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5.12 Soils

This section discusses the Mojave Solar Project's potential soils-related hazards and impacts.

5.12.1 LORS Compliance

This section addresses the LORS applicable to soils that are relevant to MSOP. Table 5.12-1 and the following text summarize the LORS that are expected to apply to the Project.

Table 5.12-1. LORS Applicable to Soils

LORS	Applicability	Where Discussed in AFC
Federal:		
None		
State:		
California Public Resources Code Section 612	Requires the Department of Conservation to prepare, update and maintain Important Farmland maps and other soils and land capability information.	Section 5.12.2.1
California Public Resources Code Section 21060.1 and 21095 (CEQA)	Defines agricultural land for the purposes of assessing CEQA environmental impacts using the Farmland Mapping and Monitoring Program (FMMP) Important Farmland Map categories.	
California Porter Cologne Water Quality Act	A National Pollution Discharge Elimination System (NPDES) California General Activities Construction Permit is necessary if an area greater than one acre will be disturbed. Industrial facilities (including power plants) with potential to affect storm water discharges are required to obtain an NPDES permit during operation (Industrial Storm Water General Permit)	Section 5.12.1.2
Local:		

County of San Bernardino 2007 Development Code, amended, January 15, 2009 Geological Hazards Overlay Chapter 82.15	County is to provide greater public safety by establishing investigation requirements for areas that are subject to potential geologic problems, including active faulting, land sliding, debris/mud flow, rock fall, liquefaction, seiche, and adverse soil conditions	Section 5.5.1.3
County of San Bernardino 2007 Development Code, amended, January 15, 2009 Conditional Grading Compliance Chapter 83.04	To ensure the compliance with conditions of approval on projects involving earthwork and compliance with dust control regulations. Provisions for on-site continuous inspections required by the Building Official.	Section 5.12.1.3
County of San Bernardino 2007 Development Code, amended, January 15, 2009 Flood Hazard Development Review Chapter 85.07	A Flood Hazard Development Review shall be completed before the approval of a land use application or issuance of a development permit in specific area or where required by the director, the Division Chief of Environmental Health Services or the Flood Plan Management Administrator.	Section 5.12.1.3

5.12.1.1 Federal

No Federal LORS related to Soils were identified as related to the Project.

5.12.1.2 State

<u>California Public Resources Code, Important Farmland</u>

California PRC Code Section 21060.1 provides definitions of agricultural land as defined by the US Department of Agriculture land inventory and monitoring criteria as modified for California. Prime Farmland, Farmland of Statewide Importance, and Unique Farmland are defined as Important Farmland in Appendix G of the State CEQA Guidelines.

Pursuant to Government Code Sections 65567(b) and Public Resources Section 612, the California Department of Conservation (CDC) Division of Land Resource Protection operates the Farmland Mapping and Monitoring Program (FMMP), a program similar to the federal program described known as the Federal Farmland Protection Policy Act. The FMMP was established in 1982 by the state of California to continue the Important Farmland mapping efforts begun in 1975 by the Natural Resource Conservation Service (NRCS),

which aimed to produce agricultural resource maps based on soil quality and land use across the nation. CDC's system was designed to inventory, map, and monitor the acreage of California farmland to document how much agricultural land was being converted to nonagricultural land or transferred into (or out of) Williamson Act contracts, which are long term contracts designed to keep agricultural land in production. CDC's classifications in the Important Farmland Inventory System are as follows:

- Prime Farmland—land that has the best combination of features for the production of agricultural crops;
- Farmland of Statewide Importance—land other than Prime Farmland that has a good combination of physical and chemical features for the production of agricultural crops, but that has more limitations than Prime Farmland, such as greater slopes or less ability to store soil moisture;
- Unique Farmland—land of lesser quality soils used for the production of the state's leading agricultural cash crops;
- Farmland of Local Importance—land of importance to the local agricultural economy;
- Grazing Land—existing vegetation that is suitable to grazing;
- Urban and Built-Up Land—land occupied by structures in density of at least one dwelling unit per 1.5 acres;
- Land Committed to Nonagricultural Use—vacant areas; existing land that has a permanent commitment to development but has an existing land use of agricultural or grazing lands; and
- Other Land—land that does not meet criteria of the remaining categories.

The FMMP map for the Project site is included in the Land Use Section as Figure 5.7-3. The FMMP designates a portion of the project site as Prime Farmland (71 acres) and Farmland of Statewide Importance (57 acres). Prime Farmland is defined as farmland with the best combination of physical and chemical features able to sustain long term agricultural production. Farmland of Statewide Importance is characterized as land with a good combination of physical and chemical characteristics for agricultural use, having only minor shortcomings (CDC 2009). The FMMP map also shows the abandoned town of Lockhart and other agricultural properties as urban and built up land west of Harper Lake Road. The SEGS solar power plant is also designated as urban and built up land.

Other Department of Conservation lands designated as Important Farmland are located in surrounding areas approximately 10-12 miles southeast of the Project site near Barstow. These lands are classified as Prime, Unique and Farmland of Statewide Importance, and also include some Williamson Act lands. Most of these agricultural lands are clustered in areas to the northwest of Barstow in the Mojave River floodplain.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1967, Water Code Section 13000 et seq., requires the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCB) to adopt water quality criteria to protect State waters.

Those criteria include the identification of beneficial uses, narrative and numerical water quality standards, and implementation procedures. Water quality criteria for the proposed project area are contained in the Water Quality Control Plan for the Lahontan Region (Basin Plan) which was adopted in 1994 and is in the process of being amended. This plan sets numerical and/or narrative water quality standards controlling the discharge of wastes to the State's waters and land. Stormwater and construction permitting is discussed in greater detail in Section 5.17, Water Resources.

5.12.1.3 Local LORS

The Project is subject to the San Bernardino County's Building and Safety Division requirements for Design, Construction, Inspection and Independent Quality Control. Building Official oversees independent review of acceptable design criteria for structures and excavations with respect to seismic design and construction based on 2006 IBC/2007 CBC.

Also, the requirements are outlined in the County's 2007 Development Code, Amended January 15, 2009, for Geological Hazards, Conditional Grading, and Flood Hazard Development Review.

Conditional Grading Compliance

On-site continuous inspections by the Building Official are required to ensure the compliance with conditions of approval on projects involving earthwork and compliance with dust control regulations.

Flood Hazard Development Review

A Flood Hazard Development Review shall be completed before the approval of a land use application or issuance of a development permit in specific area or where required by the Flood Plain Management Administrator. This project is not in a mapped Flood Plain. Drainage sheet flow coming from off-site tributaries will be channel around the proposed structures and back to historical sheet flows into the existing dry lake bed.

5.12.1.4 Involved Agencies

The agency contact for grading, building, NPDES, and floodplain development permits are identified in Table 5.12-2.

Table 5.12-2. Agencies and Agency Contacts

Agency Contact	Phone/Email	Permit/Issue
Richard Booth Senior Engineering Geologist California Regional Water quality Control Board Lahontan Region 2501 Lake Tahoe Blvd. South lake Tahoe, CA 96150	(530)542-5574 RBooth@waterboards.ca.gov	NPDES Permit governing storm water discharges associated with construction activity for any disturbance of greater than one acre and for industrial activities.
Gia Kim Division Chief Land Development Division 825 East Third Street, Room,204 San Bernardino, CA 92415-0835	(909) 387-8145 gkim@dpw.sbcunty.gov	Grading, Drainage, Road Improvements
Sameh F. Basta, P.E. Chief, Desert Section Land Development Division 15456 West Sage Street, Suite 206 Victorville, CA 92392	(909) 842-4366 sbasta@dpw.sbcounty.gov	Grading, Drainage and Flood Hazard Development Review

5.12.1.5 Required Permits and Permit Schedule

Building and grading permits are required by the San Bernardino County Building and Safety Department. Applications are required at least six (6) to twelve (12) weeks prior to construction.

Table 5.12-3. Permits Required and Permit Schedules

Permit/Approval	Schedule
Notice of Intent (NOI) - Construction Phase Storm Water Permit	A Construction General Permit is required. A SWPPP that specifies BMPs to reduce or prevent construction pollutants from leaving the site. The NOI will be submitted prior to construction. It is anticipated that the NOI will be secured within one month of construction.
Storm Water Pollution Prevention Plan Operations Phase Storm Water Permit	An Industrial General permit will be required for the Project operations phase. A separate SWPPP is required that outlines the monitoring and reporting plan, along with BMPs for the facility. The permit application package will be submitted to the County at the time of plan review for construction,
Building Permit	Application must be submitted six (6) to twelve (12) weeks prior to the start of construction.
Grading Permit	Application must be submitted six (6) to twelve (12) weeks prior to the start of construction.
Flood Hazard Development Review	Application must be submitted six (6) to twelve (12) weeks prior to the start of construction. Part of Development Review submittal for Grading and Drainage permit

5.12.2 Affected Environment

This subsection discusses baseline soil and agricultural conditions at the Project site. Physical soil properties and the potential for contaminated soils are discussed.

5.12.2.1 Regional Setting

The MSP site is located in the central Mojave Desert, in San Bernardino County, California. The Mojave Desert is part of the greater Mojave Desert Geomorphic Province. This province lies between the northeast-trending Garlock fault on the north and the northwest-trending San Andreas fault on the south. Characteristic landforms in the Mojave Desert include alluvial fans, plains, playa lakes, low pediments, and scattered buttes. The majority of the natural drainage in the vicinity of the Project site is to the northeast.

Soil is a naturally occurring mixture of mineral and organic ingredients with definite form, structure, and composition. The average composition of soil by volume of the major soil ingredients is 45 percent minerals (clay, silt,, sand, gravel, and stones), 25 percent water, 25 percent air, and 5 percent organic matter or humus (U.S. Department of Agriculture, 2009).

Soils in the Mojave Desert are shallow, deep, or very deep and are well drained to excessively drained (U.S. Department of Agriculture, 1981). The surface layer ranges from sand to clay loam. Sandy surface layers are highly susceptible to blowing, shallow soil depth, low available water capacity and a have a hazard of erosion due to slopes and insufficient plant cover (U.S. Department of Agriculture, 1981).

The Project is located in an area that was used largely for agricultural purposes in the past, but only a small portion of the site is presently cultivated. The agricultural area in the northeast corner of Section 32 currently produces alfalfa. Former agricultural lands in the Project area are now fallow due to fluctuating water availability. The 128 acres of irrigated land on the project site is the last remnant of alfalfa cultivation in this area. There are a few small farm structures and an abandoned general store on the site, but all of the structures are currently unoccupied and in substantial disrepair. A review of the San Bernardino County Williamson Act Lands 2005 Map (2006) indicates that the site is "non-Enrolled Land" meaning that the land is not enrolled with the Williamson Act Program. The FMMP has designated 128 acres on the Project site as Prime Farmland (57 acres) and Farmland of Statewide Importance (71 acres). For a more detailed discussion of agricultural resources, please refer to Section 5.7, Land Use.

In the region summers are long and very hot. Winters are quite warm despite an occasional series of days when the nightly minimum temperature drops below freezing. Rainfall is scant in all months, and irrigation is required for all crops (U.S. Department of Agriculture, 1986). In winter, the average temperature is 47°F at the city of Barstow (located approximately 15 miles southeast of the Project site) with an average daily minimum temperature of 33°F. In summer, the average temperature is 82°F at Barstow with an average daily maximum temperature of 97°F. Annual precipitation at Barstow averages 4.33 inches. The majority of the rainfall occurs during December, January, and February. The prevailing wind is from the west. Average windspeed is highest, 8 miles per hour, in summer. The highest recorded windspeed is 87.4 miles per hour (U.S. Department of Agriculture, 1986).

5.12.2.2 Soils at the Project Site

The ground surface in the region of the Project generally slopes gently downward to the northeast direction. Drainage at the Project site occurs as sheet flow across the property towards Harper Dry Lake. Much of the surface water infiltrates into the sandy alluvium.

The majority of the Project site is underlain by Cajon sand and Cajon loamy sand with Kimberlina loamy fine sand and the Norob-Halloran complex covering smaller portions of the site (Soil Map, Figure 5.12- 1). Non-irrigated, the on-site soils are classified as having a very severe limitation that make them unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland or wildlife habitat (U.S. Department of Agriculture, 2009). Irrigated, most of the on-site soils are classified as having a severe limitation that restricts the choice of plants or requires very careful management or both with the main

problem being the hazard of erosion. The parent material for the on-site soils is alluvium, mostly derived from granitic rock sources. The dominant soil types on the site are classified as "somewhat excessively drained."

Table 5.12-4. Soil Mapping Unit Descriptions and Characteristics

Map Unit	Description
112	Cajon Sand • Formed in sandy alluvium from dominantly granitic rocks • More than 80-inches and somewhat excessively drained • Slopes range from 0 -2% • Negligible to low runoff • Rapid permeability • Slight to moderate water erosion hazard • High hazard of wind erosion • Capability Subclass VIIe • Soil Taxonomy Classification: Mixed, thermic Typic Torripsamments
117	Cajon Loamy Sand • Formed in sandy alluvium from dominantly granitic rocks • More than 80-inches and somewhat excessively drained • Slopes range from 0 -2% • Negligible to low runoff • Rapid permeability • High water and wind erosion hazard • Capability Subclass VIIe • Soil Taxonomy Classification: Mixed, thermic Typic Torripsamments

Map Unit	Description
137	Kimberlina Loamy Fine Sand • Formed from mixed alluvium • More than 80-inches deep and well-drained • Slopes from 0 – 2% • Low to moderate runoff • Rapid permeability • Moderate hazard from wind and water erosion • Capability Subclass VIIe • Soil Taxonomy Classification: Coarse-loamy, mixed (calcareous), thermic Typic Torriorthents
152	Norob-Halloran Complex • Formed from granitic alluvium • More than 80-inches deep and moderately well drained • Slopes are 0 - 5% • Moderate runoff • Moderately low to moderately high permeability • Moderate hazard from wind and water erosion • Capability Subclass 4s (irrigated), 7s (nonirrigated) • Soil Taxonomy Classification: Fine-loamy, mixed
[1]United States Department of Agriculture, 2009, Web Soil Survey website:http://websoilsurvey,nrcs,usda.gov/app/WebSoilSurvey.aspx, accessed May, 2009	

5.12.2.3 Hazards Related to Soil Conditions

Please see Section 5.5.2.3, Geologic Hazards for a discussion on slope stability, subsidence, collapsible soil conditions, and expansive soils.

Based on the Phase I Environmental Site Assessment (ESA) conducted for the site (Included as Appendix I), contaminated soils that could be disturbed by Project construction are not present at the Project site or at properties adjacent to the site. Minor surface staining from prior agricultural activities at the site including general agricultural maintenance activities that have ceased persist in a minimal number of locations.

5.12.3 Environmental Impacts

Environmental impacts associated with the construction and operations of the MSP are discussed in the following sections.

Significance criteria were developed based on California CEQA Appendix G and CEQA Guidelines and evaluated using professional judgment. Impacts may be considered significant if:

- Substantially increased wind or water-induced soil erosion occurred as result of Project construction or operation,
- Substantially increased sedimentation occurred in areas adjacent to construction areas,
- Construction activities were to occur in areas of high erosion susceptibility and the disturbed areas were left exposed and not properly stabilized.

A full discussion of Prime Farmland and Farmlands of Statewide Importance is included in Section 5.7, Land Use.

5.12.3.1 Construction

Mass grading of the plant site will result in a relatively flat site that slopes gently to the east and north with terraces for each field. The preliminary site grading is shown in Appendix K. Earthwork associated with the Project will include mass grading, excavations for foundations and underground systems, and the total earth movement that will occur is approximately 4.158 million cubic yards.

Soils types that will be affected by grading include are shown in Table 5-12-4. The runoff potential of these soils is negligible to moderate, the water erosion hazard is moderate to high, and the wind erosion hazard is moderate to high. Topographic slopes in the Project area are approximately one percent.

During construction with the implementation of BMPs such as straw bales, silt fences, limiting exposed areas, etc., the impacts of soil erosion during construction should be less than significant. There will be no fill disposal or fill procurement sites.

<u>Water Erosion</u>

The runoff designations for the soils affected during site grading are low to negligible for the Cajon sand and the Cajon loamy sand, dominant soil types on the site and negligible to moderate for the other soil types. During construction the majority of the on-site soils will exhibit a rapid permeability. Given the climatic conditions, particularly the relatively low rainfall amounts, the implementation of BMPs, including temporary erosion control such as crushed rock, silt fences and fiber rolls during construction and BMPs as outlined in the DESCP (Appendix K), will limit the potential for soil loss from water erosion.

The potential for soil loss by water erosion was estimated using the Universal Soil Loss Equation for predevelopment, during construction and post-development conditions. Under current conditions the soil loss is estimated to be about one ton per year. As described above and in the DESCP, construction activities will increase the potential for soil loss, and the estimate of soil loss during this period is about 150 tons per year without implementation of control measures and BMPs as described in the DESCP. BMPs will include:

- Local soil berms and a detention area will be constructed to contain storm water runoff.
- During site grading, clearing and grubbing will be confined to only those areas needed for facility construction as indicated in the conceptual grading plan (see Appendix K).
- Temporary erosion controls including crushed rock, silt fences and fiber rolls will be used as needed to minimize erosion in active grading areas. Soil stockpiles will be covered prior to forecasted storm events and during windy conditions. Fiber rolls or gravel bags will be placed around the perimeter of the stockpiles to further minimize the potential for runoff.
- Additionally, water will be used to control dust and will be applied at a rate so as to minimize runoff.

BMPs will be applied and repaired as soon as erosion is evident and as soon as possible. Temporary erosion control measures will be implemented as need to control erosion. Temporary sediment control materials will be maintained onsite throughout the term of the Project so as to respond as needed to unforeseen rain or emergencies.

Wind Erosion

The soils on the Project site have a moderate to high hazard for wind erosion. BMPs as described above and in the DESCP (Appendix K) are expected to minimize soil loss due to wind erosion. Systematic watering of active grading areas during construction at least twice daily is expected to significantly reduce wind-borne dust. Water will be used during grading, both in the site preparation, compaction effort and to support dust control. Water applied to control dust will be pumped from existing groundwater wells and will be applied at a rate to minimize and control runoff.

5.12.3.2 Operation

With the implementation of BMPs, and associated monitoring activities included in the operation phase SWPPP and the DESCP, soil erosion would be expected to be minor during Project operation. Further, the Project will utilize soil stabilizers within the solar array area in order to reduce the amount of dust deposited on the solar collectors (dust affects their efficiency).

Post construction actions will include dust control through periodic watering, placement of gravel berms and detention structures to control sediment loss and manage storm water runoff. The power island area will be graded with moderate slopes to direct runoff to the oil-water separator in curbed areas and onto the solar filed in not curbed areas. Diversion ditches and the detention area will be designed to accommodate flow from a 100-year storm event. Roads and paved areas will be kept free of dust, dirt and visible soil materials. An entrance/outlet tire wash shall be constructed and maintained. Sufficient materials will be kept onsite to implement temporary control measures during the operational life of the plant.

By its nature, a solar thermal project must keep dust to a minimum, as a film on the mirrors of the solar array will reduce the efficiency of the Project. Dust control will be achieved by

a combination of soil stabilizers, water from the mirror washing, and compaction of the driving surface over time. This has been the experience at the neighboring SEGS facilities.

Since the Project is solar and emissions are minimal, no effect on surrounding soil-vegetation systems is expected.

5.12.3.3 Cumulative Impacts

With the implementation of measures to control erosion and sedimentation, including standard, good construction practices and the mitigation measures described below, the Project would have minimal impacts on soils conditions. Although there are none currently proposed, other potential projects in the area would be required to comply with the same water quality-related regulatory programs (e.g., NPDES permits and grading ordinances) and would be expected to control erosion under these regulations. Thus, the Project would not contribute significantly to cumulative soils impacts in the general area that might result from other projects. The Project would have few impacts on agricultural resources, and thus would not contribute to possible cumulative impacts on agricultural resources of the area.

5.12.4 Mitigation Measures

Implementation of the mitigation measures presented below will minimize soil loss (and thus also protect water quality), from Project construction and operations phase activities.

SOIL-1: Erosion control will be developed and implemented to ensure minimum soil loss and to maintain water quality. Temporary and long-term erosion control measures will be constructed and maintained as necessary during and following construction until long-term stabilization has been established for the life of the Project.

Such erosion and sedimentation control measures may include but are not limited to: minimizing disturbance; wetting the roads in active construction areas, and laydown areas; controlling speed on unpaved surfaces; placing gravel in entrance ways; use of straw bales, silt fences, and earthen berms to control runoff.

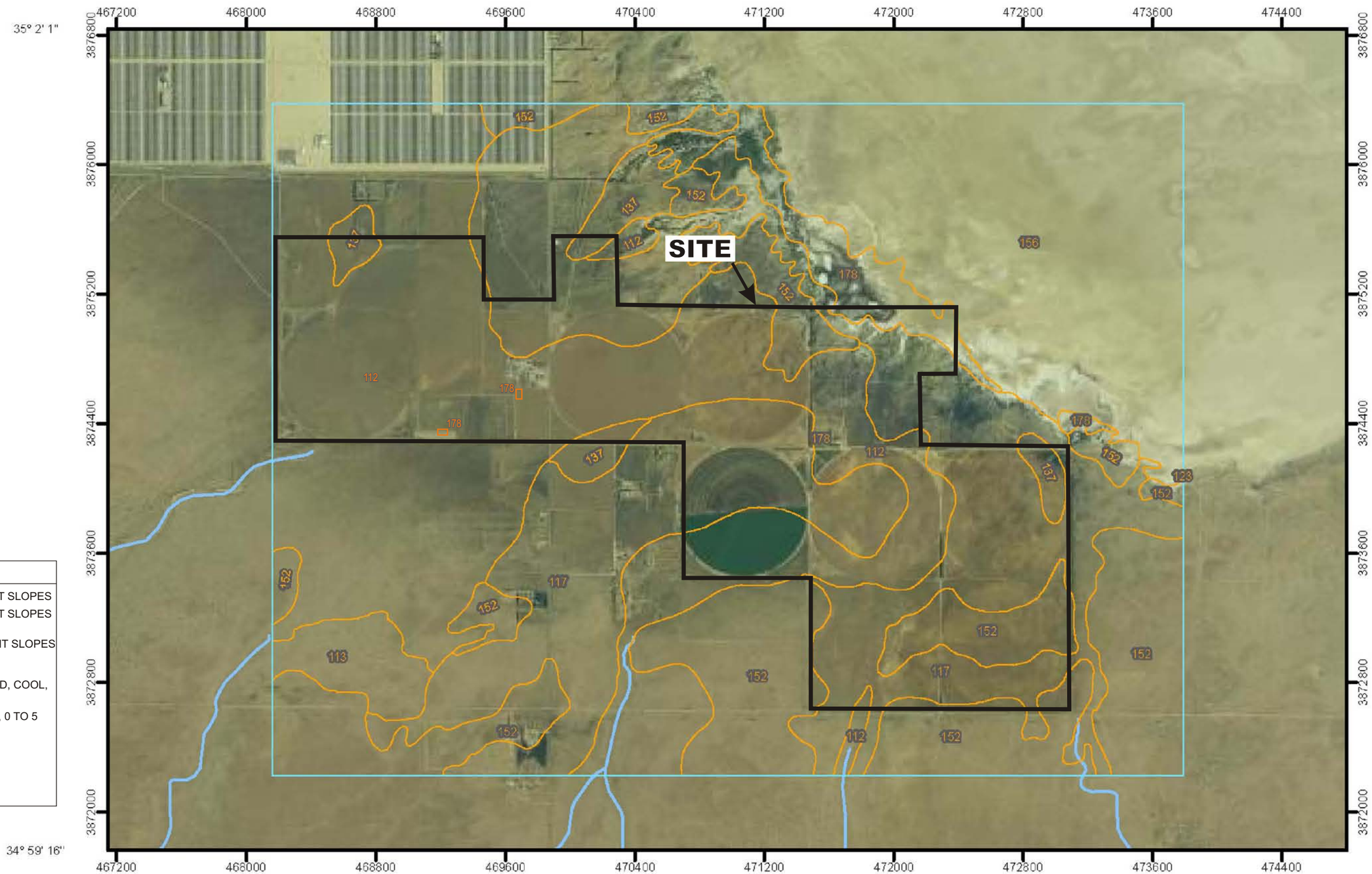
SOIL-2 Conduct Project construction grading in compliance with good industry practice and San Bernardino County grading permit requirements.

SOIL-3 Conduct Project construction activities and operation in accordance with the construction and operations phase Storm water Pollution Prevention Plans (SWPPP) and associated Monitoring Program, and with the DESCP submitted to the CEC. SWPPPs will be required for both construction and operation phases (the DESCP will encompass both Project phases), and these documents will include Best Management Practices (e.g., use of runoff control measures such as hay bales and silt fences, regular inspections of drainage control structures) to reduce erosion and sedimentation.

5.12.5 References

United States Department of Agriculture, 1986, Soil Survey of San Bernardino County, California Mojave River Area.

United States Department of Agriculture, 2009, Web Soil Survey website:http://websoilsurvey,nrcs,usda.gov/app/WebSoilSurvey.aspx, accessed May, 2009.



LEGEND

112	CAJON SAND, 0 TO 2 PERCENT SLOPES
113	CAJON SAND, 2 TO 9 PERCENT SLOPES
117	CAJON LOAMY SAND, LOAMY SUBSTRATUM, 0 TO 2 PERCENT SLOPES
123	DUNE LAND
137	KIMBERLINA LOAMY FINE SAND, COOL, 0 TO 2 PERCENT SLOPES
152	NOROB-HALLORAN COMPLEX, 0 TO 5 PERCENT SLOPES
156	PLAYAS
178	WATER

APPROXIMATE SCALE

0 2000 4000 FEET

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

fig 105879004 soil

Ninyo & Moore		SOIL MAP	FIGURE
PROJECT NO.	DATE	MOJAVE SOLAR PROJECT LOCKHART, CALIFORNIA	5.12-1
105879004	7/09		