Plan – Post Construction. During the construction stages of the Project, additional water wells may need to be drilled to augment the primary water well, as the water requirements for the peak construction stages of the Project will increase to approximately 10 times the peak facility operations demand. SES may utilize, to the extent possible, the aforementioned primary well and any additional water wells during the construction stages and normal operation of the future adjacent SES Project Site adjoining the western boundaries of the Project Site.

Since the primary water well will be located at the Water Treatment Facility within the Main Services Complex, the well water pump will discharge the well water directly into a Well Water Storage Tank, also located within the Water Treatment Facility. Construction water augmentation from the secondary water well and/or from other on-site wells, will be conveyed via water trucks or via temporary above-ground conduits, e.g., aluminum pipes, fire hoses.

3.6 TRANSMISSION: INTERCONNECTION TO ELECTRIC GRID

This section describes the transmission interconnection between the Project and the existing electric grid.

The Project will produce a nominal net output of up to 850MW to supply to the SCE high-voltage system at the SCE Pisgah Substation, which is located adjacent to the Project.

The Applicant will build a 34.5kV to 220kV substation on the Project Site. The Project substation will consist of an open air bus with 17 35kV collection feeder circuit breakers. Each feeder breaker will be connected to one of the 48MW or 51MW overhead collection lines described in Section 3.4.3, Power Process Description. Additional 35kV circuit breakers will connect to power factor correction capacitor banks located in the substation yard.

For the 500MW Phase I of the Project, the first interconnection substation will initially consist of four power transformers rated at 100/133/167 mega volt amperes (MVA) each to convert the generation collection voltage from 34.5kV to the transmission tie voltage of 220kV. The substation will ultimately contain six 100/133/167MVA, 34.5kV to 220kV step-up power transformers. Each power transformer will 48MW and 51MW overhead collection lines, as illustrated on Figures 3-32 through 3-34.

The power transformers will be protected by 220kV power circuit breakers. Provisions will be made to expand the substation from 500 to 850MW with the addition of two power transformers

in Phase II of the Project. Figure 3-35, 850MW Solar One Substation General Arrangement Plan, illustrates the plan view of the substation. Figure 3-36, 850MW Solar One Substation Elevation, Sheet 1, and Figure 3-37, 850MW Solar One Substation Elevation, Sheet 2, show elevation views of the substation.

Each transformer will collect 150MW of generation via three overhead 34.5kV collection circuits, each protected by a 35kV power circuit breaker. The 34.5kV feeders will be terminated on outdoor circuit breakers.

Control, metering, and protection systems for the line, substation, and collection systems will be contained within a control building located adjacent to the substation. The control building will also contain the necessary communications equipment to meet owner, CAISO, and SCE requirements.

Additional substation equipment will include a 34.5kV power-factor correction capacitor control system designed to meet the power factor and zero and low-voltage ride-through requirements of the Interconnect Agreement.

One 220kV main circuit breakers will connect to the 220kV transmission circuit on a 220kV single-circuit transmission line to the SCE Pisgah Substation.

The transmission line to the SCE Pisgah Substation will be an approximately 2 mile-long, single-circuit line, as shown on Figures 3-5, 220kV Transmission Line, Part A, Phase I, and Figure 3-6, 220kV Transmission Line, Part A, Phase II.

The on-site portion of the interconnection transmission line will be installed in a 100-foot ROW from the Solar One Substation heading east and parallel to the BNSF Railroad ROW, and south crossing the BNSF railroad to a point where the line turns east leaving the site and undercrossing three SCE transmission lines before it finally enters the SCE Pisgah Substation from the south. The on-site portion of the 220kV interconnect transmission line is illustrated on Figure 3-5, 220kV Transmission Line, Part A, Phase I, and Figure 3-6, Solar One and Solar Three Transmission Lines. The routing was selected to minimize the distance required and to reduce the undercrossing of the line with assembled SunCatchers.

The off-site portion of the 220kV interconnect transmission line will be routed under existing SCE transmission lines.

SCE has proposed expanding and upgrading the the 220kV SCE Pisgah Substation, increasing the voltage to 500kV, looping the Eldorado-Lugo 500kV line into the SCE Pisgah Substation and upgrading 65 miles of the existing Lugo-Pisgah No 2 220kV transmission line to 500kV. In addition, modifications within the SCE Eldorado and Lugo substations will be required. The off-site 220kV interconnect transmission line is illustrated on Figure 3-7, 500kV Transmission Line Under Crossing Detail, and Figure 3-8, 220kV Transmission Line, Under Crossing Detail.

The SCE Pisgah Substation will be a 220kV to 500kV substation. Generation will enter the substation at 220kV and power will leave the substation at 220kV and 500kV.

The Gen-Tie transmission line towers will consist of H-Frame towers at the undercrossing of the existing SCE 500kV and 220kV transmission lines and single-circuit lattice steel towers and/or steel poles elsewhere. See Figure 3-38, Typical H-Frame Transmission Structure, and Figure 3-39, Typical Single-Circuit Transmission Structures.

The single circuit overhead 220kV transmission line will be constructed with aluminum steel-reinforced conductors, thermally rated to carry full Project output in emergency conditions and in normal conditions. One fiber optic cable and a microwave dish and tower will be provided for communication with SCE and the CAISO.

The overhead 220kV transmission conductors will be supported by a dead-end structure in the Solar One Substation and 12 to 15 single-circuit lattice steel transmission towers and/or steel poles, as illustrated on Figure 3-39, Typical Single-Circuit Transmission Structures.

An application was filed by the Applicant with SCE to perform a System Impact Study for the Project. This System Impact Study determined the effect on the Pisgah transmission system based on power flows on the existing transmission lines and transformers, short circuit duties of the existing substation facilities, and the electrical stability of the interconnected system considering various contingencies and fault conditions. CASIO issued the final System Impact Study on November 2008. This study is attached in Appendix H, System Impact Study.

SCE completed a facility study for the Project. The facility study outlines measures required for transmission facility overloads and the cost associated with the upgrading of the transmission and substation facilities. See plat maps (1 through 58) in Appendix EE, Summary Environmental Report for the Proposed Lugo-Pisgah 500kV Transmission Line and Substation Upgrades, for more details related to these upgrades.

3.6.1 Design, Construction, and Operation of Transmission Facilities

The Project will be connected to the power grid through the SCE Pisgah Substation by a single-circuit, three-phase, 220kV transmission line. It is expected that SCE will complete final design and construction of transmission facilities and reliability upgrades.

The Project transmission system will require construction of approximately 2 miles of single-circuit, 220kV transmission line. As depicted on Figure 3-5 through Figure 3-8, the Project transmission line extends from the Solar One Substation to a point inside the ROW of the SCE Pisgah Substation. The transmission line starts within the Project Site boundary but a 0.14 mile-long segment that connects to the SCE Pisgah Substation is outside the Project Site boundary.

Construction of the line will include dead-end structures at the substation and 12 to 15 lattice steel towers and/or tubular steel poles with concrete foundations and new double bundled 1,590-kilo circular miles aluminum steel-reinforced conductors for the circuit.

The power poles will be spaced approximately 650 feet to 800 feet apart (the final calculation will take into account the grading and other factors to determine the final spacing).

The construction of the Project transmission line will involve the following facilities and tasks listed below.

- **Staging Areas:** These yards are staging areas for trailers, office personnel, equipment, material staging, and employee parking and will be provided in a disturbed area (within a 26-acre laydown area) along the south and eastern boundaries of the .
- **Road Work:** As needed, dirt roads will be cleared for access along the on-site transmission line route to coincide with the southern perimeter road for the Project Site. These roads will

provide access to the tower locations. Where the off-site transmission line crosses the existing SCE ROW, the existing access road to the existing transmission line will be utilized.

- **Foundations:** Each structure will have a foundation installed that will require curing before the tower or pole installation. These pole foundations will be installed in locations that avoid sensitive environmental resources identified in Project environmental surveys.
- **Tower Erection:** Where used, steel tower structures will be shop-fabricated to the maximum extent possible and erected at the site. The cross arms, insulators, and other hardware will be installed on the towers to the maximum extent possible before erection.
- **Pole Erection:** Where used, each pole will be made up of two sections, which will be assembled on-site and welded together. Afterward, insulators and conductor hardware will be installed.
- **Conductors:** From pulling sites, the conductors will be installed, sagged, and permanently connected to the insulators.
- **Pulling Sites:** Approximately two pulling sites are required to install the conductors along the transmission line. The pulling sites will be located on existing access roads or access roads that will be constructed as part of the transmission line installation.
- **Communication System:** The overhead ground/fiber optic communications optical ground wire cable will be installed using the same pulling sites used for the conductor installation.
- **Cleanup:** Although cleanup will be ongoing as the work proceeds, once construction is completed, a final cleanup of the entire transmission construction site will be performed to clear the area of any remaining construction-related debris.

3.6.2 Transmission Line Safety and Nuisance

This section discusses safety and nuisance issues associated with the proposed electrical interconnection of the Project.

3.6.2.1 Transmission Line Description

A single-circuit, 220kV transmission line will be required to deliver the Project's electric output to the Western Electricity Coordinating Council transmission grid. Each circuit will be sized to carry approximately full Project output under normal conditions and emergency conditions in 55 degrees Celsius ambient temperature. The circuit will terminate at the Solar One Substation. The connection to the grid will be made at the SCE Pisgah Substation. The single-circuit transmission line will consist of approximately 2 miles of new construction. The transmission line is illustrated in Figure 3-5, 220kV Transmission Line.

3.6.2.2 Aviation Safety – Transmission Line

The Code of Federal Regulations Part 77 authorizes the FAA to establish the standard for determining obstruction in navigation space and sets forth requirements for notification of proposed construction. These regulations require notification for any construction that is over 200 feet in height aboveground level. Notification is also required if the obstruction is less than

specified heights and falls within the restricted airspace in the approach to airports. For airports with runways longer than 3,200 feet, the restricted space extends 20,000 feet (3.2 nautical miles) from the runway. For airports with runways of 3,200 feet or less, the restricted space extends 10,000 feet (1.6 nautical miles) from the runway.

Supporting structures for the proposed 220kV transmission line will be shorter than 110 feet and will not encroach into restricted air space. Therefore, no Notice of Construction or Alteration filing with the FAA is required.

3.6.2.3 Electrical Clearances

High-voltage overhead transmission lines are composed of bare conductors connected to supporting structures by means of porcelain, glass, or plastic insulators. The air surrounding the energized conductor acts as the insulating medium. Maintaining sufficient clearances, or air space, around the conductors to protect the public and utility workers is paramount to the safe operation of the line. The safety clearance required around the conductors is determined by normal operating voltages, conductor temperatures, short-term abnormal voltages, avoidance of wind-blown swinging conductors, contamination of the insulators, clearances for workers, and clearances for public safety. Minimum clearances are specified in CPUC General Order 95. In American National Standards Institute Z-133.1-2000, clearances were developed for safe and reliable operation of high-voltage lines. Typically, clearances are specified for the following:

- distances between energized conductors,
- distances between energized conductors and supporting structures,
- distances between energized conductors and other power or communication wires on the same supporting structure, or between other power or communication wires above or below the conductors,
- distances from energized conductors to the ground and other features, such as roadways, railroads, driveways, parking lots, navigable waterways, airports, etc.,
- distances from energized conductors and buildings and signs, and
- distances from energized conductors and other parallel power lines.

Table 3-3, LORS for Electrical Clearances, describes electrical clearances LORS.

Table 3-3
LORS for Electrical Clearances

Laws, Ordinances, Regulations, and Standards	Applicability
GO-128, CPUC, "Rules for Underground Electric Line Construction"	Covers required clearances, grounding techniques, maintenance, and inspection requirements.
GO-95, CPUC, "Rules for Overhead Electric Line Construction"	Covers required clearances, grounding techniques, maintenance, and inspection requirements.
Title 8 CCR Section 2700 *et seq.* "High Voltage Electric Safety Orders''	Establishes essential requirements and minimum standards for installation, operation, and maintenance of electrical installation and equipment to provide practical safety and freedom from danger.

Table 3-3
LORS for Electrical Clearances

Laws, Ordinances, Regulations, and Standards	Applicability
GO-52, CPUC, "Construction and Operation of Power and Communication Lines"	Applies to the design of facilities to provide or mitigate inductive interference.
ANSI/IEEE 593, "IEEE Recommended Practices for Seismic Design of Substations"	Recommends design and construction practices.
IEEE 1119, "IEEE Guide for Fence Safety Clearances in Electric - Supply Stations"	Recommends clearance practices to protect persons.
IEEE 998, "Direct Lightning Stroke Shielding of Substations"	Recommends protections for electric system from direct lightning strikes.
IEEE 980, "Containment of Oil Spills for Substations"	Recommends preventions for release of fluids into eco-system.

Source: Stirling Energy Systems, Inc., 2008.
Notes:
ANSI = American National Standards Institute
CCR = California Code of Regulations
CPUC = California Public Utilities Commission
GO = General Order
IEEE = Institute of Electrical and Electronics Engineers, Inc.

3.6.2.4 Noise and Radio Frequency

An electric field is generated in the air surrounding a transmission line conductor when the transmission line is in operation. A corona discharge occurs at the conductor surface when the intensity of the electric field at the conductor surface exceeds the breakdown strength of the surrounding air. The electrical energy released from the conductors during this process is known as corona loss and is manifested as audible noise and radio or television interference.

Energized electric transmission lines can generate audible noise from corona discharge, most often perceived as a buzz or hum. This condition is usually worse when the conductors are wet. The Electric Power Research Institute has conducted several transmission line tests and studies that measure sound levels for several power line sizes with wet conductors (EPRI 1975, 1982). The "Transmission Line Reference Book, 345kV and Above" also notes that the noise produced by a conductor attenuates (decreases) by 2 to 3 decibels for each doubling of the distance from the source.

Radio and television interference, known as gap-type noise, is caused by a film on the surface of two hardware pieces that are in contact. The film acts as an insulator between the surfaces. This insulator results in small electric arcs that produce noise and interference. This type of noise is not a problem in well-maintained transmission lines. Well-trained transmission line maintenance crews will maintain the Project transmission line. Therefore, any problems that might occur can be readily pinpointed and corrected. Further, the distance to the nearest residential development makes it unlikely that the Project transmission line would have an effect on radio or television reception.

Many factors contribute to the pre-project ambient noise levels in the area of the Project Site. The Project transmission line will be designed such that noise from the transmission line will

continue to be well below undesirable levels. Any noise or radio/television interference complaints will be logged, investigated, and, to the degree possible, mitigated.

3.6.2.5 Induced Currents and Hazardous/Nuisance Shocks

Introduction

Touching underground metallic objects near a transmission line can cause hazardous or nuisance shocks if the line is not properly constructed. Since the electric fields of the transmission line will be negligible aboveground, and the line will be built in conformance with California Public Utilities Commission (CPUC) General Order 95 requirements and the California Code of Regulations (CCR), Title 8, Section 2700 requirements, hazardous shocks are highly unlikely to occur as a result of the Project construction and operation.

Electric and Magnetic Fields

Electric and magnetic fields (EMFs) occur independently of one another at the 60Hz frequency used in transmission lines, and both are created by electric charges. Electric fields exist when these charges are not moving. Magnetic fields are created when these same electric charges are moving. The magnitude of both electric and magnetic fields from three-phase transmission lines falls off rapidly as the distance from the source increases (proportional to the inverse of the square of the distance).

Transmission lines, distribution lines, house wiring, and appliances generate electric fields in their vicinity because of unbalanced electrical charge on unshielded energized conductors. Electric fields are expressed in volts per meter or kilovolts (thousands of volts) per meter (kV/m).

Once electric currents are in motion, they create magnetic fields. The strength of the magnetic field is proportional to the magnitude of the current in the circuit. Magnetic fields can be characterized by the force they exert on a moving charge or on an electrical current. A magnetic field is a vector quantity that is characterized by both magnitude and direction. Electric currents are sources of magnetic fields. Magnetic fields are measured in milligauss.

At the ground under a transmission line, the electric field is nearly constant in magnitude and direction over distances of a few meters. However, in close proximity to the transmission or distribution line conductors, the field decreases rapidly as distance from the conductor increases. Similarly, near small sources, such as appliances, the field is not uniform and falls off even more rapidly with distance from the device. If an energized conductor is inside a grounded conducting enclosure, then the electric field outside the enclosure is zero and the source is said to be shielded.

In January 1991, the CPUC issued an Order Instituting Investigation (I.91-01-012 [CPUC 1991]) into the potential health effects from electric and magnetic fields emitted by electric power and cellular telephone facilities. In September 1991, the assigned CPUC administrative law judge issued a ruling that created the "California EMF Consensus Group." This group of representatives from utilities, industry, government, private and public research, and labor organizations submitted a document entitled "Issues and Recommendations for Interim Response

and Policy Regarding Power Frequency EMFs" on 20 March 1992 (California EMF Consensus Group 1992). Regarding the relevant policy consensus recommendation titled "Facility Siting," the group stated that the CPUC should recommend that utilities take public concern about electromagnetic fields into account when siting new electric facilities. Although this group could not conclude that there is a relationship between EMFs and human health effects, they also could not conclude that this relationship does not exist; therefore, they recommended that the CPUC authorize further research.

California does not presently have a regulatory level for magnetic fields. However, the values estimated for the Project are well below those established by states that do have limits. Other states have established regulations for magnetic field strengths that have limits ranging from 150 milligauss to 250 milligauss at the edge of the ROW, depending on voltage. The California Energy Commission (CEC) does not presently specify limits on magnetic fields for 220kV transmission lines.

Electric Fields: Project Effects

The line voltage and the distance of conductors from the point of measurement largely determine the electric fields of the Project. Conducting objects such as vegetation, the earth, or buildings perturb or distort the field. These can in some cases act as shields, which significantly reduce electric field levels. Increasing the distance from the conductors of the transmission line to potential receptors is the most effective way to reduce electric field effects in overhead transmission lines.

The electric field strengths from the proposed transmission line are calculated to be insignificant. Although California does not have any regulatory level for electric fields, it is anticipated that the Project's electric field strengths will be well below levels established by those states that do have regulatory limits. States with regulations have ranges from 1.0kV/m to 2.0kV/m at the edge of the ROW to 11kV/m within the ROW, depending on the line voltage.

Electric field strengths have been calculated for the Project and the results are shown in Appendix I, Electric and Magnetic Field Calculations.

Magnetic Fields: Project Effects

Unlike the electric fields, magnetic fields are not necessarily perturbed or shielded by most common objects. Effective ways to reduce magnetic field strengths in overhead transmission lines include increasing the distance from the conductors of the transmission line to potential receptors and arranging phases to increase cancellation of fields. The higher the overhead transmission lines are aboveground level, the lower the magnetic field strength is at ground level.

Magnetic field strengths have been calculated for the Project. The results are shown in Appendix I, Electric and Magnetic Field Calculations.

3.7 WATER SUPPLY AND TREATMENT

The following types of water will be required for the Project:

- SunCatcher equipment washing water,

- potable water,
- dust control water, and
- fire protection water.

When completed, the Project will require a total of approximately 36.2 acre-feet of well water per year. SunCatcher mirror washing and operations dust control under regular maintenance routines will require an average of approximately 25.8 gallons of well water per minute, with a daily maximum requirement of approximately 43.7 gallons of raw water per minute during the summer peak months each year, when each SunCatcher receives a single mechanical wash.

The Project water supply requirements are tabulated in Table 3-4, Water Usage Rates for Solar One Operations. The table provides both the expected maximum water usage rates and the annual average usage rates. The water balance for the Project is illustrated in Appendix J, Water Balance Flow Diagrams.

Table 3-4
Water Usage Rates for Solar One Operations

Water Use	Daily Average (gallons per minute)	Daily Maximum (gallons per minute)	Annual Usage (acre-feet)
Equipment Water Requirements			
SunCatcher mirror washing	11.8[1]	19.7[2]	16.1[3]
Water Treatment System Discharge			
Brine to evaporation ponds	6.0	11.4[4]	8.1
Potable Water Use			
For drinking and sanitary water requirements	3.8[5]	4.6[6]	5.2[7]
Dust Control			
Well water for dust control during operations	4.2[8]	8.3[9]	6.7[10]
Totals	**25.8**	**43.7**	**36.2**

Source: Stirling Energy Systems, Inc., 2008.

Notes:

[1]Based on 34,000 SunCatchers requiring a monthly wash with an average of 14 gallons of demineralized water per spray wash and a five-day work week (21 work days per month).

[2]During a 3 month period, all SunCatcher mirrors are given a scrub wash requiring up to three times the normal wash of 14 gallons per SunCatcher. Therefore, the Daily Maximum usage rate is based on two-thirds of the SunCatchers receiving a normal wash and one-third receiving a scrub wash.

[3]Based on every SunCatcher having approximately 8 normal washes per year with one additional scrub wash.

[4]Based on the maximum amount of demineralized water required for mirror washing and assumes a decrease in raw water quality requiring an additional 20 percent of system discharge.

[5]Assumes 30 gallons per person per day for 182 people.

[6]Maximum amount assumes a 20 percent contingency over the Daily Average.

[7]Assumes a six-day work week and average daily usage.

[8]Assumes 6,000 gallons per day based on utilizing soil binders on all roadways for dust control mitigation.

[9]Assumes up to 12,000 gallons per day based on utilizing soil binders on all roadways for dust control mitigation.

[10]Assumes daily average dust control operations.

3.7.1 Water Supply Source

The water sources in the local area primarily consist of underground aquifer water. Water requirements for the facility will be drawn from the aquifer by way of an adjacent well with the possibility of additional wells being added to provide water supply as needed.

3.7.2 Water Quality

Although a pump test and water quality tests were performed on a nearby existing well, the data was insufficient to make proper determinations.

Table 3-5

Well Water Quality Analysis

(Well testing analysis is currently work in progress and will be included in Table 3-5 within a supplemental filing.)

3.7.3 Water Treatment Requirements

Water for SunCatcher mirror washing, fire water, and potable use will be provided from the Primary Water Well located on site and may be augmented by the secondary water well(s). SunCatcher mirror washing requires the water to be demineralized to prevent mineral deposits forming on the SunCatcher mirrors.

The treatment requirements and the process units required to prepare the water to a level of quality that will be suitable for potable and fire water needs will be further evaluated during final Project engineering. This engineering will include an evaluation of the treatment equipment and processes available to provide the required process water at the flow and quality needed for mirror washing. This equipment evaluation will include demineralizer systems and a look at alternate treatment methods.

Water for potable use will meet Environmental Protection Agency (EPA) standards. Disinfection will be required as an additional treatment process to produce water that meets drinking water standards. This water will be stored along with the fire-suppression water in an aboveground water storage tank, approximately 175,000-gallons in size.

3.7.4 Water Treatment Systems

The Project will require treated water that will be used primarily for the washing of mirrors (demineralized process water), fire protection, and potable domestic uses. Water will be piped to the on-site water treatment facility, where it will be treated to a level that facilitates its use for these purposes and stored in at-grade steel tank reservoirs and/or polyethylene tanks. Using a value engineering method, further evaluation will be performed for the various options that may be available to treat, store, and distribute the water as needed. It is envisioned that the water treatment system will consist of a well water tank with a permanent booster pump station, a potable water treatment system, a ground-set steel potable water and fire water storage tank, booster pump station to accommodate potable water needs and fire flow requirements, a

disinfection system, a demineralized water treatment system for mirror washing water, two polyethylene storage tanks for demineralized water storage, chemical storage, reject water and sludge disposal and evaporation ponds, and various piping, valves, and miscellaneous equipment to support the system.

The water treatment facility will be protected by a shade structure constructed as part of the Main Services Complex. The shade structure will cover equipment for processing and treating water required for fire protection, SunCatcher mirror washing, and potable water uses. The water treatment shade structure will contain the water treatment system, an analytical laboratory area, a separate bulk chemical storage area for the water treatment process, and a separate electrical Motor Control Center area.

The water treatment structure will measure approximately 40 feet long by 40 feet wide by 14 feet in height; the structure will be constructed with a metal roof. All equipment will be floor mounted and raised slightly above the finished floor on housekeeping pads. Curbs will be installed for spill containment where needed. Corrosion-resistant coatings will be applied, as necessary, on floors and structural members.

3.7.5 SunCatcher Mirror Washing

Since water quality data is not available at the time of this writing, for the purposes of this discussion water from the underground aquifer is assumed to have approximately 810 milligrams per liter (mg/L) of total dissolved solids (TDS). The water treatment process will be a demineralizer system that will produce demineralized water with a TDS of less than 20 mg/L. The daily average water requirement for SunCatcher mirror washing under regular maintenance routines will be approximately 11.8 gallons of water per minute.

3.7.6 Fire Protection Water

The Main Services Complex will include an approximately 175,000-gallon tank to store treated water for fire protection applications and domestic uses. In addition there will be an approximately 175,000-gallon tank that will be used to store well water for construction and operations which will also be available for supplemental fire protection water. This volume of water will meet all LORS, including the San Bernardino County Fire Department requirements for fire water.

3.7.7 Dust Control Water

Primary fugitive dust suppression during construction will use water from the proposed ground water well(s). As discussed in Section 3.5.10, the primary water well will be located within the Water Treatment Facility with additional water wells drilled to augment the primary water well as needed to meet the peak construction water demands. Construction water augmentation from the Secondary Water Well or from other on-site wells will be conveyed via water trucks or via temporary above-ground conduits (e.g., aluminum pipes, fire hoses).

Initially, the well water will be used in the areas disturbed by construction during the construction activity for the primary access routes, the construction laydown areas, the grading of the sites for the Main Services Complex and the Satellite Services Complex, and the

substation sites, as well as the clearing areas disturbed by the construction of each 18MW or 24MW solar group. The 18MW solar group clearing areas are illustrated on Figure 3-13, Solar One 18MW Solar Group Plan.

Water trucks will be used throughout the duration of the construction phase for the Project. Truck filling stations will be located at the Main Services Complex, at the Satellite Services Complex, and at various temporary truck filling stations throughout the Project Site. The demineralized waterline between the Main Services Complex and Satellite Services Complex will be used to supply well water for dust control for the portion of the Project Site located south of the BNSF railway, utilizing a steel casing to be jacked under the BNSF railway. The dust control water requirements are illustrated in Table 3-6, Construction and Dust Control Water Truck Quantities by Month.

3.7.8 Potable Water

In 1971, laws and regulations governing the certification of potable water treatment facility operation were enacted. These laws and regulations establish the level at which water treatment facilities should be manned; the minimum qualifications for testing at each of the five grade levels, and the criteria for renewal and revocation of certificates. Water from the well water storage tank will be treated to level suitable for potable uses. The potable water, along with the fire suppression water, will be stored in a designated storage facility equipped with chemical dosage for disinfection. This treated potable water will be available at the Main Services Complex and may be piped to the Satellite Service Complex. Either treated potable water or bottled water will be available at the Satellite Services Complex. The treated potable water will meet all EPA potable water quality standards.

3.8 WASTEWATER AND WASTE MANAGEMENT

The water treatment wastewater generated by the demineralizer equipment contains relatively high concentrations of TDS. Wastewater or brine generated by the demineralizer unit will be discharged to a concrete-lined evaporation pond, or equivalent. Each pond will be sized to contain 1 year of discharge flow, approximately 2 million gallons. A minimum of 1 year is required for the water treatment waste to undergo the evaporation process. The second pond will be in operation while the first is undergoing evaporation. The two ponds will alternate their functions on an annual basis. The solids will be scheduled for removal during the summer months, when the concentration of solids is at its greatest due to an increase in evaporation rates, in order to achieve maximum solids removal.

The brine constituents include those from the well water source which will be shown in Table 3-5, Well Water Quality Analysis. The assumed TDS concentration of the reject water may be up to four to five times those of the well water source. The TDS concentration anticipated in the brine when treating to less than 20 mg/L is approximately 3,600mg/L based on the assumed source TDS level of 810mg/L.

After the brine has gone through the evaporation process, the solids that settle at the bottom of the evaporation pond will be tested by the Applicant and disposed of in an appropriate non-hazardous waste disposal facility.

3.8.1 Sanitary Wastewater System

Sanitary wastewater generated at the facility cannot be conveyed to an existing sewage facility or pipeline as there are no public or private entities that manage sanitary wastewater flows for locations in the vicinity of the Project Site. The wastewater generated at the Main Services Complex will be discharged into a sub-surface wastewater disposal system with septic tanks and leach fields, and will be designed in accordance with the applicable LORS, including San Bernardino County, California State Regional Water Quality Board, and the Department of Health Services.

The general threshold limit for a standard approval process for septic tanks and leach fields through the local Regional Water Quality Control Board (RWQCB) is 500 gallons per acre per day. The expected daily sanitary wastewater flow from Solar One ranges from an average of 5,500 gallons to a peak of 6,600 gallons; the required set aside area given this flow is approximately 14 acres. Given the Project Site area is much greater than 14 acres, the threshold limit for septic tank and leachfield applications will be met. The required leachfield area is estimated to be approximately 1,100 square-feet (0.025 acre).

The sanitary wastewater system consists of a septic tank located at the Main Services Complex with leach fields located adjacent to the Main Services Complex, utilizing the open space between nearby SunCatchers. The septic tank, a key component of a septic system, is a small scale sewage treatment system common in areas with no connection to main sewerage pipes provided by private corporations or local governments. Septic systems are a type of On-Site Sewage Facility (OSSF). The term "septic" refers to the anaerobic bacterial environment that develops in the tank and which decomposes or mineralizes the waste discharged into the tank. Periodic preventive maintenance is required to remove the irreducible solids which settle and gradually fill the tank, reducing its efficiency. The septic tanks will require annual inspections to monitor for the build up of solids and sludge. Once the available storage volume in the septic tank has been reduced by 25-percent, the sewer sludge shall be pumped from the septic tank and transported for disposal at an approved off-site disposal facility.

From the septic tank, the clarified liquid effluent will be disposed in sanitary leach fields. The leach field system will be designed as two (2) independent leach systems, each sized to dispose of 100 percent of the system effluent from the septic tank. The installation of the independent leaching areas will allow for a primary and a secondary system to dispose of the wastewater flows. The flows from the septic tank can then be cycled between the two leaching systems by utilizing the installed distribution boxes to deliver the effluent to one leach field at a time to minimize the possibility of a long term leach field failure.

The leach field being utilized will get a regular flow of bacteria from the fluids exiting the septic tank. This bacterium creates organic slimes in the soil, which potentially can clog the soil pores and cut down on the absorption capacity of the soils.

The installation of two independent leaching systems will allow for one of the leach field systems to be used for a period of one year and then the distribution valve would be switched over to the second leach field system which would then serve as the leach field for the next year. The leach field that was being used will be closed down and will lie fallow and recover from the

bacterial loading it has received during the previous year. This process of alternating the two leaching systems every year under normal usage should enable the leach fields to last indefinitely. The system may be installed in one phase or in two phases based on the Solar One construction phase.

Table 3-6
Construction and Dust Control Water Truck Quantities by Month

	Number of Trucks per Month									
Month after Construction Start	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Dust Control Water Truck	7	14	12	8	6	8	8	6	6	6
Construction Water Truck	3	12	12	2	2	4	7	7	7	4
Water Truck Usage by 1,000 Gallons										
Dust Control Water Truck	3640	7280	6240	4160	3120	4160	4160	3120	3120	3120
Construction Water Truck	1560	6240	6240	1040	1040	2080	3640	3640	3640	2080
	Number of Trucks per Month									
Month after Construction Start	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Dust Control Water Truck	3	6	12	14	12	9	9	8	9	7
Construction Water Truck	2	2	4	12	3	3	2	3	3	3
Water Truck Usage by 1,000 Gallons										
Dust Control Water Truck	1260	3120	6240	7280	6240	4680	4680	4160	4680	3640
Construction Water Truck	1040	1040	2080	6240	1560	1560	1040	1560	1560	1560
	Number of Trucks per Month									
Month after Construction Start	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Dust Control Water Truck	7	7	7	5	4	4	4	4	4	4
Construction Water Truck	2	2	1							
Water Truck Usage by 1,000 Gallons										
Dust Control Water Truck	3640	3640	3640	2600	2080	2080	2080	2080	2080	2080
Construction Water Truck	1040	1040	520	0	0	0	0	0	0	0
	Number of Trucks per Month									
Month after Construction Start	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Dust Control Water Truck	4	4	4	4	4	4	1	1	1	
Construction Water Truck										
Water Truck Usage by 1,000 Gallons										
Dust Control Water Truck	2080	2080	2080	2080	2080	2080	520	520	520	0
Construction Water Truck	0	0	0	0	0	0	0	0	0	0

Source: Stirling Energy Systems, 2008.

3.8.2 Water Treatment System Solid Wastes

Solid waste from the Project's water treatment system will be trucked off-site from the evaporation ponds as a low-moisture cake. Based on the assumed well water TDS of 810 mg/L, an estimated 68,000 pounds per year of salt cake will be trucked off-site to an appropriate landfill or recycled. The waste is anticipated to be non-hazardous, as shown in Table 3-7, List of Inorganic Persistent and Bioaccumulative Toxic Substances, Their Soluble Threshold Limit Concentration, and Total Threshold Limit Concentration Value, and Table3-8, Maximum Concentration of Contaminants for the Toxicity Characteristic in Non-Solid Waste. The full 68,000 pounds will be scheduled for removal at the end of the evaporation process. The type of vehicle proposed for use in hauling the solids off-site has a capacity of 20 tons. Therefore, approximately two loads will be required per year.

Table 3-7

List of Inorganic Persistent and Bioaccumulative Toxic Substances, Their Soluble Threshold Limit Concentration, and Total Threshold Limit Concentration Value

(Well testing analysis is currently work in progress and data will be included in Table 3-7 within a supplemental filing.)

Table 3-8
Maximum Concentration of Contaminants
for the Toxicity Characteristic in Non-Solid Waste

(Well testing analysis is currently work in progress and data will be included in Table 3-8 within a supplemental filing.)

An active landfill, the Barstow Sanitary Landfill, is located approximately 30 miles from the Project Site, approximately three miles outside of the City of Barstow, off of Highway 247. The main roadways for travel from the Project Site to the landfill are I-40 and Interstate 15 (I-15). The landfill accepts a maximum of 750 tons per day.

An alternative landfill location for future use will be the Victorville Sanitary Landfill, located in the City of Victorville. This facility has future plans for 100 feet of vertical expansion over the entire 67-acre landfill footprint. The main roadways for travel from the Project Site to the landfill are I-40 and I-15.

3.8.3 Waste Management

The Project will generate a variety of non-hazardous and hazardous wastes during construction and operation. These solid wastes are outlined in Table 3-9, Summary of Construction Waste Streams and Management Methods, and Table 3-10, Summary of Operation Waste Streams and Management Methods.

These wastes include liquids and solids from the wastewater system, replaceable parts, rags, and other waste materials and chemicals produced from maintenance activities, including equipment and vehicle maintenance.

The handling and disposal of hazardous wastes is discussed in Section 3.8.3, Waste Management.

Table 3-9
Summary of Construction Waste Streams and Management Methods

Waste Stream and Classification	Origin and Composition	Estimated Amount	Estimated Frequency of Generation	On-Site Treatment	Waste Management Method
Construction waste – non-hazardous recyclable	Scrap wood, steel, glass, plastic, and paper	90 cubic yards per week	Intermittent	Segregation into composition type; store for less than 30 days	Recycling facility
Construction waste – hazardous	Empty hazardous material containers	2 cubic yards per week	Intermittent	Store for less than 90 days	Return to vendor or to hazardous waste disposal facility
Construction waste – hazardous	Solvents, used oils, paint, oily rags, cleaners, and adhesives	200 gallons	Every 90 days	Store for less than 90 days	Dispose to hazardous waste disposal facility or recycle
Construction vehicles – hazardous	Waste oil including used motor oil, transmission fluid, hydraulic fluid, and antifreeze	226 gallons	Every 90 days	Store for less than 90 days	Dispose to hazardous waste disposal facility or recycle
Spent batteries – hazardous	Lead acid and alkaline	45 per year	Intermittent	Store for less than 90 days	Dispose to recycling facility
Storm water from construction – non-hazardous	Surface runoff (water, inert material, dirt and concrete particles)	17 gallons per day	Intermittent	None	Water will percolate into on-site soils
Residual solids from retention pond – non-hazardous	Dirt and concrete particles	57 cubic yards one time at end of construction	5 x 10 cubic yards Truck	None	Excavate at end of construction and spread on-site
Sanitary waste – non-hazardous	Portable chemical toilets sanitary waste	452 gallons per day	Periodically pumped to tanker truck by licensed contractor	None	Ship to sanitary water treatment plant

Source: Stirling Energy Systems, 2008.

Table 3-10
Summary of Operation Waste Streams and Management Methods

Waste Stream and Classification	Origin and Composition	Estimated Amount	Estimated Frequency of Generation	On-Site Treatment	Waste Management Method
Office and packaging materials from supplies deliveries – non-hazardous	Paper, wood, plastic, and cardboard	11 cubic yards per week	Intermittent	Segregation into composition type; store for less than 30 days	Weekly collection for recycling and/or approved waste disposal

Table 3-10
Summary of Operation Waste Streams and Management Methods

Waste Stream and Classification	Origin and Composition	Estimated Amount	Estimated Frequency of Generation	On-Site Treatment	Waste Management Method
Sanitary wastewater solids – non-hazardous	Rest rooms and sanitary waste	5,650 gallons per month	Intermittent	None	Dispose to sanitary leach field
Spent batteries – hazardous, recyclable	Lead acid, alkaline, gel cell, nickel, and cadmium	34 units per week	Intermittent	Store for less than 30 days	Dispose to authorized waste recycling facility
PCU oil[1] – motor oil – hazardous, recyclable	PCU overhaul	20 gallons per month	Intermittent	Two 100 United States gallon tanks for filtering and re-use in PCU	Recycle
PCU coolant – ethylene glycol – hazardous	PCU overhaul	20 gallons per month	Intermittent	Store for less than 90 days	Dispose to authorized waste disposal facility
PCU hydrogen gas – non-hazardous, recyclable	Refill k-bottles in place	5,650 k-bottles per month	2 times per year per SunCatcher	Refill k-bottles on-site	Empty k-bottles returned through supplier
Oily absorbent and spent oil filters – hazardous, recyclable	PCU and hydraulic equipment overhauls	One 55-gallon drum per month	Intermittent	Store for less than 90 days	Dispose to authorized recycle facility
Oily rags – non-hazardous	PCU and hydraulic equipment overhauls	One 55-gallon drum per month	Intermittent	Store for less than 90 days	Launder at authorized recycle facility
Used hydraulic fluid, oils and grease – hazardous, recyclable	PCU and hydraulic equipment overhauls	Less than 13 gallons per month	Intermittent	Store for less than 90 days	Dispose to authorized recycle facility
De-mineralized water treatment wastewater salt cake – non-hazardous or designated waste	Zero discharge system; naturally occurring salt compounds	68,000 pounds per year	Intermittent	Evaporative pond containment	Non-hazardous waste disposal facility

Source: Stirling Energy Systems, 2008.
Notes:
[1]Assumption is based on 5,300 United States gallons per year for Power Conversion Unit oil changes at a 98 percent recovery rate.
PCU = Power Conversion Unit

3.8.3.1 Solid Waste – Non-Hazardous

Construction Wastes

Inert solid wastes resulting from construction activities may include recyclable items such as paper, cardboard, solid concrete and block, metals, wire, glass, Type 1 to 4 plastics, drywall, and wood. Non-recyclable items include insulation, other plastics, food waste, roofing materials, vinyl flooring and base, carpeting, paint containers, packing materials, and other construction wastes. Management of these wastes will be the responsibility of the construction contractor(s). Typical management practices required for contractor waste include recycling when possible,

proper storage of waste and debris to prevent wind dispersion, and weekly pickup of wastes with disposal at a local approved landfill.

It is expected that a 40-cubic-yard container will need to be emptied on a weekly basis during the construction of the buildings and once a month thereafter. Recyclable materials will be separated into labeled bins and removed from the site as needed. This construction waste is not expected to have a significant effect on public health or cause adverse effects on local landfill capacity. Table 3-9, Summary of Construction Waste Streams and Management Methods, provides an overview of the waste streams anticipated for the construction phase of the Project.

Any wastes classified as hazardous, such as solvents, degreasing agents, concrete curing compounds, paints, adhesives, chemicals, or chemical containers, will be stored and disposed of as required by local and state regulations. Material quantities of hazardous wastes are not expected. Lubricating oils generated from the construction vehicles will be recycled at local approved recycling facilities.

Operation Wastes

Inert solid wastes generated at the Project during operation will be predominantly office wastes and routine maintenance wastes, such as scrap metal, wood, and plastic from surplus and deactivated equipment and parts. Scrap materials such as paper, packing materials, glass, metals, and plastics will be segregated and managed for recycling. Non-recyclable inert wastes will be stored in covered trash bins in accordance with local ordinances and picked up by an authorized local trash hauler on a regular basis for transport and disposal in a suitable landfill area. Table 3-10, Summary of Operation Waste Streams and Management Methods, provides an overview of the waste streams anticipated for the operation.

3.8.3.2 Non-Hazardous Liquid Waste

Non-hazardous liquid wastes produced for the Project consist of water treatment system wastes. Handling and disposal of these wastes are discussed in Section 3.4.5.2, Electrical Collection System.

Skim oil collected from oil/water interceptor and other liquids from equipment maintenance will be transported by an authorized carrier to a certified recycling facility.

3.8.3.3 Hazardous Waste

Solar One will implement a Hazardous Materials Management Program (HMMP) developed for the Project construction and operation phases. At a minimum, the HMMP will include procedures for:

- hazardous materials handling, use and storage,
- emergency response,
- spill control and prevention,
- employee training, and
- recordkeeping and reporting.

The HMMP will be developed and implemented before the start of construction. The program will be revised and updated as required in a timely manner, and employees will be trained and the program will be implemented before the start of commercial operation. The procedures outlined in the HMMP will be in accordance with all applicable LORS.

3.8.4 Management and Disposal of Hazardous Materials

3.8.4.1 Chemical Management

Table 3-11, Summary of Water Treatment Materials Usage and Storage, and Table 3-12, Summary of Non-Water Treatment Materials Usage and Storage, list the chemicals to be used, handled, and stored at the Project Site during Project operation.

Table 3-11
Summary of Water Treatment Materials Usage and Storage

Chemical	Application	Expected Storage Quantity (gallons – average)
Sodium hypochlorite 12.5 percent solution (bleach)	Disinfectant for potable water	4

Source: Stirling Energy Systems, Inc., 2008.
Note: This table also appears in Appendix L, Hazardous Materials Handling.

Table 3-12
Summary of Non-Water Treatment Materials Usage and Storage

Chemical	Application	Storage Location	Storage or Usage Quantity	
			Average	Maximum
Insulating oil (heat transfer)	Electric equipment	N/A	60,000 gallons, initial fill	Not stored on-site, initial fill quantity is brought to site at the time of replacement
Lubricating oil	Solar Stirling Engine/dish drives	Maintenance buildings	122,778 gallons, initial fill with usage of 46 gallons per month	300-gallon recycle tank located in the Maintenance Building
Hydrogen	PCU working fluid	k-bottles mounted on each SunCatcher	Usage of 56,667 cubic feet per day	Initial fill
Ethylene glycol	Inlet air chiller loop – alternating	Maintenance buildings	110,000 gallons, initial fill, with usage of 46 gallons per month	Initial fill
Various solvents, detergents, paints, and other cleaners	Building maintenance and equipment cleaning	Maintenance buildings	Three 55-gallon drums, commercial 1-gallon containers	Ten 55-gallon drums, commercial 1-gallon containers

Table 3-12
Summary of Non-Water Treatment Materials Usage and Storage

Chemical	Application	Storage Location	Storage or Usage Quantity	
			Average	Maximum
Gasoline	Maintenance vehicles	Two double-wall 5,000 gallon refueling station with containment	2,500 to 5,000 gallon refueling stations	Full tank of 5,000 gallons
Diesel fuel	Fire water pump and maintenance vehicles	Fire water skid double-wall 5,000 gallon refueling station with containment	100 gallons for initial fill, 2,500 to 5,000 gallon refueling stations	Maintain full diesel tank of 5,000 gallons

Source: Stirling Energy Systems, Inc., 2008.
Notes:
N/A = not applicable
PCU = Power Conversion Unit

The storage, use, and handling of these hazardous materials will be in accordance with applicable LORS and will be conducted as listed below.

- An HMMP will be developed and implemented before turnover of site management from the construction contractor to the operating company.
- Project personnel will be trained in hazardous materials and hazardous waste awareness, handling, and management as required for their level of responsibility.
- Bulk chemicals will be stored in the original shipping container provided by and returned to the chemical provider.
- Hydrogen gas will be provided and refilled at each SunCatcher k-bottle by the gas provider, with storage facilities for k-bottles following all applicable LORS. These are outlined in Appendix K, Hydrogen System Design Criteria.
- Chemical storage areas and feed/transfer areas will be equipped with secondary containment sufficient to contain the volume of the largest container or tank including an allowance for rainwater.
- Small-quantity chemicals used for maintenance tasks will be kept in appropriate flammable material or corrosive material storage lockers per all applicable LORS.
- Periodic inspections will ensure that all containers are secure and properly marked.

3.8.4.2 Hazardous Wastes

Table 3-10, Summary of Operation Waste Streams and Management Methods, lists the types of wastes to be generated during commercial operation of the Project. These wastes will be managed in accordance with the applicable LORS and will be consistent with the implementation of the HMMP for the Project. Key aspects of Project waste management are listed below.

- The Applicant will secure an EPA Hazardous Waste Generator ID number before turnover of site management from the construction contractor to the operating company.
- All hazardous wastes will be stored in appropriate bulk storage containers or in labeled 55-gallon drums equipped with secondary containment and closed tops with bungs for liquid wastes or in secured open-top drums for solid wastes.
- All waste drums will be stored in accordance with good practice and applicable LORS, and will be protected from environmental conditions; including rain, wind, and direct heat; and physical hazards such as vehicle traffic and sources of heat and impact.
- Storage of hazardous waste will at no time exceed 90 days from the date of initial accumulation of a total of 55 gallons of hazardous waste or more on-site.
- PCU engine oil will be stored in 150-gallon double-walled storage tanks on-site in accordance with good engineering practices and applicable LORS. Two tanks will contain recovered oil from PCU overhauls to be filtered for re-use in PCU operation. Filtered oil will be contained in two additional 150-gallon double-walled tanks for storage.
- Elevation and azimuth gearbox oil will be stored in 150-gallon double-walled storage tanks on-site in accordance with good engineering practices and applicable LORS. One tank will contain recovered oil from PCU overhauls to be filtered for re-use in PCU operation. Filtered oil will be contained in a second 150-gallon double-walled tank for storage.
- Waste lubricating oils will be recovered and reclaimed by a waste oil-recycling contractor.
- Used hydrogen gas k-bottles will be stored to the specific requirements outlined in NFPA 50A following good engineering practices and applicable LORS. The cylinder storage location will be in a well-ventilated, dry compound, secured from unauthorized access, well protected from vehicle, pedestrian, and other potential sources of impact, and separated from other potentially combustible materials or other oxidizers by a barrier of noncombustible material. Further description of the storage and handling of hydrogen gas is outlined in Appendix K, Hydrogen System Design Criteria.
- Spent lubricating oil filters from PCUs and vehicles will be disposed at an authorized waste disposal facility.
- Batteries will be reclaimed and recycled by authorized facilities.
- California-authorized and certified hazardous waste haulers will transport hazardous wastes to registered waste treatment, storage, disposal, and recycling facilities.
- Hazardous waste generation, handling, and storage areas will be inspected and monitored on a regular basis.
- Emergency response and reporting will be performed per written procedures that follow government and industry requirements and standards.
- Workers will be trained to handle hazardous wastes generated at the site.

AES of Fontana, located at 13579 Whitram Avenue, Fontana, California, has been identified as a business that specializes in transporting, disposing, and recycling of hazardous waste. AES works in accordance with EPA and either recycles or treats all hazardous waste by distributing

different types of materials to appropriate companies in the area. Table 3-13, Business Listings of Specific Hazardous Waste Handlers, lists the appropriate businesses that address the specific types of hazardous waste.

Table 3-13
Business Listings of Specific Hazardous Waste Handlers

Hazardous Material Type	AES Distribution List	Contact Information and Location
All fluids and wastes from trucks (motor oil, coolant, hydraulic fluid, etc.)	D-K Environmental Refinery	323-268-3387 Los Angeles, CA
Spent alkaline batteries and spent lamps from lighting fixtures	Lighting Resources, LLC Universal Waste	800-572-9253 Ontario, CA
Absorbent automotive waste (plus contaminated dirt and gravel)	Siemens Carbon Regeneration Facility	866-372-9378 Colorado River Indian Reservation, Near Parker, AZ
Spent lead-acid or nickel-cadmium batteries	Exide Technologies	818-252-2022 Arleta, CA

Source: Stirling Energy Systems, Inc., 2008.
Note: This table also appears in Appendix L, Hazardous Materials Handling.

3.8.4.3 Accidental Release

Four types of hazardous materials will be used at the Project Site during the operational phase that pose a risk of accidental release: hydrogen gas, gasoline fuel, diesel fuels for Project vehicles, and transformer insulating oil.

The most likely cause of an accidental release would be gasoline or diesel fuel leakage due to an accidental collision or a spill while refueling a maintenance vehicle. A less likely possibility of tank leakage is aging tank material and/or oxidation of the tank structure.

Protective measures to be adopted during a gasoline spill include the following.

- Eliminate all sources of ignition in the vicinity of the spill or released vapor.
- If the material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.
- Stop the source of the release if it can be done without risk.
- Contain the release to prevent further contamination of soil, surface water, or groundwater.
- Clean up the spill as soon as possible, observing precautions in exposure controls/personal protection.
- Use appropriate techniques such as applying non-combustible absorbent materials or pumping.
- Ensure that all equipment used when handling the product is grounded.
- Use a vapor suppressing foam to reduce vapors.
- Use clean, non-sparking tools to collect absorbed material.

- Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable LORS.
- Report gasoline spills to local authorities as appropriate or required. This material is covered under the EPA-administered Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) Petroleum Exclusion. Therefore, gasoline releases to the environment may not be reportable under CERCLA.

Transformer oil poses a minor risk of accidental spill.

A second cause of accidental release could occur during the refilling of a SunCatcher hydrogen k-bottle cylinder. These cylinders contain 196 cubic feet and the engine contains 14 cubic feet for a total of 210 cubic feet. This amount is below the 400-cubic-foot threshold defined in 29 Code of Federal Regulations 1910.103 and NFPA-55, Chapter 10. Even though the system is exempt from these requirements, they will be considered for the Application for Certification (AFC).

Only experienced and properly instructed personnel will handle compressed hydrogen gas. During filling, the cylinders will be secured in an upright position. The valve protection cap will be removed only just before connecting the cylinder to the manifold. The cylinder units will be electrically bonded to the system before discharging hydrogen. Personnel will ensure all connections will remain gas-tight during filling.

If a release were to occur, personnel would be required to evacuate the immediate area then eliminate any possible sources of ignition, provide necessary ventilation, and shut off the source of hydrogen, if possible. If hydrogen is leaking from a cylinder or valve, personnel would be required to call the supplier's emergency phone number. Since this type of incident would most likely occur at the SunCatcher, personnel would likely be instructed to allow the hydrogen gas to dissipate to the atmosphere. Hydrogen poses no adverse effects on the environment. The risk of fire is minimized because refilling operations occur outdoors, preventing hydrogen from attaining the minimum 4 percent lower explosive limit.

Appendix K, Hydrogen System Design Criteria, provides further information on the handling of hydrogen gas.

Transformer oil is not stored on-site except in the transformers. Each substation transformer contains approximately 10,000 gallons of insulating oil. Each GSU contains approximately 530 gallons of oil. The total transformer oil contained in all of the transformers amounts to approximately 360,510 gallons.

Substation transformers will be delivered to the site without the oil. The oil will be inserted into the transformer tanks from delivery tankers on-site. Precautions will be taken during oil transfer to prevent spills. Adsorbent materials will be carried on the supply truck for quick response to an inadvertent oil spill. Any soil contaminated by a spill will be removed to an off-site hazardous waste disposal facility. Substation transformer pads will be designed for containment of the transformer oil in the event the tank is breached.

GSUs will be filled with oil when they are delivered to the Project Site.

During Project operation, samples of transformer oil will be drawn for testing from a test port on each transformer tank approximately every 3 months. Oil will be removed from the tank for maintenance on intervals of 10 to 15 years.

3.8.4.4 Storm Water Management

Storm water is considered a wastewater stream. A storm water drainage system designed to match existing drainage patterns and meeting all local regulations will collect and direct all rainwater from the entire Project Site, managing the flow through the use of existing dry washes, swales, ditches, culverts, and site grading to the pre-development site discharge location. Erosion and sedimentation control will be implemented during construction to retain sediment on-site and to prevent violations of water quality standards. These actions will be taken in accordance with the BMPs. A Storm Water Pollution Prevention Plan (SWPPP) will be prepared to conform to State Water Resource Control Board Order Number 99-08-DWQ, General Permit Number CAS000002.

The proposed site development will slightly alter the land areas of the site. Existing sparse vegetation will be removed as required during site preparation. The general preparation of the overall site will be followed by the grading activities required for the construction of the roadways and buildings. Grading for the construction of the roadways and buildings may include application of earth-binding materials to disturbed areas not occupied by Project facilities or surfaced with concrete, asphalt, or crushed aggregate.

Site drainage during construction will follow predevelopment flow patterns, with ultimate discharge to the BNSF ROW and ultimately at the westernmost property boundary. Debris basins and/or low-flow culverts consisting of a small-diameter storm drain with a perforated stem pipe will be installed for sediment control and to provide for storm peak attenuation. These are based on BMP for erosion and sediment control; they are illustrated in Figure 3-30, Low Flow Culvert Crossing at Life Line Roadway, and Figure 3-31, De-Silt Basin.

Roadway dips, as illustrated in the Figure 3-29, Arizona Crossing, will be used in combination with debris basins for roadway crossing of major washes. In the Main Services Complex, the storm water will be directed to a retention basin, where the site runoff will infiltrate and/or evaporate. The retention basin will be sized to meet the San Bernardino County development criteria.

The temporary erosion and sedimentation control measures to be used during construction will be designed to prevent sediment from being displaced and carried off-site by storm water runoff. Before beginning excavation activities, debris basins, silt fence, straw bales, or other BMPs will be constructed/installed along the perimeter of the Project, where minor runoff to off-site areas could occur. Debris basins will be constructed for the major site runoff discharge and will also provide for low flow retention. The silt fence will filter sediments from construction runoff. Berms with perforated risers will be used at road crossings and other locations as needed to control sediment transportation. During construction, the extent of earth disturbances will be minimized as much as is practical. A sediment trap will be constructed for the major site runoff discharge. The sediment trap will be located immediately upstream of the property boundary.

Diversion swales with berms will be constructed as necessary to divert runoff from off-site areas and on-site undisturbed areas around the construction site. Temporary BMP control measures will be maintained during the rainy season as necessary throughout the construction period.

3.9 PROJECT CONSTRUCTION

3.9.1 Project Construction Schedule

The Project will be developed in two phases. The overall schedule will be approximately 58 months in duration, as described on Figure 3-40, Solar One Milestone Schedule – Phase I, and Figure 3-41, Solar One Milestone Schedule – Phase II. Construction will require approximately 41 months. Major milestones are listed in Table 3-14, Project Schedule Major Milestones.

Table 3-14
Project Schedule Major Milestones

Activity	Time Frame
Pre-construction initiated	Y2/Q2
Project approval initiated	Y2/Q1
Design documents initiated	Y2/Q1
Bid and award initiated	Y2/Q2
Procurement initiated	Y1/Q1
Phase I	
Phase I – Start Construction	**Y0/Q0**
Construction preps completed	Y1/Q1
Site layout completed	Y1/Q1
Off-site transmission completed	Y1/Q2
Civil completed	Y1/Q4
Phase I – Substation and Transmission	**Y1/Q3**
Cable, Pole and 9MW infrastructure completed	Y1/Q1
On-Site transmission line	Y1/Q2
Substation infrastructure (first two-thirds)	Y1/Q3
Controls for first 18MW	Y1/Q3
Phase I – SunCatcher Installation	**Y2/Q3**
Final road prep and dust control	Y2/Q3
Foundations complete	Y2/Q2
18MW power collection ready	Y3/Q2
SunCatcher assembly complete	Y3/Q2
Phase II	
Design documents initiated	Y1/Q1
Bid and award initiated	Y1/Q2
Procurement initiated	Y2/Q1
Phase II – Start Construction	**Y2/Q1**
Site layout completed	Y2/Q1
Civil completed	Y2/Q3
Phase II – Substation and Transmission	**Y2/Q2**

Table 3-14
Project Schedule Major Milestones

Activity	Time Frame
Cable, pole, and 9MW infrastructure	Y2/Q1
Substation infrastructure	Y2/Q2
Controls for first 18MW	Y2/Q2
Phase II – SunCatcher Installation	**Y4/Q2**
Final road prep and dust control	Y4/Q1
Foundations complete	Y2/Q4
18MW power collection ready	Y3/Q2
SunCatcher assembly	Y4/Q2

Source: Stirling Energy Systems, Inc., 2008.
Notes:
The year/quarter timeframes are referenced to the Phase I activity, "Start of Construction."
Y = year
Q = quarter
MW = megawatt

Heavy construction for the Project will be scheduled to occur between 0700 and 1900 Monday through Friday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities.

Some activities will continue 24 hours per day, 7 days per week. These activities include, but are not limited to, SunCatcher assembly, refueling of equipment, staging of materials for the next day's construction activities, quality assurance/control, and commissioning.

3.9.2 Construction Site Security

The Project Site will be fenced at the start of construction, as described in Section 3.4.1, Project Site Arrangement. The construction entrance to the site will be via a gated entrance from Hector Road at the southern boundary of the site and from the temporary access road from I-40 at the eastern Project boundary.

The temporary access road will be used for constructed-related entry and exit to the Phase I site. The Hector Road gate will be used for construction-related entry and exit to the Phase II site; this gate will also be used for both entry and exit during Project operations.

3.9.3 Site Mobilization

The Phase I Project facilities and amenities will be established during the first few months of the build-out. The majority of these facilities will be located in the 14-acre construction laydown area adjacent to the Main Services Complex. Project amenities will consist of site offices, restroom facilities, meal rooms, limited parking areas, vehicle marshalling areas/traffic staging, and construction material/equipment storage areas. Construction power to the Project Site facilities will be provided by mobile diesel-driven generator sets and/or temporary and/or permanent service(s) from the local power provider. Additional construction employee parking will be provided on the 26-acre laydown and staging areas on the south and east entrances to the

Project. Employees may be moved to and from the Project Site from surrounding areas and/or the laydown parking areas, in shuttles and/or other mass conveyance vehicles.

3.9.4 Project Site Preparation

The ground surface at the Project Site generally slopes southwest for Phase I and west for Phase II. Site preparation will be based on avoiding major drainages and minimizing surface-disturbing activities. Also, areas of sensitive habitat and cultural resource will be avoided wherever possible.

The clearing, blading, and grading operations will be undertaken using standard contractor heavy equipment. This equipment will consist of, but not be limited to, motorgraders, bulldozers, elevating scrapers, hydraulic excavators, tired loaders, compacting rollers, and dump trucks.

To minimize site disturbance, a three dimensional (3-D) digital site plan will be prepared based on the grading plans. The digital site plan data will then be transferred to construction vehicles equipped with Global Positioning System (GPS) Grade Control and/or Advanced Tracking Sensor (ATS) Robotic Total Stations for stakeless construction. The 3-D digital plan from the survey and CAD data will provide a direct connection between the engineers' office and construction machine operators.

GPS Grade Control displays design surfaces, grades, and alignments in the cab and enables operators to perform bulk earthwork and mass excavation in a stakeless environment using either automatic or manual blade control. ATS Robotic Total Stations use a total station to track automatically a target mounted on the blade of the machine. The ATS continuously measures the target's position and transmits the data to the in-cab computer, which then determines the desired elevation and slope for that position. GPS grade-control systems can be precise to 0.1 foot. When combined with an ATS, the grading accuracy can narrow to ±0.02 foot, which provides precise, finished grade work.

With this approach, considerable work is completed well before the heavy machines and construction crews arrive at the site. It is anticipated that construction will take place as follows:

- Brush trimming will be conducted between alternating rows of SunCatchers, as illustrated in Figure 3-11, Solar One 1.5 MW Solar Group Plan. Brush trimming consists of cutting the top of the existing brush while leaving the existing native plant root system in place to minimize soil erosion.
- The bulk of the grading operations, consisting of the SunCatcher groups, may be performed with reduced site disturbance by having several construction equipment travel in parallel in a north-south direction, covering a path width of 144-feet. The GPS and/or ATS equipped machinery will have the blades lowered and raised based on the 3-D digital site plan model, thus leaving the vegetation root system in place for areas that do not need grading. The impact is thus reduced to the vehicle wheels and blading where limited cut and fill is needed to install and maintain the SunCatchers. The machinery will then return in a similar fashion, in a south-north direction, blading the next SunCatcher group. The east-west movement will be limited to roadway construction as shown in Figure 3-11, Solar One 1.5 MW Solar Group Plan, thus minimizing impact to the 40-foot wide natural area between SunCatcher Groups.

- Limited localized channel grading will take place to improve channel hydraulics and to control flow direction where buildings and roadways are proposed. The Main Services Complex and the electrical substation will be protected from a 100-year flood by berms and/or channels that will direct the flow around the perimeter of the sites, if required.

3.9.5 Foundations

From the preliminary geotechnical investigations, it is expected that lightly loaded equipment and structures, including some of the equipment foundations in the substation yard, small equipment such as the fire water pump and standby generator, the support structures for the water treatment plant and the hydrogen storage area, and the transmission line lattice steel towers will be supported on shallow footings. Shallow footings will be continuous strip and isolated spread footings.

The majority of each SunCatcher will be supported by a single metal fin-pipe foundation that is hydraulically driven into the ground. These foundations are expected to be approximately 20 feet long and 24 inches in diameter, with 12-inch wide fins extending from each side of the pipe pile. Shallow drilled pier concrete foundations of approximately 36 inches in diameter and an embedment depth with a minimum socketed depth into rock of 6 feet would be used for hard and rock-like ground conditions.

The buildings and major structures such as yard tanks will be supported on shallow spread and continuous footings or mat-type foundations.

Deep foundations will be required for heavy items, such as the power transformers at the electrical substation.

3.9.6 Groundwater

A recent geotechnical investigation conducted for the Project indicated that the depth to groundwater on an existing well within the Project Site boundary is 310 feet. The deepest Project excavations are anticipated to be approximately 30 feet deep for the debris basins at the northernmost Project boundary. Accordingly, it is not anticipated that groundwater will be encountered during construction. If groundwater is encountered and dewatering is required, then approved BMP, such as those described in the State of California Storm Water BMP Handbook NS-2, dated January 2003 or subsequent versions, will be employed.

3.9.7 Water

As discussed in Section 3.7.1, Water Supply Source, a proposed primary water well will be located in a Water Treatment Facility within the Main Services Complex per Figure 3-3, Solar One – Site Plan – Post Construction. As discussed in Section 3.5.10, Well Water Supply Line, additional water wells may need to be drilled to augment the Primary Water Well, as the water requirements for the peak construction stages of the project will increase to approximately 10 times the peak facility operations demand. It is also important to note that SES may utilize, to the extent possible, both of the aforementioned primary and secondary water wells during the

construction stages and normal operation of the future Solar Three Project Site adjoining the western boundaries of the Solar One site.

Since the primary water well will be located at the Water Treatment Facility within the Main Services Complex, the well water pump will discharge the well water directly into a Well Water Storage Tank, also located within the Water Treatment Facility. Construction water augmentation from the secondary water well, and/or from other on-site wells, will be conveyed via water trucks or via temporary aboveground conduits, e.g., aluminum pipes, fire hoses.

Initially, the well water will be used in the areas disturbed by construction activity for the primary access routes, the construction laydown areas, the grading of the sites for the Main Services Complex and the Satellite Services Complex, and the substation sites, as well as the clearing areas disturbed by the construction of each 18MW or 24MW solar group. The 18MW solar group clearing areas are illustrated on Figure 3-13, Solar One 18MW Solar Group Plan.

Water trucks will be used throughout the duration of the construction phase for the Project. Truck filling stations will be located at the Main Services Complex, at the Satellite Services Complex, and at various temporary truck filling stations throughout the Project Site. The demineralized and/or potable waterline(s) between the Main Services Complex and Satellite Services Complex will be used to supply well water for construction and dust control water for the Phase II portion of the Project Site, utilizing a steel casing to be jacked under the BNSF railway. The dust control water requirements are illustrated in Table 3-6, Construction and Dust Control Water Truck Quantities by Month.

Storm water discharges from construction activities are subject to BMPs specifically designed for construction activities. Approved BMP appropriate to the Project Site and its specific conditions will be selected from the California Storm Water BMP Handbook. The proposed debris basins/retention basins will also allow for ground water recharge.

The following soil mitigation measures will be implemented to reduce potentially significant soils effects to less-than-significant levels. An acceptable level of soil erosion, as used herein, is defined as that amount of soil loss that would not affect (i.e., limit) the potential long-term beneficial uses of the soil as a growth medium or adversely affect water resources because of accelerated erosion and subsequent sedimentation. Section 5.5, Water Resources, discuses mitigation measures related to potential effects to water quality associated with soil erosion.

With implementation of the mitigation measures listed below, no significant unavoidable adverse effects to soils resources are anticipated because of Project construction.

- **Soil-1:** Conduct grading operations consistent with the San Bernardino County Grading Ordinance.
- **Soil-2:** Prepare and implement a detailed Erosion Control Plan before construction, which may be a component of the SWPPP.
- **Soil-3:** Limit soil erosion/dust generation by wetting active construction areas (including roads) with water or by applying dust palliatives (soil binders).
- **Soil-4:** Stabilize disturbed areas that will not be covered with structures (e.g., buildings or collectors) or pavement after grading and/or cut-and-fill operations. Stabilization methods will include moisturizing and compacting and/or application of polymeric soil stabilizers.

The disturbed areas of the water line route will be reseeded using a seed mixture native to the area.

- **Soil-5:** Minimize disturbance of soils and vegetation by reducing access and construction areas to smallest practical dimensions.
- **Soil-6:** Cut/mow vegetation when removal is necessary; clear vegetation only to the extent necessary during construction activities.
- **Soil-7:** Segregate and stockpile removed topsoil for reuse if practicable.
- **Soil-8:** Implement drainage control measures and grade Project Site to direct surface water into the retention basins.
- **Soil-9:** Conduct post-construction monitoring of areas that were disturbed during the construction phase.

In addition to the soil mitigation measures identified above, the following BMPs may be selected.

- Temporary soil stabilization (SS) techniques, such as scheduling construction sequences to minimize land disturbance during the rainy and non-rainy seasons and employing BMPs appropriate for the season; preserving existing vegetation by marking areas of preservation with temporary orange propylene fencing; using geotextiles, mats, plastic covers, or erosion control blankets to stabilize disturbed areas and protect soils from erosion by wind or water; using earth dikes, drainage swales, or lined ditches to intercept, divert, and convey surface runoff to prevent erosion; using outlet protection devices and velocity dissipation devices at pipe outlets to prevent scour and erosion from storm water flows; and/or using slope drains to intercept and direct surface runoff or groundwater to a stabilized water course or retention area.
- Sediment Control (SC) techniques, such as using silt fences, straw bales, and/or fiber rolls to intercept and slow the flow of sediment-laden runoff such that sediment settles before runoff leaves the site.
- Wind Erosion (WE) control by applying water or dust palliatives, as required, to prevent or alleviate windblown dust.
- Tracking Control (TC) techniques to limit track-out, such as using stabilized points of entering and exiting the Project Site and stabilized construction roadways on the site.
- Other measures, as appropriate, to comply with the regulations.

3.9.8 Heavy Equipment Delivery

Heavy construction equipment will be moved to the Project Site either by road, using road transport suitable for the size and weight of that equipment, or by railcar. Primary equipment such as the 34.5kV to 220kV power transformers will be delivered to the Project Site by special conveyance due to their weight and size. Typically, deliveries of material and equipment to the site may be made by truck or by railcar.

SunCatcher superstructures may be delivered to the assembly buildings on transport trucks in major components, with approximately 1.5 SunCatchers per trailer, or on railcars.

Delivery of other SunCatcher components (PCUs, mirrors, controls, drives, and wiring) will arrive on pallets, crates, or returnable racks either by transport truck for assembly onto the erected superstructure, with approximately 40 units per transport truck, or by railcar.

3.9.9 Construction Workforce

The Projected monthly construction labor is presented in Table 3-15, Construction Trade Projection (850MW), for the 41-month construction period. The size of the on-site workforce will range from 131 during month 1 to 703 during the peak period in month 7. Solar One will provide approximately $40 million in payroll during the first year of the construction period.

3.9.10 Construction Traffic

Construction traffic is anticipated to commence during the last quarter of 2010 and continue through the 41-month construction schedule. Traffic should peak during the first two quarters of 2011.

Every effort will be made to employ qualified subcontractors and construction personnel from the local area. Bid solicitations will be made through plan centers and trade publications that serve a 200-mile radius from the site and beyond. It is expected that 90 percent of the workforce will reside in Southern California. The remainder may come from other areas of the southwest. Many of the higher-skill-level positions required for essential trades, such as high-voltage line electricians, controls and information technology specialists, and engineers, will likely come from outside the local area. For construction of the Project, Solar One will have access to a resource pool of workers with these specialized skills within:

- a 150-mile driving distance along interstate highways from the greater Los Angeles, California, area, and
- a 115-mile driving distance along interstate highways from the greater Riverside, California, area.

During Project construction, it is anticipated that specialized trades and higher-skill-level construction personnel will commute to the Project Site on a weekly basis and stay in temporary housing or apartments during the week for the duration of the construction phase. Similarly, contractor or subcontractor employees will commute on a weekly basis and lease temporary housing or apartments in the Barstow and Victorville areas. The construction employee commutes will depend on the competitive bid selection of contractors and subcontractors and travel distance from their offices.

Table 3-15
Construction Trade Projection (850MW)

Discipline	Hrs	Month After Construction Start																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Carpenters	110664	10	25	25	25	25	19	41	40	40	28	28	38	29	29	29	29	38	32	32	32
Concrete Crews	108656	7	26	26	26	26	23	49	42	42	24	24	40	33	33	33	33	40	30	30	30
Electricians	208826	17	35	41	31	30	57	67	60	54	54	54	54	106	96	102	101	94	104	104	104
Ironworkers	120104	16	34	34	34	34	23	37	36	36	24	24	34	33	33	33	33	38	32	32	32
Laborers	217860	20	50	67	60	54	64	136	83	39	35	30	35	72	69	89	81	79	88	66	63
Miscellaneous Crews	20000							10	10	10	10	10	10					10	10	10	10
Operators	257754	35	94	85	67	55	62	89	77	77	65	51	92	104	112	98	83	81	60	63	54
Plumbers	39840		5	9	4	4	4	26	26	26	14	14	14	5		4	4	14	18	18	18
SES Technicians	136320						16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sun.Assemblers	394240						64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
Sun.Electricians	98560						16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sun.Ironworkers	197120						32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Sun.Laborers	60800						16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sun.Material Handlers	98560						16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sun.Operators	30400						8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Sun.Teamsters	45600						12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sun.Technicians	197120						32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Teamsters	114402	26	58	47	36	24	29	31	22	22	22	5	9	33	53	40	28	28	28	28	17
Technicians	4094						5	5	5	5	5	5	5	6	6	6	5	5		1	1
Total	**2,460,921**	**131**	**327**	**334**	**283**	**252**	**498**	**703**	**613**	**563**	**493**	**457**	**543**	**633**	**643**	**646**	**609**	**639**	**614**	**596**	**573**

Discipline	Month After Construction Start																				
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Carpenters	28	34	30	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Crews	24	25	19	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricians	98	98	98	88	88	88	88	88	4												
Ironworkers	28	31	27	7	4	4	4	4	4	4	4	4									
Laborers	39	39	49	38	28	28	28	28	8	8	8	8	4	4	4	4					
Miscellaneous Crews	10	10	10																		
Operators	50	49	45	14	14	14	14	14	13	12	12	12	12	12	12	12	1	1	1	0	0
Plumbers	14	14	10																		
SES Technicians	16	16	16	16	16	16	16	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Sun.Assemblers	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
Sun.Electricians	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sun.Ironworkers	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Sun.Laborers	16	16	16	16	16	16	16	16													
Sun.Material Handlers	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sun.Operators	8	8	8	8	8	8	8	8													
Sun.Teamsters	12	12	12	12	12	12	12	12													
Sun.Technicians	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Teamsters	17	16	16	12	12	12	12	12	12	12	12	12	12	12	12	12	1	1	1	0	0
Technicians	1	1	1																		
Total	**521**	**529**	**517**	**378**	**358**	**358**	**358**	**374**	**233**	**228**	**228**	**228**	**220**	**220**	**220**	**220**	**194**	**194**	**194**	**192**	**192**

The estimated construction traffic is summarized in Table 3-16, Estimated Daily Construction Traffic.

Table 3-16
Estimated Daily Construction Traffic

Vehicle Type	Average Daily Round Trips	Peak Daily Round Trips
Construction personnel (buses)	12	24
Construction personnel (private vehicles)	30	70
Delivery trucks	81	173
Heavy vehicles and trucks	20	46
Totals	**143**	**313**

Source: Stirling Energy Systems, 2008.

3.9.11 Land Disturbance

The estimated land disturbance for the Project is provided in Table 3-17, Estimated Disturbed Area Summary. Figure 3-28, 1.5MW Solar One Construction Disturbance Plan, shows the disturbed area for a typical 1.5MW solar group and Section 3.9.4, Project Site Preparation, describes methods that will be implemented to minimize construction disturbance.

Table 3-17
Estimated Disturbed Area Summary

Project Component Item	Area		Proposed Length	Comments
	Construction Disturbance	Operations Permanent Disturbance		
Off-Site Development				
Off-site access road	11 acres	11 acres	3 miles	30-foot width for roadway and drainage from I-40
Off-site transmission line	0.9 acres	Included below	0.14 miles	50 feet each side of center
Tower structures	Included above	0.02 to 0.05 acres		1 to 2 towers x 1,024 SF per tower
Subtotal	**12 acres**	**11 acres**		
On-Site Balance-of-Plant Development				
Construction staging and construction administration area near BNSF/SCE Pisgah Substation	26 acres	N/A		Located in Phase I, approx. 0.5 mi north of SCE Pisgah substation
Construction staging and construction administration area at Hector Road	26 acres	N/A		Located in Phase II
On-site construction laydown	11 acres	N/A		Located adjacent to MSC
Site boundary fence line	55 acres	28 acres	38 miles	12-foot width construction access; 3 feet each side of the fence
Site paved roadways[3]	138 acres	111 acres	38 miles	30 feet width for roadway and drainage

Unpaved perimeter roadways	15 acres	15 acres	10 miles	12 feet wide
Main Services Complex	42 acres	14.4 acres		Construction disturbance based on buildings, parking, assembly, and construction areas
Satellite Services Complex	21 acres	10 acres		Construction disturbance based on buildings, parking, assembly, and construction areas
Assembly buildings and storage	Included above	N/A		Post construction the assembly building and their associated laydown areas will be decommissioned and dishes installed on this acreage. The MSC assembly buildings used during construction of Phase I will be moved to the SSC for the construction of Phase II
Subtotal	**334 acres**	**178 acres**		
On-Site Wet and Dry Utilities Access				
Water pipeline	3.6 acres	2.9 acres	2 miles	Disturbance based on 2-in diameter waterline from MSC to SSC; 15-ft wide construction access; 12-ft wide operations access
On-site electrical and communications overhead service	5 acres	N/A	9,068 feet	12 feet each side of center
Solar One Substation	4 acres	2.8 acres		530 feet by 555 feet
On-site transmission line	10.3 acres	N/A	1.7 miles	50 feet each side of center
Transmission access road	Included above	2.5 acres	1.7 miles	12 feet wide
Transmission tower structures	Included above	0.3 acre		12 to 14 towers at 1,024 SF per tower
34.5kV overhead runs to Solar One Substation	6.0 acres	N/A		17 miles by 12-foot wide with a significant portion overlapping other construction disturbed areas (75 percent)
Subtotal	**29 acres**	**9 acres**		

Solar Field Development = 567 by 1.5MW Solar Groups [2,4]				
SunCatcher drainage swale	874 acres	874 acres		40 feet wide by 56 feet long per 2 SunCatchers
SunCatcher foundation	2.5 acres	2.5 acres	12 to15 ft	2-ft diameter post
SunCatcher pad clearing	110 acres	110 acres		12 foot wide by 12 foot long cleared pad area for each SunCatcher, excluding foundation area
North-south access routes	262 acres	262 acres	180 miles	12-foot wide road servicing 2 SunCatchers
East-west access routes	31 acres	31 acres	21 miles	12-foot wide road within area of limited disturbance constructed over 600V Collector Cable; 40 feet long by 12 feet wide per 12 SunCatchers
East-west PCU access routes	702 acres	702 acres	386 miles	15-foot wide road servicing each SunCatcher PCU and providing east-west access to dish groups over generator group feeders
Debris basins for off-site flows	220 acres	220 acres		Located along northern project boundary
Debris basins for on-site flows	65 acres	65 acres		Located throughout the site
Electrical Collection System				
North-south 600 V underground	60 acres	N/A		cable disturbance based on north-south cables outside of roadways cable trench based on 2-foot each side of center of cable, excluding previously accounted disturbance
1750kVA transformers, junction boxes, and east-west 600 V underground	235 acres	2 acres		1 transformer with collector panel and 4 junction boxes per 1.5MW with east-west 600 V cables disturbance based on 41 feet by 88 feet area per group of 12 SunCatchers
34.5kV underground	38 acres	N/A		cable trench based on 6-foot each side of center, excluding previously accounted disturbance
Subtotal	**333 acres**	**2 acres**		
Total Area	**3,270 acres**	**2,712 acres**		Includes 10% contingency

Source: Stirling Energy Systems, Inc., 2008.

Notes:

[1]Refer to Figures 3-1 through 3-3 for locations of Project components.

[2]Assumes 850MW net development of 34,000 SunCatchers.

[3]The term "paved roadway" refers to a roadway surface that allows for heavy weight vehicles to travel at a greater speed. Additional binder concentration may be applied in lieu of asphalt pavement or pavement may be added for operations phase.

[4]Reference Figure 3-28, 1.5MW Solar One Construction Disturbance Plan.

During installation of the SunCatchers, approximately 80 percent of the total land will be disturbed by brush trimming operations. The proposed construction method combined with the modularity of the SunCatcher design and off-site manufacturing will enable a phased deployment, thereby minimizing the proportion of the overall site that is disturbed at any give time during construction.

The plan site layout minimizes traffic road operations of the Project.

kV = kilovolt
MW = megawatt
N/A = not applicable
SF = square feet
V = volts

3.9.12 Materials and Equipment Staging Areas

Four construction staging and laydown areas will be used for the Project. Two 26-acre construction laydown areas will be provided one at the south entrance off Hector Road and one at the east entrance just north of the SCE Pisgah Substation. An approximately 14-acre construction laydown area will be provided adjacent to the Main Services Complex and an approximately 6-acre construction laydown area will be provided adjacent to the Satellite Services Complex.

All four construction staging areas will contain temporary construction facilities, including site offices, restrooms, meal rooms, conference rooms, storage facilities, and parking and vehicle maintenance and storage areas.

The construction laydown areas adjacent to both the Main and Satellite Services Complex may also contain temporary fueling stations. An 8-foot-diameter by 13⅓-foot-long diesel fuel storage tank with secondary containment may be temporarily located on a paved surface in these laydown areas.

The 26-acre laydown areas located near the south and east entrances to the Project Site are nearly level and thus will require little grading. The laydown areas adjacent to the Main and Satellite Services Complex are on a gently sloping, rocky area that will require minimum grading and fill operations to create a level area. Pads will be prepared for setting the trailers housing the temporary construction facilities.

The 26-acre construction staging areas are shown on Figure 3-42, Construction Laydown Area Site Plan. The 14-acre construction laydown area adjacent to the Main Services Complex is shown on Figure 3-43, Main Services Complex Construction Laydown Area.

3.9.13 Construction Equipment Requirements

During construction, a variety of equipment will be required. Estimates of the types of equipment and the timing of their use are provided in Table 3-18, Estimated Construction Equipment Usage Schedule.

3.9.14 Project Operation

The Project will be an "as-available" resource. Therefore, the Project will operate anywhere between a minimum of approximately 18MW net when the first units are interconnected to the grid during the construction period to 850MW on completion of construction. The capability for independent operation of all 34,000 units will give maximum flexibility in operations. The Project is expected to have an annual availability of 99 percent.

The Project will be dispatched by the CAISO, through day-ahead, hour-ahead, and real-time scheduling, as required to meet the demands of the Southern California market. The market will dictate unit operations and total power requirements.

The Project will operate approximately 3,500 hours per annum and is expected to have an overall availability of 99 percent or higher. The number of available operating hours is determined by the availability of the sun's energy at greater than 250 watts per square meter. SunCatchers will be unable to generate electricity when the sun's energy is below 250 watts per square meter in the early morning or late evening hours and when cloud cover limits the sun's energy for power generation. Also, SunCatchers will be unable to generate electricity during daylight hours when the wind speed exceeds 35 miles per hour, as SunCatchers will be stowed in a safe de-track position at this wind speed to prevent damage. SunCatchers are designed to withstand wind speeds of 50 miles per hour in the operating mode and 90 miles per hour in the stowed position. Because the SunCatchers move slowly, they start moving into stow position once winds reach 35 miles per hour in order to be in stow position by the time winds reach 90 miles per hour. Because of the geographical size of the Project, cloud cover and/or wind conditions may only affect a portion of the Project at any given time.

It is expected that the Project will be operated with a staff of approximately 180 full-time employees. The Project will operate seven days per week, generating electricity during normal daylight hours when the solar energy is available. Maintenance activities will occur seven days a week, 24 hours a day to ensure SunCatcher availability when solar energy is available. Table 3-19, Projected Operations and Maintenance Personnel Requirements, provides a projection of the breakdown of operating, maintenance, engineering, contract, and administration staffing by three-month periods for the first eight years of operation.

Table 3-18
Estimated Construction Equipment Usage Schedule

Construction Equipment Description	HP	D	G	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
4-Wheeler	15		x	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
Air Compressor	50	x		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
Asphalt Paver	120	x		2	2	1	1	1	2	2	2	2	2			2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
Backhoe	120	x		4	16	16	12	11	14	22	19	19	16	16	25	35	32	29	28	27	23	23	23	22	24	23	14	12	12	12	12	6													
Cable/Rigging Truck					1	1	1									1	1	1																											
Compactor	120	x		11	27	23	16	11	13	14	11	11	11	5	9	20	24	20	14	13	14	14	10	10	10	10	6	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1			
Concrete Pump	250	x		1	2	2	2	2	1	1						1	1	1	1						3	3	3																		
Crane	250	x		1	4	4	4	4	10	11	10	10	10	10	15	15	10	10	10	9	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Doser	250	x		4	5	3	2	2	1	4	2	2	2	2	6	8	8	5	4	4	2	2	2	2	3	3	1																			
Drilling Rig	250	x		3	9	7	6	6	11	11	10	10	10	10	22	22	17	17	16	16	5	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dump Truck	250	x		7	12	10	7	5	6	8	6	6	6	3	7	10	12	10	7	7	7	7	5	5	6	6	3	2	2	2	2	2	2	2	2	2	2	2	2						
Finishers				2	4	4	4	4	4	10	10	10	4	4	4	4	4	4	4	4	6	6	6	4	4	2																		
Flatbed Truck	250	x		7	20	20	16	15	23	19	18	18	18	18	32	41	36	36	34	33	23	24	24	24	26	26	20	18	18	18	18	12	6	6	6	2	2	2	2	0	0	0	0	0	0
Fork Lift	50	x		3	7	7	7	7	12	16	14	14	14	14	14	12	12	12	12	14	14	14	14	14	16	16	12	10	10	10	18	10	10	10	10	10	10	10	10	8	8	8	8	8	8
Fuel/Service Truck				6	14	12	10	8	10	10	7	7	7	4	7	9.3	13	11	9	9	6	6.3	4.3	4.3	5.3	5.3	4	3	3	3	3	3	3	3	3	3	3	3	3	3						
Generator	50	x		2	2	2	2	2	7	7	6	6	6	6	11	8	8	8	7	6	1	2	2	2	3	3	2	1	1	1	1	1	1	1	1	1	1	1	1						
Grader	175	x		6	11	9	7	5	6	8	6	6	6	3	7	12	14	11	9	9	8	8	6	6	6	6	4	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1			
JLG				2	10	10	10	10	12	18	14	14	14	14	14	12	12	12	12	14	14	14	14	14	14	14	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Light Tower	50	x		1	2	2	2	2	2	2	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
Loader	250	x		6	15	13	9	7	8	14	11	11	8	5	8	13	13	11	9	8	10	10	8	7	8	7	3	2	2	2	2	2	2	2	2	2	2	2	2						
Maxi Sneeker	50	x			3	3	1	1	7	7	6	6	6	6	7	15	13	13	13	12	12	12	12	12	12	12	12	12	12	12	12	6													
Pickup Truck	150		x	22	55	49	39	32	41	49	41	41	41	32	42	50	60	53	44	50	39	41	35	35	38	38	23	20	20	20	28	20	20	20	20	20	20	20	20	8	8	8	8	8	8
PLC Trencher					1	1	1									1	1	1																											
Reel Truck				1	1	1	1	1																																					
Screed				1	2	2	2	2	2	5	5	5	2	2	2	2	2	2	2	2	3	3	3	2	2	1																			
Skid Steer	50	x							5	5	5	5	5	5	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5													
Telehandler	120	x							4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Track Transporter									4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Water Truck	250	x		10	26	24	10	8	12	15	13	13	10	5	8	16	26	15	12	11	11	12	10	9	9	8	5	4	4	4	4	4	4	4	4	4	4	4	4	1	1	1	0	0	0
Welding Machine	50	x		1	2	2	2	2	1	1						1	1	1	1						1	1	1																		
Totals				**106**	**256**	**231**	**177**	**151**	**221**	**270**	**228**	**228**	**210**	**176**	**257**	**333**	**345**	**307**	**272**	**271**	**226**	**231**	**211**	**205**	**223**	**217**	**148**	**127**	**127**	**127**	**143**	**104**	**81**	**81**	**81**	**77**	**77**	**77**	**77**	**39**	**39**	**39**	**36**	**36**	**36**

Source: Stirling Energy Systems,Inc., 2008

Notes:

D = diesel

HP = horsepower

G = gas

TABLE 3-19
PROJECTED O&M PERSONNEL REQUIREMENTS

ID	RESOURCE DESCRIPTION	PROJECTED O&M STAFFING			3-MONTH PERIODS AFTER NOTICE TO PROCEED																														Man Months
					YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				YEAR 6				YEAR 7				YEAR 8				
		300	600MW	850MW	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
A	**GENERAL & ADMINISTRATION (G&A)**																																			
1	Operations Manager	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
2	HR & Admin	1	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	37
3	OH&S Supervisor	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
4	General Accounting	1	2	3	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	38
5																																				
	TOTAL G&A	**4**	**6**	**7**	**3**	**3**	**4**	**5**	**5**	**5**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**113**
B	**ENGINEERING**																																			
1	Operations Supervisor	2	3	4				2	2	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	49
2	Controls Engineer	1	2	2				1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	25
3	Electrical Engineer	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	28
4	Mechanical Engineer	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	28
5	Maintenance Supervisor	2	4	4				2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	50
	TOTAL ENGINEERING	**7**	**11**	**14**	**2**	**2**	**2**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**8**	**8**	**13**	**13**	**13**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**180**
C	**NON-EXEMPT STAFF**																																			
1	Operating Technicians	4	6	8				4	4	4	4	4	4	4	4	4	6	6	6	6	6	6	6	6	8	8	8	8	8	8	8	8	8	8	8	84
2	SunCatcher Mirror Washing	16	32	45				2	2	4	6	8	10	12	16	18	20	22	24	26	28	30	32	34	36	38	40	45	45	45	45	45	45	45	45	294
3	Instrumentation & Control Technician	2	4	4				2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	50
4	Electrician	2	4	4				2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	50
5	Mechanical Technician	24	48	68				8	8	8	16	16	16	24	24	24	32	38	38	46	46	46	54	54	54	60	60	60	68	68	68	68	68	68	68	498
6	Commissioning Technicians							16	16	16	16	16	16	16	16	16	16	16	16																	192
	NON-EXEMPT SUBTOTAL	**48**	**94**	**129**				**34**	**34**	**36**	**46**	**48**	**50**	**60**	**64**	**66**	**82**	**90**	**92**	**86**	**88**	**90**	**100**	**102**	**106**	**114**	**116**	**121**	**129**	**129**	**129**	**129**	**129**	**129**	**129**	**1168**
D	**CONTRACT STAFF**																																			
1	Security	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	160
2	House-Keeping	4	4	4							4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	56
3	High-Voltage Maintenance	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	80
	ON-SITE CONTRACT SUBTOTAL	**16**	**16**	**16**	**12**	**12**	**12**	**12**	**12**	**12**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**296**
E	**Summer Mechanical Wash**									**4**				**12**				**20**				**28**				**36**				**44**				**44**			**64**
F	**CONTINGENCY @ 10%**		**10**	**16**	**2**	**2**	**2**	**6**	**6**	**6**	**8**	**8**	**8**	**9**	**9**	**10**	**12**	**13**	**13**	**12**	**13**	**13**	**14**	**14**	**14**	**15**	**15**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**176**
G	**GRAND TOTAL**	**75**	**137**	**182**	**19**	**19**	**20**	**64**	**64**	**70**	**90**	**85**	**87**	**110**	**103**	**106**	**129**	**158**	**140**	**134**	**138**	**168**	**151**	**153**	**157**	**202**	**168**	**174**	**182**	**226**	**182**	**182**	**182**	**226**	**182**	**182**	**2004**

Source: Stirling Energy Systems, Inc., 2008.

Notes:

%	=	percent
Admin	=	Administration
G&A	=	general and administration
HR	=	human resources
MW	=	megawatt
O&M	=	operations and maintenance
OH&S	=	operations health and safety
Q	=	quarter
Y	=	year

3.10 PROJECT SAFETY DESIGN

3.10.1 Natural Hazards

The primary natural hazards at the Project Site are seismic activity, wind and dust, heat, and localized flooding.

3.10.1.1 Seismic Hazards

To protect the Project from seismic risks, all design and construction will be in conformance with 2007 CBC requirements. The structural and seismic engineering design criteria to be used for the Project are included in Appendix M, Structural Engineering Design Criteria.

3.10.1.2 Wind and Dust Hazards

All buildings and facilities will be designed for the wind loads stated in the 2007 CBC, the 2007 UBC, and the 2006 IBC. The SunCatcher has been designed to withstand winds of 90 miles per hour with a 1.6 safety factor. Particular care will be exercised to control sand and dirt particulates for all occupied areas, including buildings and equipment rooms and locations. All Project facilities will be designed to minimize particulate intrusion and will utilize appropriate levels of filtration. Staging and temporary service areas will be established with particle control in mind.

The SunCatchers will be regularly washed to keep mirror surfaces free of dust buildup to optimize solar energy potential.

Fugitive dust control during Project construction and operation will be conducted using water application and/or environmentally acceptable surface treatments.

3.10.1.3 Heat Hazards

All Project buildings and support areas will be designed and constructed with climate control appropriate to the area for protection of both personnel and equipment. Climate control will be provided by air-conditioning, insulation, and natural and forced-air ventilation. Also, the solar orientation of the Project facilities and the glass and color selection will be designed to minimize the effects of solar heat gain.

3.10.1.4 Flood Hazards

In general, drainage through the Phase 1 project area flows to the southwest; however, some flows are diverted by the railroad and flow west along the southern boundary of Phase 1. Drainage through the Phase 2 project area flows primarily from east to west. Drainage impacting the Project area, from both the off-site and on-site watershed, flows from a nearly 60 square mile watershed. The off-site watershed lies to the east, north, and south of the site.

Flow Characteristics

The off-site watershed and the Project Site are determined to be part of a series of alluvial fans and, as such, the site will likely experience alluvial fan flooding hazards for the engineering design conditions (generally between 25 to 100-year flood events). However, the overall risk from flooding is low in most years because of the relatively low annual rates of precipitation observed in the area.

Localized channel grading will take place to improve channel hydraulics and control flow direction where buildings and roadways are proposed. The Main and Satellite Services Complex will be protected from a 100-year flood by berms or swales that will direct the flow around the perimeter of the building site, if required.

Roadway dips (Arizona Crossings), culverts, and debris basins (retention basins) will be used to reduce flood hazards through the site and on roadways. A designated evacuation route will allow emergency access to and from the Main Services Complex to I-40. The evacuation route consists of an east-west and a north-south on-site paved arterial roadway section and the temporary off-site access road that connects the site to I-40. Culverts for the evacuation route will be designed such that the roadway section shall have its driving surface constructed above the projected profile of a 25-year event.

Hydraulic analysis will be performed on the channels to determine the depth and speed of flows. This information will be used in the design of the SunCatchers so as to minimize scour and deposition around their foundations.

3.10.1.5 Fire Hazards

Depending on the time of year and on the amount of rainfall, humidity level, wind speed and direction grassland/desert scrub wildland fires may vary from low to extreme fire levels.

3.10.2 Emergency Systems and Safety Precautions

This section discusses the safety precautions and the fire protection systems that Project personnel will use.

3.10.2.1 Safety Precautions

Solar One will implement programs to ensure compliance with the requirements of federal and state occupational safety and health programs. Solar One will also identify and implement Project-specific programs that effectively assess potential hazards and mitigate them on a routine basis.

3.10.2.2 Fire Systems

The Project will have on-site fire-protection systems and will be supported by local fire protection services. Section 3.10.3, Fire Protection and Safety Systems, provides a detailed description of the fire protection systems.

The Project will include both portable and fixed fire suppression equipment and systems. Portable fire extinguishers will be located at strategic locations throughout the Project Site. The

fixed fire protection system will provide a wet, water-based sprinkler fire-suppression system for the buildings.

Employees will be given fire safety training, including instruction in fire prevention, the use of portable fire extinguishers and hose stations, and the reporting of fires to the local fire department. Employees will only attempt to suppress fires in their incipient phase. Fire drills will be conducted at least twice each year for each work area.

The Solar One site is located within the San Bernardino County Fire Department district. The Project Site would be serviced by:

- The Harvard-Station 46 located at 39059 Kathy Lane, Newberry Springs, CA 92365 located approximately 31 miles northwest of the site,
- The volunteer fire department located in Newberry Springs, CA approximately 15 miles west of the site, and.
- The volunteer fire department located in Daggett, CA located 25 miles from the site.

Access to the site for all of these fire departments would be along I-40 to Hector Road and /or the temporary access road at the eastern Project boundary.

The Harvard-Station 46 in Newberry Springs would provide the primary fire protection, fire fighting, and emergency response services to the Solar One site. The Newberry Fire Chief will perform a final fire safety inspection upon completion of the construction and, thereafter, will conduct periodic fire safety inspections and training to Solar One employees. Prior to start up, the Newberry Fire Department will be requested to visit the Project Site to become familiar with the site and with project emergency response procedures.

3.10.3 Fire Protection and Safety Systems

The Project fire protection and safety systems will be designed to limit personnel injury, property loss, and Project downtime as a result of fire or other event. The systems will be designed in accordance with:

- federal, state, and local fire codes, occupational health and safety regulations, and other jurisdictional requirements,
- the CBC, and
- NFPA standard practices.

Table 3-20, Fire Protection Systems Design Conditions, provides a summary of the design conditions of the Project's fire protection systems. The following sections describe the Project fire protection and safety systems.

Table 3-20
Fire Protection Systems Design Conditions

Location	Type of System
Buildings	Automatic Clean Agent System per NFPA 2001 for Control Room, wet/dry/pre-action sprinkler system for administrative areas, maintenance area, assembly bays, and offices. Fire water supply will be from the demineralized water contained in 175,000-gallon storage tank located at the Main Services Complex. Note: The fixed fire systems in the buildings will be provided as required by local jurisdiction or the UBC. Hose stations and portable extinguishers will be provided throughout buildings as required by code. Detection system and fire alarm pull stations will be provided for the Control Room. Pull stations shall be located in buildings as required by code.
SunCatchers	SunCatchers require no fire protection, are of non-combustible design and require no combustion for the generation of electricity. Maintenance service vehicles will be equipped with appropriate portable fire extinguishers.
Water treatment area	An automatic wet pipe sprinkler system, portable "BC" rated fire extinguishers in all areas and hose reel stations with 100-foot hose in the area.
Main Service Complex	Wet barrel type fire hydrants will be designed, installed and located as per NFPA 24 and as required per local jurisdiction. The location of hydrants will not be more than 300 feet apart in all outside areas as required by code.
Satellite Services Complex	Portable extinguishers will be provided throughout the shade structure as required by code. A temporary fire protection system consisting of a diesel fire pump and an aboveground water tank will be designed and installed to provide fire protection to the temporary assembly buildings.

Source: Stirling Energy Systems, 2008.
Notes:
CO_2 = carbon dioxide
NFPA = National Fire Protection Association
UBC = Uniform Building Code

3.10.3.1 Fire Water System

The fire water supply and pumping system will provide an adequate quantity of firefighting water to yard hydrants, hose stations, and fire sprinkler systems. The system will be capable of supplying maximum water demand for any fire protection requirements, as per applicable LORS.

The Project fire water system will consist of a water storage tank, a diesel fire water pump, yard hydrants, fire risers, and fire sprinkler systems within the buildings. The fire water pump, located at the Main Services Complex, will be sized in conjunction with a potable water storage tank. The potable and fire flow water will be stored in an aboveground steel tank with supply and fire flow pumps sized to handle the specific demands. The water in the fire flow and potable fire flow tank will be chlorinated and circulated to keep it fresh. The fire distribution system will need to be flushed periodically to keep water fresh and free from algae growth.

The fire-suppressions and potable water storage tank will be supplied from the pretreatment water treatment system, which will be located in the water treatment structure next to the tank. Water will be supplied to the water treatment system from a second 175,000-gallon well water

storage tank. The well water will be supplied through an on site well or wells from the underlying aquifer.

The fire-suppression and potable water storage tank will be sized to store the minimum requirement for domestic water and building fire-suppression water. The design of the storage tank piping will prevent the potable and other water needs from drawing down the water in the storage tank to a level below the minimum requirement for the Project's fire-suppression water system. The diesel-driven fire water pump and controller will be interfaced with the building fire alarms and fire sprinkler systems to run on reduced pressure during fire flow events. An electric-driven fire water jockey pump will maintain water pressure in the fire sprinkler system within the Project facilities and support areas. The diesel-driven pump will start automatically if the pressure in the fire water loop drops below a given set point. Automatic valves will open to draw water from the fire-suppression water storage tank if pressure falls below the lower set point. The fire water pump will run until manually stopped. The fire water pump will be installed in accordance with NFPA 20.

3.10.3.2 Fixed Fire Protection Systems

The fixed fire protection system for Project facilities will be a traditional wet system design that provides coverage and protection within the occupied facilities and the surrounding outside non-occupied support areas. The water treatment, administration, maintenance, and assembly buildings will be provided with a fire sprinkler system design that includes fire riser(s) with the required fire inspection and testing valves, instrumentation and monitoring. The fire sprinkler system design will be consistent with UBC/IBC Type II-N facilities construction and applicable LORS.

Automatic fire suppression systems will be provided in the control rooms and electrical equipment rooms.

The non-occupied support areas, including the vehicle fueling station, will be provided with a standpipe and hose fire protection design. The hydrogen k-bottle storage area may be provided with a permanent wet fire sprinkler system design consistent with the design of hydrogen gas storage facilities.

The following standards and good engineering practices will be considered in the design of the fire protection systems:

- NFPA 13, Standard for the Installation of Sprinkler Systems (2007 Edition),
- NFPA 14, Standard for the Installation of Standpipe and Hose Systems (2007 Edition),
- NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection,
- NFPA 22, Standard for Water Tanks for Private Fire Protection,
- NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances,
- NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,
- NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages, and

- NFPA 55, Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks.

3.10.3.3 Fire Alarm and Detection

Permanently installed fire alarm detection systems will be provided and designed in accordance with the National Electrical Code (NFPA 70) and NFPA 72. Pull stations will be provided as well as audible and visible annunciation throughout the Project facilities in a zone addressable system; the main monitoring consoles will be located in the Project control rooms. Heat and smoke detectors will also be designed into the zone addressable system. A pre-action fire suppression control system will be provided for the control rooms and related information technology equipment support areas.

3.10.3.4 Portable Extinguishers

Portable hand fire extinguishers (e.g., carbon dioxide and dry-chemical) will be placed throughout the Project buildings and support areas in accordance with the requirements and guidelines of NFPA 10.

3.10.3.5 Miscellaneous Fire Safety Items

The design and construction of all building and support areas will be free of asbestos and will meet all code and risk management requirements for low toxicity and particulate expulsion during combustion. Both Project construction and Project operations management and personnel will coordinate and work closely with the local fire marshal, fire department, and related emergency response agencies regarding operating and emergency response procedures.

3.10.3.6 Safety Fixtures

Where required by code, safety showers and emergency eye wash stations will be provided at all Project buildings and support areas that store or use chemicals, including the assembly and maintenance buildings, the water treatment building, the vehicle fueling area, and the hydrogen storage area. A first aid station, complete with all emergency medical supplies, will be provided in the operation and administration building near the break room. Also, all Project construction and operation and maintenance vehicles will be equipped with complete first aid kits and two-way radios. The locations of the proposed safety showers and emergency eye wash stations at the Main Services Complex are illustrated in the following figures:

- Figure 3-44, Main Services Complex Plumbing Site Plan – Part A,
- Figure 3-45, Main Services Complex Plumbing Site Plan – Part B, and
- Figure 3-46, Main Services Complex Plumbing Site Plan – Part C.

3.10.3.7 Fire and Explosion Risks

Three types of hazardous, highly flammable, or explosive materials will be used at the Project Site during operations: hydrogen gas, oxygen and acetylene welding gases, and gasoline fuel for

the operations vehicles. Two other flammable materials that are difficult to ignite will also be used at the site during Project operations: transformer insulating oil and diesel fuels for the operations vehicles.

Gasoline is a Type 1B flammable liquid and is considered a severe fire hazard. Gasoline vapor is heavier than air. Vapor or gases may be ignited by distant ignition sources and flash back. To mitigate the fire and explosion risks, the gasoline storage tank shall have emergency relief venting in the form of construction or a device or devices that will relieve excessive internal pressure caused by an exposure fire.

The gasoline and diesel fuels will be stored in two sets of 5,000-gallon tanks located adjacent to the Main Services Complex. An additional tank(s) may be located at the Satellite Services Complex.

Gasoline and diesel fuel tanks will be located away from electrical lines and other potential ignition sources. The fuel tanks will be provided with dikes and/or a fire wall capable of containing the volume of the largest tank. These tanks will be installed in a way that the exterior surface, including the bottom of the tank and connection piping, can be directly monitored and directly viewed, which are requirements of the CCR (26 CCR Division 9 Title 14, Toxic Tank Settings), to prevent damage to natural resources in the case of a spill. The 2001 California Fire Code has additional requirements, which will be described in Section 5.15, Hazardous Materials Handling.

The storage tanks for gasoline and diesel fuel will be protected from vehicular and other impacts by bollards constructed of steel pipe filled with concrete and set in concrete or equivalent.

Hydrogen, a flammable gas, will be used in the PCU Solar Stirling Engine as a working fluid, not as a combustion fuel. A maximum of 100 k-bottles of hydrogen may be stored at the Main Services Complex at any one time to provide for maintenance replacement and make-up consumption of hydrogen by the PCU Solar Stirling Engine. The gas will be in approved individual gas cylinders (k-bottles) supplied by an approved hydrogen gas supplier. The cylinders will be stored outside, near the Main Services Complex, away from electrical lines and other potential ignition sources, as required by the applicable LORS. Cylinders will be stored upright, chained to a supporting structure, and protected from vehicular and other impacts by bollards constructed of steel pipe filled with concrete and set in concrete or equivalent.

The potential fire or explosion risks for hydrogen storage and use for SunCatchers are not significant. Hydrogen gas will be only used outdoors in well-ventilated open areas. Thus, any hydrogen gas will dissipate to the atmosphere, thus mitigating the potential fire and explosion risk. Further details on the storage, use, and handling of hydrogen gas are outlined in Appendix K, Hydrogen System Design Criteria.

Other gases to be stored and used at the Project Site may include shop welding gases for maintenance activities. Typical welding gases are oxygen and acetylene. The potential effects of the use of these gases at the Project Site do not appear to be significant based on the following items.

- A limited quantity of each gas will be stored at Project facilities (a maximum of 6 to 10 bottles of these gases will be stored at the Main Services Complex.

- The gases will be stored in U.S. Department of Transportation–approved safety cylinders under Department of Transportation rules and regulations and will be secured to prevent upset and physical damage and to facilitate inventory control.
- Incompatible gases (e.g., flammable gases and oxidizers) will be stored separately.
- The gases will be stored in multiple standard-sized portable cylinders (in contrast to larger cylinders), generally limiting the quantity of gas released from an individual cylinder failure to less than 200 cubic feet.

Transformer oil will not be stored on-site except in the transformers. Nearly the only risk of a transformer oil fire would be the unlikely event of a catastrophic transformer failure. This event would require an emergency response from the San Bernardino County Fire Department.

3.11 PROJECT RELIABILITY

This section discusses the expected Project availability, equipment redundancy, the reliability of the water supply, and Project quality control measures.

3.11.1 Project Availability

The Project has a designed operating life of 40 years and is capable approximately 3,500 hours of annual electricity production, with a projected annual availability of approximately 99 percent while on-sun. The annual net energy to be produced by the Project is estimated to be approximately 1,840,000MWh/year at full build-out.

The SunCatcher generates "as available" electricity, depending on cloud cover and wind conditions. The Project is a peaking resource, generating more power in the highest solar insolation of the day (afternoons) when the solar energy input is the highest (over 1,000W/m^2). Of all solar technologies, the SunCatcher can operate with the least amount of solar input and can recover more quickly when clouds pass over the site. Winds greater than 35 miles per hour will require the SunCatcher to shut down into a safe stow position, and cloud cover and the times of sunrise and sunset affect the SunCatcher power generating capability.

Reliability and availability projections are based on a 40-year operating life. Operations and maintenance procedures will be consistent with industry standard practices to maintain the useful life of all Project equipment.

3.11.2 Redundancy of Critical Components

The Project will utilize approximately 34,000 independent SunCatchers to produce 850MW of capacity. As a result, the Project has a high level of designed redundancy. A single SunCatcher shutdown will have a negligible effect on the overall power-generating capacity of the Project.

The solar field is grouped in 1.5MW blocks of 60 SunCatchers each. Each block has an electrical collection system and a GSU transformer. The Project will have 567 of these blocks when the Project is fully built out, so the loss of a single GSU or underground feeder will result in the loss of only 0.18 percent of the total power output of the Project.

At the substation level, there are six power transformers, five collecting power from 150MW blocks of the Project and one collecting power from a single 100MW block. The loss of one transformer will reduce the normal capacity of the Project by 18 percent at most; however, the remaining transformers will be capable of carrying the full output of the Project indefinitely under favorable thermal conditions, and even under adverse thermal conditions (55 degrees Celsius ambient temperature) can carry the full output of the Project for up to 8 hours, followed by a resting period of at least 8 hours.

The interconnection transmission line is a single-circuit line. Double-circuit transmission towers may be installed so that the transmission line can be upgraded to a second circuit at a future date. If one circuit, of the upgraded double-circuit line, is lost, the entire output of the Project can be transmitted to the grid on the remaining line for up to 24 hours in a 55 degrees Celsius ambient temperature. Most transmission line outages can be repaired within that time frame.

3.11.3 Reliability of Water Supply

On-site storage capability will be sufficient for 3 to 5 days of operation without degradation and will also be able to accommodate maintenance of the water delivery system and the treatment needs of the equipment. In the event that the Primary Water Well is temporarily unable to meet Project water supply requirements, additional water may be obtained from a Secondary Water Well(s) or transported to the Project Site from the surrounding area. During such an event, four or five large (10,000-gallon) tanker trucks per day would be sufficient to sustain regular operations. See Section 5.5, Water Resources, for additional information.

The SunCatchers require no water in the generation of electricity. Water will be used solely for washing dust build-up from SunCatcher mirror assemblies and in the cooling system on the PCU of each SunCatcher. Well Water from the Primary Water Well will be pumped to a 175,000-gallon well water storage tank. The well water storage tank will provide water for the demineralizing process, and the demineralized water will be stored in two 17,000-gallon tanks for SunCatcher mirror-washing water. The demineralized water tank will contain a 1- to 2-day supply of mirror-washing water. A potable water tank will provide both fire-suppression water and domestic water to the Main Services Complex. The potable water tank will be designed to maintain a constant supply of fire-protection water unavailable for mirror washing.

3.11.4 Project Quality Control

The objective of the Project quality control program is to ensure that all systems, equipment, and components have the appropriate quality measures applied during design, procurement, fabrication, construction, and operation of the Project. High levels of safety, constructability, reliability, availability, operability, and maintainability are the goal of the quality control program.

The required quality for a system will be ensured by the application of controls to various Project activities. The appropriate controls will be determined by the specific activity. Design activity controls will include checking and review, and manufacturing and construction controls will employ inspection and testing.

For quality assurance planning purposes, the Project activities have been divided into the following phases that apply to specific periods of time during the Project.

- **Conceptual Design:** activities such as definition of requirements and engineering analyses.
- **Detail Design:** activities such as the preparation of calculations, drawings, and lists needed to describe, illustrate, or define systems, structures, or components.
- **Procurement Specifications:** activities necessary to compile and document the contractual, technical, and quality provisions for procurement specifications for Project systems, components, or services.
- **Manufacturers' Control and Surveillance:** activities necessary to ensure that the manufacturers conform to the provisions of the procurement specifications.
- **Manufacturer Data Review:** activities required to review manufacturers' drawings, data, instructions, procedures, plans, and other documents to ensure coordination of Project systems and components and conformance to procurement specifications.
- **Receipt Inspection:** inspection and review of product at the time of delivery to the construction site.
- **Construction/Installation:** inspection and review of storage, installation, cleaning, and initial testing of systems, subsystems, or components at the Project Site.
- **System/Component Testing:** actual operation of Project components in a system in a controlled manner to ensure that the performance of systems and components conform to specified requirements.
- **Project Operation:** actual Project operation by Solar One.

As the Project progresses, the design, procurement, fabrication, erection, and commissioning of each Project component, subsystem, and system will progress through the nine phases defined above.

The following quality control record system will be maintained and used for review and reference:

- Project equipment/vendor instruction manuals,
- system design calculations and drawings,
- Project design manual,
- quality assurance audit reports,
- inspection and equipment testing reports,
- conformance to construction records and drawings,
- equipment procurement specifications (contract issue and change orders),
- purchase orders and change orders, and
- Project correspondence.

For procured component purchase orders, a list of qualified suppliers and subcontractors will be developed. Before contracts are awarded, the subcontractors' capabilities and experience will be

evaluated. The evaluation will consider suppliers' and subcontractors' personnel, production capability, past experience and performance, seismic experience, and quality assurance program.

During construction, the following field activities will be conducted:

- inspections of equipment/components as they are received,
- construction/installation of equipment,
- system/component testing, and
- Project startup and commissioning.

The construction contractor will be contractually responsible for performing the work in accordance with all safety, environmental, and quality requirements specified by applicable LORS and the Project contract.

The subcontractors' compliance with the Project quality requirements will be monitored through inspections, audits, and administration of independent testing contracts.

3.12 PROJECT CLOSURE

3.12.1 Introduction

Project closure can be temporary or permanent. Temporary closure is defined as a shutdown for a period exceeding the time required for normal maintenance, including closure for overhaul or replacement of the major components, such as major transformers, switchgear, etc. Causes for temporary closure include inclement weather and/or natural hazards (e.g., winds in excess of 35 mph, or cloudy conditions limiting solar insolation values to below the minimum solar insolation required for positive power generation, etc.), or damage to the Project from earthquake, fire, storm, or other natural acts. Permanent closure is defined as a cessation in operations with no intent to restart operations owing to Project age, damage to the Project that is beyond repair, adverse economic conditions, or other significant reasons.

3.12.2 Temporary Closure

In the unforeseen event that the Project is temporarily closed, a contingency plan for the temporary cessation of operations will be implemented. The contingency plan will be followed to ensure conformance with applicable LORS and to protect public health, safety, and the environment. The plan, depending on the expected duration of the shutdown, may include the draining of chemicals from storage tanks and other equipment and the safe shutdown of equipment. Wastes will be disposed of according to applicable LORS, as discussed in Section 3.8.4, Management and Disposal of Hazardous Materials, and in Section 5.14, Waste Management.

3.12.3 Permanent Closure

The planned life of Solar One is 40 years; however, if the Project is still economically viable, it could be operated longer. It is also possible that the Project could become economically noncompetitive before 40 years have passed, forcing early decommissioning. Whenever the

Project is permanently closed, the closure procedure will follow a plan that will be developed as described below.

The removal of the Project from service, or decommissioning, may range from "mothballing" to the removal of equipment and appurtenant facilities, depending on conditions at the time. Because the conditions that would affect the decommissioning decision are largely unknown at this time, these conditions would be presented to the CEC, the BLM, and other applicable agencies.

To ensure that public health, safety, and the environment are protected during decommissioning, a decommissioning plan will be submitted to the CEC for approval before decommissioning. The plan will discuss the following:

- proposed decommissioning activities for the Project and appurtenant facilities constructed as part of the Project,
- conformance of the proposed decommissioning activities with applicable LORS and local/regional plans,
- activities necessary to restore the Project Site if the plan requires removal of equipment and appurtenant facilities,
- decommissioning alternatives other than complete restoration to the original condition, and
- associated costs of the proposed decommissioning and the source of funds to pay for the decommissioning.

In general, the decommissioning plan for the Project will attempt to maximize the recycling of Project components. Solar One will attempt to sell unused chemicals back to the suppliers or other purchasers or users. Equipment containing chemicals will be drained and shut down to ensure public health and safety and to protect the environment. Non-hazardous wastes will be collected and disposed of in appropriate landfills or waste collection facilities. Hazardous wastes will be disposed of according to applicable LORS. The site will be secured 24 hours per day during the decommissioning activities, and Solar One will provide periodic update reports to the CEC, the BLM, and other appropriate parties.

3.13 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The applicable LORS for each engineering discipline are included as part of the engineering design criteria appendices (see Appendix O, Civil Engineering and Civil Design; Appendix M, Structural Engineering Design Criteria; Appendix F, Mechanical and Fire Protection Engineering Design Criteria; Appendix P, Electrical Engineering Design Criteria; Appendix Q, Control Systems Engineering Design Criteria; Appendix R, Fuel Handling Design Criteria; Appendix S, Material Safety/Equipment; Appendix K, Hydrogen System Design Criteria; and Appendix T, Phase I Environmental Site Assessment).

3.14 REFERENCES

California EMF Consensus Group. 1992. Issues and Recommendations for Interim Response and Policy Regarding Power Frequency EMFs. March 20.

CPUC (California Public Utilities Commission). 1991. Order Instituting Investigation. CPUC I.91-01-012.

EPRI (Electric Power Research Institute). 1975. Transmission Line Reference Book, 345kV and Above.

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SES Solar Three, LLC and Solar Six, LLC. 2008. *Project Description and Plan of Development.*

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Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (g) (1)	...provide a discussion of the existing site conditions, the expected direct, indirect and cumulative impacts due to the construction, operation and maintenance of the Project, the measures proposed to mitigate adverse environmental impacts of the Project, the effectiveness of the proposed measures, and any monitoring plans proposed to verify the effectiveness of the mitigation.	Section 3.3.1 Section 3.5.7 Section 3.5.9		
Appendix B (h) (4) (A)	Heat and mass balance diagrams for design conditions for each mode of operation.	N/A		
Appendix B (h) (4) (B)	Annual fuel consumption in BTUs for each mode of operation, including hot restarts and cold starts.	Section 3.4.4.1		
Appendix B (h) (4) (C)	Annual net electrical energy produced inMWh for each mode of operation including starts and shutdowns.	Section 3.11.1		
Appendix B (h) (4) (D)	Number of hours the plant will be operated in each design condition in each year.	Section 3.11.1		
Appendix B (h) (4) (E)	If the Project will be a cogeneration facility, calculations showing compliance with applicable efficiency and operating standards.	N/A		
Appendix B (h) (4) (F)	A discussion of alternative generating technologies available for the Project, including the projected efficiency of each, and an explanation why the chosen equipment was selected over these alternatives.	Section 3.1 Section 4.0		

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Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (i) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, leases, and permits applicable to the Project, and a discussion of the applicability of, and conformance with each. The table or matrix shall explicitly reference pages in the application wherein conformance, with each law or standard during both construction and operation of the facility is discussed.	Section 3.6.2 Section 3.13 Appendix F, Mechanical and Fire Protection Engineering Design Criteria Appendix K, Hydrogen System Design Criteria Appendix L, Hazardous Materials Handling Appendix M, Structural Engineering Design Criteria Appendix O, Civil Engineering and Civil Design Appendix P, Electrical Engineering Design Criteria Appendix Q, Control Systems Engineering Design Criteria Appendix R, Fuel Handling Design Criteria		
Appendix B (i) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits, leases, and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the commission to certify sites and related facilities.	N/A		

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Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (i) (2)	The name, title, phone number, address (required), and email address (if known), of an official who was contacted within each agency, and also provide the name of the official who will serve as a contact person for Commission staff.	Section 5.0		
Appendix B (i) (3)	A schedule indicating when permits outside the authority of the commission will be obtained and the steps the applicant has taken or plans to take to obtain such permits.	N/A		
Appendix B (h) (1) (A)	A description of the site conditions and investigations or studies conducted to determine the site conditions used as the basis for developing design criteria. The descriptions shall include, but not be limited to, seismic and other geologic hazards, adverse conditions that could affect the Project's foundation, adverse meteorological and climatic conditions, and flooding hazards, if applicable.	Section 3.3.2 Section 3.4.2 Section 3.10.1.4 Table 3-1 Table 3-2		
Appendix B (h) (1) (B)	A discussion of any measures proposed to improve adverse site conditions.	Section 3.5.9 Section 3.10		
Appendix B (h) (1) (C)	A description of the proposed foundation types, design criteria (including derivation), analytical techniques, assumptions, loading conditions, and loading combinations to be used in the design of facility structures and major mechanical and electrical equipment	Section 3.4.4.2 Section 3.5.6 Section 3.6.1 Section 3.9.5		

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Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (h) (1) (D)	For each of the following facilities and/or systems, provide a description including drawings, dimensions, surface-area requirements, typical operating data, and performance and design criteria for protection from impacts due to adverse site conditions:			
Appendix B (h) (1) (D) (i)	The power generation system;	Section 3.4.4 Figure 3-1 Figure 3-2 Figure 3-3 Figure 3-11 Figure 3-12 Figure 3-13 Figure 3-14 Figure 3-15 Figure 3-16		
Appendix B (h) (1) (D) (ii)	The heat dissipation system;	Section 3.4.4.2		
Appendix B (h) (1) (D) (iii)	The cooling water supply system, and, where applicable, pre-plant treatment procedures;	Section 3.5.10 Section 3.7 Appendix J, Water Balance Flow Diagrams		
Appendix B (h) (1) (D) (iv)	The atmospheric emission control system;	N/A		
Appendix B (h) (1) (D) (v)	The waste disposal system and on-site disposal sites;	Section 3.8 Table 3-9 Table 3-10		
Appendix B (h) (1) (D) (vi)	The noise emission abatement system;	Section 3.6.2.4		

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Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (h) (1) (D) (vii)	The geothermal resource conveyance and re-injection lines (if applicable);	N/A		
Appendix B (h) (1) (D) (viii)	Switchyards/transformer systems; and	Section 3.6 Appendix EE, Lugo-Pisgah No. 2 500kV Transmission Line and Substation Siting Study Figure 3-32 Figure 3-33 Figure 3-34 Figure 3-35 Figure 3-36 Figure 3-37		
Appendix B (h) (1) (D) (ix)	Other significant facilities, structures, or system components proposed by the applicant.	Table 3-1 Table 3-2		
Appendix B (g) (1)	...provide a discussion of the existing site conditions, the expected direct, indirect and cumulative impacts due to the construction, operation and maintenance of the Project, the measures proposed to mitigate adverse environmental impacts of the Project, the effectiveness of the proposed measures, and any monitoring plans proposed to verify the effectiveness of the mitigation.	N/A		
Appendix B (b) (3)	Applications for geothermal facilities shall contain the following additional information:	N/A		

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Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (b) (3) (A)	Maps at a scale of 1:24,000 (or appropriate map scale agreed to by staff) showing the location of the geothermal leaseholds, along with a description by section, township, range, county, and assessor's parcel numbers of the leaseholds;	N/A		
Appendix B (b) (3) (B)	Full-page color photographic reproductions of the geothermal leaseholds;	N/A		
Appendix B (b) (3) (C)	A description of the process by which the geothermal leasehold was selected and the consideration given to engineering constraints, site geology, environmental impacts, water, steam, waste and fuel constraints, electric transmission constraints, and any other factors considered by the applicant. Include references to any environmental documents which address steam field development;	N/A		
Appendix B (b) (3) (D)	A detailed description of the type, quality, and characteristics of the geothermal resource, including pressure and temperature flow rates, constituents and concentrations of non-condensable gases, and constituent concentrations of dissolved solids, and descriptions and concentrations of any substances potentially harmful to public health and safety or to the environment;	N/A		

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Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (b) (3) (E)	Proposed locations of production and re-injection wells for the Project. Include the applicant's assessment of geothermal resource adequacy, including the production history of those wells within the leaseholds dedicate to the Project, including pressure decline curves as available; and	N/A		
Appendix B (b) (3) (F)	A discussion of the potential impacts on the temperature, mineral content, and rate of flow of thermal springs affected by the Project.	N/A		
Appendix B (i) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, leases, and permits applicable to the Project, and a discussion of the applicability of, and conformance with each. The table or matrix shall explicitly reference pages in the application wherein conformance, with each law or standard during both construction and operation of the facility is discussed; and	N/A		
Appendix B (i) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits, leases, and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the commission to certify sites and related facilities.	N/A		

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Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (i) (2)	The name, title, phone number, address (required), and email address (if known), of an official who was contacted within each agency, and also provide the name of the official who will serve as a contact person for Commission staff.	N/A		
Appendix B (i) (3)	A schedule indicating when permits outside the authority of the commission will be obtained and the steps the applicant has taken or plans to take to obtain such permits.	N/A		
Cal. Code Regs., title 20, § 1704, (a) (3) (A)	Descriptions of all significant assumptions, methodologies, and computational methods used in arriving at conclusions in the document.	Throughout the AFC		
Cal. Code Regs., title 20, § 1704, (a) (3) (B)	Descriptions, including methodologies and findings, of all major studies or research efforts undertaken and relied upon to provide information for the document; and a description of ongoing research of significance to the Project (including expected completion dates; and	Throughout the AFC		
Cal. Code Regs., title 20, § 1704, (a) (3) (C)	A list of all literature relied upon or referenced in the documents, along with brief discussions of the relevance of each such reference	Throughout the AFC		
Cal. Code Regs., title 20, § 1704, (a) (4)	Each principal subject area covered in a notice or application shall be set forth in a separate chapter or section, each of which shall identify the person or persons responsible for its preparation.	Section 7.0		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One	Technical Staff:			
Project Manager:					Docket:		Technical Senior:			

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (a) (1) (A)	A general description of the proposed site and related facilities, including the location of the site or transmission routes, the type, size and capacity of the generating or transmission facilities, fuel characteristics, fuel supply routes and facilities, water supply routes and facilities, pollution control systems, and other general characteristics.	Section 3.4 Figure 3-1 Figure 3-2 Figure 3-3 Figure 3-10B Figure 3-11 Figure 3-12 Figure 3-14 Figure 3-24 Figure 3-25 Figure 3-26 Figure 3-27 Figure 3-29 Figure 3-30 Figure 3-31 Figure 3-35 Figure 3-36 Figure 3-37 Figure 3-42 Figure 3-43		
Appendix B (a) (1) (B)	Identification of the location of the proposed site and related facilities by section, township, range, county and assessor's parcel numbers.	Section 3.2 Section 5.9 Figure 3-3		
Appendix B (a) (1) (C)	A description of and maps depicting the region, the vicinity, and the site and its immediate surroundings.	Section 3.2 Figure 1-1 Figure 1-2 Figure 3-3		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	Information	AFC Section Number	Adequate Yes Or No	Information Required To Make AFC Conform With Regulations
Appendix B (a) (1) (D)	A full-page color photographic reproduction depicting the visual appearance of the site prior to construction, and a full-page color simulation or artist's rendering of the site and all Project components at the site, after construction.	Figure 3-10A Figure 3-10B Figure 3-10C		
Appendix B (a) (1) (E)	In an appendix to the application, a list of current assessor's parcel numbers and owners' names and addresses for all parcels within 500 feet of the proposed transmission line and other linear facilities, and within 1,000 feet of the proposed power plant and related facilities.	Section 5.9 Appendix C, Property Owners Within 1,000 Feet of Project Site		
Appendix B (a) (2)	Project Schedule: Proposed dates of initiation and completion of construction, initial start-up, and full-scale operation of the proposed facilities.	Table 3-14		
Appendix B (a) (3) (A)	A list of all owners and operators of the site(s), the power plant facilities, and, if applicable, thermal host, the geothermal leasehold, the geothermal resource conveyance lines, and the geothermal re-injection system, and a description of their legal interest in these facilities.	Section 1.4 Section 3.1		
Appendix B (a) (3) (B)	A list of all owners and operators of the proposed electric transmission facilities.	Section 1.4 Section 3.1		
Appendix B (a) (3) (C)	A description of the legal relationship between the applicant and each of the persons or entities specified in subsections (a)(3)(A) and (B).	Section 1.4 Section 3.1		
Appendix B (b) (1)	In a section entitled, "Generation Facility Description, Design, and Operation" provide the following information:			

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (b) (1) (A)	Maps at a scale of 1:24,000 (1" = 2000'), (or appropriate map scale agreed to by staff) along with an identification of the dedicated leaseholds by section, township, range, county, and county assessor's parcel number, showing the proposed final locations and layout of the power plant and all related facilities;	Figure 1-1 Figure 1-2 Figure 1-3 Figure 3-1 Figure 3-2 Figure 3-3 Figure 5.9-3		
Appendix B (b) (1) (B)	Scale plan and elevation drawings depicting the relative size and location of the power plant and all related facilities to establish the accuracy of the photo simulations required in Sections (a)(1)(D) and (g)(6)(F);	Figure 3-1 Figure 3-2 Figure 3-3 Figure 3-11 Figure 3-12 Figure 3-13 Figure 3-14		
Appendix B (b) (1) (C)	A detailed description of the design, construction and operation of the facilities, specifically including the power generation, cooling, water supply and treatment, waste handling and control, pollution control, fuel handling, and safety, emergency and auxiliary systems, and fuel types and fuel use scenarios; and	Section 3.4 Section 3.5 Section 3.7 Section 3.8		
Appendix B (b) (1) (D)	A description of how the site and related facilities were selected and the consideration given to engineering constraints, site geology, environmental impacts water, waste and fuel constraints, electric transmission constraints, and any other factors considered by the applicant.	Section 4.2.1		
Appendix B (b) (2)	In a section entitled, "Transmission Lines Description, Design, and Operation" provide the following information:			

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	Information	AFC Section Number	Adequate Yes Or No	Information Required To Make AFC Conform With Regulations
Appendix B (b) (2) (A)	Maps at a scale of 1:24,000 (or appropriate map scale agreed to by staff) of each proposed transmission line route, showing the settled areas, parks, recreational areas, scenic areas, and existing transmission lines within one mile of the proposed route(s);	Figure 3-5 Figure 3-6 Figure 3-7 Figure 3-8		
Appendix B (b) (2) (B)	A full-page color photographic reproduction depicting a representative aboveground section of the transmission line route prior to construction and a full-page color photographic simulation of that section of the transmission line route after construction.	Figure 3-10C		
Appendix B (b) (2) (C)	A detailed description of the design, construction, and operation of any electric transmission facilities, such as power lines, substations, switchyards, or other transmission equipment, which will be constructed or modified to transmit electrical power from the proposed power plant to the load centers to be served by the facility. Such description shall include the width of rights-of-way and the physical and electrical characteristics of electrical transmission facilities such as towers, conductors, and insulators.	Section 3.4.5 Section 3.6 Appendix EE, Lugo-Pisgah No. 2 500kV Transmission Line and Substation Siting Study Appendix H, System Impact Study Appendix I, Electric and Magnetic Field Calculations		
Appendix B (b) (2) (D)	A description of how the route and additional transmission facilities were selected, and the consideration given to engineering constraints, environmental impacts, resource conveyance constraints, and electric transmission constraints; and	Section 3.6		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (e) (1)	A discussion of how facility closure will be accomplished in the event of premature or unexpected cessation of operations.	Section 3.12		
Appendix B (g) (1)	...provide a discussion of the existing site conditions, the expected direct, indirect and cumulative impacts due to the construction, operation and maintenance of the Project, the measures proposed to mitigate adverse environmental impacts of the Project, the effectiveness of the proposed measures, and any monitoring plans proposed to verify the effectiveness of the mitigation.	Section 3.3.1 Section 3.5.7 Section 3.5.9		
Appendix B (h) (3) (A)	A discussion of the sources and availability of the fuel or fuels to be used over the estimated service life of the facilities.	Section 3.1.1		
Appendix B (h) (3) (B)	A discussion of the anticipated service life and degree of reliability expected to be achieved by the proposed facilities based on a consideration of:	Section 3.1 Section 3.11		
Appendix B (h) (3) (B) (i)	Expected overall availability factor, and annual and lifetime capacity factors;	Section 3.1 Section 3.9.14 Section 3.11 Section 3.11.2		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (h) (3) (B) (ii)	The demonstrated or anticipated feasibility of the technologies, systems, components, and measures proposed to be employed in the facilities, including the power generation system, the heat dissipation system, the water supply system, the reinjection system, the atmospheric emission control system, resource conveyance lines, and the waste disposal system;	Section 3.1 Section 3.4.4 Appendix B, Solar Stirling Engine		
Appendix B (h) (3) (B) (iii)	Geologic and flood hazards, meteorologic conditions and climatic extremes, and cooling water availability;	Section 3.9.4 Section 3.10 Appendix E, Preliminary Geotechnical and Geologic Hazards Evaluation Appendix N, Initial Drainage Report		
Appendix B (h) (3) (B) (iv)	Special design features adopted by the Applicant or resource supplier to ensure power plant reliability including equipment redundancy; and	Section 3.1 Section 3.4.4 Section 3.9.14 Section 3.11 Section 3.11.2 Appendix B, Solar Stirling Engine		
Appendix B (h) (3) (B) (v)	For technologies not previously installed and operated in California, the expected power plant maturation period.	Section 3.4.4		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (i) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, leases, and permits applicable to the Project, and a discussion of the applicability of, and conformance with each. The table or matrix shall explicitly reference pages in the application wherein conformance, with each law or standard during both construction and operation of the facility is discussed; and	Section 3.6.2.1 Section 3.13 Appendix F, Mechanical and Fire Protection Engineering Design Criteria Appendix K, Hydrogen System Design Criteria Appendix M, Structural Engineering Design Criteria Appendix O, Civil Engineering and Civil Design Appendix P, Electrical Engineering Design Criteria Appendix Q, Control Systems Engineering Design Criteria		
Appendix B (i) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits, leases, and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the commission to certify sites and related facilities.	N/A		

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Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (i) (2)	The name, title, phone number, address (required), and email address (if known), of an official who was contacted within each agency, and also provide the name of the official who will serve as a contact person for Commission staff.	N/A		
Appendix B (i) (3)	A schedule indicating when permits outside the authority of the commission will be obtained and the steps the applicant has taken or plans to take to obtain such permits.	Throughout the AFC		
Appendix B (g) (1)	...provide a discussion of the existing site conditions, the expected direct, indirect and cumulative impacts due to the construction, operation and maintenance of the Project, the measures proposed to mitigate adverse environmental impacts of the Project, the effectiveness of the proposed measures, and any monitoring plans proposed to verify the effectiveness of the mitigation.	Section 3.3.1 Section 3.5.7 Section 3.5.9 Section 3.6.2 Appendix I, Electric and Magnetic Field Calculations		
Appendix B (g) (18) (A)	The locations and a description of the existing switchyards and overhead and underground transmission lines that would be affected by the Project.	Figure 3-1 Figure 3-2 Figure 3-3 Figure 3-5 Figure 3-6 Figure 3-7 Figure 3-8		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (g) (18) (B)	An estimate of the existing electric and magnetic fields from the facilities listed in (A) above and the future electric and magnetic fields that would be created by the Project, calculated at the property boundary of the site and at the edge of the rights-of-way for any transmission line. Also provide an estimate of the radio and television interference that could result from the Project.	Section 3.6.2.2 Section 3.6.2.3 Appendix I, Electric and Magnetic Field Calculations		
Appendix B (g) (18) (C)	Specific measures proposed to mitigate identified impacts, including a description of measures proposed to eliminate or reduce radio and television interference, and all measures taken to reduce electric and magnetic field levels.	Section 3.6.2.2 Section 3.6.2.3		
Appendix B (i) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, leases, and permits applicable to the Project, and a discussion of the applicability of, and conformance with each. The table or matrix shall explicitly reference pages in the application wherein conformance, with each law or standard during both construction and operation of the facility is discussed; and	Section 3.6.2.1 Section 3.13 Throughout the AFC		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One	Technical Staff:			
Project Manager:					Docket:		Technical Senior:			

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (i) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits, leases, and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the commission to certify sites and related facilities.	Throughout the AFC		
Appendix B (i) (2)	The name, title, phone number, address (required), and email address (if known), of an official who was contacted within each agency, and also provide the name of the official who will serve as a contact person for Commission staff.	Throughout the AFC		
Appendix B (i) (3)	A schedule indicating when permits outside the authority of the commission will be obtained and the steps the applicant has taken or plans to take to obtain such permits.	Throughout the AFC		
Appendix B (h) (2) (A)	A discussion of the need for the additional electric transmission lines, substations, or other equipment, the basis for selecting principal points of junction with the existing electric transmission system, and the capacity and voltage levels of the proposed lines, along with the basis for selection of the capacity and voltage levels.	Section 3.6 Appendix H, System Impact Study Figure 3-5 Figure 3-6 Figure 3-7 Figure 3-8 Figure 3-32 Figure 3-33 Figure 3-34		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (h) (2) (B)	A discussion of the extent to which the proposed electric transmission facilities have been designed, planned, and routed to meet the transmission requirements created by additional generating facilities planned by the applicant or any other entity.	Section 3.6 Appendix H, System Impact Study Figure 3-5 Figure 3-6 Figure 3-7 Figure 3-8		
Appendix B (b) (2) (C)	A detailed description of the design, construction, and operation of any electric transmission facilities, such as power lines, substations, switchyards, or other transmission equipment, which will be constructed or modified to transmit electrical power from the proposed power plant to the load centers to be served by the facility. Such description shall include the width of rights-of-way and the physical and electrical characteristics of electrical transmission facilities such as towers, conductors, and insulators. This description shall include power load flow diagrams which demonstrate conformance or nonconformance with utility reliability and planning criteria at the time the facility is expected to be placed in operation and five years thereafter; and	Appendix H, System Impact Study Figure 3-5 Figure 3-6 Figure 3-7 Figure 3-8 Figure 3-32 Figure 3-33 Figure 3-34		

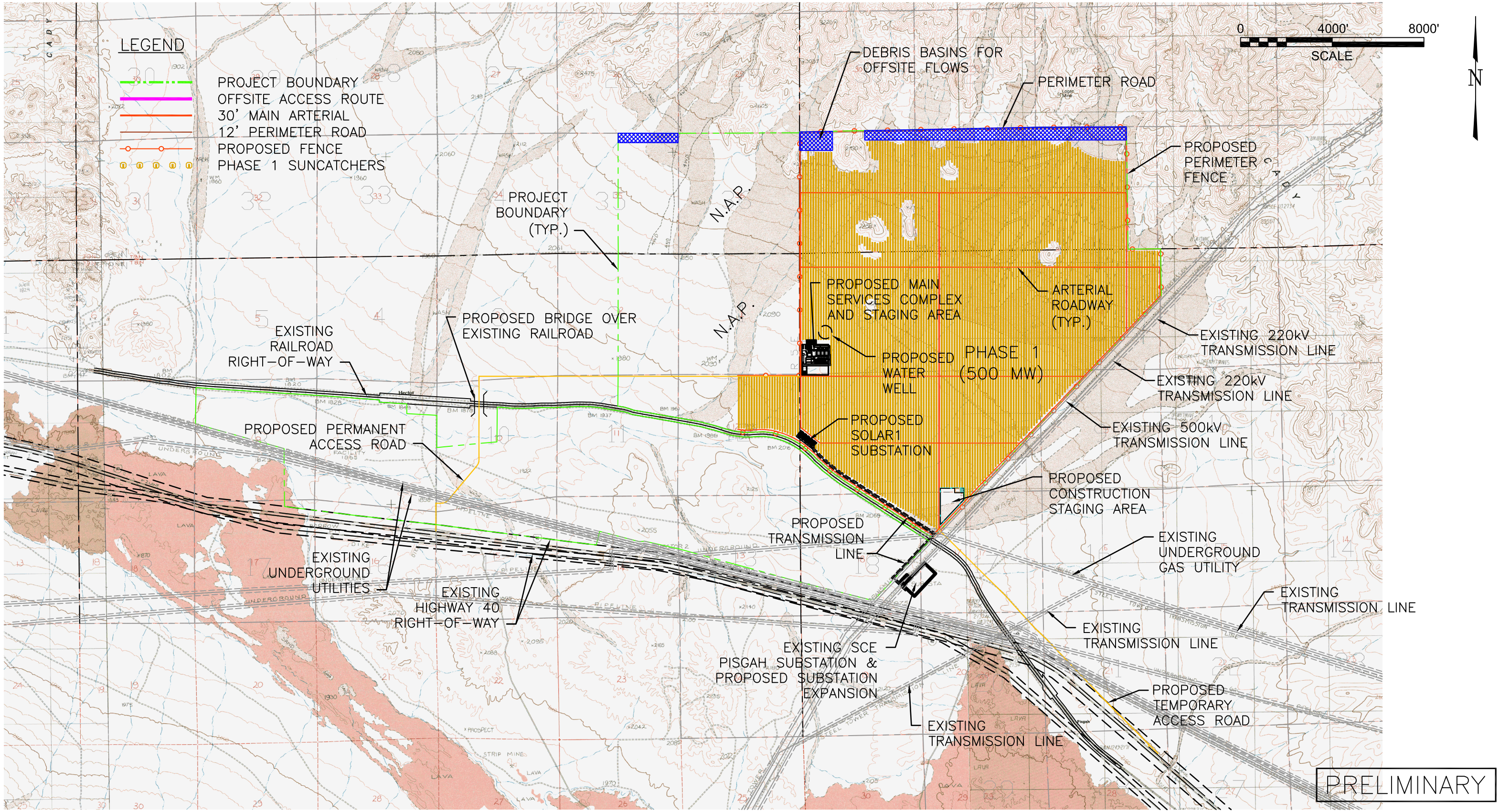
Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	Information	AFC Section Number	Adequate Yes Or No	Information Required To Make AFC Conform With Regulations
Appendix B (b) (2) (D)	A description of how the route and additional transmission facilities were selected, and the consideration given to engineering constraints, environmental impacts, resource conveyance constraints, and electric transmission constraints.	Section 3.6 Appendix H, System Impact Study Figure 3-5 Figure 3-6 Figure 3-7 Figure 3-8 Figure 3-32 Figure 3-33 Figure 3-34		
Appendix B (b) (2) (E)	A completed System Impact Study or signed System Impact Study Agreement with the California Independent System Operator and proof of payment. When not connecting to the California Independent System Operator controlled grid, provide the executed System Impact Study agreement and proof of payment to the interconnecting utility. If the interconnection and operation of the Project will likely impact an transmission system that is not controlled by the interconnecting utility (or California Independent System Operator), provide evidence of a System Impact Study or agreement and proof of payment (when applicable) with/to the impacted transmission owner or provide evidence that there are no system impacts requiring mitigation.	Appendix H, System Impact Study		

Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Efficiency and Facility Design**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

Siting Regulations	**Information**	**AFC Section Number**	**Adequate Yes Or No**	**Information Required To Make AFC Conform With Regulations**
Appendix B (i) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, leases, and permits applicable to the Project, and a discussion of the applicability of, and conformance with each. The table or matrix shall explicitly reference pages in the application wherein conformance, with each law or standard during both construction and operation of the facility is discussed; and	Section 3.6.2 Section 3.13 Throughout the AFC		
Appendix B (i) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits, leases, and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the commission to certify sites and related facilities.	Throughout the AFC		
Appendix B (i) (2)	The name, title, phone number, address (required), and email address (if known), of an official who was contacted within each agency, and also provide the name of the official who will serve as a contact person for Commission staff.	Throughout the AFC		
Appendix B (i) (3)	A schedule indicating when permits outside the authority of the commission will be obtained and the steps the applicant has taken or plans to take to obtain such permits.	Throughout the AFC		

SES Stirling Energy Systems, Inc.



NO.	DATE		BY	APP.
A	11/18/08	ISSUED FOR REVIEW	GSP	SD

STANTEC CONSULTING INC.
9400 S.W. BARNES ROAD
STE. 200
PORTLAND, OREGON, 97225
503.297.1631
STANTEC.COM

DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/23/08
SCALE 1"=4000'		APP.	DATE

Stirling Energy Systems

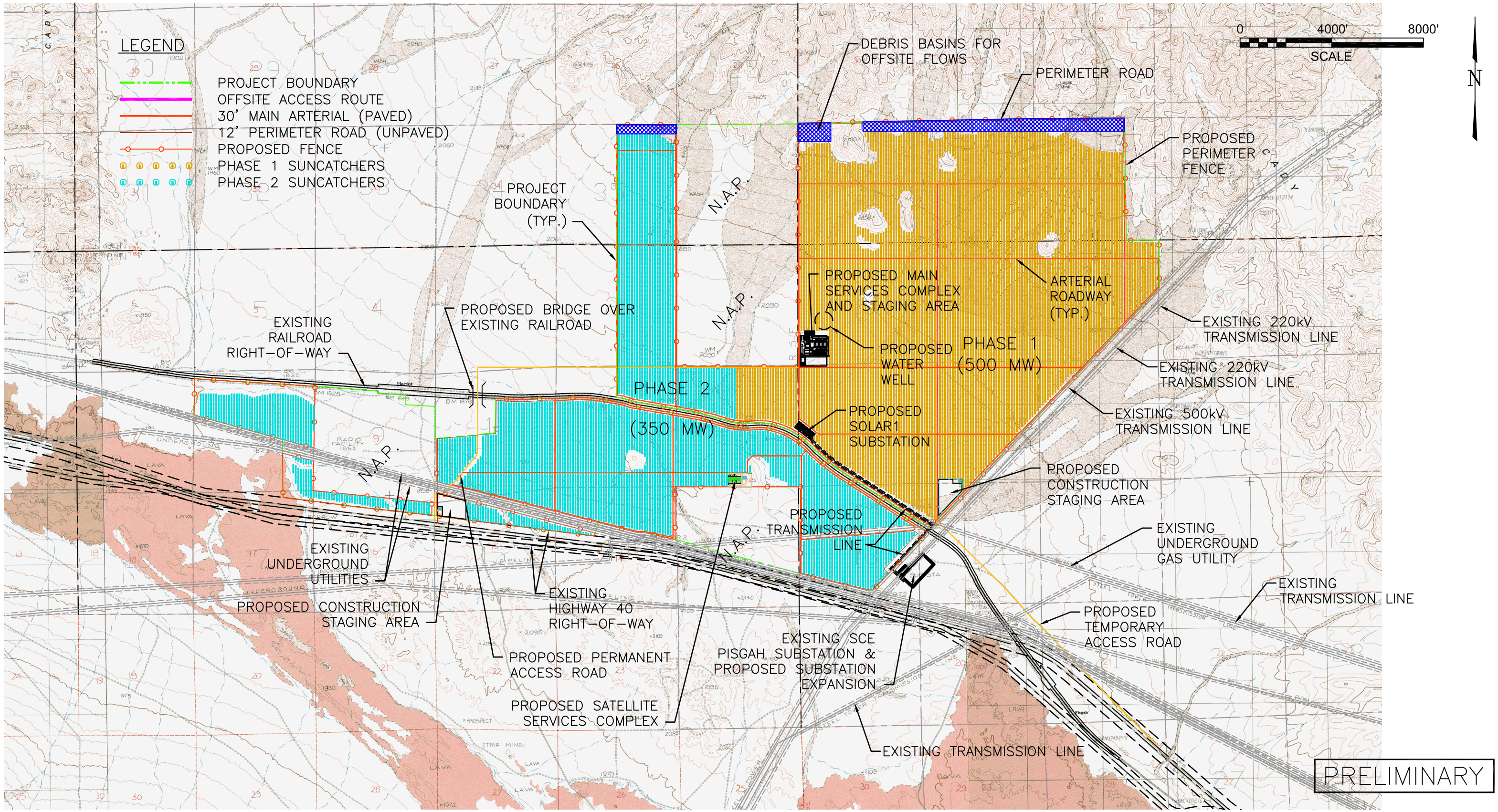
PROJECT: 2000024301

TITLE:
SOLAR ONE – SITE PLAN
PHASE 1, DURING CONSTRUCTION

FIGURE 3-1

SHT. 1 of 3

REV. A



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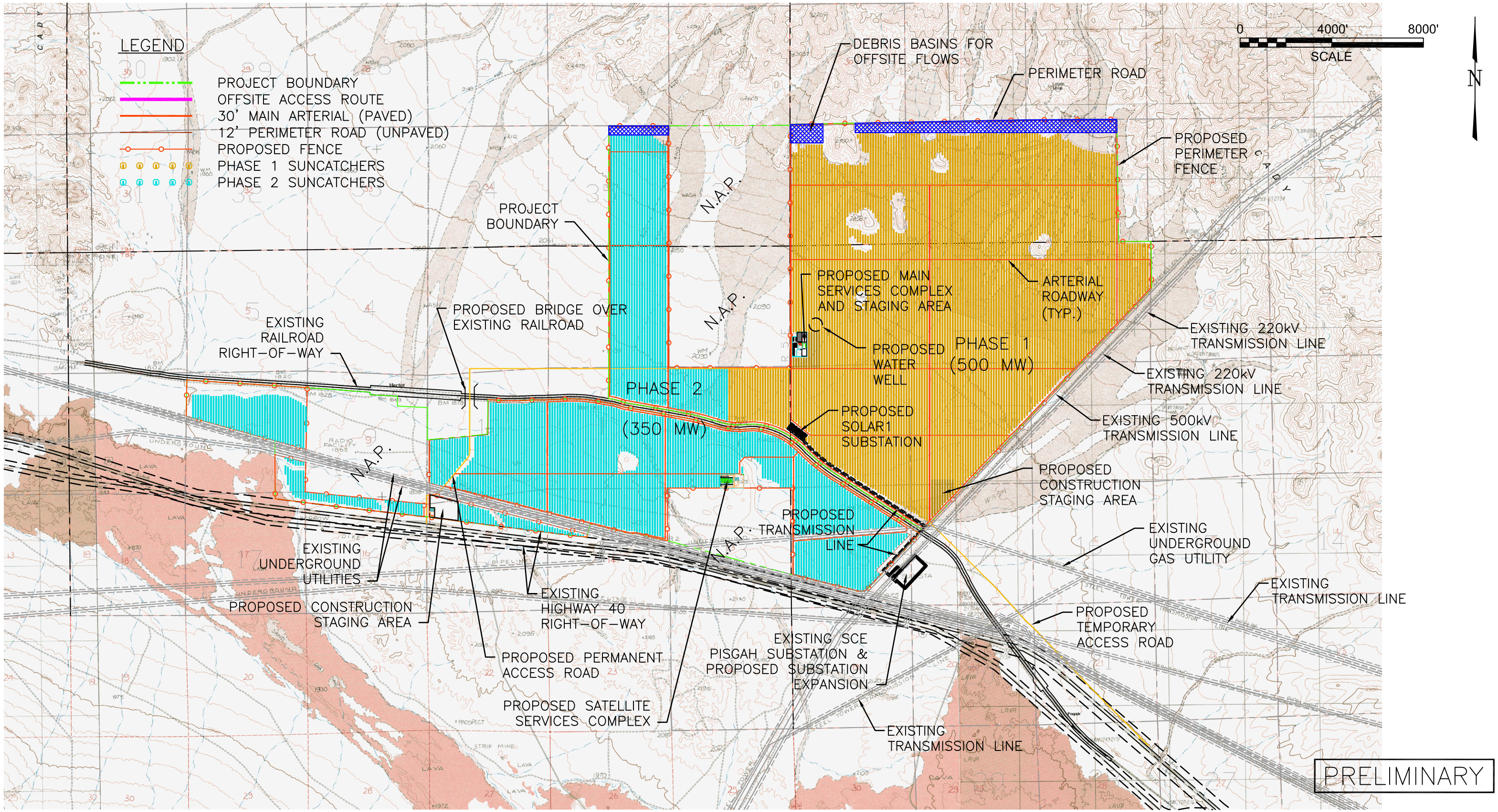
SCALE 1"=4000'		APP.	DATE

SES Stirling Energy Systems

PROJECT: 2000024301

TITLE:
SOLAR ONE – SITE PLAN
PHASE 2, DURING CONSTRUCTION

FIGURE 3-2 | SHT. 2 | REV. A



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A	11/18/08	ISSUED FOR REVIEW	GSP	SD

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PORTLAND, OREGON, 97225
503.297.1631
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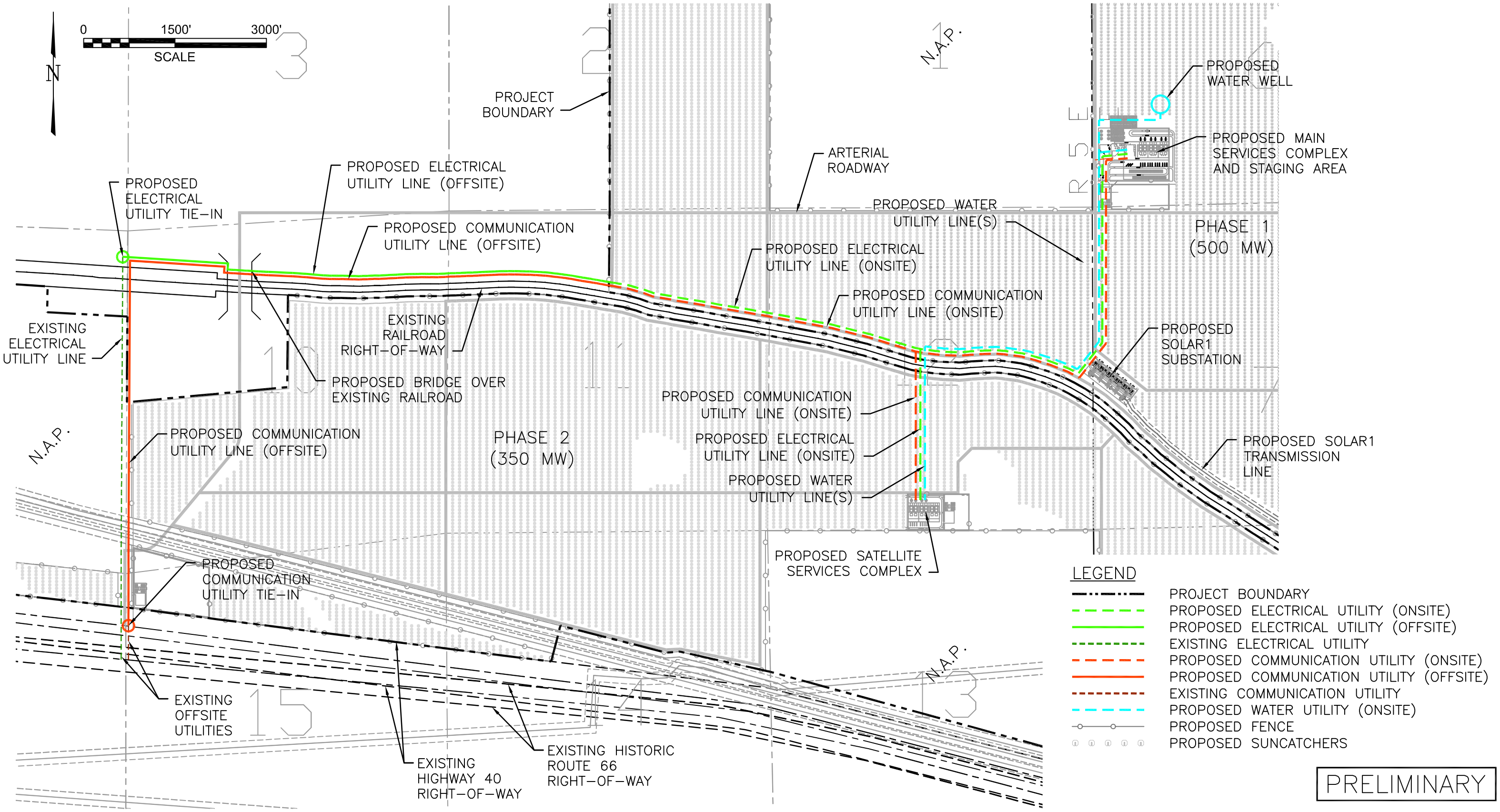
DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/23/08
SCALE 1"=4000'		APP.	DATE

Stirling Energy Systems

TITLE:

SOLAR ONE – SITE PLAN POST CONSTRUCTION

PROJECT:		SHT.	REV.
2000024301	FIGURE 3-3	3	A



NO.	DATE		BY	APP.
P1	11/18/08	ISSUED FOR REVIEW	SD	

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PORTLAND, OREGON, 97225
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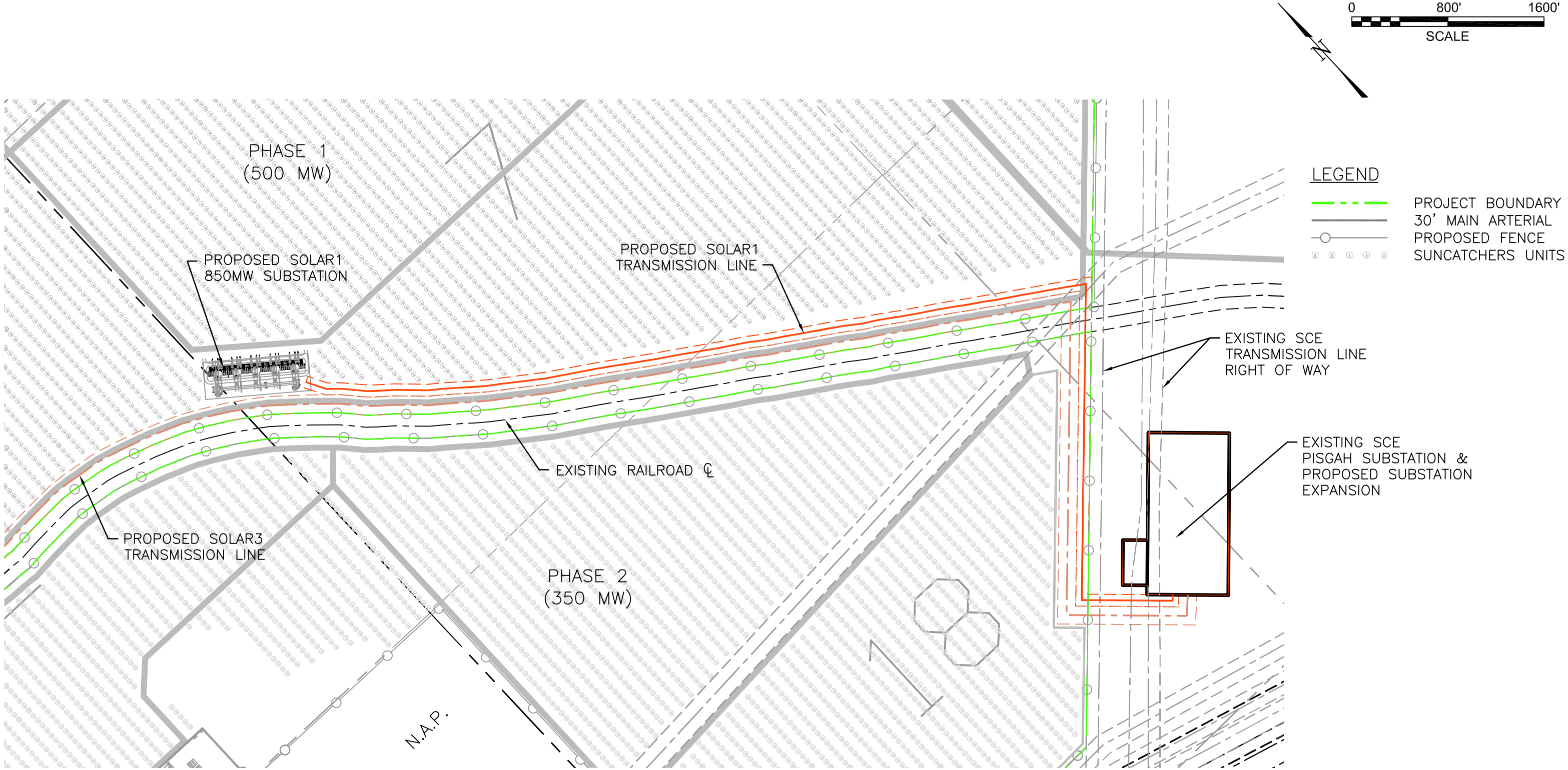
SCALE 1"=1500'		APP.	DATE

Stirling Energy Systems

PROJECT: 2000024301

TITLE:
UTILITY PLAN
OFFSITE UTILITY SERVICE

FIGURE 3–4 | SHT. 1 | REV. P1



PRELIMINARY

NO.	DATE		BY	APP.
A	11/18/08	ISSUED FOR REVIEW	GSP	SD

STANTEC CONSULTING INC.
9400 S.W. BARNES ROAD
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PORTLAND, OREGON, 97225
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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 11/04/08
SCALE 1"=800'		APP.	DATE

Stirling Energy Systems

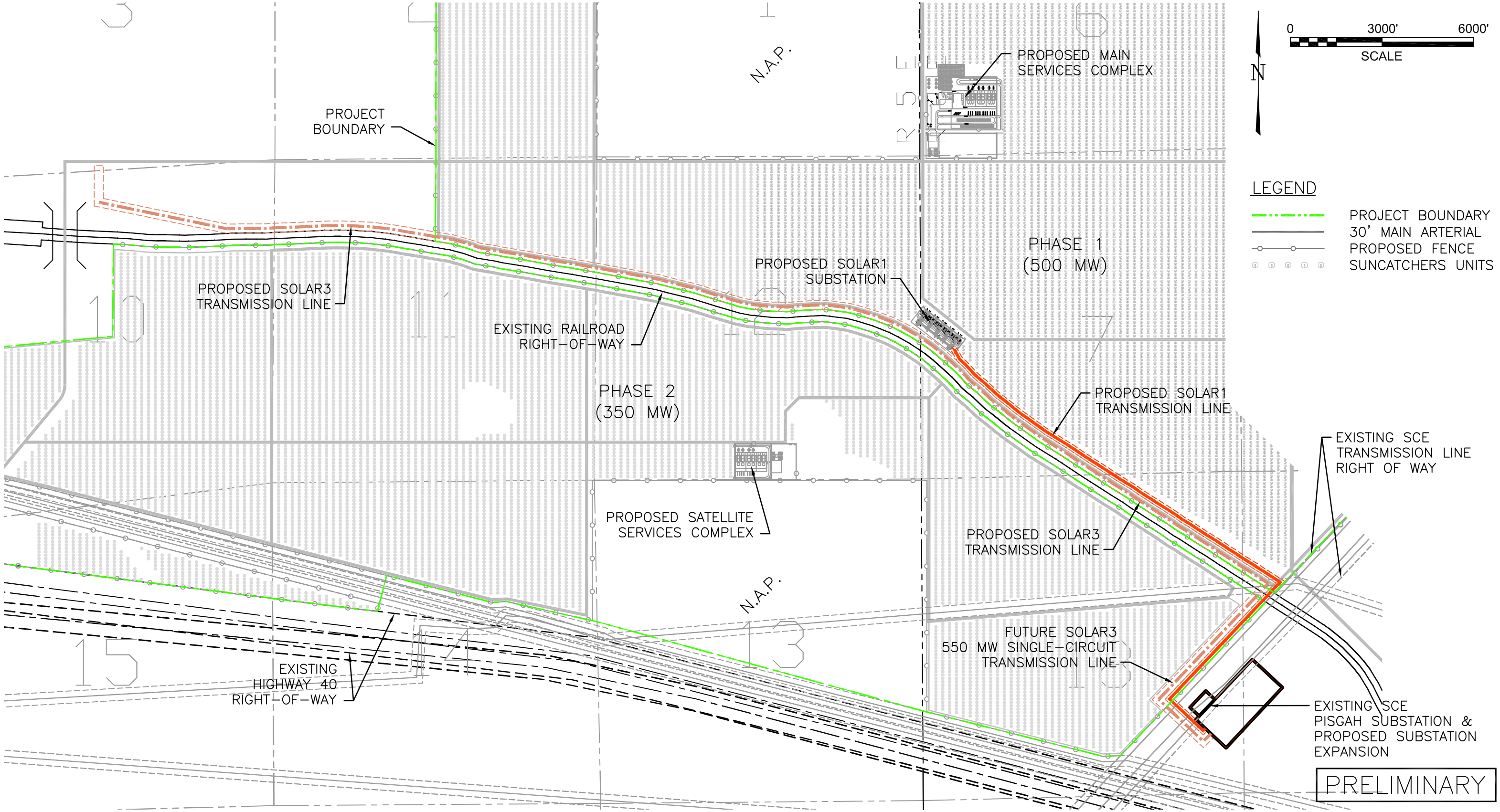
PROJECT: 2000024301

TITLE:
SOLAR ONE
220kV TRANSMISSION LINE

FIGURE 3-5

SHT. 1 of 1

REV. P1



NO.	DATE		BY	APP.
P1	11/18/08	ISSUED FOR REVIEW	SD	

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PORTLAND, OREGON, 97225
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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/02/08
SCALE 1"=1500'		APP.	DATE

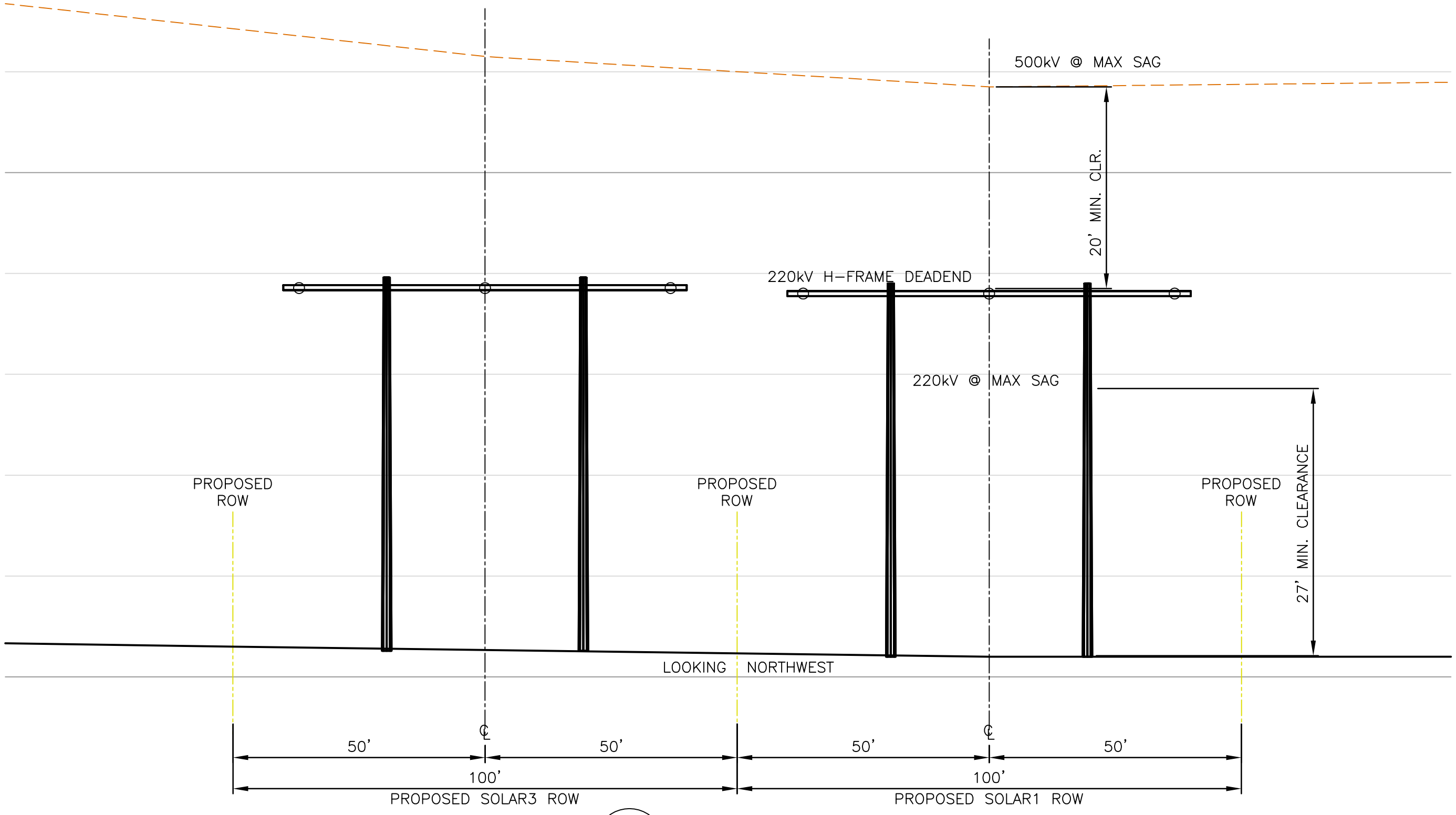
SES Stirling Energy Systems

PROJECT: 2000024301

TITLE:

SOLAR ONE & SOLAR THREE TRANSMISSION LINES

FIGURE 3-6	SHT. 1	REV. P1



SECTION
SCALE: 1"=10' (VERTICAL)
1"=20' (HORIZONTAL)

PRELIMINARY

NO.	DATE		BY	APP.
P1	11/18/08	ISSUED FOR PRELIMINARY REVIEW	PH	

STANTEC CONSULTING INC.
9400 S.W. BARNES ROAD
STE. 200
PORTLAND, OREGON, 97225
503.297.1631
STANTEC.COM

DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 07/30/07
SCALE V:1"=10' H:1"=20'		APP.	DATE

SES Stirling Energy Systems

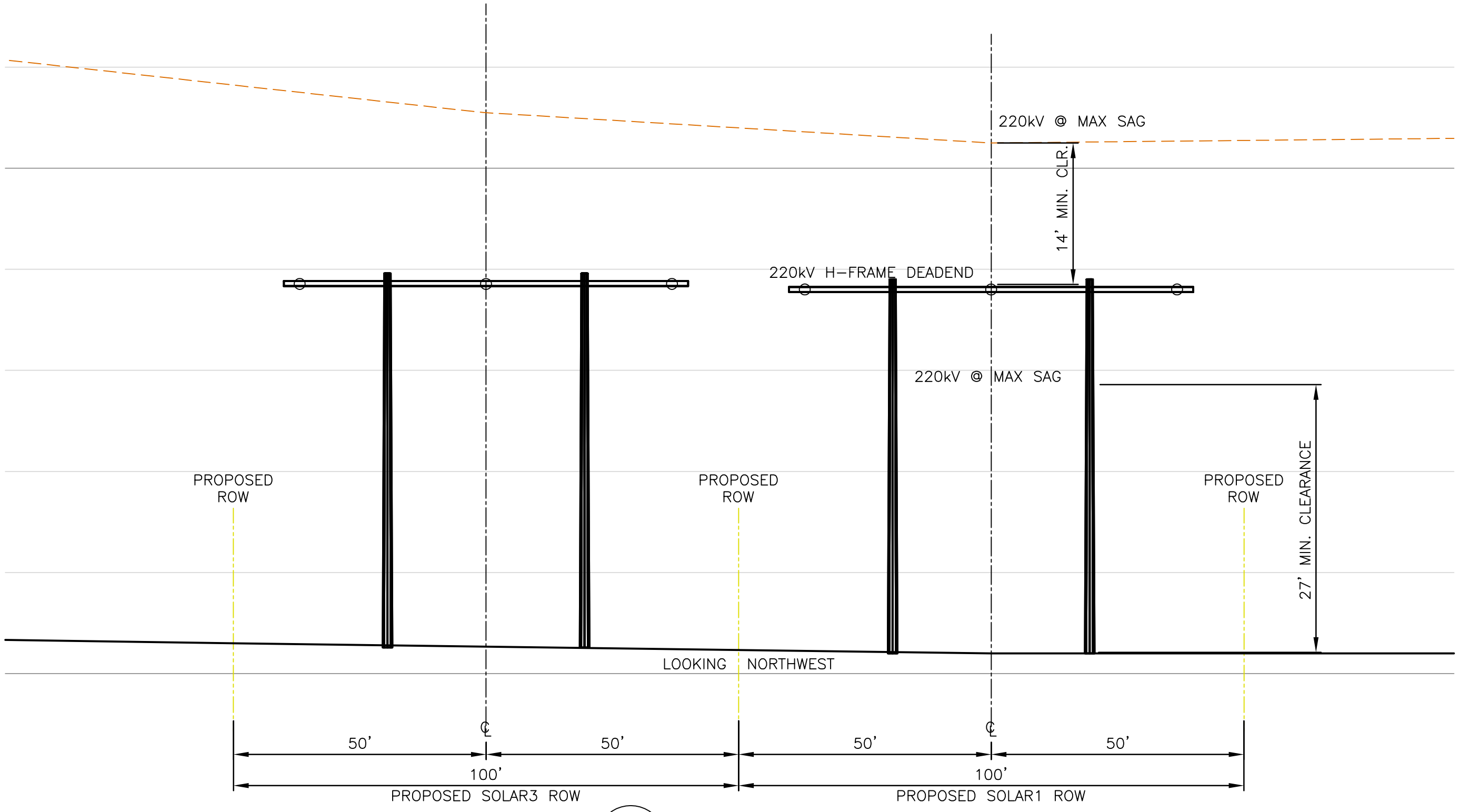
PROJECT: 2000024301

TITLE: 500kV TRANSMISSION LINE UNDERCROSSING DETAIL

FIGURE 3-7

SHT. 1

REV. P1



SECTION
SCALE: 1"=10' (VERTICAL)
1"=20' (HORIZONTAL)

PRELIMINARY

NO.	DATE		BY	APP.
P1	11/18/08	ISSUED FOR PRELIMINARY REVIEW	PH	

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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 07/30/07
SCALE V:1"=10' H:1"=20'		APP.	DATE

SES Stirling Energy Systems

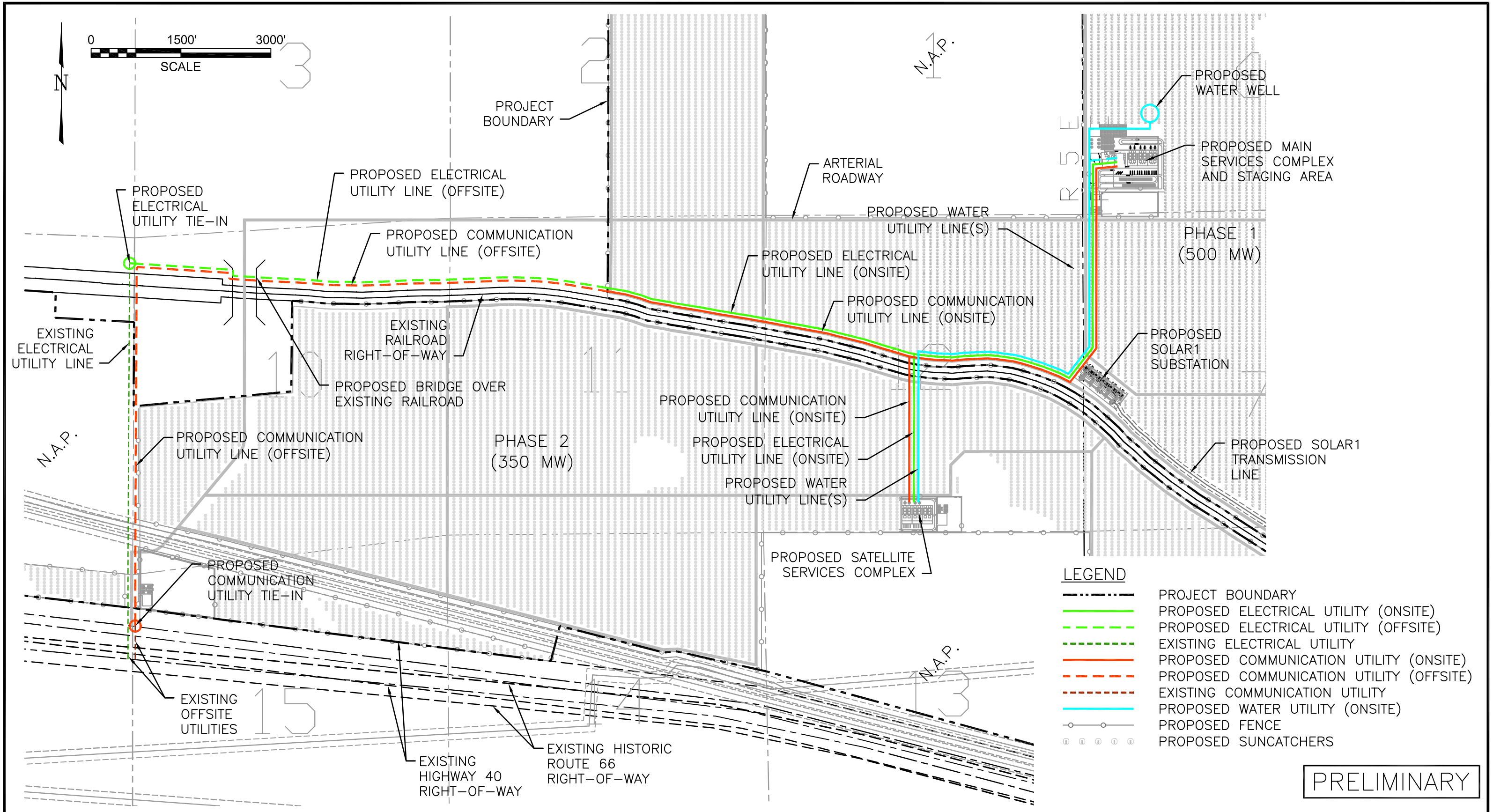
PROJECT: 2000024301

TITLE:
220kV TRANSMISSION LINE UNDERCROSSING DETAIL

FIGURE 3-8

SHT. 1

REV. P1



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NO.	DATE		BY	APP.
P1	11/18/08	ISSUED FOR REVIEW	SD	

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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 11/07/08
SCALE 1"=1500'		APP.	DATE

Stirling Energy Systems

PROJECT: 2000024301

TITLE:
UTILITY PLAN
ONSITE UTILITY SERVICE

FIGURE 3–9

SHT. 1

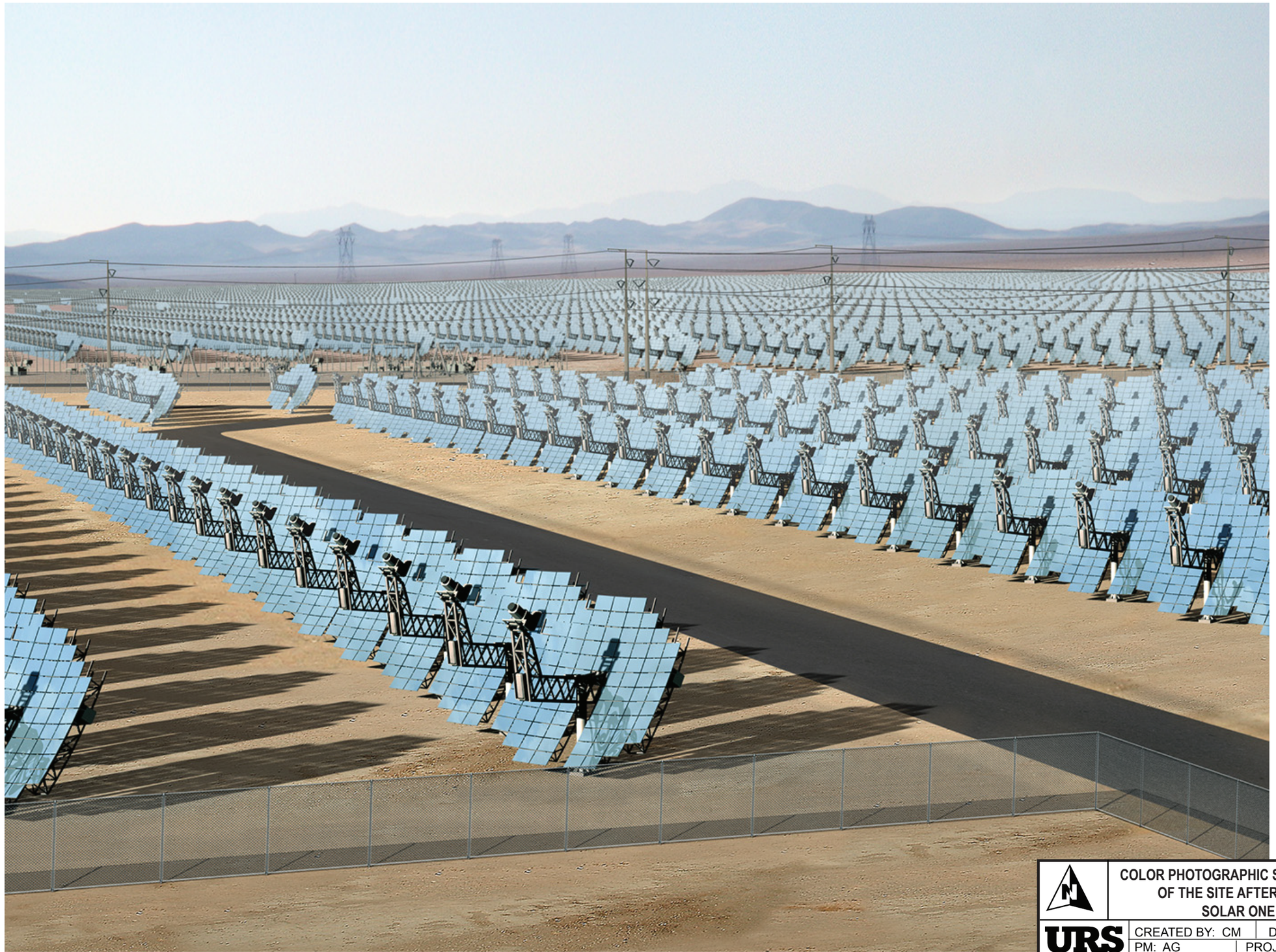
REV. P1

EXISTING COLOR PHOTOGRAPHIC REPRODUCTION DEPICTING THE VISUAL APPEARANCE OF THE SITE PRIOR TO CONSTRUCTION

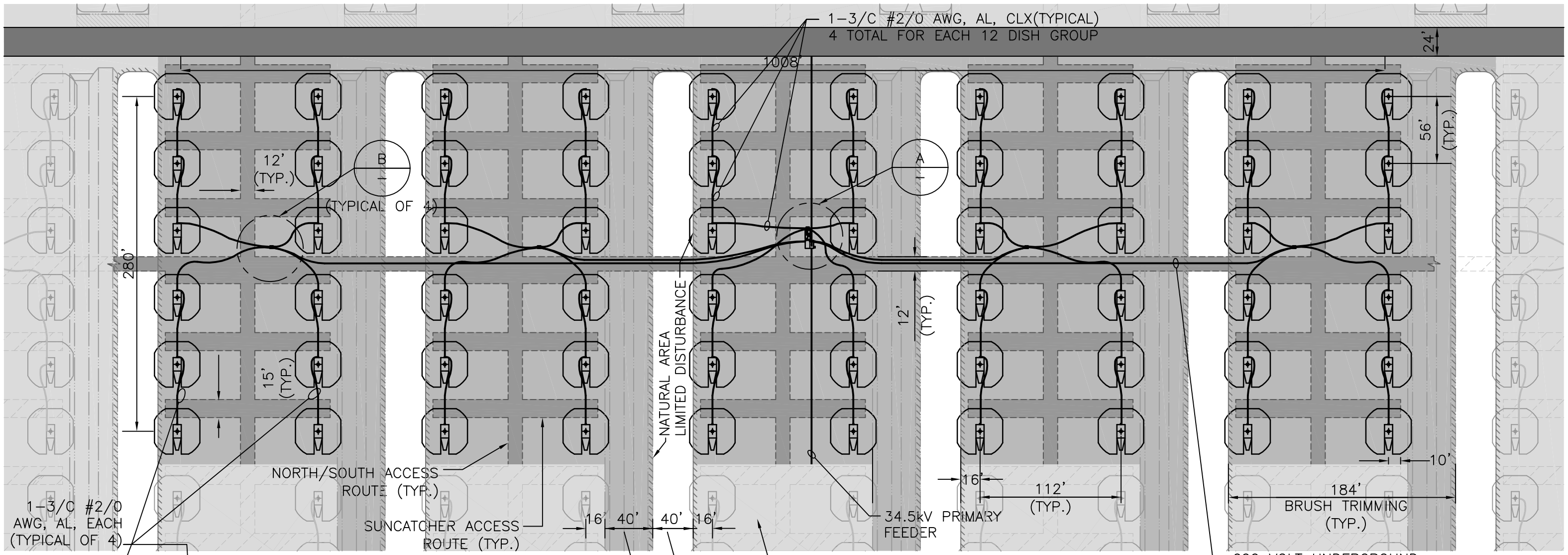
URS	CREATED BY: CM	DATE: 11-18-08	FIG. NO:
	PM: AG	PROJ NO: 27658171	3-10A

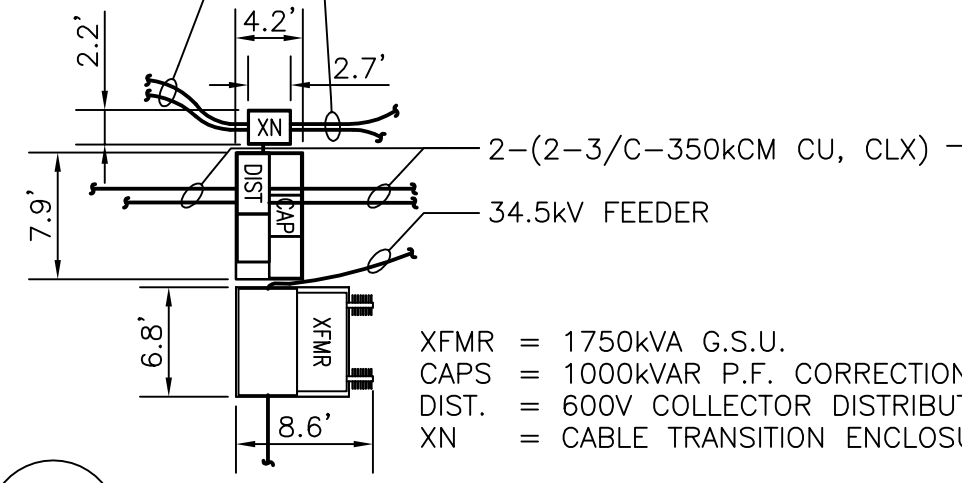
COLOR PHOTOGRAPHIC REPRODUCTION DEPICTING THE VISUAL APPEARANCE OF THE SITE AFTER CONSTRUCTION

URS	CREATED BY: CM	DATE: 11-18-08	FIG. NO:
	PM: AG	PROJ NO: 27658171	**3-10B**

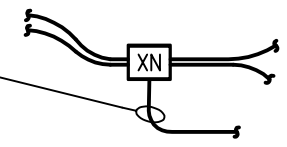


	COLOR PHOTOGRAPHIC SIMULATION CLOSE-UP OF THE SITE AFTER CONSTRUCTION SOLAR ONE PROJECT		
URS	CREATED BY: CM	DATE: 11-18-08	FIG. NO: 3-10C
	PM: AG	PROJ NO: 27658171	





XFMR = 1750kVA G.S.U.
CAPS = 1000kVAR P.F. CORRECTION CAPS.
DIST. = 600V COLLECTOR DISTRIBUTION PANEL
XN = CABLE TRANSITION ENCLOSURE.



A — DETAIL – CENTRAL POWER DIST.
DIMS ARE APPROXIMATE
N.T.S.

B — DETAIL – REMOTE CABLE TRANSITION
DIMS ARE APPROXIMATE
N.T.S.

N
NOT TO SCALE

LEGEND
- BRUSH TRIMMING
- PAVED ROADWAYS
- UNPAVED ACCESS ROUTE
- SUNCATCHER UNIT

NOTES
1. THIS IS A REPRESENTATION (BUT NOT NECESSARILY TYPICAL) OF A 1.5MW SOLAR GROUP. THE 1.5MW SOLAR GROUPS WILL BE ARRANGED TO FIT THE CONTOURS OF THE SITE.
2. ONE 1.5MW SOLAR GROUP IS COMPRISED OF SIXTY (60) SUNCATCHER UNITS CONNECTED INTO FIVE (5) TWELVE-UNIT GROUPS CONNECTED TO A 600V, 400A COLLECTION PANELBOARD.

PRELIMINARY

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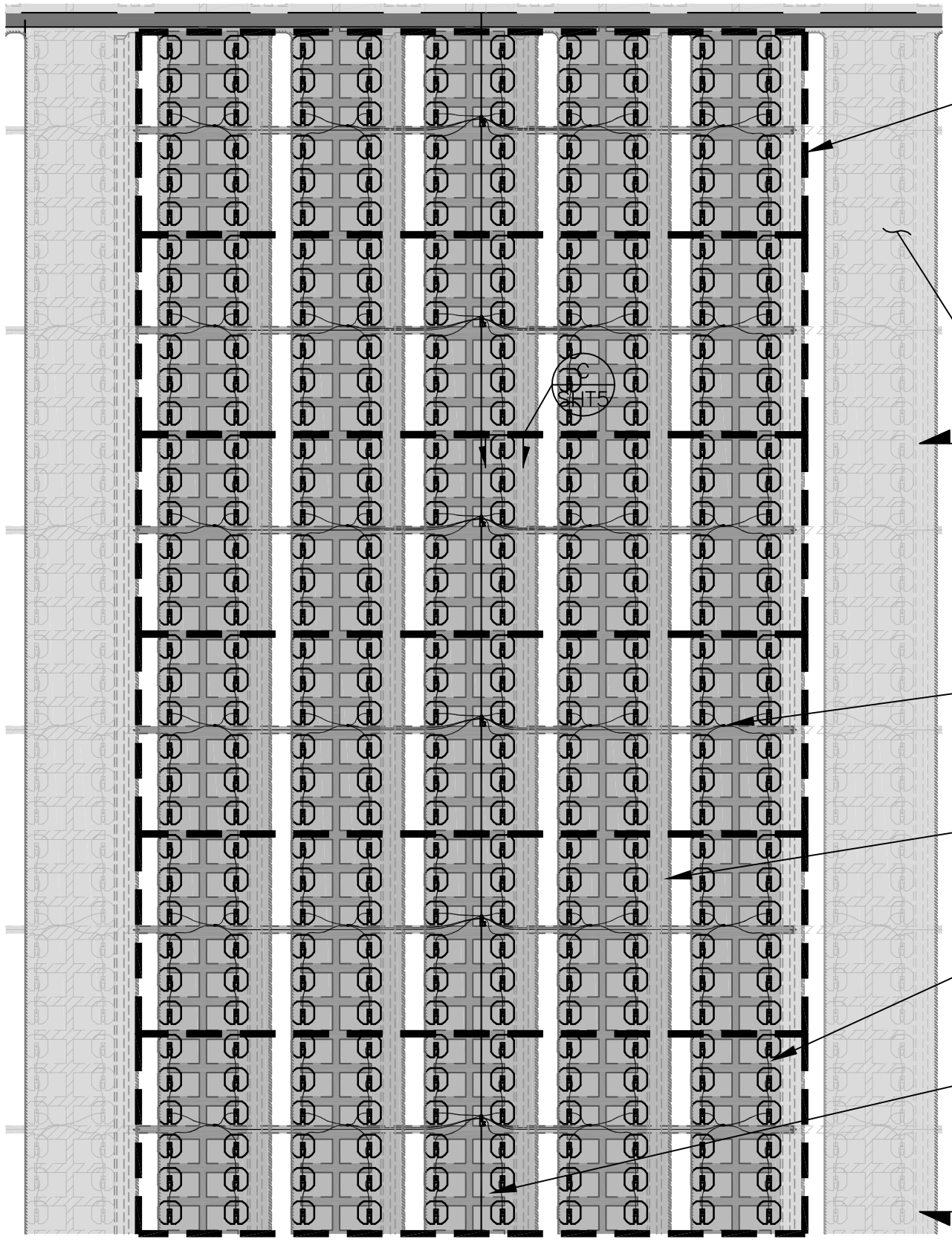
DRN. STC/THU	DES. STC/PM	CHK. STC/	DATE 08/28/08
SCALE 1"=80'-0"		APP.	DATE

PROJECT: 2000024301

TITLE:
SOLAR ONE
1.5MW SOLAR GROUP PLAN

FIGURE 3-11 | SHT. 1 of 4 | REV. P1



1.5MW GENERATOR GROUP (GG) (TYP.)
SEE SHEET 1 OF 4

ADJACENT SOLAR GROUPS

600V, CABLE SIZE TRANSITION ENCLOSURE (TYP. OF 30)

DRAINAGE BERM/SWALE

600 VOLT UNDERGROUND FEED TO EACH DISH GROUP (REFER TO S1-E-0001)

3/C 4/0 AL 34.5kV CABLE UNDERGROUND TO OVERHEAD COLLECTION LINE

LEGEND

- BRUSH TRIMMING
- PAVED ROADWAYS
- UNPAVED ACCESS ROUTE
- SUNCATCHER UNIT

NOTES

1. THIS IS A REPRESENTATION (BUT NOT NECESSARILY TYPICAL) OF AN 9MW SOLAR GROUP. THE 9MW SOLAR GROUPS WILL BE ARRANGED TO FIT THE CONTOURS OF THE SITE.
2. THE SIX (6) 1.5MW SOLAR GROUPS ARE CONNECTED IN SERIES TO THE RISER TO THE OVERHEAD 34.5kV COLLECTION LINE BY 34.5kV UNDERGROUND CABLES

N

NOT TO SCALE

PRELIMINARY

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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/03/08
SCALE 1"=160'-0"		APP.	DATE

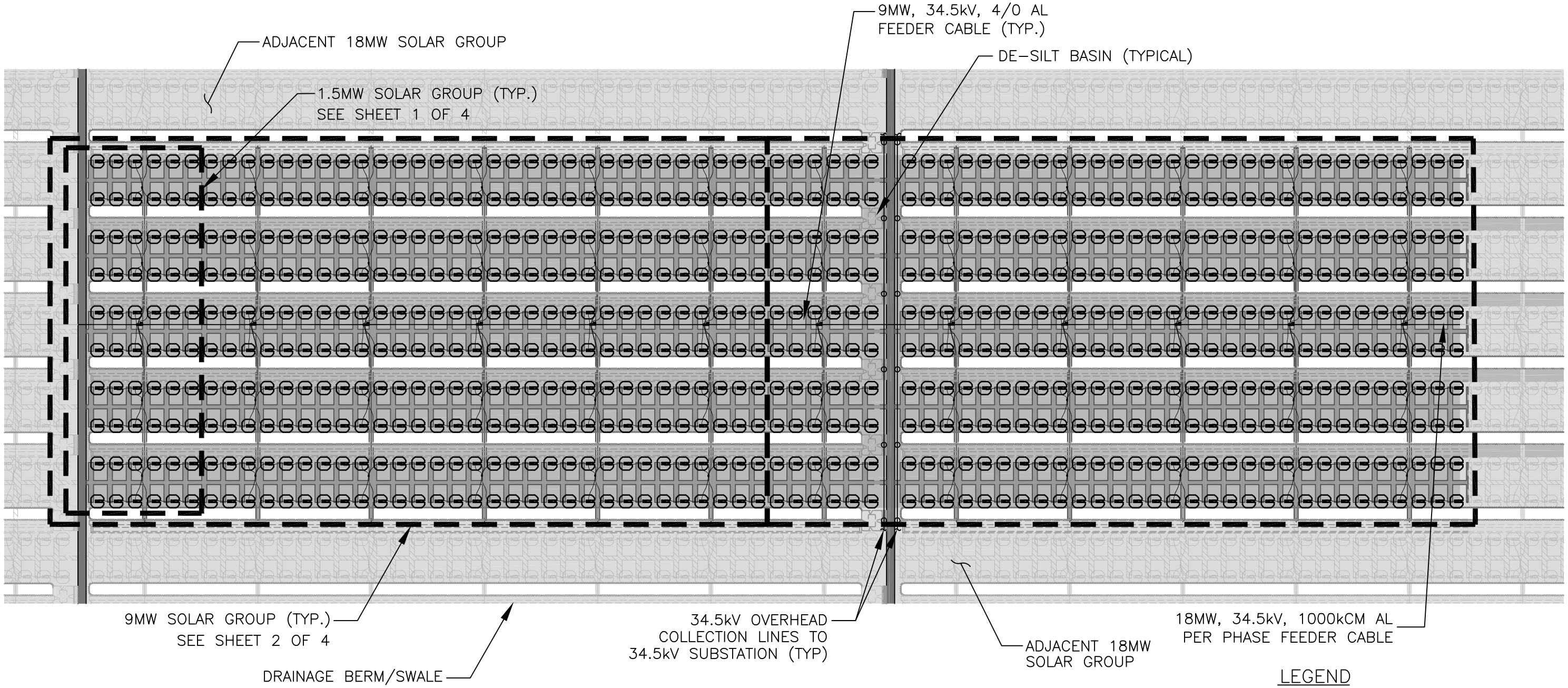
PROJECT: 2000024301

TITLE:
SOLAR ONE
9MW SOLAR GROUP PLAN

FIGURE 3-12

SHT. 2 of 4

REV. P1



NOT TO SCALE

NOTE

THIS IS A REPRESENTATION (BUT NOT NECESSARILY TYPICAL) OF AN 18MW SOLAR GROUP. THE 18MW SOLAR GROUPS WILL BE ARRANGED TO FIT THE CONTOURS OF THE SITE.

LEGEND

- BRUSH TRIMMING
- PAVED ROADWAYS
- UNPAVED ACCESS ROUTE
- SUNCATCHER UNIT

PRELIMINARY

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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/03/08
SCALE 1"=300'-0"		APP.	DATE

Stirling Energy Systems

PROJECT: 2000024301

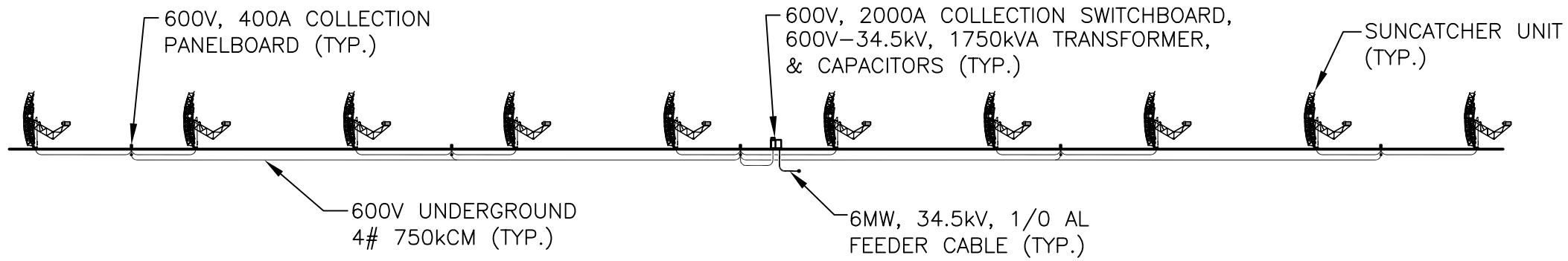
TITLE:

SOLAR ONE
18MW SOLAR GROUP PLAN

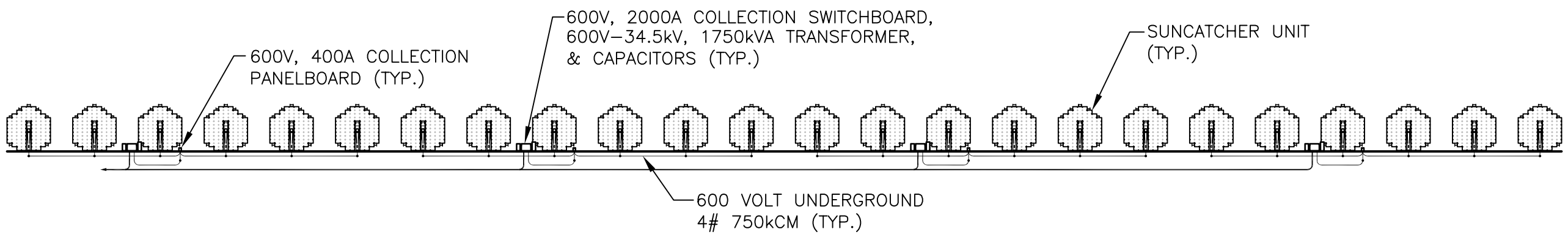
FIGURE 3-13

SHT. 3 of 4

REV. P1



AA / – SECTION (LOOKING NORTH)
(SUNCATCHER UNITS FACING EAST)
SCALE: 1"=100'



BB / – SECTION (LOOKING WEST)
(SUNCATCHER UNITS FACING EAST)
SCALE: 1"=100'

PRELIMINARY

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DRN. STC/GSP	DES. STC/PH	CHK. STC/	DATE 05/24/07
SCALE AS SHOWN		APP.	DATE

SES Stirling Energy Systems

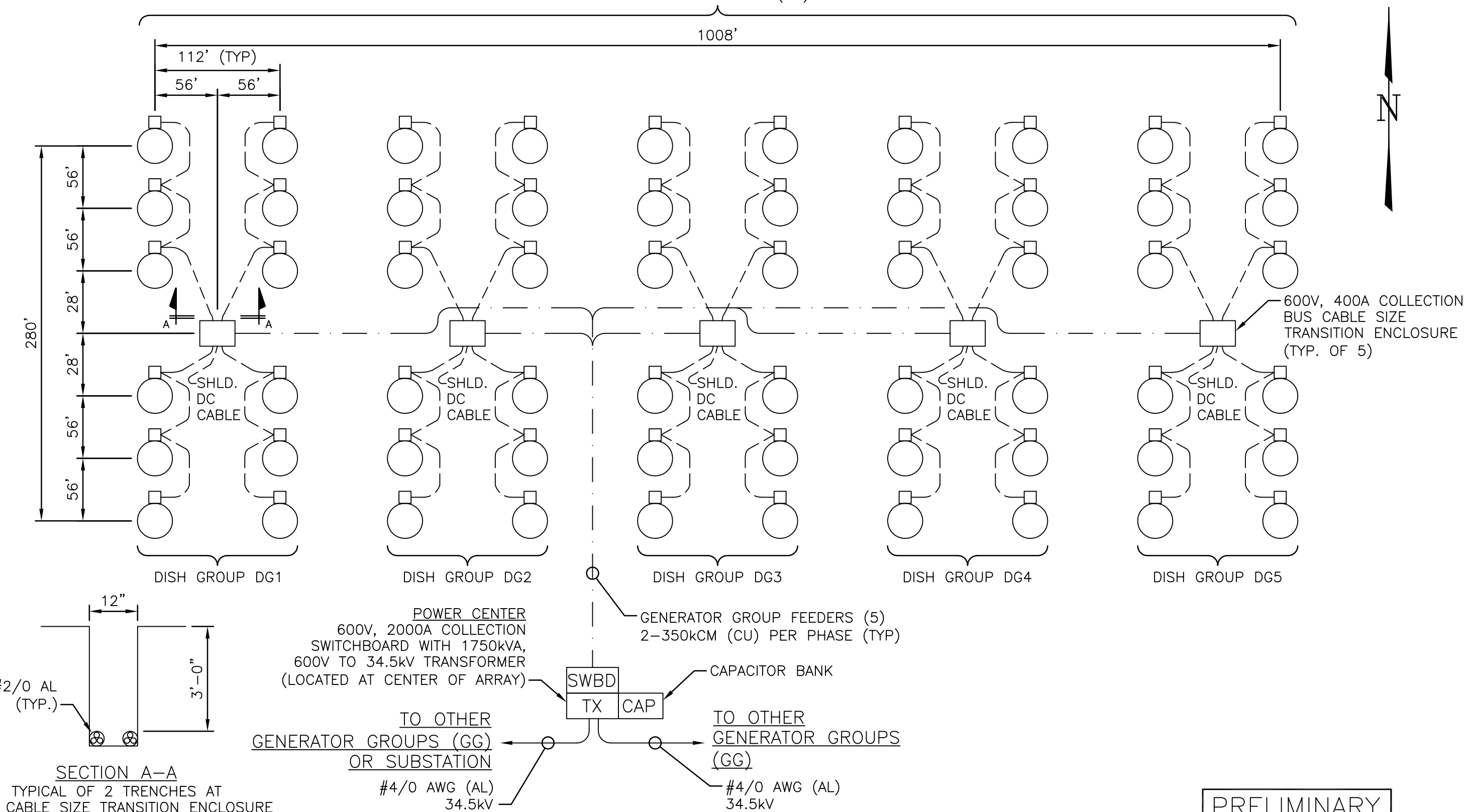
PROJECT: 2000024301

TITLE:
SOLAR ONE
6MW SOLAR GROUP ELEVATIONS

FIGURE 3–14

SHT. 4 of 7

REV. P1



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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/03/08
SCALE NONE		APP.	DATE

PROJECT: 2000024301

TITLE: 1.5MW SOLAR GENERATOR GROUP ELECTRICAL ONE LINE DIAGRAM

FIGURE 3-15

SHT. 1 of 2

REV. P1

(3) 1/C 4/O AWG AL

TO PREVIOUS GENERATOR GROUP (GG) OR SUBSTATION

(FUSED PRIMARY SWITCH)

TO NEXT GENERATOR GROUP (GG)

(3) 1/C 4/O AWG AL

A

B

CAPSWITCHER

600V
960 kVAR
CAPACITOR BANK

400A CABLE TRANSITION ENCLOSURE (TYP. OF 5)

#2/0 (AL) (TYP.)

GENERATOR STEP-UP TRANSFORMER (GSU) 1750kVA 575V TO 34.5kV

RES

600V COLLECTION SWITCHBOARD

2000A BUS

1200F / 1200T

600F / 400T

600F / 400T

600F / 400T

600F / 400T

600F / 400T

DISH GROUP DG1 (300kW)

DISH GROUP DG5 (300kW)

2-350kCM (CU) PER PHASE (TYPICAL OF 5)

ONE SUNCATCHER GENERATOR (GU) (25kW)

3/C #4 (AL) (TYP.)

DISH GROUP DG2 (300kW)

DISH GROUP DG3 (300kW)

DISH GROUP DG4 (300kW)

PRELIMINARY

NO.	DATE		BY	APP.
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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/03/08
SCALE NONE		APP.	DATE

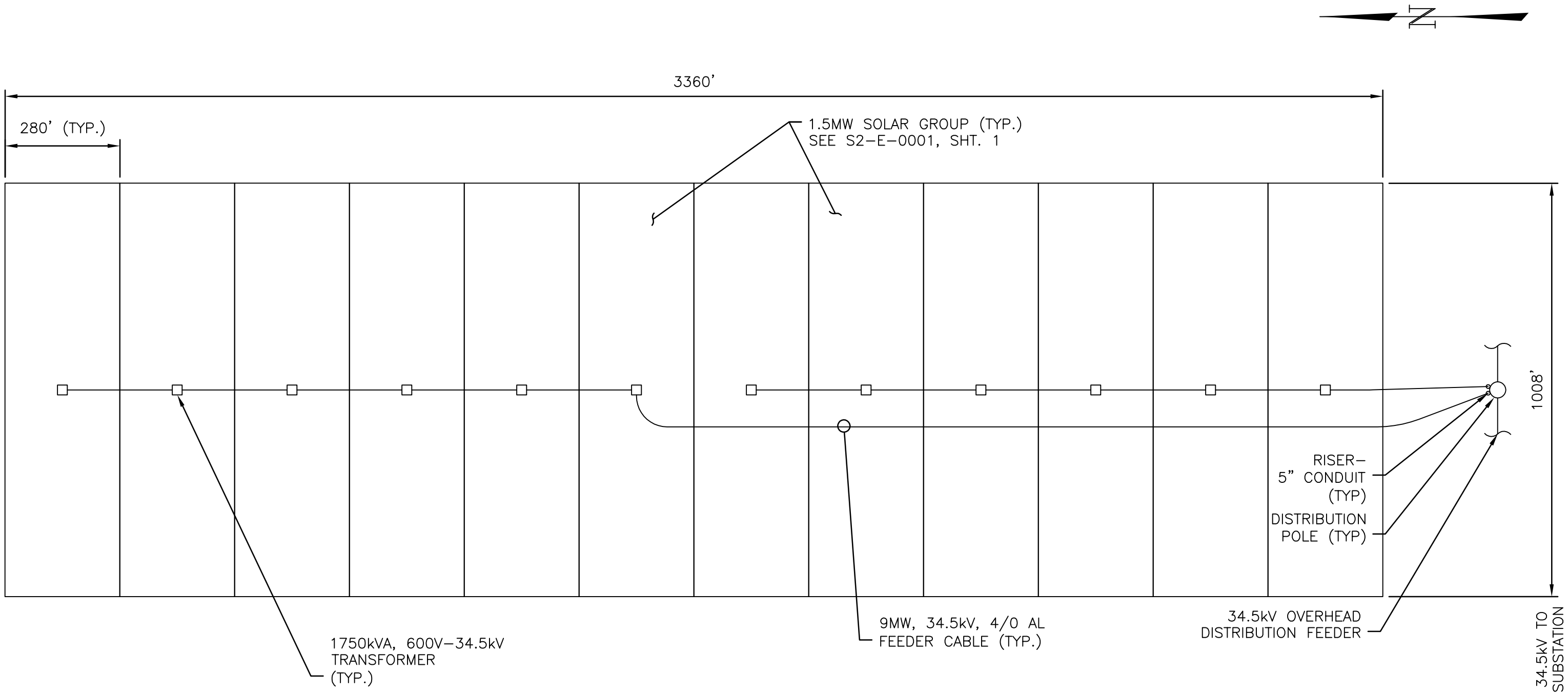
PROJECT: 2000024301

TITLE: 1.5MW SOLAR GENERATOR GROUP ELECTRICAL ONE LINE DIAGRAM

FIGURE 3-16

SHT. 2 of 2

REV. P1



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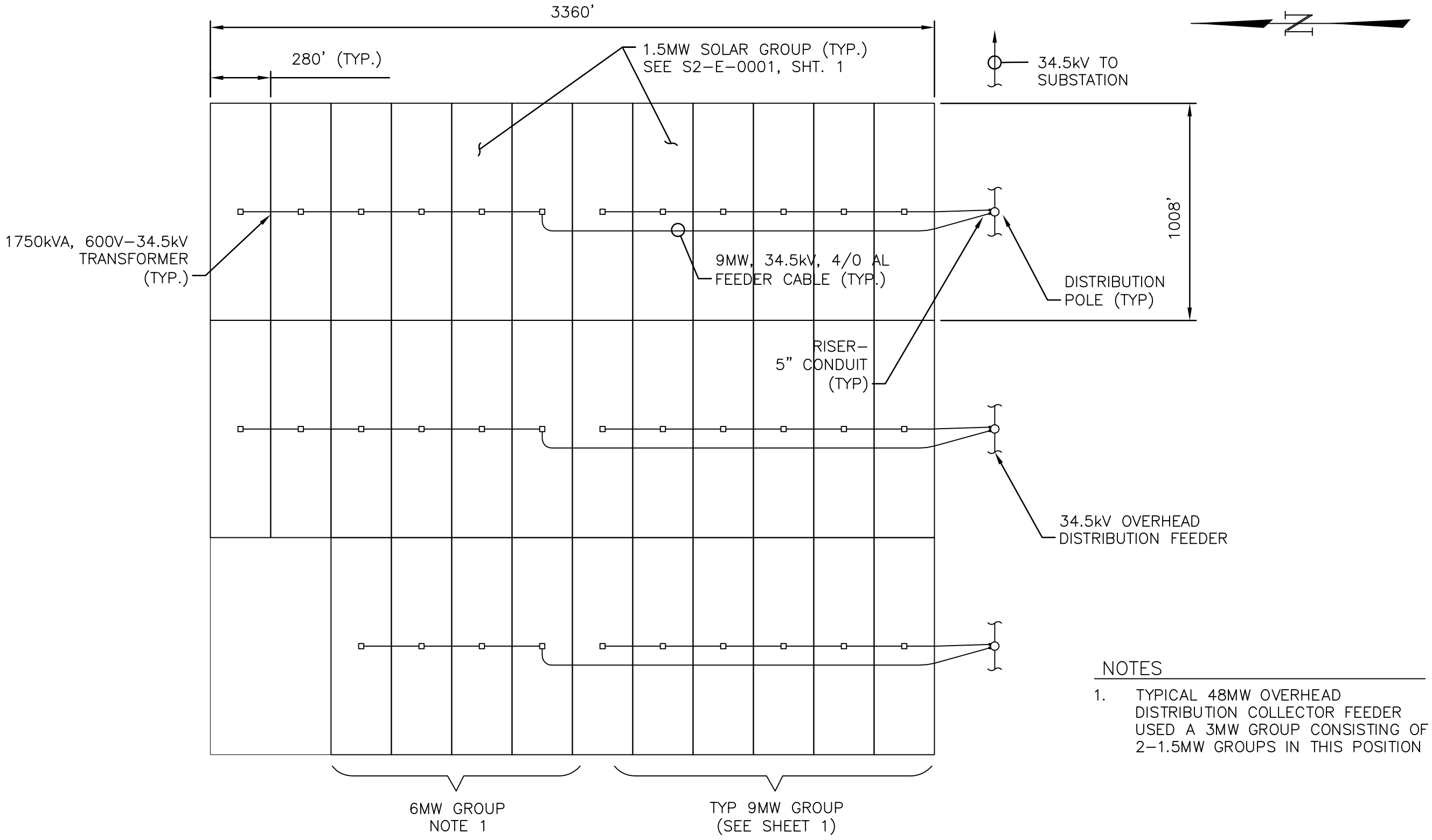
SCALE 1"=240'		APP.	DATE

PROJECT: 2000024301

Stirling Energy Systems

TITLE:
SOLAR ONE – 18MW FEEDER GROUP
GENERAL ARRANGEMENT

FIGURE 3-17 | SHT. 1 of 2 | REV. P1



TYPICAL 51MW OVERHEAD DISTRIBUTION COLLECTOR FEEDER

NOTES

1. TYPICAL 48MW OVERHEAD DISTRIBUTION COLLECTOR FEEDER USED A 3MW GROUP CONSISTING OF 2-1.5MW GROUPS IN THIS POSITION

PRELIMINARY

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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/03/08
SCALE 1"=400'		APP.	DATE

Stirling Energy Systems

PROJECT: 2000024301

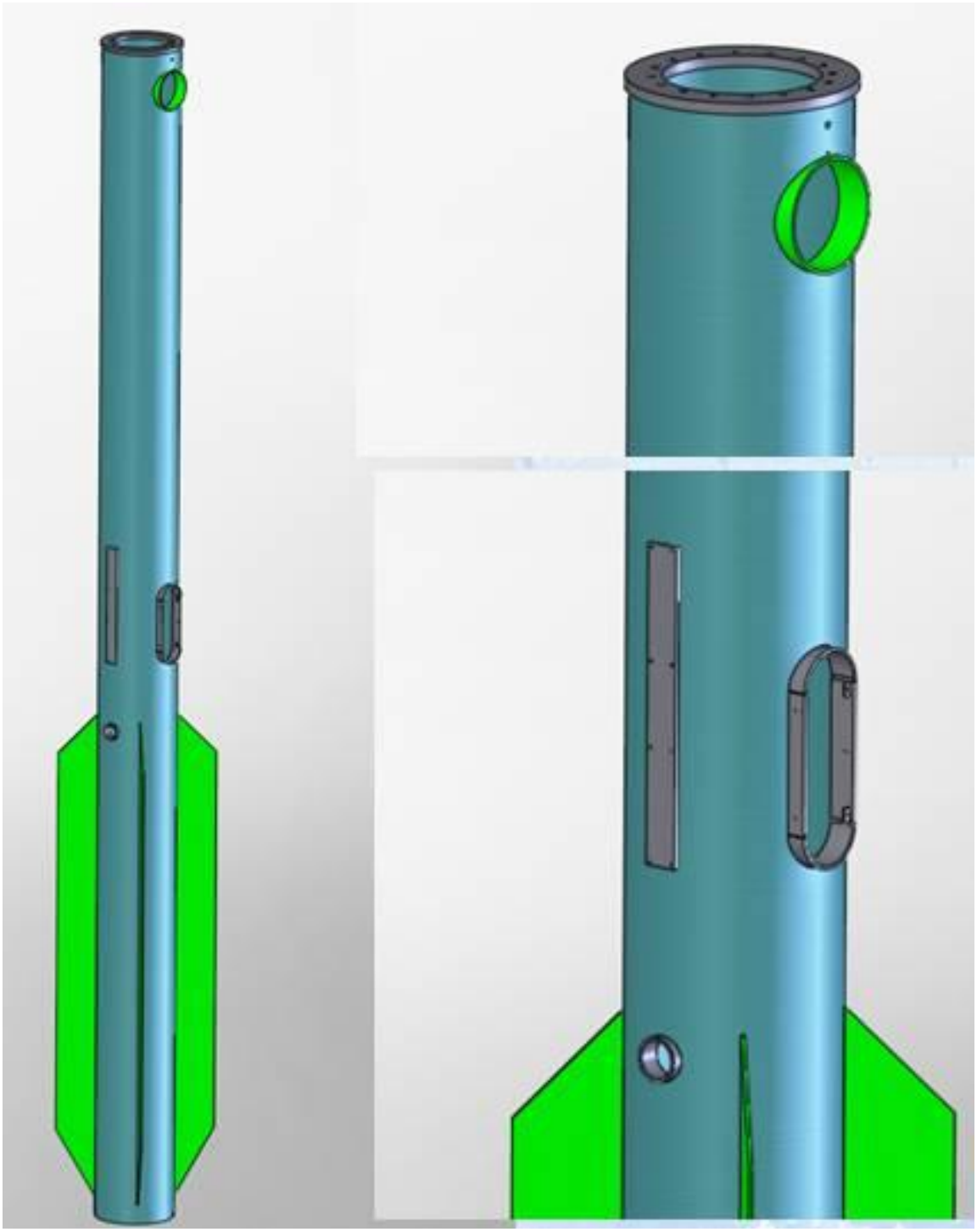
TITLE: SOLAR ONE – 51MW FEEDER GROUP GENERAL ARRANGEMENT

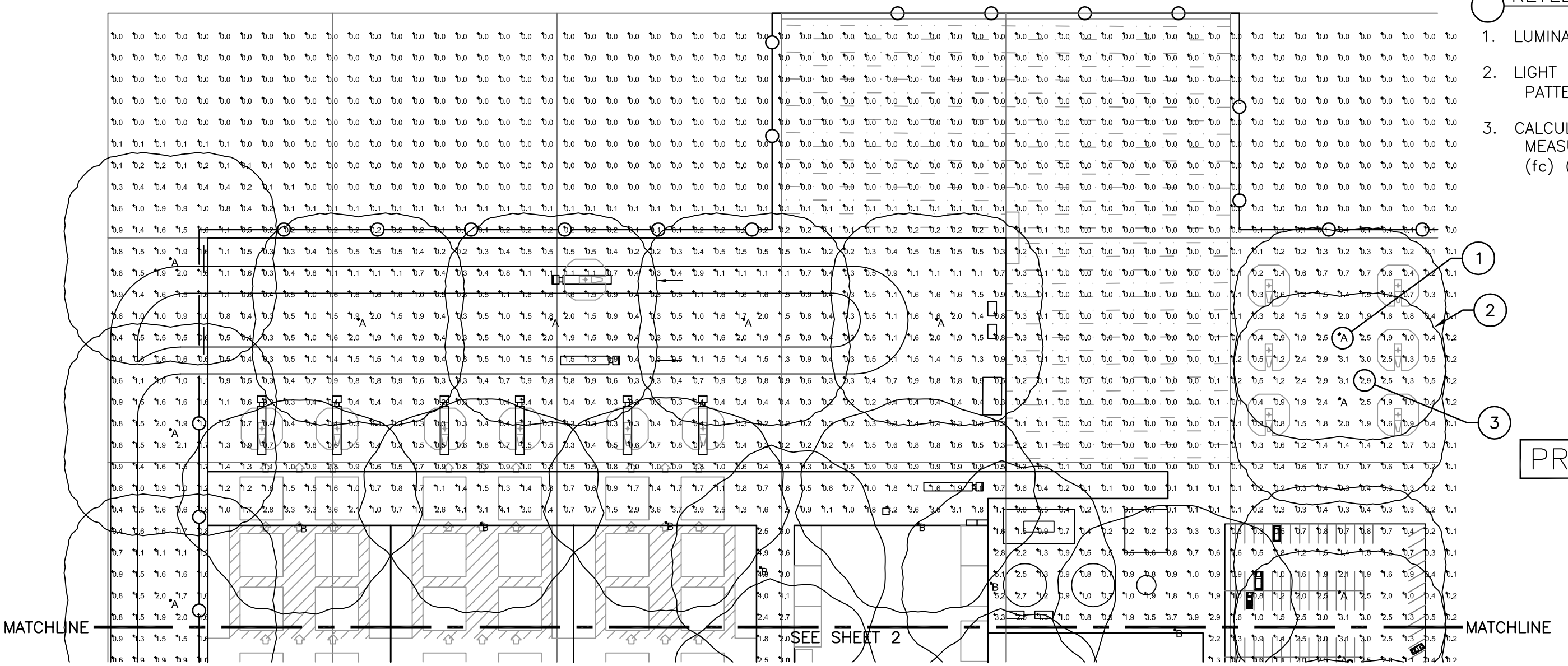
FIGURE 3-18

SHT. 2 of 2

REV. P1

Figure 3.4-13
Integrated Metal Fin Pipe Foundation/Pedestal





KEYED NOTES

1. LUMINAIRE TYPE (TYPICAL).
2. LIGHT FIXTURE DISTRIBUTION PATTERN (TYPICAL).
3. CALCULATED LIGHT LEVEL MEASURED IN FOOTCANDLES (fc) (TYPICAL).

PRELIMINARY

LUMINAIRE SCHEDULE

Symbol	Label	Qty	Catalog Number	Description	Lamp	File	Lumens	LLF	Watts
○	A	50	KVF 400S SYMFL/SSS27.5	SQUARE AREA LIGHT, SYMMETRIC DISTRIBUTION, FLAT LENS.	ONE 400-WATT CLEAR ED-18 HIGH PRESSURE SODIUM, VERTICAL BASE UP POSITION.	ltl9438.IES	50000	0.81	468
□	B	13	KSF2 400S R4W WM	ARM MOUNTED PREMIUM CUTOFF W/R4W REFL, CLEAR GLASS FLAT LENS.	ONE 400-WATT CLEAR ET-18 HIGH PRESSURE SODIUM, HORIZONTAL POSITION.	Ltl8506.IES	50000	0.81	468

STATISTICS

Description	Symbol	Avg	Max	Min	Max/Min	Avg/Min
ENTIRE SITE	+	0.8 fc	5.5 fc	0.0 fc	N / A	N / A

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SCALE 1"=100'		APP.	DATE

Stirling Energy Systems

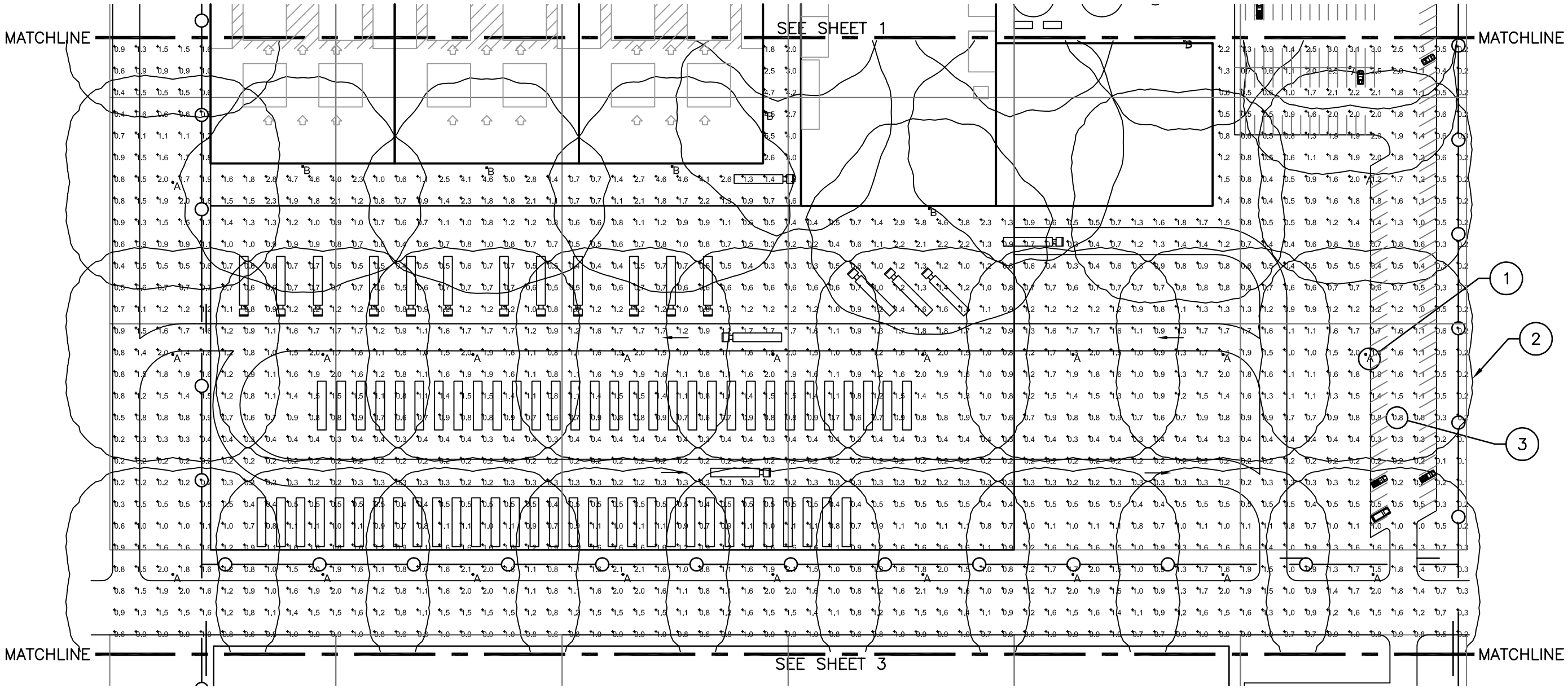
PROJECT: 2000024301

TITLE:
MAIN SERVICES COMPLEX
LIGHTING SITE PLAN PART A

FIGURE 3–20

SHT. 1 of 3

REV. P2



KEYED NOTES

1. LUMINAIRE TYPE (TYPICAL).
2. LIGHT FIXTURE DISTRIBUTION PATTERN (TYPICAL).
3. CALCULATED LIGHT LEVEL MEASURED IN FOOTCANDLES (fc) (TYPICAL).

PRELIMINARY

NO.	DATE		BY	APP.
P1	04/23/07	ISSUED FOR PRELIMINARY REVIEW	PH	
P2	04/16/08	REVISED ADMIN. & MAINT. BUILDINGS FOR 750MW	PH	
P3	11/18/08	ISSUED FOR REVIEW	SD	

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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/03/08
SCALE 1"=100'		APP.	DATE

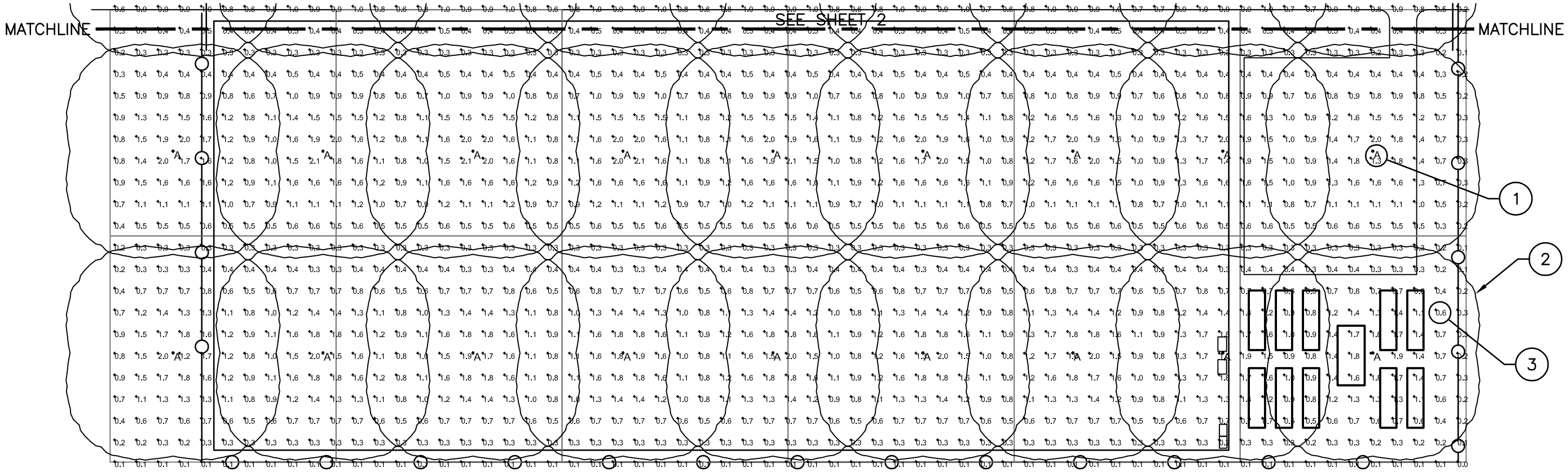
PROJECT: 2000024301

TITLE:
MAIN SERVICES COMPLEX
LIGHTING SITE PLAN PART B

FIGURE 3-21

SHT. 2 of 3

REV. P3



KEYED NOTES

1. LUMINAIRE TYPE (TYPICAL).
2. LIGHT FIXTURE DISTRIBUTION PATTERN (TYPICAL).
3. CALCULATED LIGHT LEVEL MEASURED IN FOOTCANDLES (fc) (TYPICAL).

PRELIMINARY

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SCALE 1"=100'		APP.	DATE

PROJECT: 2000024301

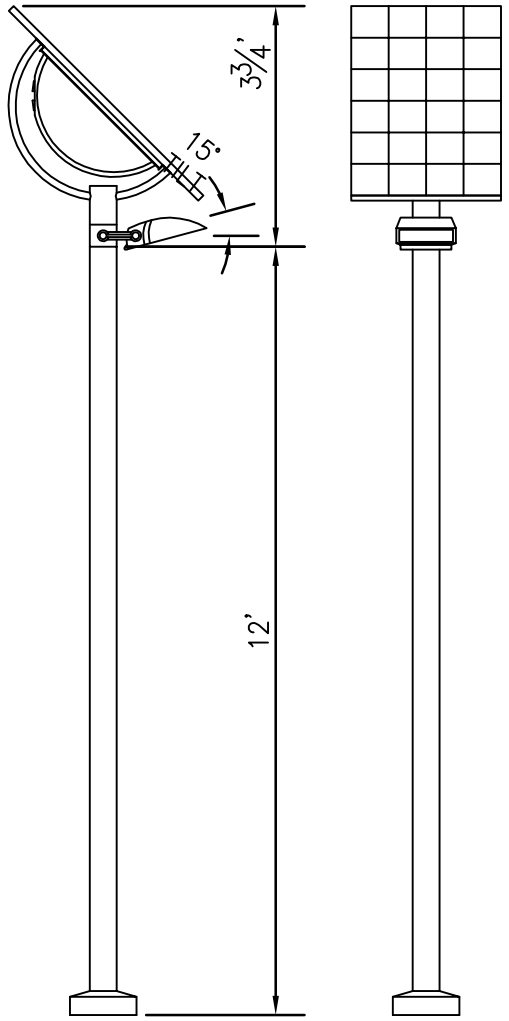
TITLE:

MAIN SERVICES COMPLEX LIGHTING SITE PLAN PART C

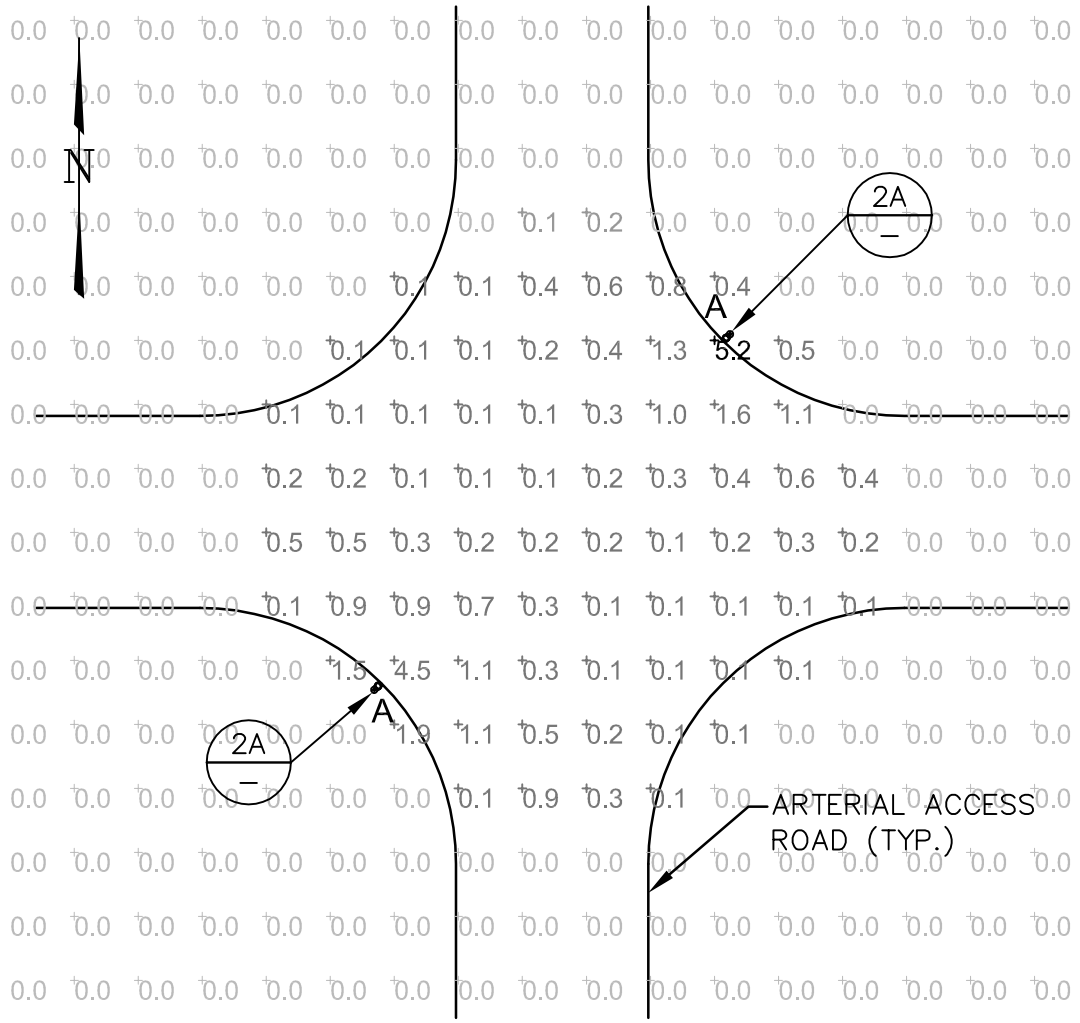
FIGURE 3-22

SHT. 3 of 3

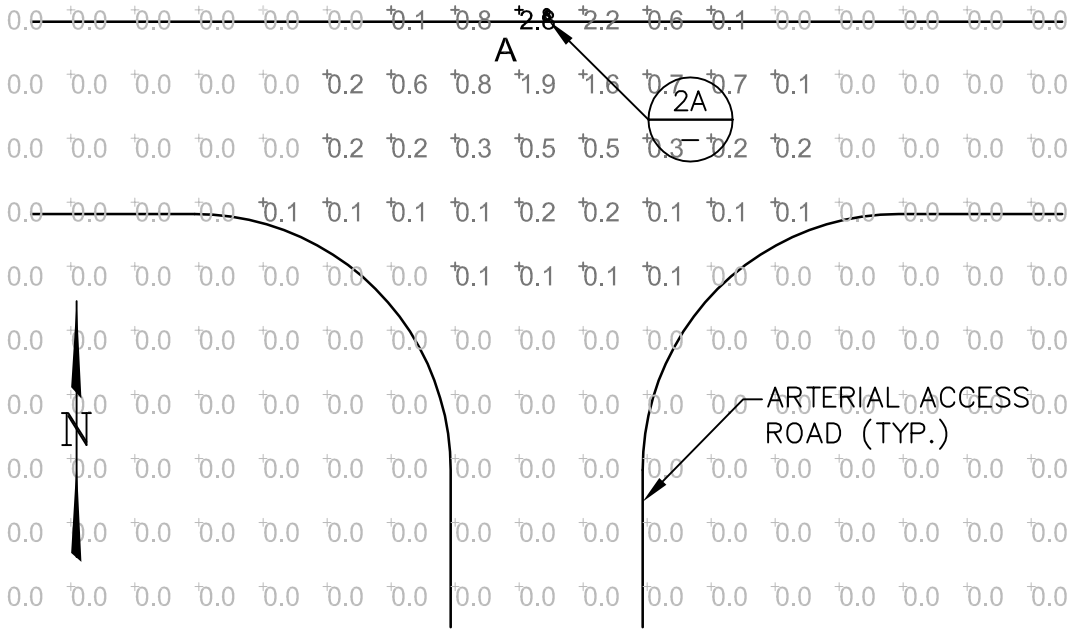
REV. P1



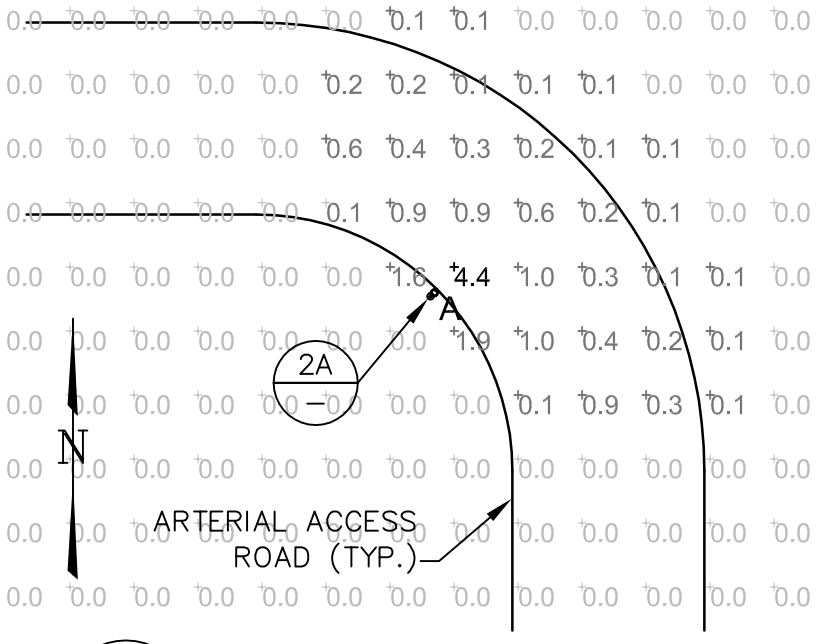
2A / — TYPICAL SELF-POWERED LAMP
SE'LUX SONNELITER SERIES SDS2
SCALE: 1"=3'-0"



— / — TYPICAL 4-WAY INTERSECTION LIGHTING
SCALE: 1"=30'



— / — TYPICAL 3-WAY INTERSECTION LIGHTING
SCALE: 1"=30'



— / — TYPICAL CURVE LIGHTING
SCALE: 1"=30'

PRELIMINARY

LUMINAIRE SCHEDULE

SYMBOL	LABEL	QTY	CATALOG NUMBER	DESCRIPTION	LAMP	FILE	LUMENS	LLF	WATTS
	A	4	SDS2 9T H035T6 (SonneLITER)	CAST ALUMINUM FIXTURE SEGMENTED REFLECTOR.	TESTED WITH ONE 70-WATT T6 CERAMIC METAL HALIDE, G12 BASE, RATED 6600 INITIAL LUMENS EACH.	SDS2-9T-H035T6.IES	3400	1.00	88

NO.	DATE		BY	APP.
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DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 11/07/08
SCALE NONE		APP.	DATE

PROJECT: 2000024301

TITLE:
SOLAR ONE – TYPICAL ROADWAY LIGHTING & PHOTOMETRIC DETAILS

FIGURE 3-23

SHT. 1 of 1

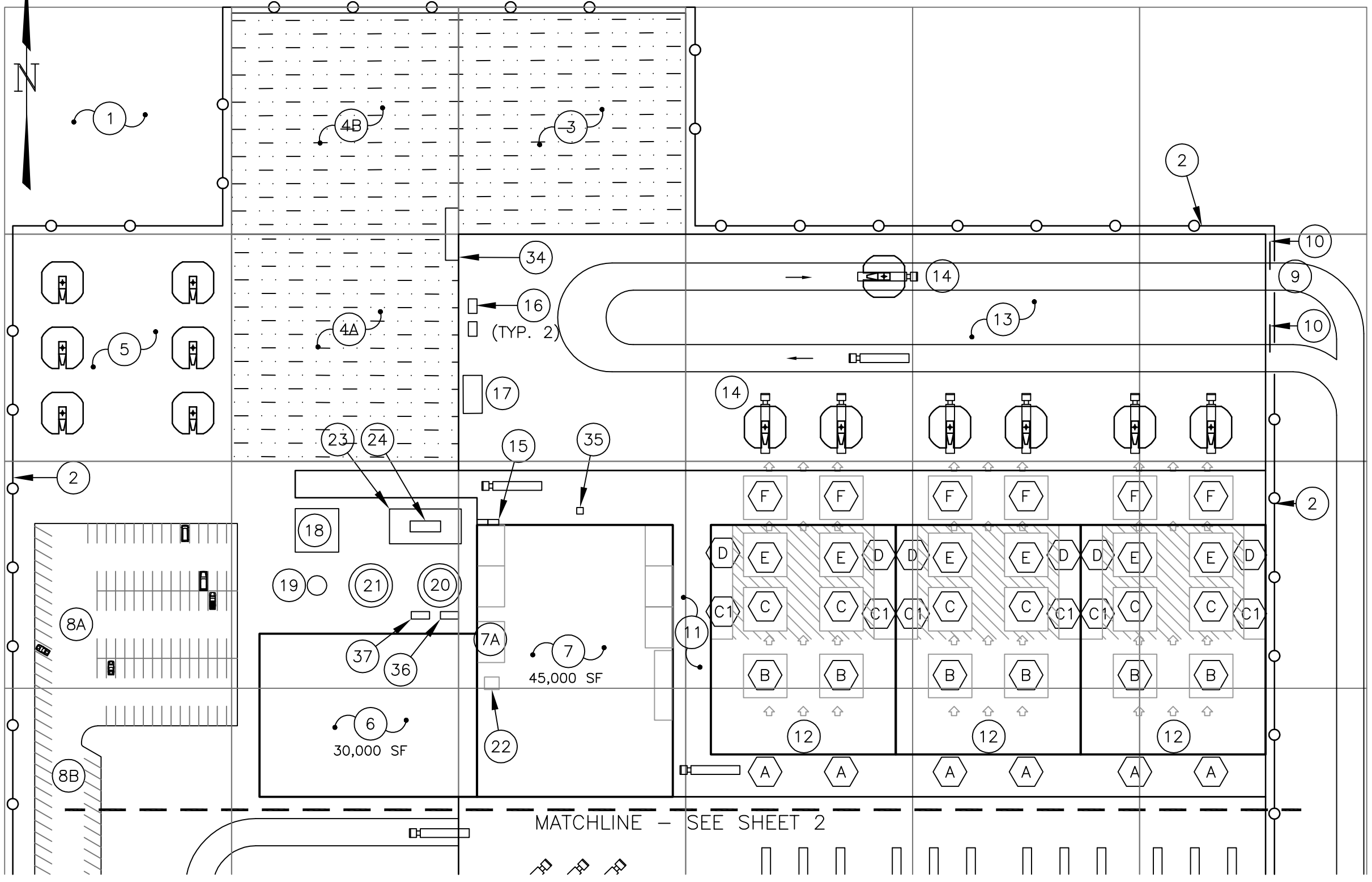
REV. P1

0 100' 200'
SCALE

N

GENERAL NOTE

THIS DRAWING INDICATES 21 ACRES OF THE TOTAL 42 ACRE ADMINISTRATION, ASSEMBLY & CONSTRUCTION AREA.



KEYED NOTES

1. 1 ACRE SECTION (TYP. FOR ALL)
2. PERIMETER FENCE
3. 1 ACRE RETENTION PONDS
4A. 1 ACRE CONCRETE LINED EVAPORATION POND
4B. 1 ACRE CONCRETE LINED EVAPORATION POND
5. CSP DISH DISPLAY/VISITOR AREA
6. ADMINISTRATION BLDG. (200'Wx150'L)
7. 44' TALL MAINTENANCE BLDG. (180'Wx250'L)
7A. CHEMICAL STORAGE AREA
8A. EMPLOYEE PARKING LOT, PAVED (185'Wx185'L)
8B. EMPLOYEE PARKING LOT, PAVED (60'Wx340'L)
9. ON–SITE ROAD, PAVED
10. ACCESS GATE
11. CSP DISH ASSEMBLY BAY, CONCRETE PAD (300'Wx725'L)
12. ASSEMBLY BUILDING 170'Wx211'Lx77'–7"H (TYP. OF 3)
13. PAVED AREA FOR ASSEMBLED DISH TRANSPORT & MAINTENANCE/DISH WASHING VEHICLES (620'Wx220'L)
14. TRUCK CAB W/ TRAILER OR FLAT BED (TYP. FOR ALL)
15. (2) 8 CU. YD. DUMPSTERS
16. 5000 GALLON FUEL STORAGE (W/ CONTAINMENT) FOR ON–SITE VEHICLES (8' DIAx13'–4")
17. STORAGE AREA FOR 100 HYDROGEN BOTTLES (15'Wx75'L)
18. 40'Wx40'L WATER TREATMENT AREA WITH PROT. ROOF.
19. POTABLE WATER TANK FED BY 2" WATER LINE (18' DIAx10' TALL)
20. FIRE PROTECTION/MIRROR WASHING WATER TANK (40' DIAx20' TALL)
21. RAW WATER TANK (40' DIAx20' TALL)
22. 150 GALLON LUBRICATING OIL RECYCLING TANK.
23. ALTERNATE 1: ABOVE GROUND 10,000 GALLON/DAY CAPACITY WASTE WATER TREATMENT FACILTY (66'–0"L x 32'–0"W)
24. ALTERNATE 2: BELOW GROUND 10,000 GALLON SEWAGE HOLDING TANK (20'L x 10'W x 8'H)
34. BACKHOE ACCESS RAMP
35. ELECTRIC SERVICE TRANSFORMER
36. DIESEL FIRE PUMP
37. DIESEL STANDBY ELECTRIC GENERATOR

CSP DISH ASSEMBLY PATH

A. PARTS STORAGE AREA
B. STRUCTURE ASSEMBLY AREA
C. MIRROR ASSEMBLY AREA
C1. MIRROR ASSEMBLY STAGING AREA
D. TESTING AREA
E. CALIBRATION AREA
F. COMPLETED ASSEMBLY TRANSPORT AREA

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Stirling Energy Systems

PROJECT: 2000024301

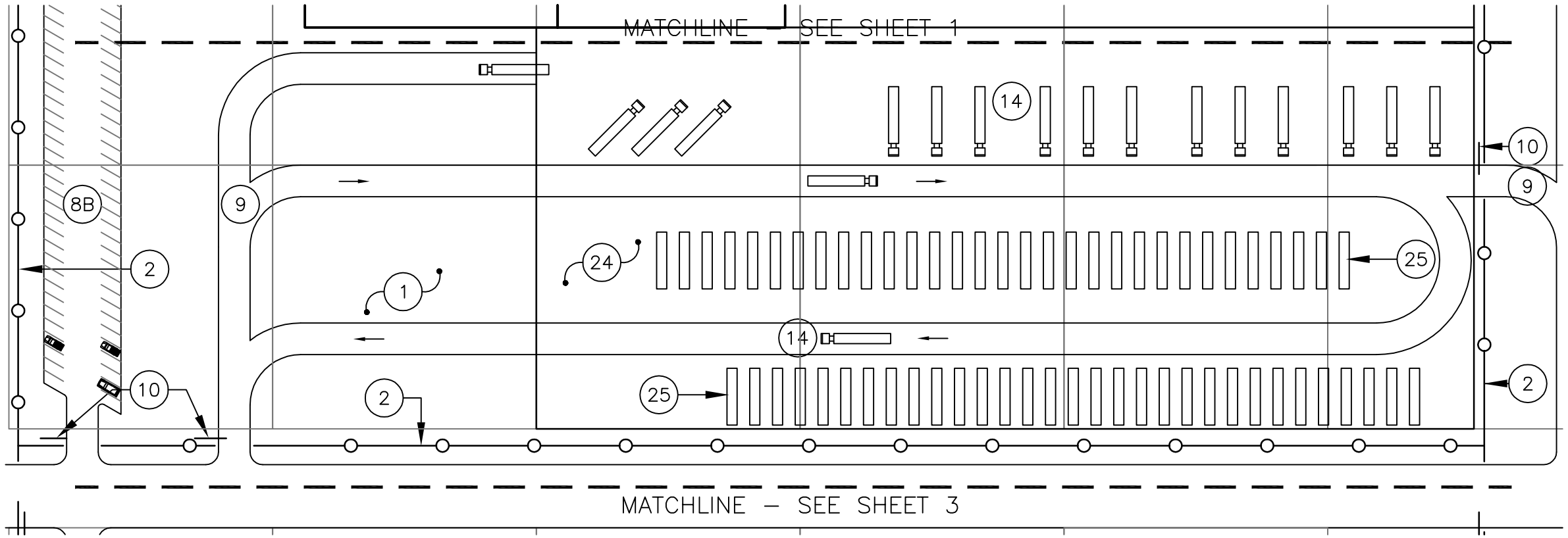
TITLE:

MAIN SERVICES COMPLEX SITE PLAN, PART A

FIGURE 3–24

SHT. 1 of 4

REV. P1

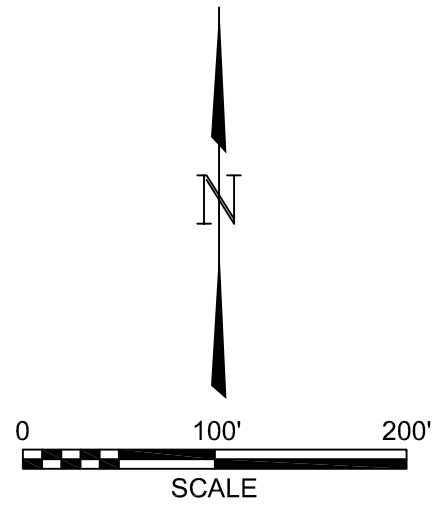


GENERAL NOTE

THIS DRAWING INDICATES 7 ACRES OF THE TOTAL 42 ACRE ADMINISTRATION, ASSEMBLY & CONSTRUCTION AREA.

KEYED NOTES

1. 1 ACRE SECTION (TYP. FOR ALL)
2. PERIMETER FENCE
8B. EMPLOYEE PARKING LOT, PAVED (60'Wx340'L)
9. ON–SITE ROAD, PAVED
10. ACCESS GATE
14. TRUCK CAB W/ TRAILER OR FLAT BED (TYP. FOR ALL)
24. PAVED AREA FOR DISH SUB–ASSEMBLY & COMPONENT DROP OFF AND OPERATIONS & MAINTENANCE SUPPLIES
25. ASSEMBLY PARTS TRAILER STORAGE AREA
26. SITE ARTERIAL ROAD



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Stirling Energy Systems

PROJECT: 2000024301

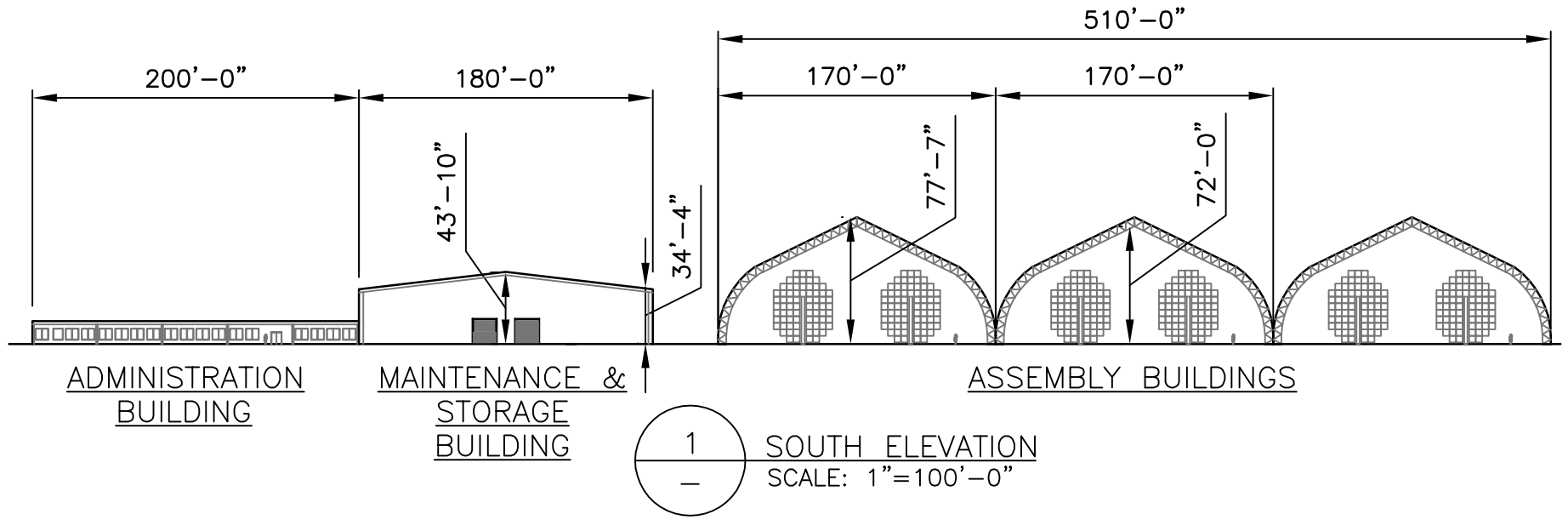
TITLE:

MAIN SERVICES COMPLEX SITE PLAN, PART B

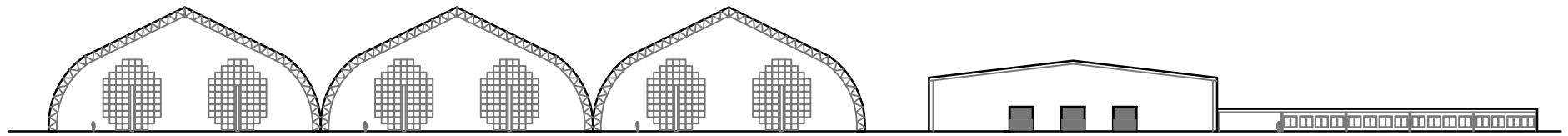
FIGURE 3–25

SHT. 2 of 4

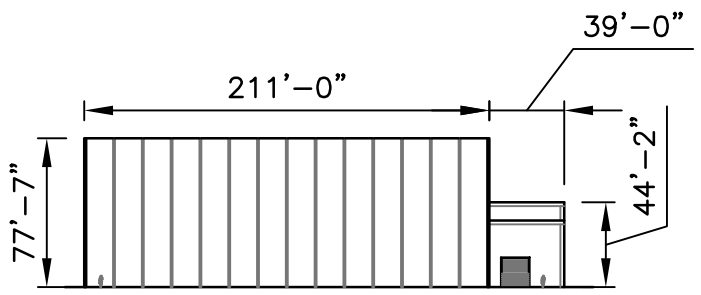
REV. P1



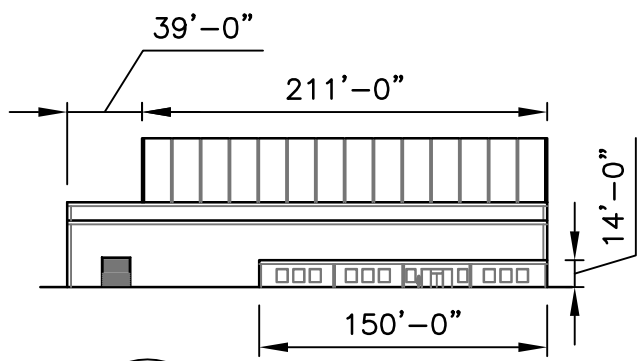
1 — SOUTH ELEVATION
SCALE: 1"=100'–0"



2 — NORTH ELEVATION
SCALE: 1"=100'–0"



3 — EAST ELEVATION
SCALE: 1"=100'–0"



4 — WEST ELEVATION
SCALE: 1"=100'–0"

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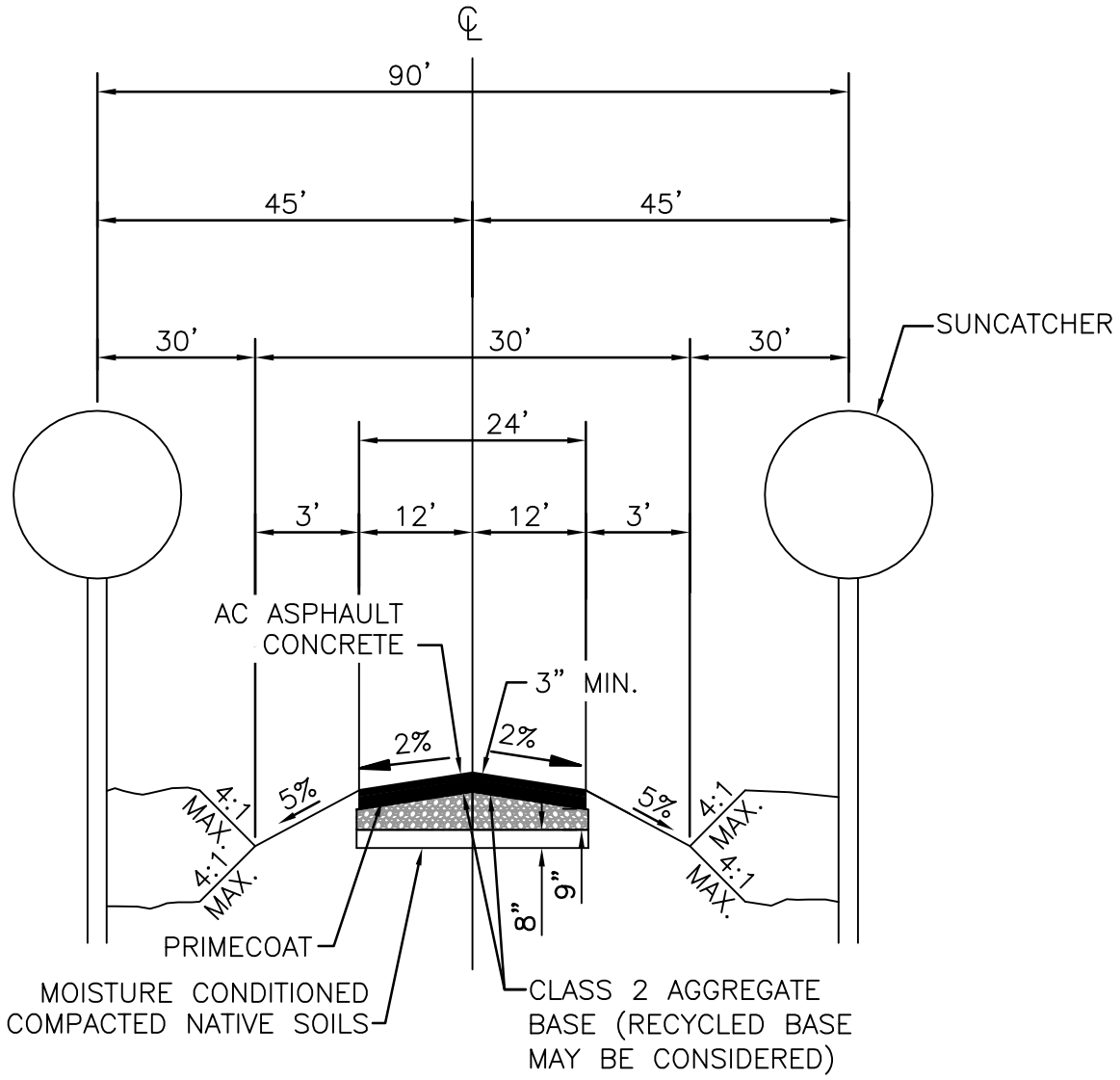
TITLE: MAIN SERVICES COMPLEX ELEVATION VIEW

FIGURE 3–26

SHT. 4 of 4

REV. P1



ARTERIAL ROADS (TYPICAL)

(N.T.S.)

NOTE

THIS SECTION IS BASED ON SAN BERNARDINO COUNTY PUBLIC WORKS DEPARTMENT _____. WITH STRUCTURAL SECTION BASED ON DWG. NO. _____.

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SES Stirling Energy Systems

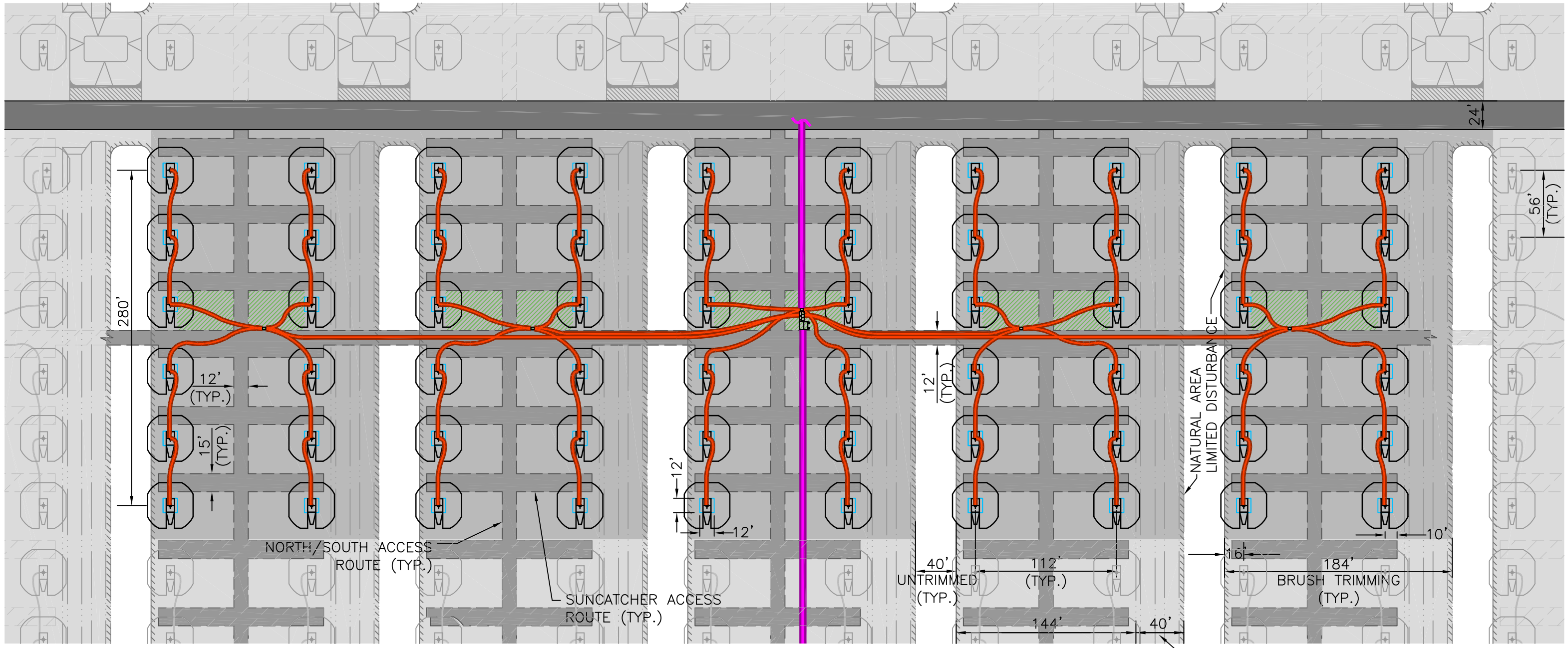
PROJECT: 2000024301

TITLE:
SOLAR ONE
PAVED ARTERIAL ROADS

FIGURE 3–27

SHT. 1

REV. P1



N

NOT TO SCALE

LEGEND

- BRUSH TRIMMING
- UNPAVED ACCESS ROUTE
- PAVED ROADWAYS
- SUNCATCHER UNIT
- SUNCATCHER PAD CLEARING
- 1,750 kVA TRANSFORMER, JUNCTION BOX, AND EAST–WEST 600V COLLECTOR CABLE
- 600V COLLECTOR CABLE WITH 4' BUFFER
- 34.5kV CABLE WITH 12' BUFFER

NOTES

1. THIS IS A REPRESENTATION OF A 1.5MW SOLAR GROUP. THE 1.5MW SOLAR GROUPS WILL BE ARRANGED TO FIT THE CONTOURS OF THE SITE.
2. ONE 1.5MW SOLAR GROUP IS COMPRISED OF SIXTY (60) SUNCATCHER UNITS CONNECTED INTO FIVE (5) TWELVE–UNIT GROUPS CONNECTED TO A 600V, 400A COLLECTION PANELBOARD.

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SCALE 1"=80'–0"		APP.	DATE

PROJECT: 2000024301

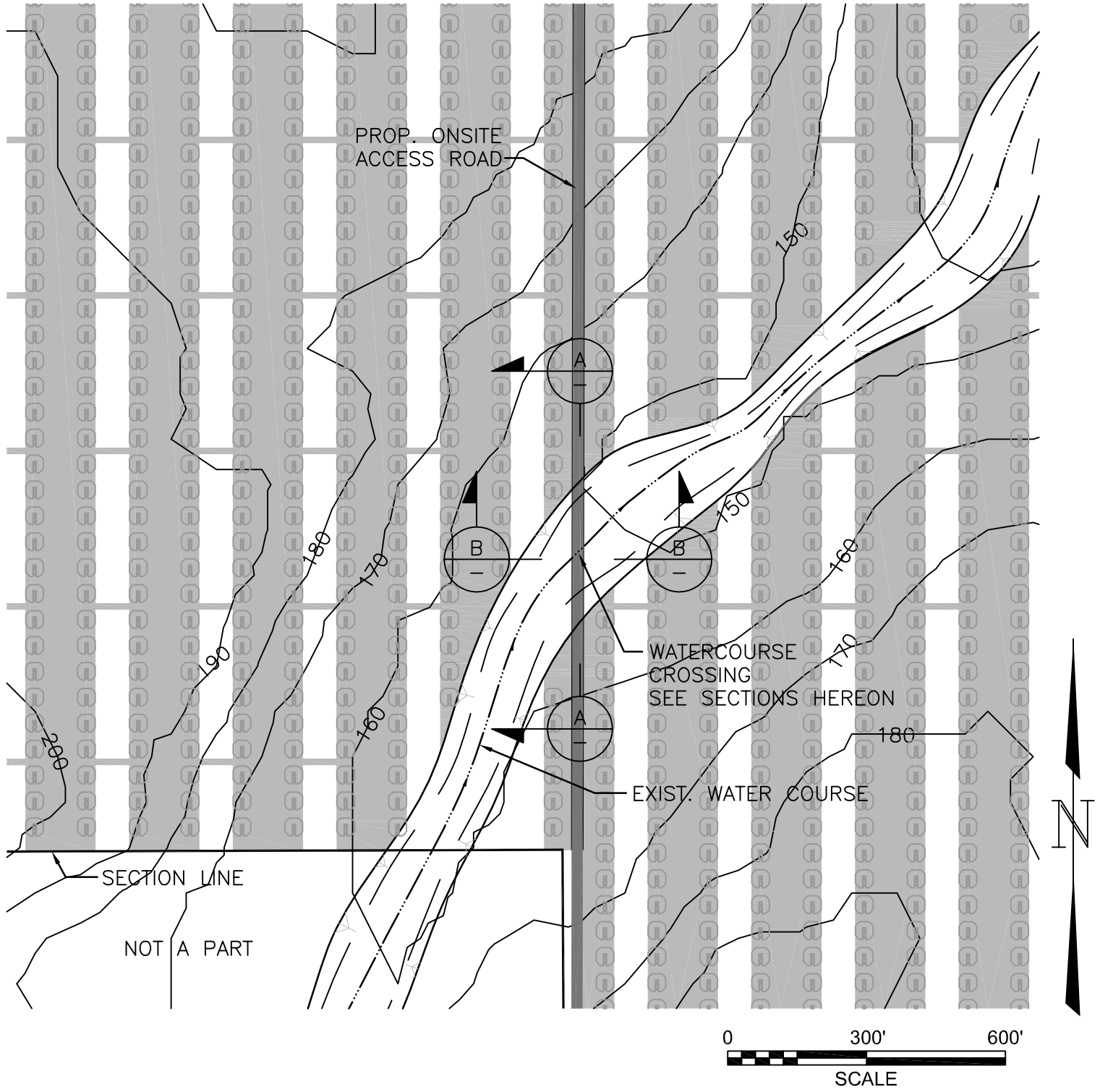
TITLE:

1.5MW SOLAR GROUP CONSTRUCTION DISTURBANCE PLAN

FIGURE 3–28

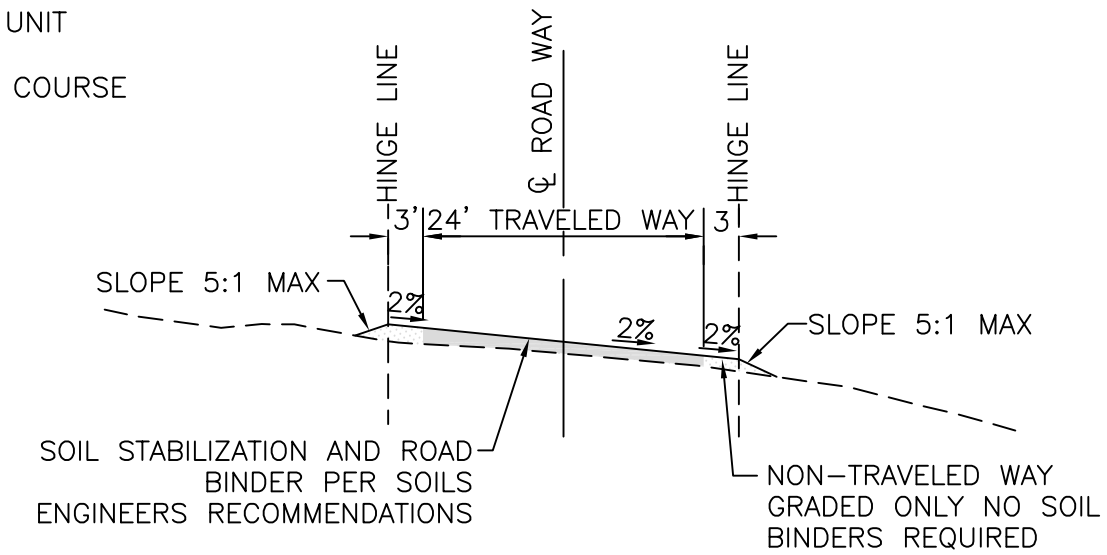
SHT. 1 of 1

REV. P1



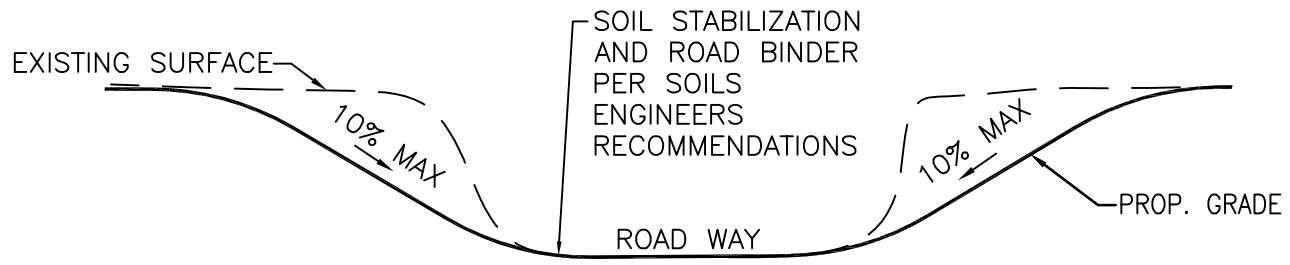
LEGEND

- BRUSH TRIMMING
- LIFE LINE ROAD WAY
- SUNCATCHER UNIT
- EXIST. WATER COURSE



SECTION B–B

SCALE: 1"=10'



SECTION A–A
(N.T.S.)

FIGURE 3.5–5

PRELIMINARY

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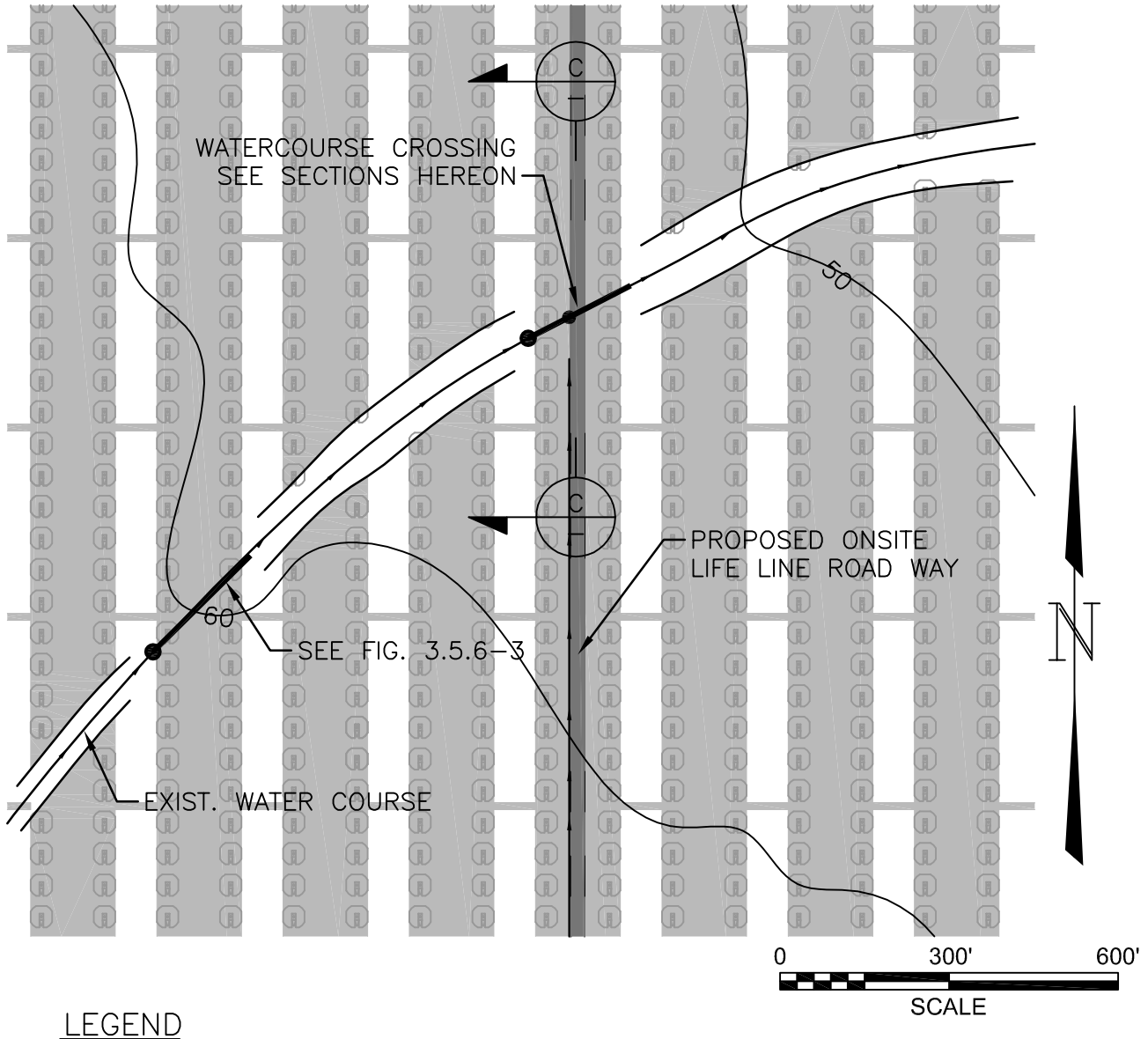
SCALE NONE		APP.	DATE

Stirling Energy Systems

TITLE:

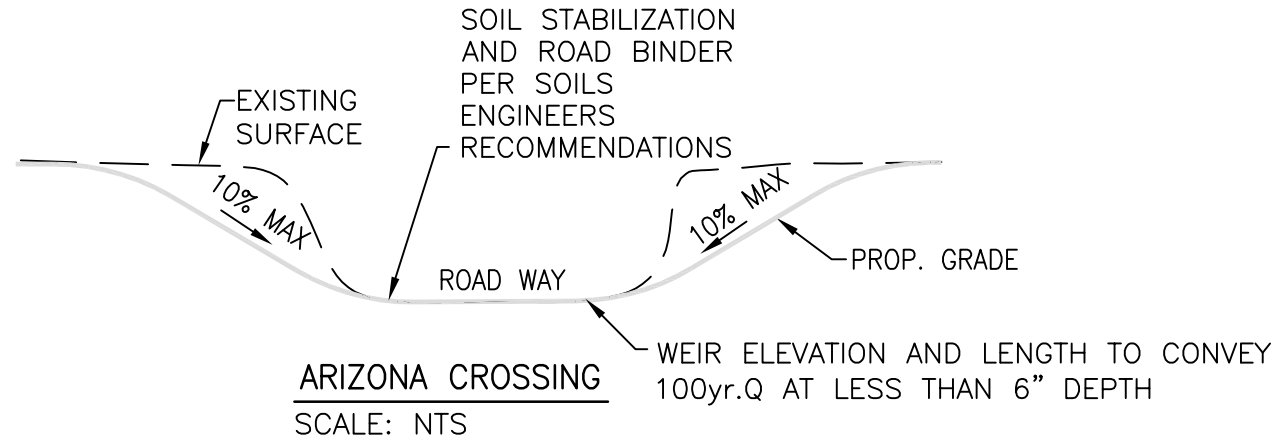
SOLAR ONE
ARIZONA CROSSING

PROJECT:		SHT.	REV.
2000024301	FIGURE 3–29	1	P1



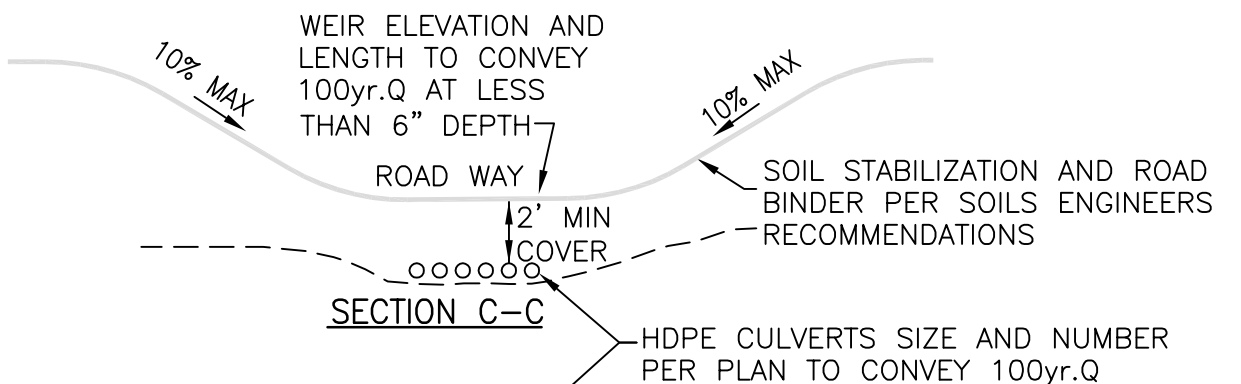
LEGEND

- BRUSH TRIMMING
- LIFELINE ROAD WAY
- SUNCATCHER UNIT
- EXIST. WATER COURSE
- HDPE CULVERT

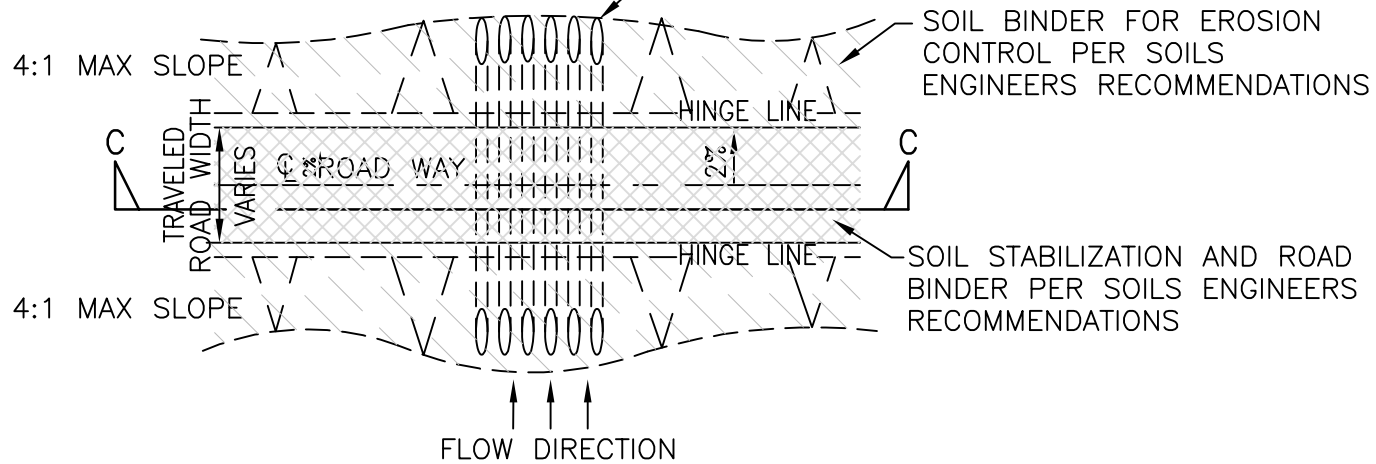


ARIZONA CROSSING

SCALE: NTS



SECTION C–C



ARIZONA CROSSING AT LIFE LINE ROAD WAY

SCALE: NTS

PRELIMINARY

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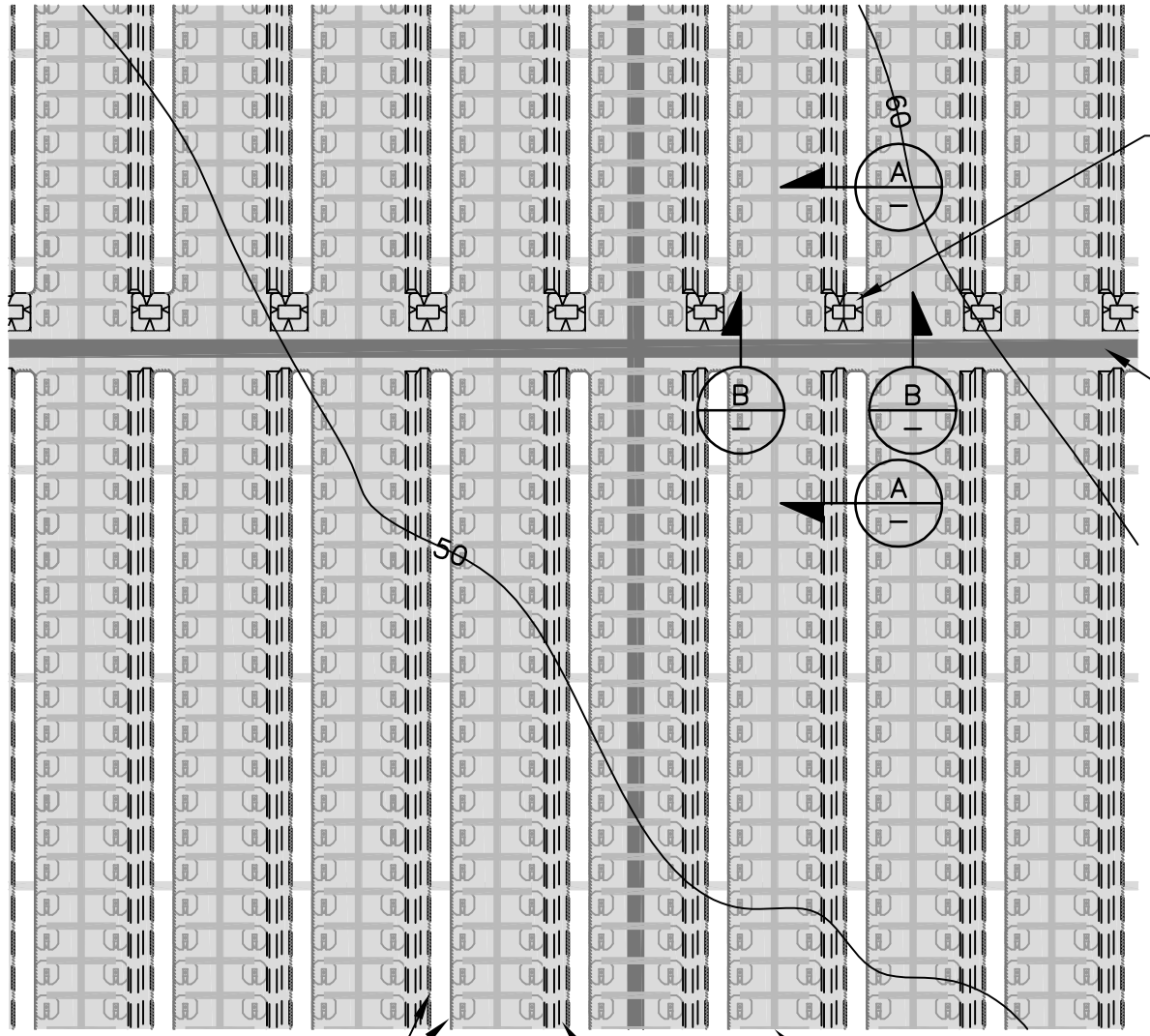
PROJECT: 2000024301

TITLE: SOLAR ONE – CULVERT CROSSING AT LIFE LINE ROAD WAY

FIGURE 3–30

SHT. 1

REV. P1



LEGEND

BRUSH TRIMMING

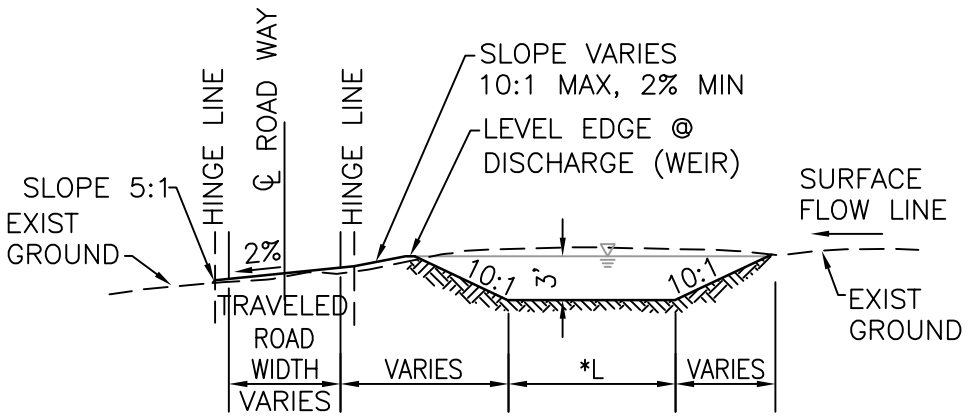
LOCAL ACCESS ROADS

ARTERIAL RAODWAY

SUNCATCHER UNIT

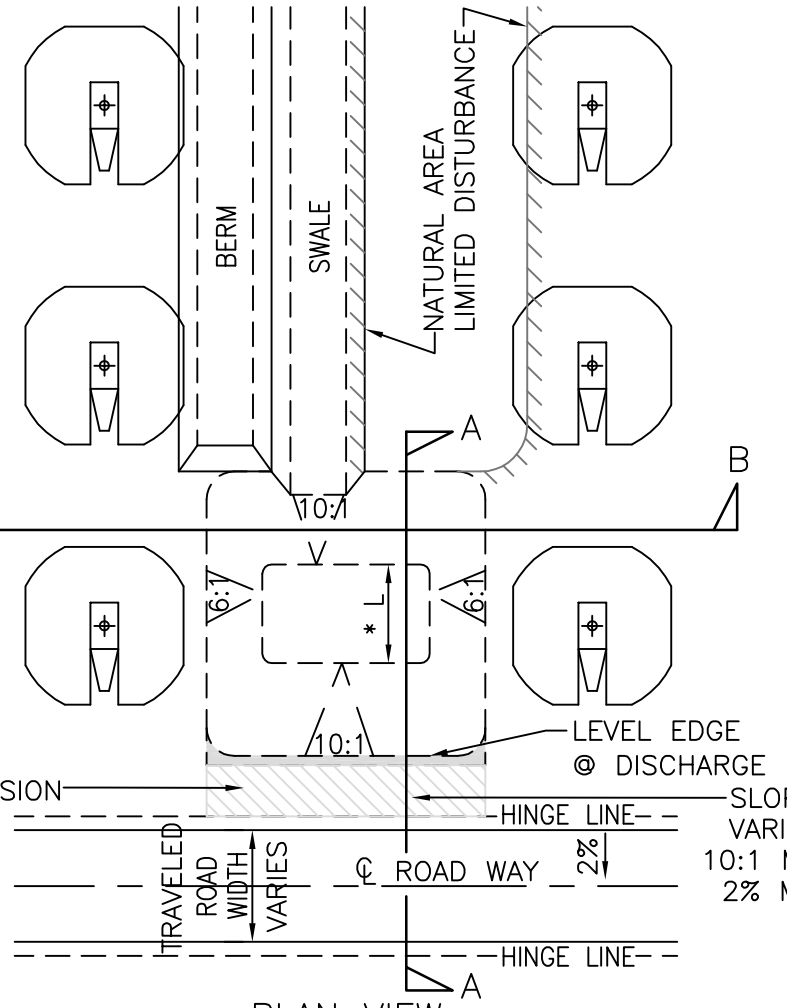
N

NOT TO SCALE



SECTION A–A

SECTION B–B
(N.T.S.)



* BASIN TYPE
'A' L=10'
'B' L=20'
'C' L=30'

PLAN VIEW

TYPICAL DE–SILT BASIN
(N.T.S.)

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TITLE:

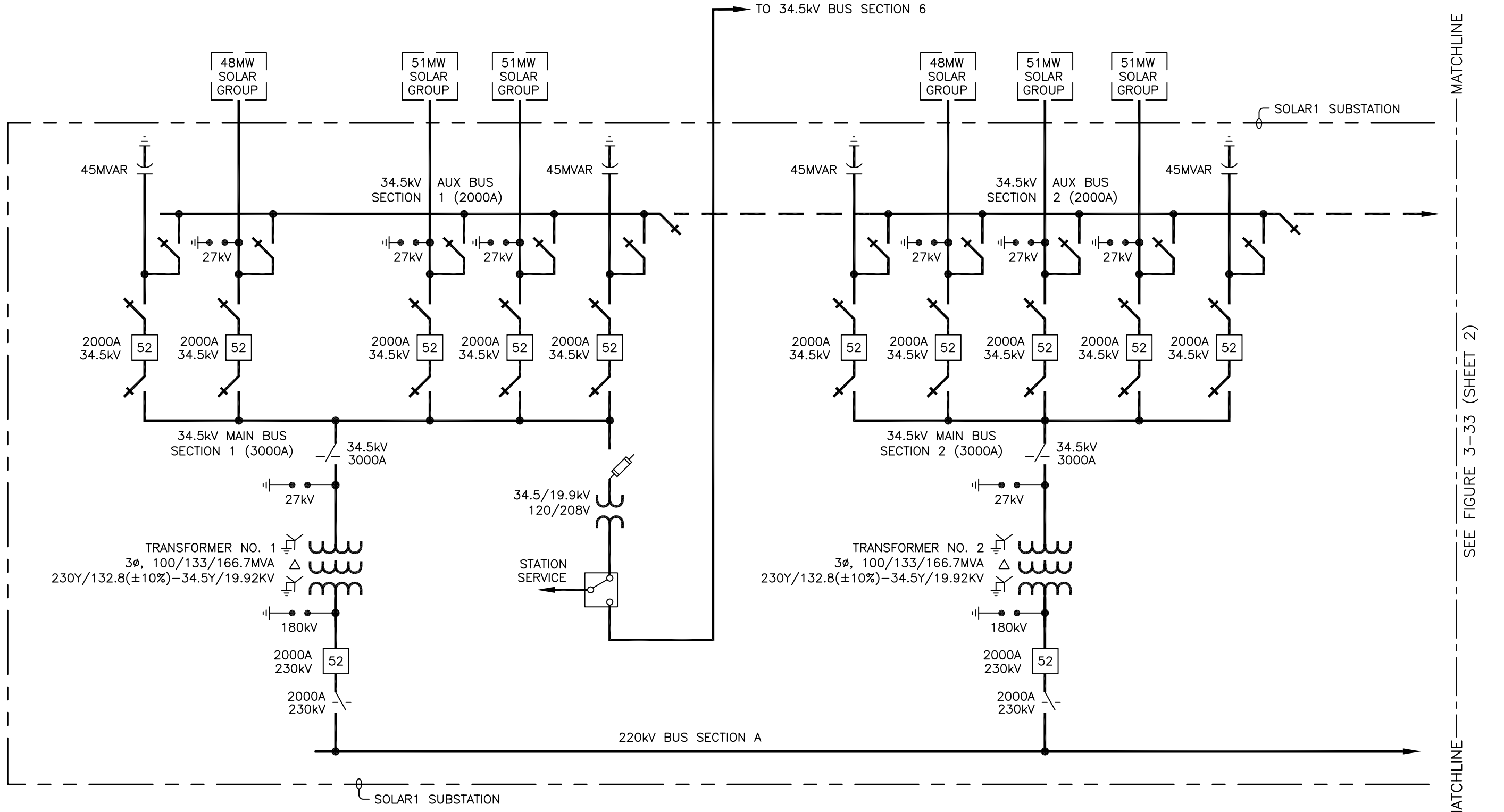
SOLAR ONE
DE–SILT BASIN

PROJECT: 2000024301

FIGURE 3–31

SHT. 1 of 1

REV. P1



NOTE

1. CAP BANK SIZE AND NUMBER OF SWITCHED STEPS TO BE DETERMINED.

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P3	11/07/08	REVISED CONFIGURATION; ISSUED FOR REVIEW	SD	
P4	11/18/08	REVISED PER SES COMMENTS; ISSUED FOR REVIEW	MDM	

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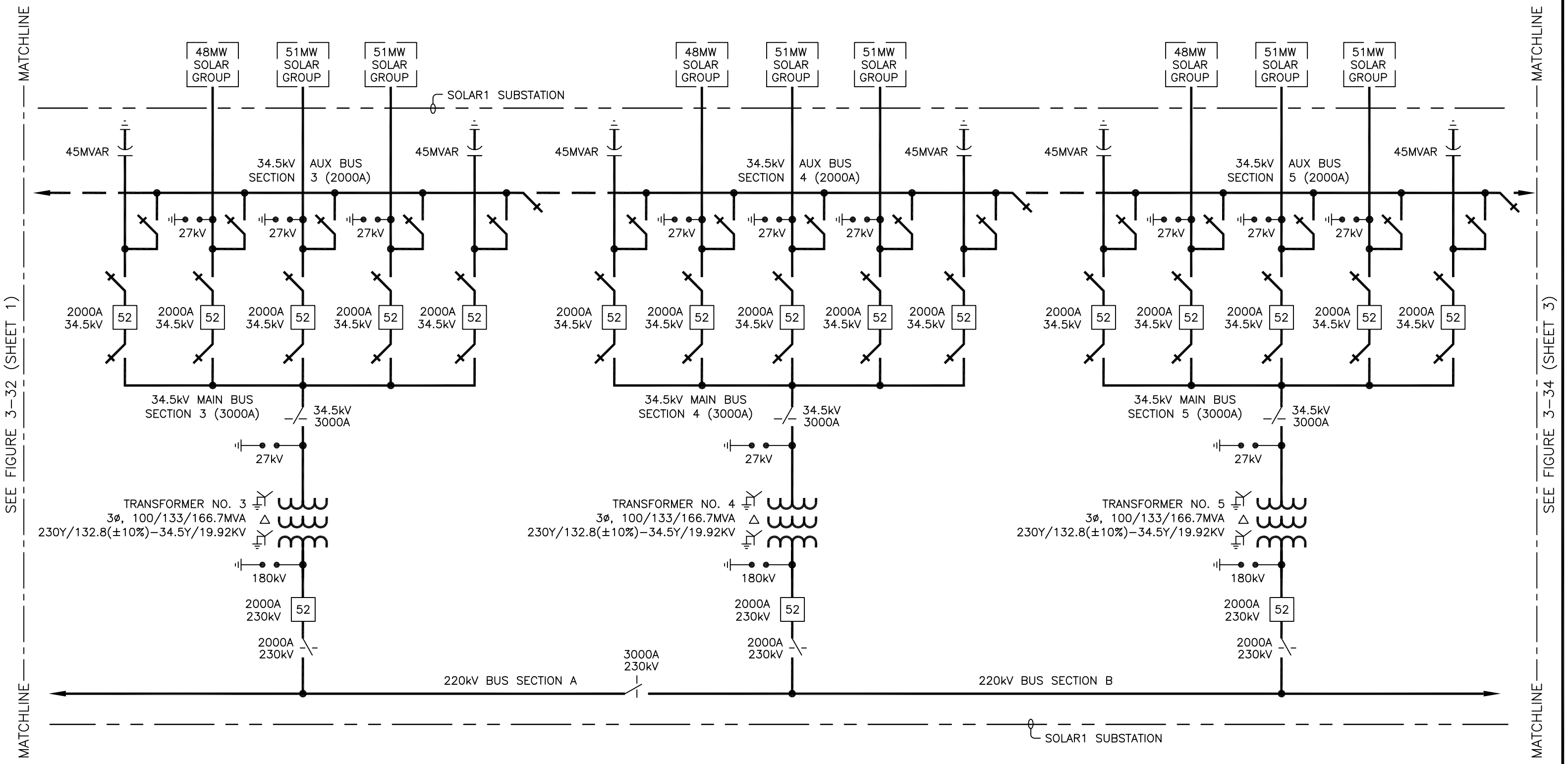
PROJECT: 2000024301

TITLE: 850MW SUBSTATION ONE LINE DIAGRAM

FIGURE 3–32

SHT. 1 of 3

REV. P4



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NO.	DATE		BY	APP.
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P2	08/07/07	REVISED UTILITY CONNECTION & COMPONENT LAYOUT	PH	
P3	11/07/08	REVISED CONFIGURATION; ISSUED FOR REVIEW	SD	
P4	11/18/08	REVISED PER SES COMMENTS; ISSUED FOR REVIEW	MDM	

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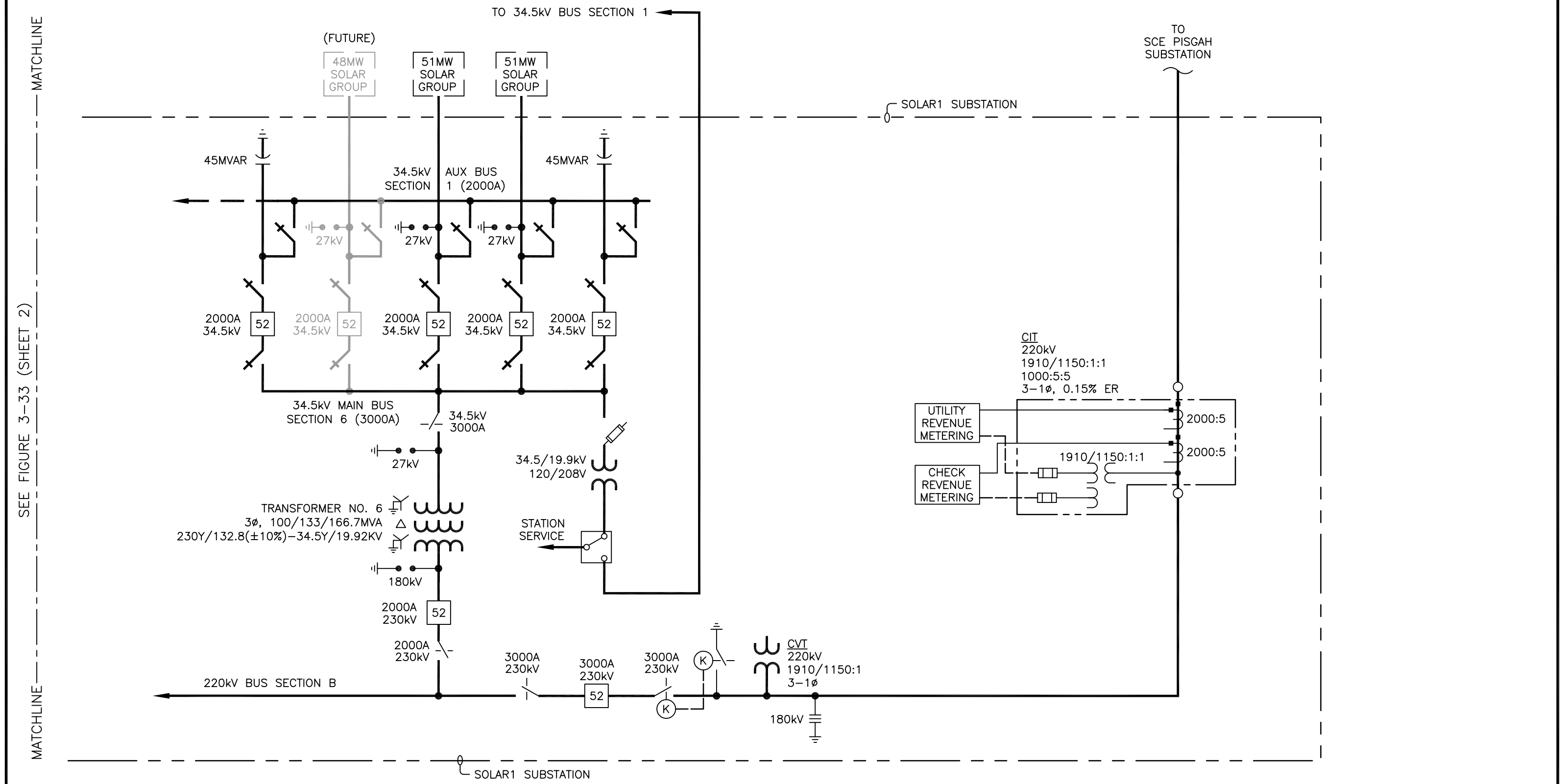
PROJECT: 2000024301

TITLE: 850MW SUBSTATION ONE LINE DIAGRAM

FIGURE 3-33

SHT. 2 of 3

REV. P4



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P3	11/07/08	REVISED CONFIGURATION; ISSUED FOR REVIEW	SD	
P4	11/18/08	REVISED PER SES COMMENTS; ISSUED FOR REVIEW	MDM	

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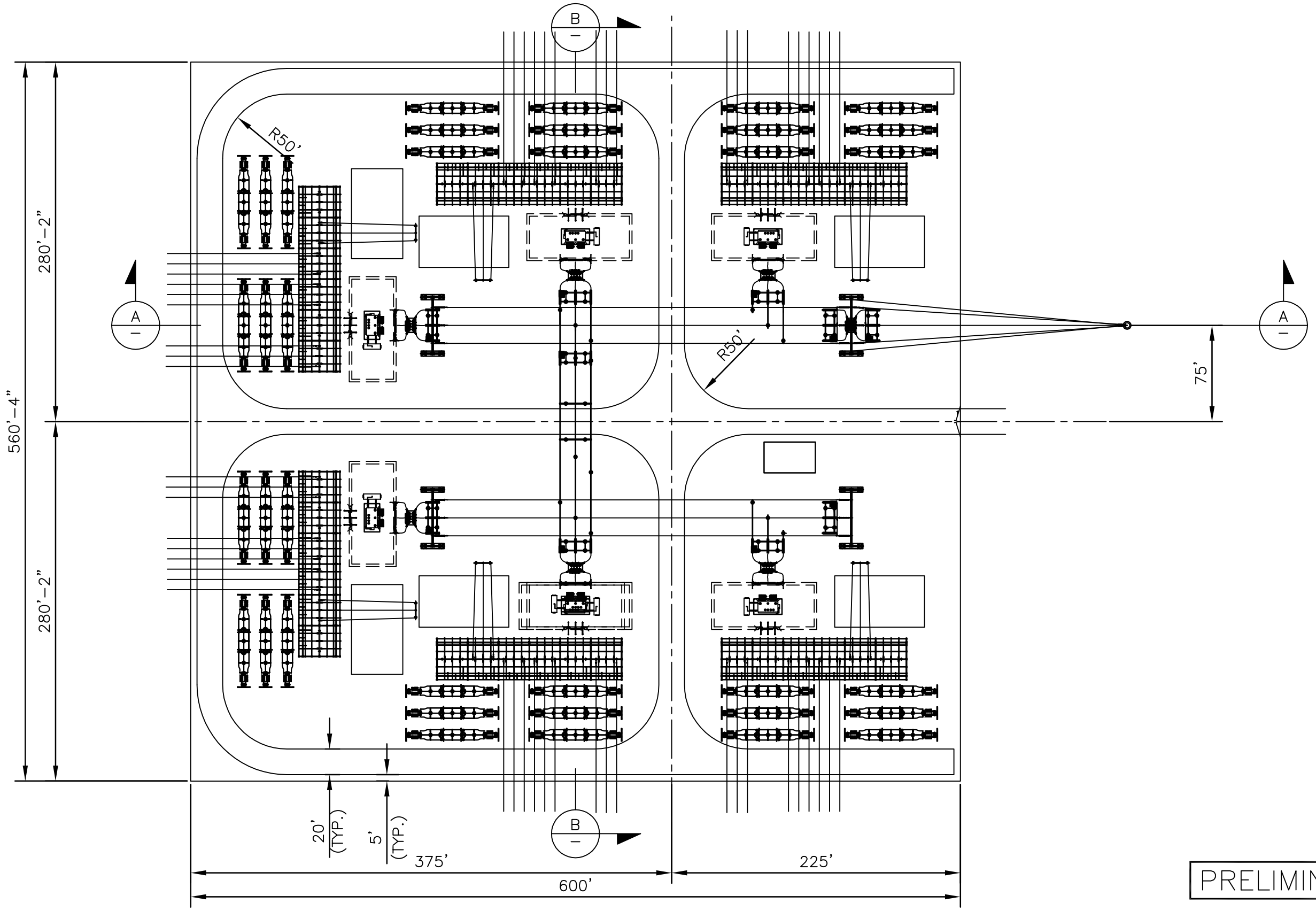
PROJECT: 2000024301

TITLE:
850MW SUBSTATION ONE LINE DIAGRAM

FIGURE 3-34

SHT. 3 of 3

REV. P4



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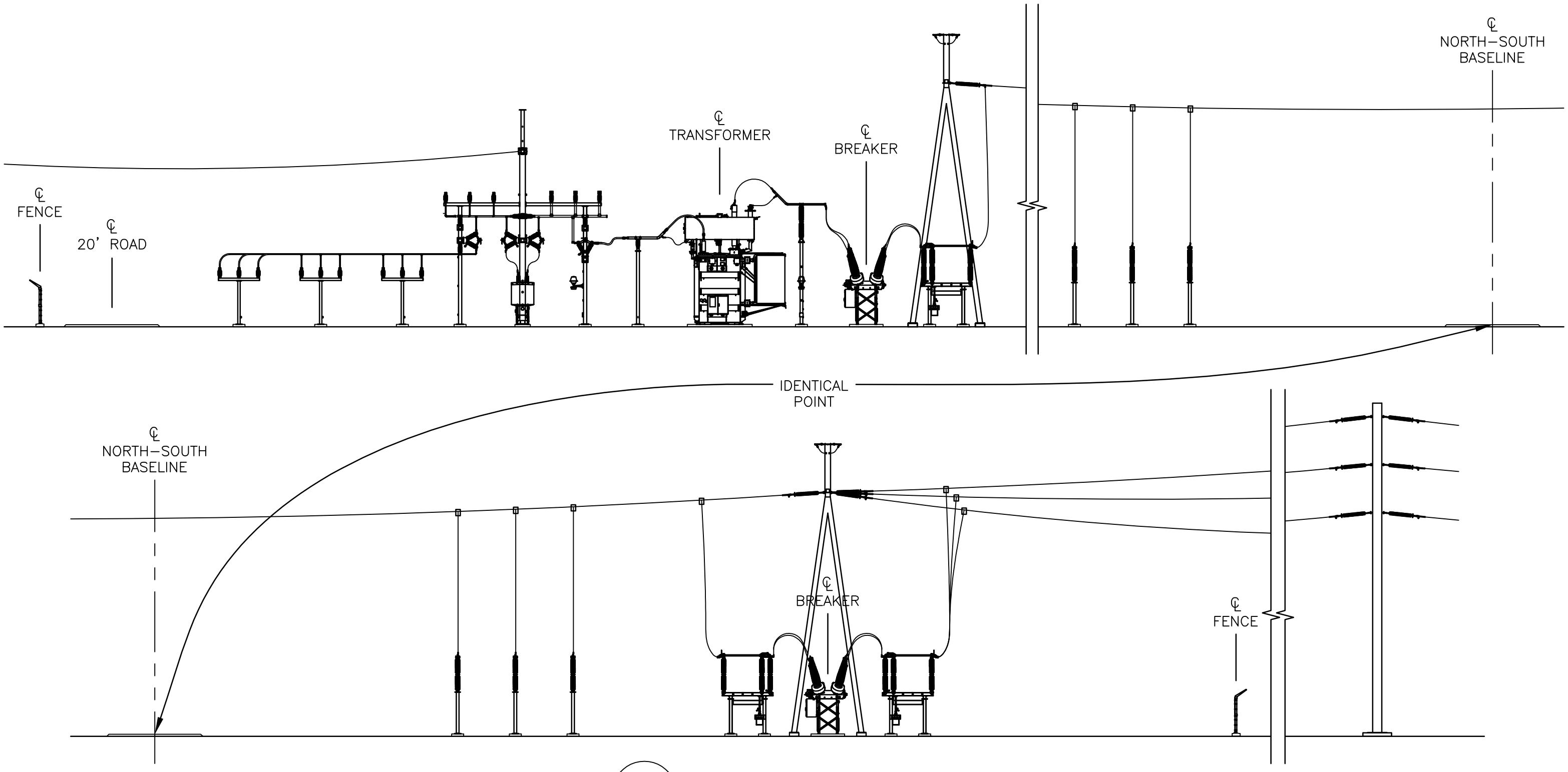
TITLE:
SOLAR ONE 850MW SUBSTATION
GENERAL ARRANGEMENT PLAN

PROJECT: 2000024301

FIGURE 3-35

SHT. 1

REV. P1



A–A / – SUBSTATION SECTION A–A
N.T.S.

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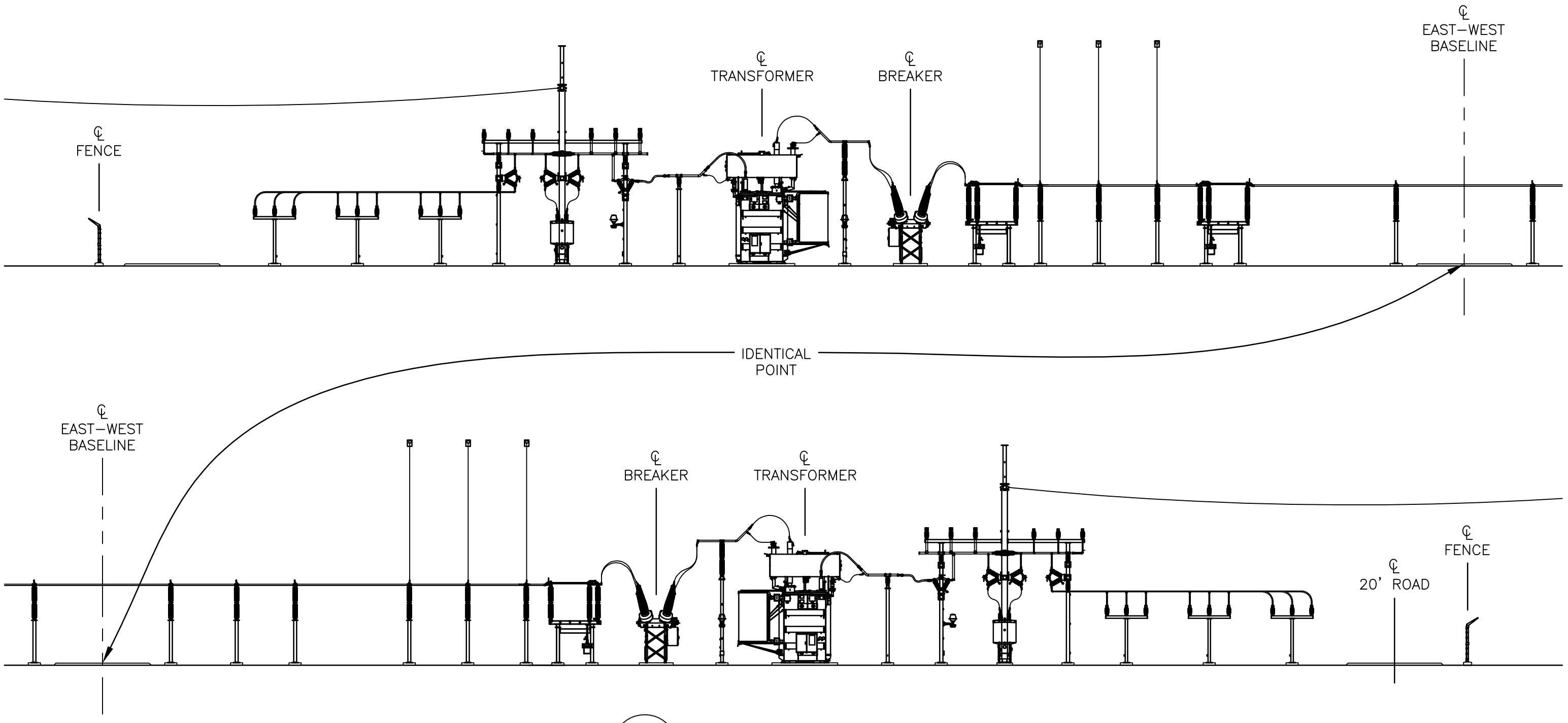
PROJECT: 2000024301

TITLE:
SOLAR ONE
850MW SUBSTATION ELEVATION

FIGURE 3–36

SHT. 1 of 2

REV. P1



B–B / – SUBSTATION SECTION B–B
N.T.S.

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TITLE:
SOLAR ONE
850MW SUBSTATION ELEVATION

PROJECT: 2000024301

FIGURE 3–37

SHT. 2

REV. P1

FIGURE 3.4-38
TYPICAL H-FRAME TRANSMISSION STRUCTURE

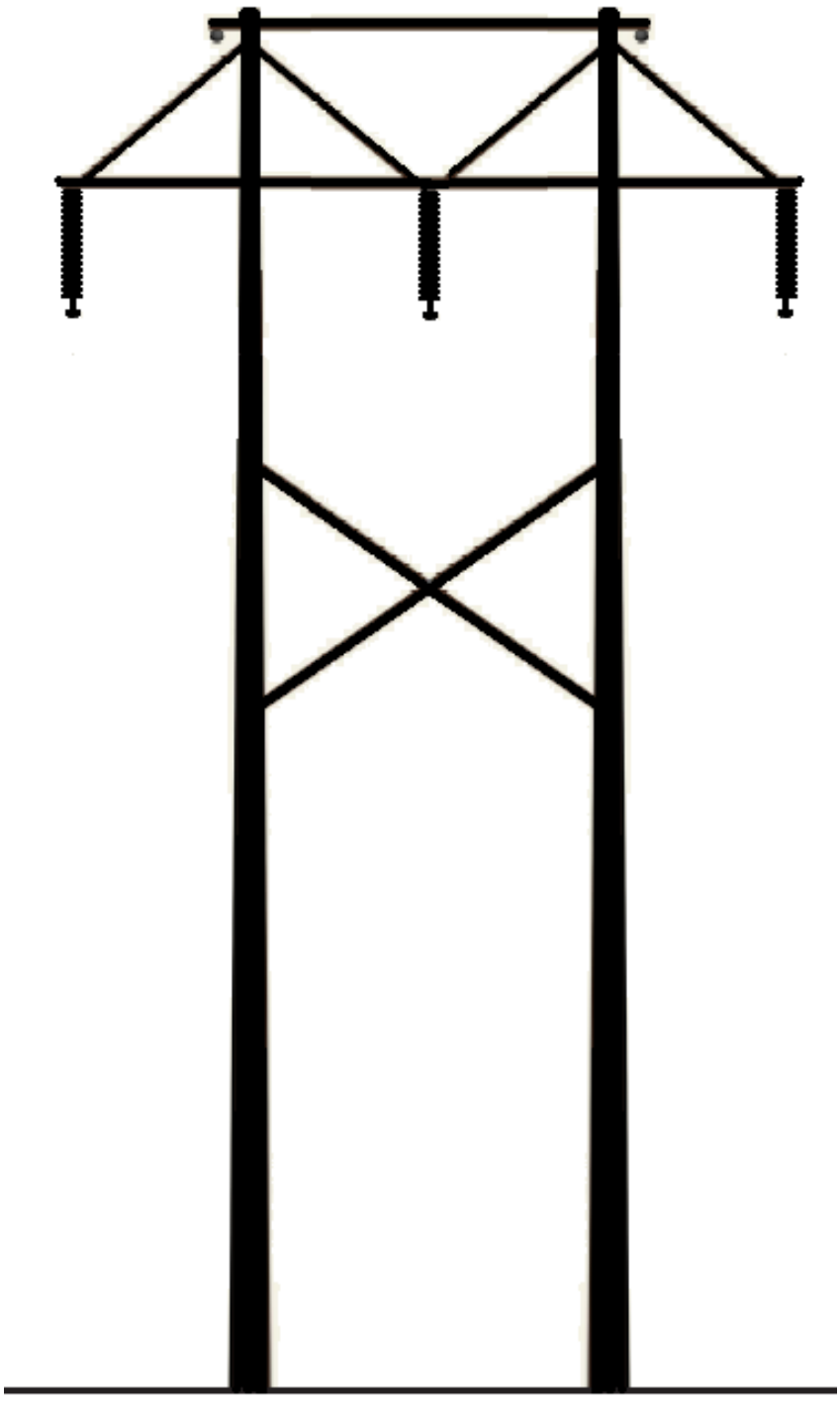


FIGURE 3.4-39
TYPICAL SINGLE-CIRCUIT TRANSMISSION STRUCTURES

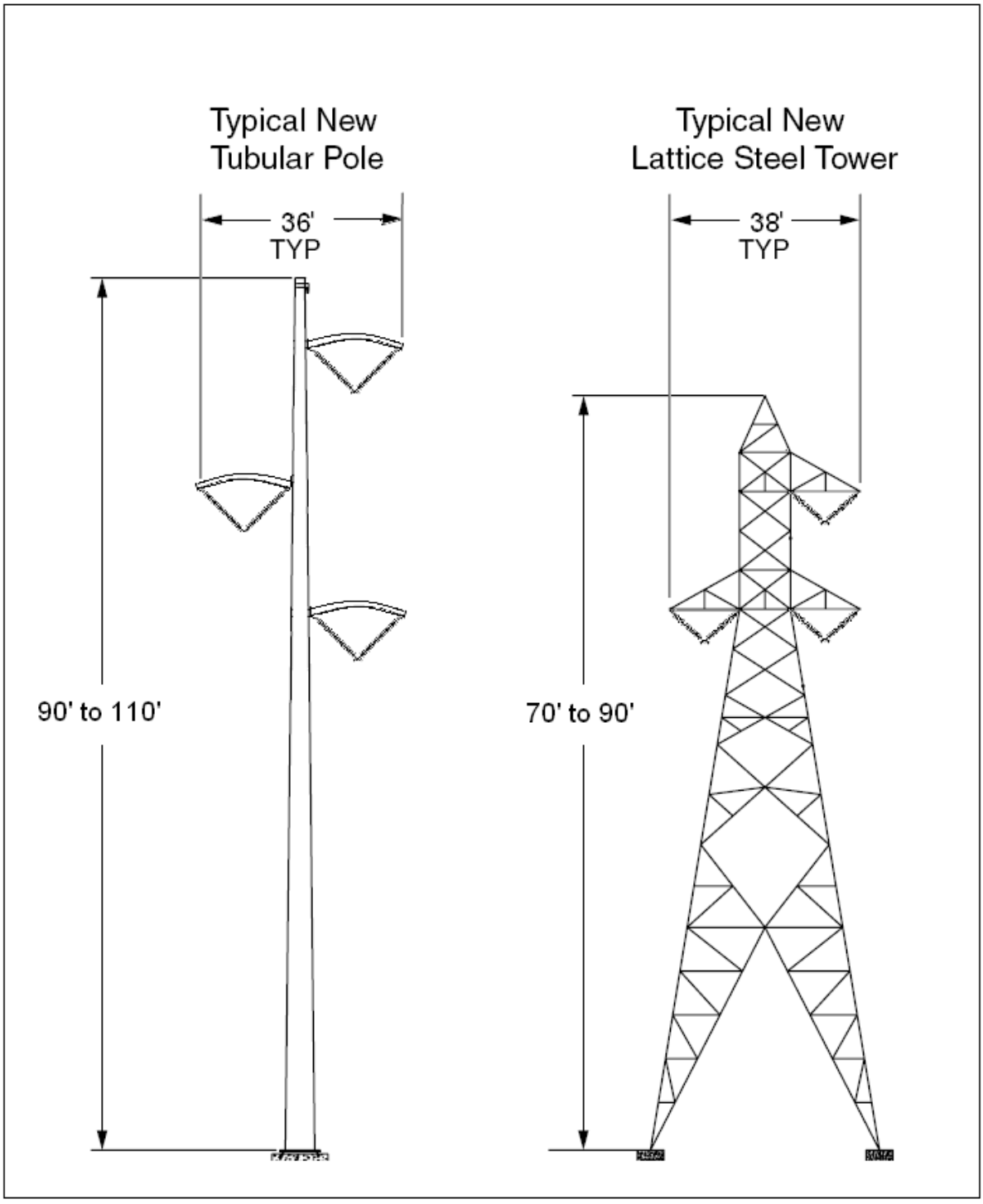


Figure 3.4-40
Solar One Construction Milestone Schedule – Phase I

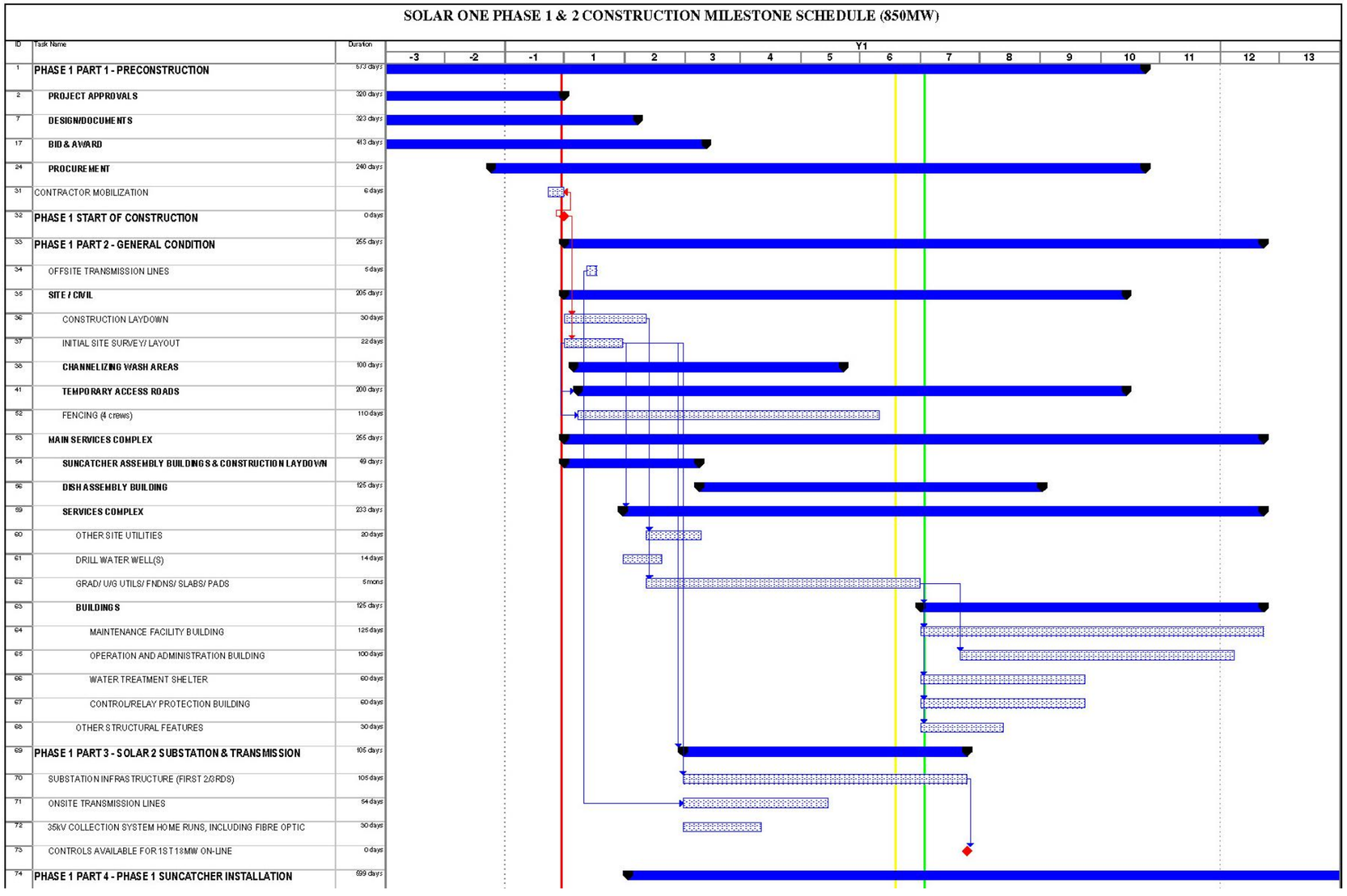
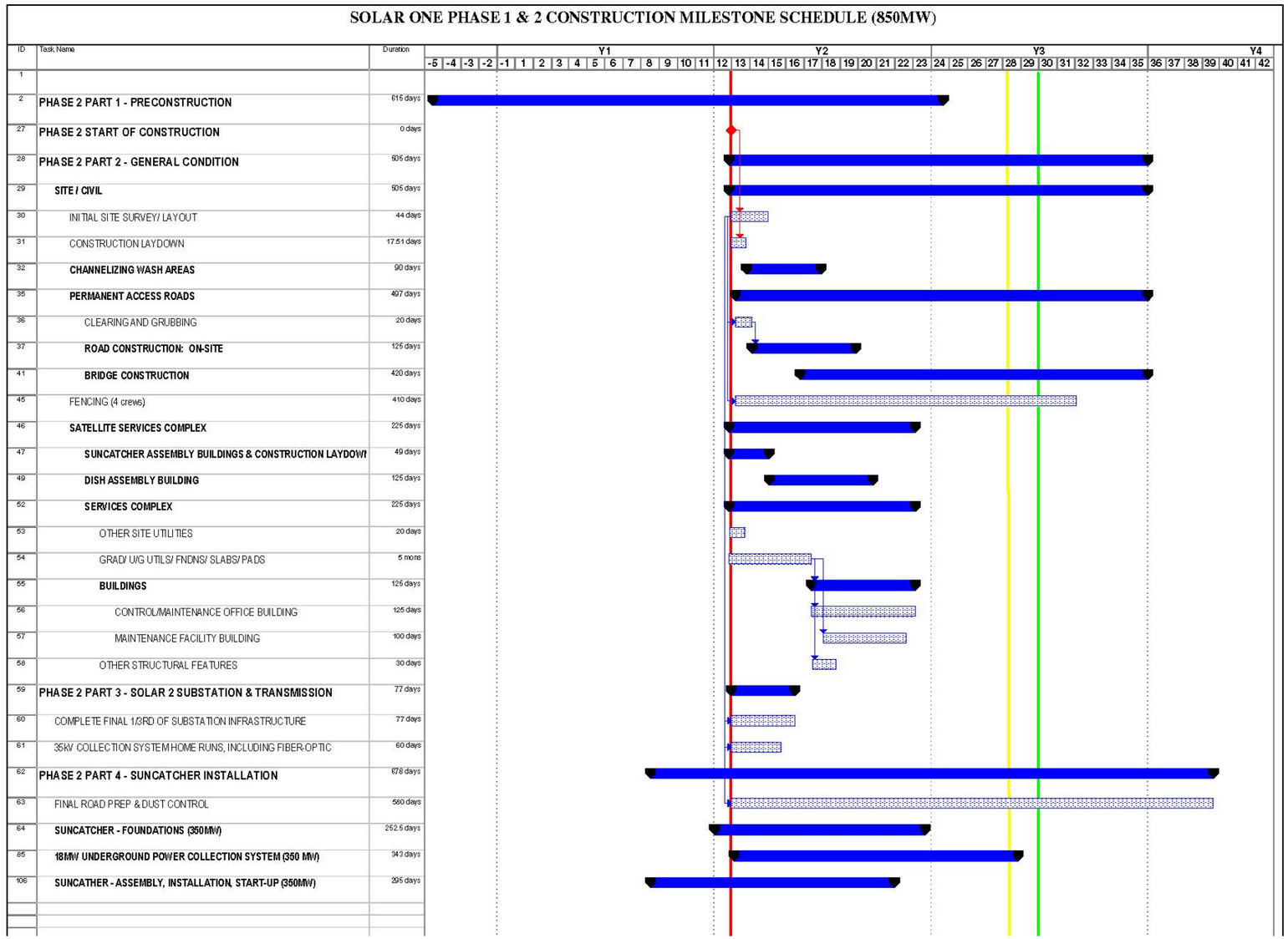
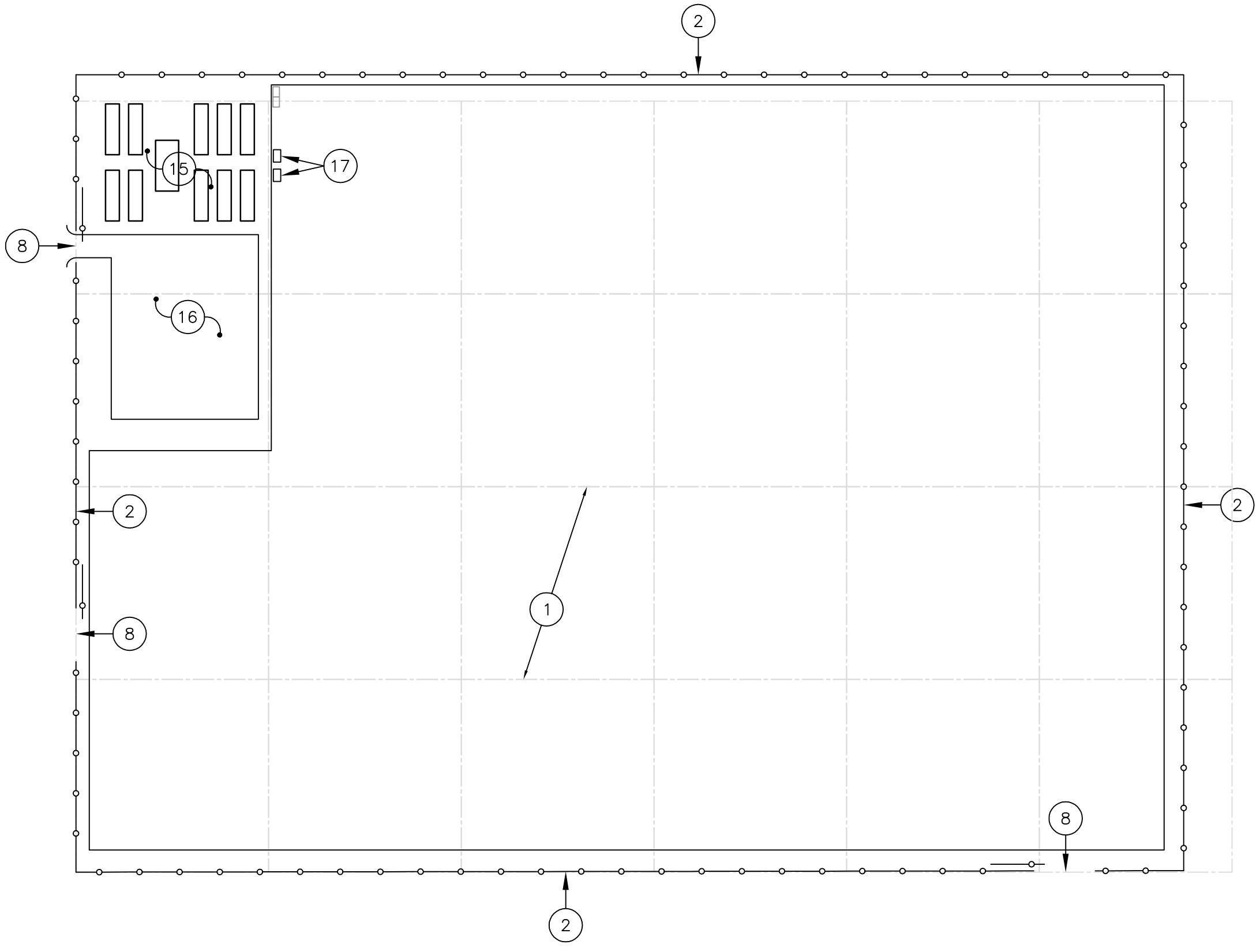


Figure 3.4-41
Solar One Construction Milestone Schedule – Phase II





KEYED NOTES

1. 1 ACRE SECTION (TYP. FOR ALL)
2. PERIMETER FENCE
8. ACCESS GATE
15. MOBILE CONSTRUCTION TRAILERS
16. CONSTRUCTION PARKING AREA
17. 20 CU. YD. TEMPORARY CONSTRUCTION DUMPSTERS

N

0 120' 240'

SCALE

PRELIMINARY

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P1	11/18/08	ISSUED FOR PRELIMINARY REVIEW	SD	

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503.297.1631
STANTEC.COM

DRN. STC/GSP	DES. STC/SD	CHK. STC/	DATE 10/03/08
SCALE 1"=120'		APP.	DATE

Stirling Energy Systems

PROJECT: 2000024301

TITLE: CONSTRUCTION LAYDOWN AREA SITE PLAN

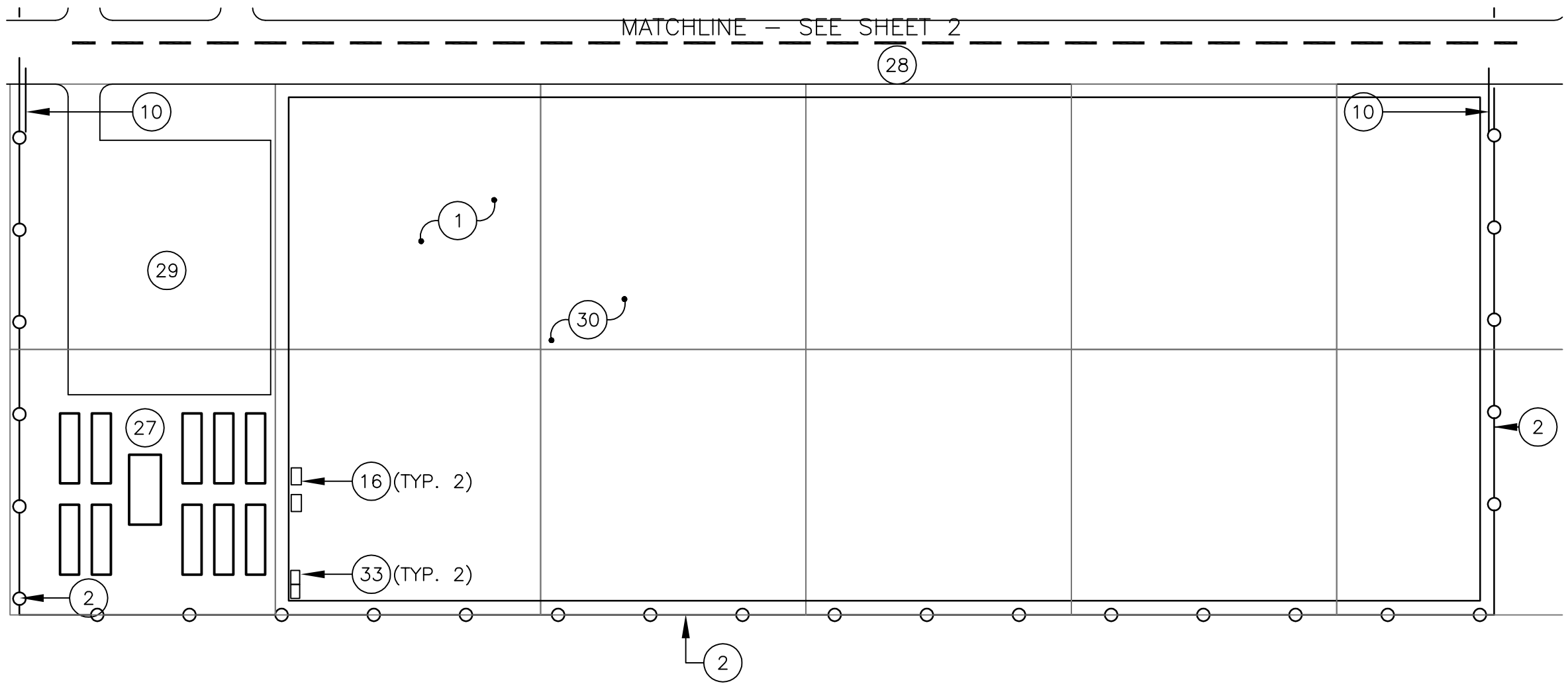
FIGURE 3-42

SHT. 1 of 1

REV. P1

0 100' 200'
SCALE

N



GENERAL NOTE

THIS DRAWING INDICATES 14 ACRES OF THE TOTAL 42 ACRE ADMINISTRATION, ASSEMBLY & CONSTRUCTION AREA.

KEYED NOTES

1. 1 ACRE SECTION (TYP. FOR ALL)
2. PERIMETER FENCE
10. ACCESS GATE
16. 5000 GALLON FUEL STORAGE (W/ CONTAINMENT) FOR ON–SITE VEHICLES (8' DIAx13'–4"L)
27. CONSTRUCTION OFFICE TRAILERS
28. SITE ARTERIAL ROAD
29. CONSTRUCTION EMPLOYEE PARKING LOT, PAVED (160'Wx200'L)
30. CONSTRUCTION LAYDOWN AREA, COMPACTED EARTH (940'Wx400'L)
33. 20 CU. YD. TEMPORARY CONSTRUCTION DUMPSTERS

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Stirling Energy Systems

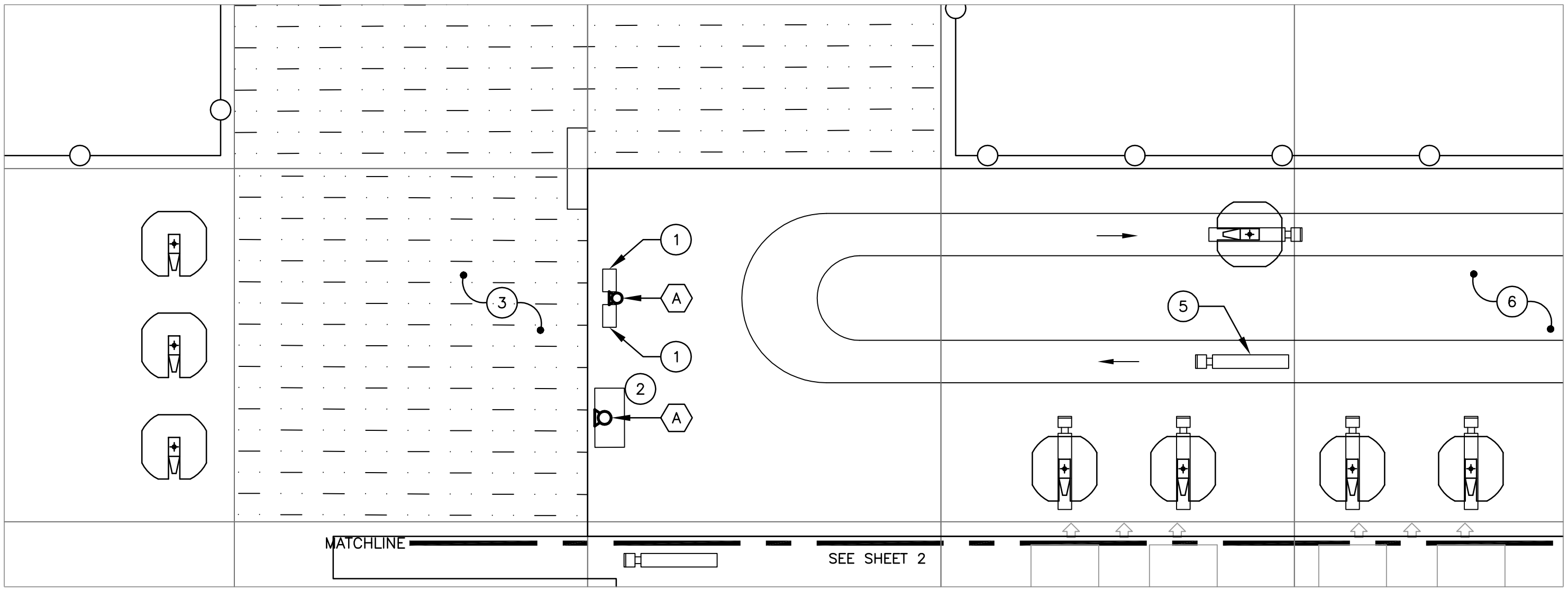
PROJECT: 2000024301

TITLE:
MAIN SERVICES COMPLEX
CONSTRUCTION LAYDOWN AREA

FIGURE 3–43

SHT. 3 of 4

REV. P1



PLUMBING EQUIPMENT

A. EMERGENCY EYEWASH/SHOWER (EW/ES) EQUAL TO HAWS MODEL 8300.

KEYED NOTES

1. 5000 GALLON FUEL STORAGE (W/ CONTAINMENT) FOR ON–SITE VEHICLES
2. STORAGE AREA FOR 350 HYDROGEN BOTTLES
3. 1 ACRE EVAPORATION POND
4. PAVED AREA FOR ASSEMBLED DISH TRANSPORT & MAINTENANCE/DISH WASHING VEHICLES
5. TRUCK CAB W/ TRAILER OR FLAT BED (TYP. FOR ALL).

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SCALE 1"=60'		APP.	DATE

Stirling Energy Systems

PROJECT: 2000024301

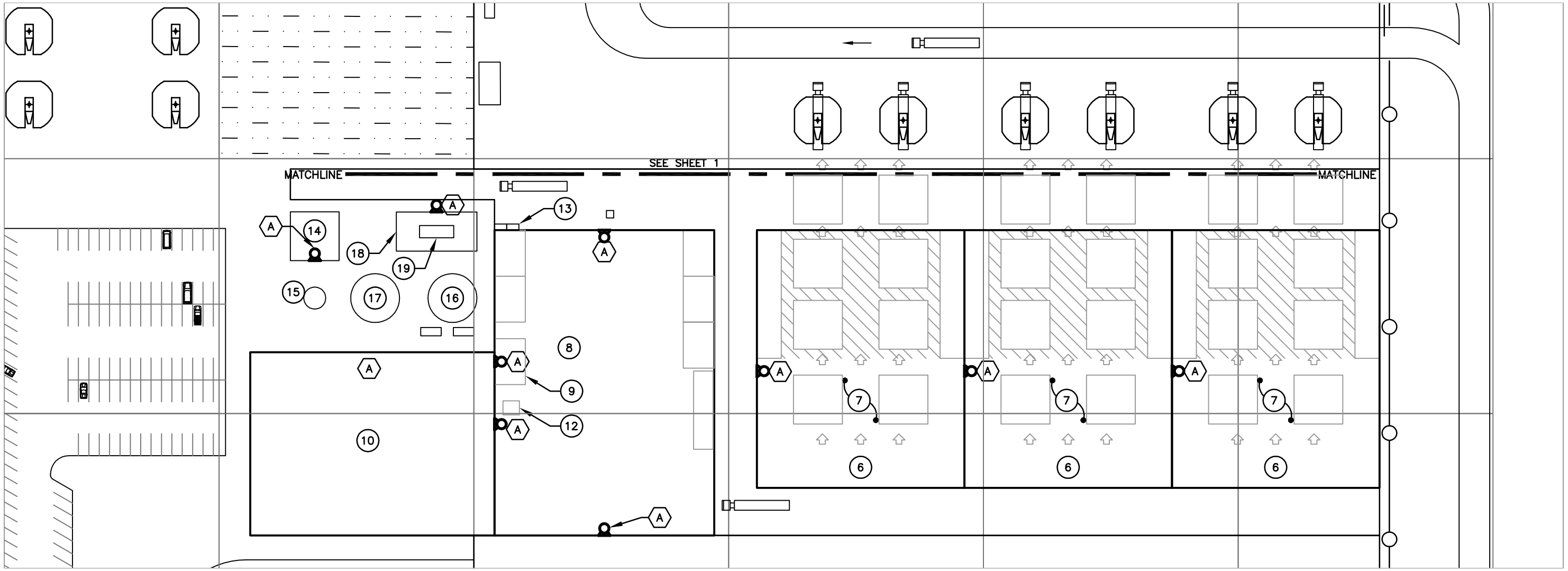
TITLE:

MAIN SERVICES COMPLEX PLUMBING SITE PLAN PART A

FIGURE 3–44

SHT. 1 of 3

REV. P1



PLUMBING EQUIPMENT

A. EMERGENCY EYEWASH/SHOWER (EW/ES) EQUAL TO HAWS MODEL 8300.

KEYED NOTES

6. ASSEMBLY BUILDING (TYP. 3)
7. CSP DISH ASSEMBLY BAY
8. MAINTENANCE/CONTROL ROOM BLDG.
9. CHEMICAL STORAGE AREA
10. ADMINISTRATION BLDG.
11. NOT USED
12. 150 GALLON LUBRICATING OIL RECYCLING TANK.
13. (2) 8 CU. YD. DUMPSTERSWATER TREATMENT BLDG.
14. WATER TREATMENT BLDG.
15. POTABLE WATER TANK
16. FIRE PROTECTION/MIRROR WASHING WATER TANK
17. RAW WATER TANK
18. ALTERNATE 1: ABOVE GROUND 10,000 GALLON/DAY CAPACITY WASTE WATER TREATMENT FACILTY
19. ALTERNATE 2: BELOW GROUND 10,000 GALLON SEWAGE HOLDING TANK.

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Stirling Energy Systems

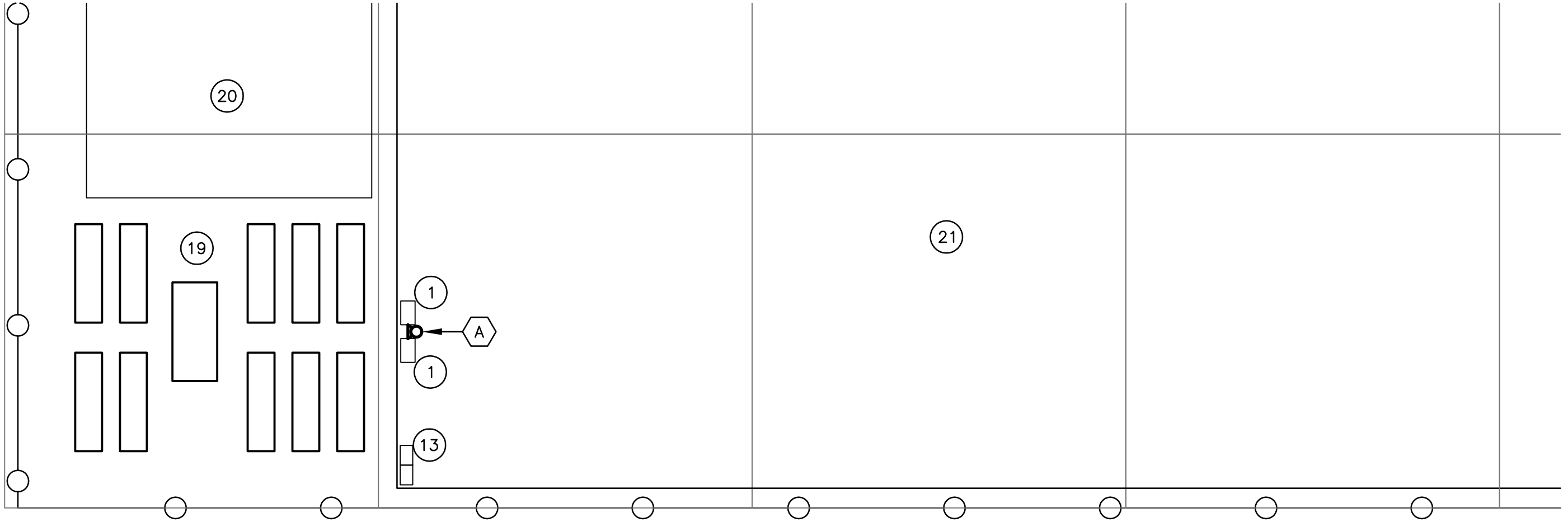
PROJECT: 2000024301

TITLE:
MAIN SERVICES COMPLEX
PLUMBING SITE PLAN PART B

FIGURE 3-45

SHT. 2 of 3

REV. P1



PLUMBING EQUIPMENT

A. EMERGENCY EYEWASH/SHOWER (EW/ES) EQUAL TO HAWS MODEL 8300.

KEYED NOTES

1. ASSEMBLY BUILDING (TYP. 3)
13. (2) 8 CU. YD. DUMPSTERSWATER TREATMENT BLDG.
19. CONSTRUCTION OFFICE TRAILERS
20. CONSTRUCTION EMPLOYEE PARKING LOT, PAVED
21. CONSTRUCTION LAYDOWN AREA

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SCALE 1"=60'		APP.	DATE

PROJECT: 2000024301

TITLE:

MAIN SERVICES COMPLEX PLUMBING SITE PLAN PART C

FIGURE 3-46

SHT. 3 of 3

REV. P1