5.11 Soils

5.11.1 Introduction

The Applicant proposes to develop a solar energy project called the Ivanpah Solar Electric Generating System (Ivanpah SEGS). It will be located in southern California's Mojave Desert, near the Nevada border, to the west of Ivanpah Dry Lake. The project will be located in San Bernardino County, California, on federal land managed by the Bureau of Land Management (BLM). It will be constructed in three phases: two 100-megawatt (MW) phases (known as Ivanpah 1 and 2) and a 200-MW phase (Ivanpah 3). The phasing is planned so that Ivanpah 1 (the southernmost site) will be constructed first, followed by Ivanpah 2 (the middle site), then Ivanpah 3 (the 200-MW plant on the north), though the order of construction may change. Each 100-MW site requires about 850 acres (or 1.3 square miles); the 200-MW site is about 1,660 acres (or about 2.6 square miles). The total area required for all three phases, including the Administration/Operations and Maintenance building and substation, is approximately 3,400 acres. The Applicant has applied for a right-of-way grant for the land from BLM. Although this is a phased project, it is being analyzed as if all phases are operational.

The heliostat (or mirror) fields focus solar energy on the power tower receivers near the center of each of the heliostat arrays (the 100-MW plants have three arrays and the 200-MW plant has four arrays). In each plant, one Rankine-cycle reheat steam turbine receives live steam from the solar boilers and reheat steam from one solar reheater—located in the power block at the top of its own tower. The solar field and power generation equipment are started each morning after sunrise and insolation build-up, and shut down in the evening when insolation drops below the level required to keep the turbine online.

Ivanpah 1, 2, and 3 will be interconnected to the Southern California Edison (SCE) grid through upgrades to SCE's 115-kilovolt (kV) line passing through the site on a northeast-southwest right-of-way. These upgrades will include the construction by SCE of a new 220/115-kV breaker-and-a-half substation between the Ivanpah 1 and 2 project sites. This new substation and the 220-kV upgrades will be for the benefit of Ivanpah and other Interconnection Customers in the region. The existing 115-kV transmission line from the El Dorado substation will be replaced with a double-circuit 220-kV overhead line that will be interconnected to the new substation. Power from Ivanpah 1, 2, and 3 will be transmitted at 115 kV to the new substation. SCE may add three new 115-kV lines to increase capacity to the existing El Dorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line heading southwest. The timing of this upgrade depends upon the development of wind projects ahead in the queue, and is not affected by the Ivanpah SEGS project.

Each phase of the project includes a small package natural gas-fired start-up boiler to provide heat for plant start-up and during temporary cloud cover. The project's natural gas system will be connected to the Kern River Gas Transmission Line, which passes less than half a mile to the north of the project site. Raw water will be drawn daily from one of two onsite wells, located east of Ivanpah 2. Each well will have sufficient capacity to supply water for all three phases. Groundwater will go through a treatment system for use as boiler make-up water and to wash the heliostats. To save water in the site's desert environment, each plant will use a dry-cooling condenser. Water consumption is, therefore, minimal

(estimated at no more than 100 acre-feet/year for all three phases). Each phase also includes a small onsite wastewater plant located in the power block that treats wastewater from domestic waste streams such as showers and toilets. A larger sewage package treatment plant will also be located at the Administration/Operations and Maintenance area, located between Ivanpah 1 and 2. Sewage sludge will be removed from the site by a sanitary service provider. No wastewater will be generated by the system, except for a small stream that will be treated and used for landscape irrigation. If necessary, a small filter/purification system will be used to provide potable water at the Administration Building.

This section describes the potential effects of the construction and operation of the Ivanpah SEGS on soils resources. Section 5.11.2 presents the laws, ordinances, regulations, and standards (LORS) applicable to soils and their use (e.g., agriculture). Section 5.11.3 describes the existing environment that could be affected, including soil types. Section 5.11.4 provides the environmental effects from project development. Section 5.11.5 presents mitigation measures that will be used to minimize any significant project impacts. Section 5.11.6 provides agency contacts. Section 5.11.7 describes the required permits and anticipated permit schedule and Section 5.11.8 provides the references used to develop this subsection.

5.11.2 Laws, Ordinances, Regulations, and Standards

Federal, state, and county LORS applicable to soils are discussed below and summarized in Table 5.11-1.

TABLE 5.11-1
Laws, Ordinances, Regulations, and Standards Applicable for Ivanpah SEGS Soils

LORS	Requirements/Applicability	Administering Agency	AFC Section Explaining Conformance
Federal			
Federal Water Pollution Control Act of 1972: Clean Water Act of 1977 (including 1987 amendments)	Regulates stormwater discharge from construction and industrial activities	Lahontan RWQCB	Sections 5.11.2.1 and 5.11.4.2.
Natural Resources Conservation Service (1983), National Engineering Handbook, Sections 2 and 3	Standards for soil conservation	Natural Resources Conservation Commission	Sections 5.11.2.1 and 5.11.5.
Bureau of Land Management	Regulations for construction on federal land	Bureau of Land Management, Lands Department	Section 5.11.2.1
State			
Porter-Cologne Water Quality Control Act of 1972; Cal. Water Code 13260-13269: 23 CCR Chapter 9	Regulates stormwater discharge	Lahontan RWQCB	Sections 5.11.2.2 and 5.11.4.2

TABLE 5.11-1
Laws, Ordinances, Regulations, and Standards Applicable for Ivanpah SEGS Soils

LORS	Requirements/Applicability	Administering Agency	AFC Section Explaining Conformance
Local			
San Bernardino County General Plan	Describes local policies for agricultural and soil resources	County of San Bernardino, Land Use Services Division and Agricultural Commissioner	Section 5.11.2.3

5.11.2.1 Federal LORS

5.11.2.1.1 Federal Water Pollution Control Act of 1972 and the Clean Water Act of 1977

The Federal Water Pollution Control Act of 1972, commonly referred to as the Clean Water Act following amendment in 1977, establishes requirements for discharges of stormwater or waste water from any point source that would affect the beneficial uses of waters of the United States. The State Water Resources Control Board (SWRCB) adopted statewide National Pollution Discharge Elimination System (NPDES) general permits that apply to stormwater discharges associated with construction, industrial, and municipal activities. The Regional Water Quality Control Board (RWQCB) is the administering agency for the NPDES permit program. The project would comply with the Clean Water Act through the preparation and implementation of a Construction and Industrial Stormwater Pollution Prevention Plan (SWPPP).

5.11.2.1.2 USDA Engineering Standards

The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), *National Engineering Handbook*, 1983, Sections 2 and 3 provide standards for soil conservation during planning, design, and construction activities. The project would need to conform to these standards during grading and construction to limit soil erosion.

5.11.2.1.3 Bureau of Land Management Regulations

The Ivanpah SEGS site is located on lands managed by the BLM. Pending approval of the Applicant's right-of-way application, grading and soil erosion regulations will be developed and included in the Conditions of Approval after a site-wide inspection report, completed by a certified professional soil scientist, has been provided by the Applicant.

5.11.2.2 State LORS

5.11.2.2.1 California Porter-Cologne Water Quality Control Act

The California Water Code requires protection of water quality by appropriate design, sizing, and construction of erosion and sediment controls. The discharge of soil into surface waters resulting from land disturbance may require filing a report of waste discharge (see Water Code Section 13260a). No discharges of soil into surface waters are anticipated, and thus, no waste discharge permit is anticipated.

5.11.2.3 Local LORS

5.11.2.3.1 San Bernardino County

Because the proposed site is located on federal land, county regulations are not directly applicable to the project. However, once the project has been approved by BLM, BLM has the option to request assistance from the County to determine and implement specific grading and soil erosion standards. Typically, this approach is only taken when a project has not undergone a California Environmental Quality Act (CEQA) review or a CEQA-equivalent process. However, in the cases where a County grading permit is required, the general requirements for that permit are subject to the General Plan (San Bernardino County, 2007a) and the San Bernardino County Development Code (San Bernardino County, 2007b).

The Conservation Element of the General Plan includes goals and policies that promote and protect soils within the county. The policies are intended to achieve four main goals, as follows:

1. Ensure conservation of soil, water, and other valuable natural resources
2. Reduce erosion and maintain soil productivity
3. Maintain healthy environments and air quality
4. Guide the planning and evaluation of proposed development

The proposed site is currently zoned for Resource Conservation, so the protection of soil resources will be an important factor related to grading permits for this project. The County of San Bernardino General Plan states that the main purpose of land set aside for resource conservation is to:

- Encourage limited rural development that maximizes preservation of open space, watershed, and wildlife habitat areas
- Identify areas where rural residences may be established on lands with limited grazing potential but which have significant open space values
- Prevent inappropriate urban population densities in remote and/or hazardous areas of the County
- Establish areas where open space and non-agricultural activities are the primary use of the land, but where agriculture and compatible uses may co-exist

Policies and programs pertaining to soil erosion are also found in the Safety Element of the General Plan. Goal S4 indicates that the County will minimize damage due to wind and water erosion where possible. Policies that are associated with this goal include:

1. Mapping potential wind erosion areas
2. Applying provisions of the Revised Erosion and Sediment Control Ordinance countywide
3. Tailoring grading, land clearance, and grazing to prevent unnatural erosion in erosion susceptible areas

Policy 2 and Policy 3 mentioned above pertain to grading and soil erosion control on the site.

Regulations related to soil grading and conservation are found in the Soil and Water Conservation chapter of the San Bernardino County Development Code (San Bernardino County, 2007b). These regulations require a project grading plan that must be approved by the Land Use Services Department within the County's Building Safety Division. In the cases where the County is asked to support the project by permitting soil grading activities, it is this department that would issue a grading permit for the project.

As described above, because the proposed site is located on federal land, county regulations are not directly applicable to the project. Permits are not anticipated to be required from County agencies, unless BLM decides to request assistance from the County to determine and implement specific grading and soil erosion standards.

5.11.3 Affected Environment

The proposed Ivanpah SEGS site is located approximately 48 miles southwest of Las Vegas in San Bernardino County, California. The project site is located on land managed by the BLM. The entire project site is currently zoned for resource conservation and contains no agricultural land.

The subject site is bounded on the north side by a Kern River Gas Transmission Line. The proposed Ivanpah SEGS will tie into the Kern River line for gas supply (all phases) and will tie into the SCE transmission lines that traverse the site between the Ivanpah 1 and Ivanpah 2 facilities in a southwest-northeast direction. To the west, the site is bounded by Ivanpah Valley, on the southeast by Interstate 15 (I-15), and on the east by the Primm Valley Golf Club and I-15. The Primm Valley Golf Club is zoned as private unincorporated land, which is the sole exception to the surrounding lands that are zoned for resource conservation.

The project area is characterized by a desert scrub community dominated by creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). The ground surface is primarily comprised of coalesced and dissected alluvial fans and desert washes.

5.11.3.1 Soil Types within the Study Area

Soil survey mapping units characterizing the types and distribution of soils within the project area, as shown on Figure 5.11-1, are taken from the online version of the *Soil Survey of the Mojave Desert Area, Northeast Part, California* (NRCS, 2007b). The electronic shape files for these mapping units were downloaded from the NRCS web site. Detailed soil descriptions were developed from the Official Series Descriptions (OSDs; NRCS, 2007a). Soil types at the project site, along the associated linear features (roadways, gas, water, and transmission lines), and within a 1-mile buffer surrounding the project boundaries and linear facilities are shown on Figure 5.11-1. Table 5.11-2 summarizes the depth, texture, drainage, permeability, and runoff potential characteristics of the individual soil mapping units identified on Figure 5.11-1. Land capability classification is also provided as an indicator of the soils primary limitations for revegetation.

TABLE 5.11-2
Soil Mapping Unit Descriptions and Characteristics

Map Unit	Description
3000	**Copperworld Association – slope class (30 to 60%)** – Somewhat excessively drained – Shallow soils – Formed on mountains in residuum and colluvium from metamorphic rock – Gravelly sandy loam surface and subsurface – Permeability is moderately low to high – Runoff is very high – Capability Class 6e – Taxonomic class: loamy, mixed, superactive, thermic Lithic Haplargids – Elevation range from 3,210 to 5,250 feet
3520	**Arizo loamy sand – slope class (2 to 8%)** – Excessively drained – Alluvial fans, inset fans, fan aprons, fan skirts, stream terraces – Formed in alluvium derived from metamorphic and sedimentary rock – Loamy sand surface over gravelly sand subsurface – Permeability is rapid to very rapid – Runoff is very low to medium – Soils are moderately alkaline – Capability Class 6e – Taxonomic class: sandy-skeletal, mixed, thermic Typic Torriorthents – Elevation range from 2,620 to 3,940 feet
3660	**Colosseum Association – slope class (2 to 4%)** – Somewhat excessively drained – Alluvial fan aprons – Formed in alluvium derived from limestone and dolomite – Fine sandy loam surface over gravelly loamy sand substratum – Permeability is rapid to very rapid – Capability Class 7s – Taxonomic class: sandy-skeletal, carbonatic, thermic Typic Haplocalcids – Elevation range from 2,620 to 3,440 feet
4122	**Popups sandy loam– slope class (4 to 30%)** – Well drained – Moderately deep to a hardpan, formed on fan remnants from mixed alluvium – Sandy loam surface and subsurface over stratified gravelly sandy clay loam and gravelly coarse sandy loam – Permeability is moderately rapid above the hardpan – Runoff is negligible to medium – Capability Class 6e – Taxonomic class: coarse-loamy, mixed, superactive, thermic Argidic Argiurids – Elevation range from 3,380 to 3,870 feet

Note: Soil characteristics are based on soil mapping provided in the published online soil survey (NRCS, 2007a) and a review of corresponding OSDs. Soil map units described above are limited to those mapped in the vicinity of the Ivanpah SEGS project and associated linear features.

In general, soils throughout the project site are coarse-grained and gravelly (Terracon Consultants, 2007). The land capability classes for soils in the project area are either 6 or 7 and are considered to have severe limitations that make them unsuitable for cultivation. Land uses for these soils are limited to pasture, range, or wildlife habitat. Natural vegetation is typically very sparse and dominated by salt- and drought-tolerant species. As such, the revegetation potential of disturbed areas not covered by permanent facilities will likely be difficult and will require suitable plants and establishment techniques.

5.11.3.2 Agricultural Use On and Around the Proposed Ivanpah SEGS Site

The proposed Ivanpah SEGS site and linear features (gas line, water line, and electrical transmission lines) are not located in an area that is used for agricultural production. None of these areas are designated as Important Farmlands (CDC, 2005).

5.11.4 Environmental Analysis

5.11.4.1 Soil Loss and Erosion

The runoff designations for soils in the project area are listed in Table 5.11-2. Topographic slopes in the project area are approximately 5 percent. Only two different soil types would be directly affected by the proposed Ivanpah SEGS project: Arizo loamy sand and Popups sandy loam. The runoff potential associated with the Arizo loamy sand is very low to medium and the majority of the site and linear features are located on this soil mapping unit. The runoff potential associated with the Popups sandy loam, located on the northwest portion of the site on part of the Ivanpah 3 solar field, is negligible to medium. Given the climatic and slope characteristics of the project area and the use of construction best management practices (BMPs), the overall potential for soil loss from water erosion is expected to be relatively low.

The wind erosion hazard was not provided for any of the soil mapping units described in the soil survey (NRCS, 2007b). However, given the sandy and loamy surface textures of the soils in this area, the soils are presumed to have a moderate to high potential for wind erosion.

5.11.4.2 Water Erosion

The potential soil loss by water erosion for the project was estimated using the Revised Universal Soil Loss Equation (RUSLE2) software (University of Tennessee, 2002). Soil loss was calculated as tons/acre/year by the program and then multiplied by the site feature acreage and assumed construction period to get total soil loss in tons for the project duration. This information is summarized in Table 5.11-3.

Soil losses are estimated using the following RUSLE2 conditions:

- **Construction** soil losses were approximated using Management as "bare ground, smooth surface;" Contouring: None, rows up and down hill; Diversion/terracing: None; and Strips and Barriers: None.

Active grading soil losses were approximated using Management as "bare ground, rough surface" soil conditions; Contouring: None, rows up and down hill; Diversion/terracing: None; and Strips and Barriers: None.

TABLE 5.11-3
Estimate of Soil Loss by Water Erosion Using Revised Universal Soil Loss Equation (RUSLE2)

Feature (acreage)[b]	Activity	Estimates Using Revised Universal Soil Loss Equation[a]			
		Duration (months)	Soil Loss (tons) without BMPs	Soil Loss (tons) with BMPs	Soil Loss (tons/yr) No Project
Site 1 (852.67 acres total; 644.10 acres to be graded)	Grading	5	144.9	1.9	0.0082
	Construction	15	202.5	5.8	---
Site 2 (849.26 acres total; 641.52 acres to be graded)	Grading	5	144.3	1.9	0.0082
	Construction	15	201.7	5.7	---
Site 3 (1654.38 acres total; 1249.70 acres to be graded)	Grading	5	308.4	4.2	0.0322
	Construction	15	447.0	12.7	---
Substation and Storage/Administration Buildings (22.15 and 2.64 = 24.79 acres)	Grading	1	1.116	0.011	0.00024
	Construction	3	1.178	0.033	---
Roads (7.35 acres)	Grading	1.5	0.496	0.005	0.000071
	Construction	1	0.116	0.003	---
Transmission Line (5.09 acres for construction; 0.008 acre for pole footprints)	Grading	1	0.0004	0.000004	0.000049
	Construction	3	0.242	0.007	---
Water Line (2.70 acres for construction; 0.013 acre for trench)	Grading	1	0.0006	0.00001	0.00003
	Construction	1	0.043	0.001	---
Gas Line Corridor (7.30 acres for construction; 0.584 acre for trench)	Grading	1	0.026	0.0003	0.00007
	Construction	3	0.347	0.010	---
Project Soil Loss Estimates	All activities listed above	89.5	**1452.45**	**32.26**	**0.049**

TABLE 5.11-3
Estimate of Soil Loss by Water Erosion Using Revised Universal Soil Loss Equation (RUSLE2)

Feature (acreage)[b]	Activity	Estimates Using Revised Universal Soil Loss Equation[a]			
		Duration (months)	Soil Loss (tons) without BMPs	Soil Loss (tons) with BMPs	Soil Loss (tons/yr) No Project

Notes:

[a] Soil losses (tons/acre/year) are estimated using RUSLE2 software.

- The soil characteristics were estimated using RUSLE2 soil profiles corresponding to the mapped soil unit.
- Soil loss (R-factors) were estimated using 2-year, 6-hour point precipitation frequency amount for the site coordinates (National Oceanic and Atmospheric Administration, 2007).
- Estimates of actual soil losses use the RUSLE2 soil loss times the duration and the affected area. The No Project Alternative estimate does not have a specific duration and loss is given as tons/year.

[b] Acreages assume a 40-foot corridor for the access roadways and 50-foot corridors for the gas, water, and transmission line construction corridors. Outside of the project footprint, the gas line will have a 4-foot-wide trench and the transmission line will have 23 poles with each pole having a 4-foot by 4-foot excavation footprint.

Other Project Assumptions as follows:

- Approximately 75.5% of the entire Ivanpah SEGS site will be graded.
- Overhead transmission lines will have 23 towers outside of project footprint. Each tower will have a 4-foot x 4-foot footprint.
- Grading/excavation for all the poles will be completed within 1 month and the entire installation will be completed within 3 months.
- Grading for each site will take 5 months and construction will take 15 months.
- Grading for access roads will take 1.5 months and construction will take 1 additional month.
- Grading for substation and storage and administration buildings will take 1 month and that construction will take an additional 3 months.
- Excavation for transmission poles and gas line trench will take 1 month each and that construction will take an additional 3 months.
- Excavation for water line trench will take 1 month and that construction will take an additional 1 month.

RUSLE2 Assumptions as follows:

100-ft slope length. Estimated soil unit slope is the midpoint of the minimum and maximum of the unit slope class.

Construction soil losses assume the following inputs: Management - Bare ground; Contouring - None, rows up and down hill;
Diversion/terracing - None; Strips and Barriers - None.

Grading soil losses assume the following inputs: Management - Bare ground/rough surface; Contouring - None, rows up and down hill;
Diversion/terracing - None; Strips and Barriers - None.

Construction with BMP soil losses assume the following inputs: Management - Silt fence; Contouring - Perfect, no row grade;
Diversion/terracing - None; Strips and Barriers - 2 fences, 1 at end of RUSLE slope.

No Project soil losses assume the following inputs: Management - Dense grass, not harvested; Contouring - None, rows up and down hill;
Diversion/terracing - None; Strips and Barriers - None.

- **Construction soil losses with implementation of construction BMPs** was approximated using Management as "Silt fence;" Contouring: Perfect, no row grade; Diversion/terracing: None; and Strips and Barriers: two fences, one at end of RUSLE2 slope.
- A **"No Project"** soil loss estimate was also approximated using Management as "Dense grass – not harvested;" Contouring: None, rows up and down hill; Diversion /terracing: None; and Strips and Barriers: None.

The estimated soil loss by water erosion is 1,452 tons for the project cycle without the use of construction BMPs. By applying a single BMP (i.e., silt fencing), the soil loss estimate is reduced to 32.3 tons over the same period. It should be recognized that the estimate of accelerated soil loss by water is conservative because of the 'worst-case' assumptions noted in Table 5.11-3. It should also be noted that the estimates of soil losses under the No Project conditions are likely low since they are based on fully vegetated conditions that are not reflective of the desert scrub currently on the site. The implementation of construction BMPs is expected to reduce soil erosion losses to levels commensurate with pre-project soil losses.

5.11.4.3 Wind Erosion

The potential for wind erosion of surface material at Ivanpah SEGS was estimated by calculating the total suspended particulates that could be emitted from active grading activities and the wind erosion of exposed soil. The total site area and estimated grading duration were multiplied by emission factors to estimate the total suspended particulate matter (TSP) emitted from the site. Fugitive dust from site grading was calculated using the default particulate matter less than 10 microns in equivalent diameter (PM_{10}) emission factor used in the California Air Resources Board Urban Emissions Model (URBEMIS2002), the South Coast Air Quality Management District (SCAQMD) CEQA Handbook (1993 and 2006), and the U.S Environmental Protection Agency's (EPA's) AP-42: Compilation of Air Pollutant Emission Factors.

Mitigation measures, such as watering exposed surfaces, are used to reduce PM_{10} emissions during construction activities. The PM_{10} reduction efficiencies are taken from the SCAQMD CEQA Handbook (1993) and were used to estimate the effectiveness of the mitigation measures. Table 5.11-4 summarizes the mitigation measures and PM_{10} efficiencies applied to the emission calculations.

TABLE 5.11-4
Mitigation Measures for Fugitive Dust Emissions

Mitigation Measure	PM_{10} Emission Reduction Efficiency	Efficiency Applied
Water active sites at least twice daily	34-68%	50%
Enclose, cover, water twice daily, or apply non-toxic soil binders, according to manufacturer's specifications, to exposed piles (i.e., gravel, sand, dirt) with 5 percent or greater silt content	30-74%	50%

Source: SCAQMD, 1993: Table 11-4.

Table 5.11-5 summarizes the mitigated TSP predicted to be emitted from the site from grading and the wind erosion of exposed soil. Without mitigation, the maximum predicted erosion of material from the site is estimated at 379 tons over the course of the project construction cycle. This estimate is reduced to approximately 133 tons by implementing basic mitigation measures (such as watering the site). These estimates are conservative because they make use of emission rates for a generalized soil rather than for specific soil properties and assume the worst-case for blowing conditions.

It is expected that the same BMPs that would be instituted to prevent erosion and sedimentation from exposed soil areas during precipitation events would also reduce offsite soil movement by wind. These BMPs would be developed during final design and would be included in the appropriate SWPPP. A copy of the draft construction SWPPP is provided in Appendix 5.15A and a copy of the draft operational SWPPP is provided in Appendix 5.15B. Given the sandy nature of the soil units, BMPs specifically designed to control wind erosion losses may be necessary.

5.11.4.4 Other Notable Soil Characteristics

A notable soil characteristic concerning the proposed project site is the inherent limitations of the native soils to support revegetation. The land capability class for the Arizo loamy sand, Popups sandy loam, and Copperworld Association is 6e. This capability class indicates that these soils have severe limitations for cultivation and are at risk for erosion. The Colloseum Association has a land capability class of 7s, which indicates the soil has very severe limitations for cultivation and the soil is very shallow, droughty, or stony.

These soil capability class designations indicate that onsite revegetation in areas not covered by permanent project facilities will be difficult. To minimize adverse effects on soil, it will be necessary to segregate and stockpile surface soils and organic matter during construction and excavation. These soils will be used to reconstitute areas that will be revegetated after construction. In addition to proper choice of plants and establishment techniques, soil amendments (i.e., fertilizers) could be considered to favor revegetation success.

5.11.4.5 Impacts on Jurisdictional Wetlands

Desert washes occur over a substantial portion of the project site. These washes are considered jurisdictional "waters of the United States." Any project grading and filling activities that result in impacts, including dredge or fill, of these water features will require a permit under Section 404 of the Clean Water Act. Impacts to wetlands and jurisdictional washes are addressed in Section 5.2, Biological Resources.

TABLE 5.11-5
Estimate of Total Suspended Particulates Emitted from Grading and Wind Erosion

Emission Source	Acreage	Duration (months)	Unmitigated TSP (tons)	Mitigated TSP (tons)
Grading Dust				
Project Site (all 3 Phases)	2,535.31	5	217.878	76.257
Substation and Storage / Admin Buildings	24.80	1	0.426	0.149
Roads	7.35	1.5	0.190	0.066
Transmission Line (poles)	0.0084	1	0.00015	0.00005
Water line (4-ft wide trench)	0.0135	1	0.00023	0.00008
Gas Line (4-ft wide trench)	0.584	1	0.010	0.004
Wind Blown Dust				
Project Site (all 3 Phases)	3,356.31	15	159.425	55.799
Substation and Storage/Admin Buildings	24.80	3	0.104	0.036
Roads	7.35	1	0.023	0.008
Transmission Line Corridor	5.09	3	0.242	0.085
Water Line Corridor	2.70	1	0.009	0.003
Gas Line Corridor	7.30	3	0.347	0.121
Estimated Total			**378.7**	**132.5**

Notes:

All linear feature impacts noted above are for portions outside of the project areas footprints.

Project Assumptions:

- Grading for each site will be completed in a 5-month period and construction on each phase will extend an additional 15 months after grading.
- Roadways will require 1.5 months for grading and additional 1 month to construct; grading at the substation and storage and administrative building areas will take 1 month followed by 3-month construction period.
- Excavation of transmission line pole holes and gas line trench will take 1 month followed by a 3-month construction period. Excavation of water line trench will take 1 month followed by a 1-month construction period
- The overhead transmission lines will have 23 new poles outside of the project footprint. Each pole will have a 4-foot by 4-foot area for a total impact permanent area of 0.0084 acre.
- Approximately 1/10th of the project site, substation and storage/administration building areas will have bare soil exposure during the length of the construction period.
- Approximately 1/2 of the transmission line and gas line corridors areas will have bare soil exposure during the length of the construction period.

Data Sources:

PM_{10} Emission Factor Source: Midwest Research Institute, South Coast AQMD Project No. 95040, Level 2 Analysis Procedure, March 1996

PM_{10} to TSP Conversion Factor Source: Bay Area Air Quality Management District CEQA Guidelines, Assessing the Air Quality Impacts of Projects, December 1999

SCAQMD CEQA Handbook (1993) Table 11-4 for mitigation efficiency rates (as summarized in Table 8.9-4)

5.11.4.6 Construction

Currently, construction plans are to clear the existing site of vegetation through the use of mulching machines then to grind the remaining vegetation into mulch for use in erosion control. Disking and light grading may be utilized prior to compaction by rolling. Grading is not intended to level the site, but rather to prepare the site for installation and future maintenance of the heliostats. Extensive grading activities, such as cut and fill, will be limited to the power block areas, receiving towers, and the major access roads (asphalt roads between power blocks and gravel roads servicing the receiving towers). Within the heliostat array fields, grading is to be performed only between every other row of the heliostat arrays that radiate outward in concentric arcs from their associated receiving towers. Other heliostat field areas may be only cleared, disked, and lightly compacted. The power block areas and receiving tower locations will then be leveled (cut and filled) and compacted using onsite soils. To reduce erosion, project construction will minimize land disturbance by limiting construction activities only to areas that are essential to the installation and operation of the project. In addition, disturbed soils will be lightly compacted to reduce the rainfall absorptive capacity and vegetative productivity of the soils that are permanently covered by project facilities.

Within the heliostat array fields, heliostat foundations are to be installed consisting of steel posts with concrete foundations or driven steel pipes (exact method to be determined during final project design). Electrical connections to each heliostat will be placed underground by means of open cut trench, or, if code and operational considerations allow, placed on grade between adjacent heliostats.

Preliminary cut and fill volume calculations required for the project have been calculated to be approximately 156,875 cubic yards of cut material (bank measurements) to fill approximately 156,875 yards (site to be balanced) assuming a shrinkage factor of 25 percent. Due to the large amount of soil and vegetation that will potentially be disturbed (approximately 2,560 acres), substantial water erosion and dust control measures will be required to prevent an increased dust load and increased sediment load to ephemeral washes on and off the project site. The volume of vegetation to be removed from the site is estimated to be approximately 0.37 cubic yards per 100 square yards. This will result in an estimated 412,600 cubic yards of mulch available for erosion control on the project site. All cleared vegetation is to be mulched or composted on site to assist in erosion control and limit waste disposal. In areas of substantial grading (power block areas, the receiving towers, and the major access roads), native vegetation may be harvested for possible reuse (replanting) or mulched or composted on site. All excavated soils are to be reused during construction at the site to prevent subsequent erosion and sedimentation issues.

Construction of linear project features will require excavated topsoil to be stockpiled separately from the underlying excavated soils. The stockpiled topsoil would then be placed and compacted over the backfilled trench. Because these trench areas would be returned to a stable, desert landscape condition, these impacts would be considered temporary.

The overhead transmission lines would result in the permanent loss of a limited soil area that is equivalent to the sum of the footprint areas for all the pole footings. It is currently estimated that 38 towers would be used with approximately 16 square feet (i.e., 4 feet by 4 feet) per tower footing for a total permanent impact area of 608 square feet (0.014 acre).

Overall the project would result in the disturbance of approximately 2,560 acres. Disturbance of this amount of area has the potential to result in increased erosion or sedimentation on or off the project site. In compliance with applicable LORS, a Construction Drainage, Erosion, and Sediment Control/SWPPP (CDESC/SWPPP) will be prepared. The CDESC/SWPPP will require the implementation of BMPs to minimize and control soil erosion and transport of soils off the project site. Compliance with the CDESC/SWPPP will ensure that construction-related soils impacts are less than significant. A copy of the Notice of Intent to comply with the NPDES General Construction Permit and a draft CDESC/SWPPP are provided in Appendix 5.15A.

5.11.4.7 Operation

Project operation would not result in impacts to the soil from erosion or compaction. Routine vehicle traffic during project operation would be limited to existing roads, most of which will be paved or covered with gravel. Access routes will also be graded between alternate rows of the heliostat arrays to permit bi-weekly washing of the mirrors with a pick-up truck-mounted tanker and the occasional cutting of vegetation to reduce the risk of fire due to plant regrowth. When linear facilities need to be inspected or maintained, vehicle traffic near these areas would be limited to the extent necessary to perform the inspection or maintenance activity. Impacts to soil from project operations would be less than significant.

5.11.4.8 Effects of Generating Facility Emissions on Soil-Vegetation Systems

Ivanpah SEGS power plants rely on energy from the sun to produce steam-generated power. However, during times of low solar energy, natural gas is used as a temporary back up for thermal stability of the equipment. Emissions, principally nitrogen oxides (NO_x), from the auxiliary boilers could have an adverse effect on soil-vegetation systems in the project vicinity. This is principally a concern where environments that are highly sensitive to nutrients or salts, such as serpentine habitats, are downwind of the project. However, there are no serpentine habitats in or surrounding the project area, and the addition of small amounts of nitrogen to the area would result in less than significant impacts on soil-vegetation systems.

5.11.5 Cumulative Effects

A cumulative effect refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project (Pub. Resources Code § 21083; Cal. Code Regs., Title 14, §§ 15064(h), 15065(c), 15130, and 15355). Cumulative projects are described in Section 5.6.7 and include the Desert Xpress Rail Line, improvements to Interstate 15, Las Vegas Valley Water District Pipeline, Southern Nevada Supplemental Airport (Ivanpah Valley Airport), and Table Mountain Wind Generating Facility.

Potential cumulative impacts to soils could occur as a result of the conversion of agricultural lands to non-agricultural uses and increased soils disturbance which increases the potential for soil erosion. As previously described, the project would have no effect on agriculture, because there are no agricultural uses on or in the immediate vicinity of the project site. Impacts due to soil disturbance on and off the site are expected to occur primarily during construction. However, these impacts would be mitigated to a less than significant level through the use of good engineering practices, compliance with federal and state LORS, and

the application of BMPs. After construction is complete, long-term erosion control BMPs would be implemented, and soil erosion on the site is expected to be less than the current, natural conditions. It is expected that the cumulative projects would employ good engineering practices and comply with all applicable federal, state, and local LORS. The project is unlikely, therefore, to have impacts to soils that would combine cumulatively with other closely related past, present, and reasonably foreseeable future projects.

5.11.6 Mitigation Measures

Erosion control measures would be required during construction to help maintain water quality, to protect the property from erosion damage, and to prevent accelerated soil erosion or dust generation that destroys soil productivity and soil capacity. Temporary erosion control measures would be implemented before construction begins and would be maintained and evaluated during construction. These temporary measures would be removed from the site after the completion of construction and, where needed, replaced by permanent control measures.

5.11.6.1 Temporary Erosion Control Measures

The Applicant shall finalize the CDESC/SWPPP and implement the temporary erosion control measures and BMPs designed to minimize soil erosion and sediment transport, as identified in the final CDESC/SWPPP, during construction. The CDESC/SWPPP will require the implementation of BMPs to minimize and control soil erosion and transport of soils off the project site. Compliance with the CDESC/SWPPP will ensure that construction-related soils impacts are less than significant. A copy of the Notice of Intent to comply with the NPDES General Construction Permit and a draft CDESC/SWPPP are provided in Appendix 5.15A.

Temporary erosion control measures that could be included in the final CDESC/SWPPP typically include revegetation, dust suppression, and sediment barriers. Potential temporary erosion control measures are described below.

- **Revegetation –** Vegetation is the most efficient form of erosion control because it keeps the soil in place and maintains the landscape over the long-term. Vegetation reduces erosion by absorbing raindrop impact energy and holding soil in place with fibrous roots. It also reduces runoff volume by decreasing erosive velocities and increasing infiltration into the soil. Due to the dry and sandy conditions of the soil, drought-tolerant species and establishment procedures that are suited to this environment will be required for revegetation of the linears.
- **Dust Suppression** – During construction of the project and the related linear facilities, dust erosion control measures would be implemented to minimize the wind-blown erosion of soil from the site. Local well water would be sprayed on the soil in construction areas to control dust and during revegetation. Assuming 0.05 feet of water will be required to control dust during the duration of construction then approximately 41.7 million gallons of water will be required.
- **Sediment Barriers –** Sediment barriers, such as straw bales, sand bags, silt fences, mulched vegetation, berms, and ditches, slow runoff and trap sediment. Sediment barriers are generally placed below disturbed areas or at the base of exposed slopes.

Sediment barriers are most often placed around sensitive areas, such as wetlands or washes, to prevent contamination by sediment-laden water.

Some barriers would be placed in locations where offsite drainage could occur to prevent sediment from leaving the site. If used, straw bales would be properly installed (staked and keyed), then removed or used as mulch after construction. Runoff infiltration/evaporation areas, drainage diversions, and other large-scale sediment traps are to be considered due to the level of grading and excavation that will occur at the power block areas. Any soil stockpiles would be stabilized and covered if left onsite for long periods of time, including placement of sediment barriers around the base of the stockpile. These methods can be employed during trenching operations for the gas and transmission lines.

5.11.6.2 Permanent Erosion Control Measures

Permanent erosion control measures onsite could include drainage, and infiltration/evaporation systems, slope stabilization, check dams, stone filter rings, and long-term revegetation. If soil conditions permit, revegetation would follow from planting for short-term erosion control. Revegetation of the area disturbed by construction would be accomplished using locally prevalent, non-invasive, fast-growing plant species compatible with adjacent existing plant species.

As described in Section 5.15, the Applicant shall finalize and implement an Industrial SWPPP to avoid or mitigate water quality impacts that could result from project operations. Under the Industrial SWPPP, operations at the plant site will be conducted in accordance with the statewide General Industrial Permit, a draft of which is provided in Appendix 5.15B. The Industrial SWPPP will include a suite of good housekeeping requirements including steps to identify and mitigate pollutants and conditions of concern, and inspections, monitoring, and sampling per the permit requirements. Compliance with the Industrial SWPPP will ensure that operations-related soils impacts are less than significant.

5.11.7 Involved Agencies and Agency Contacts

Permits from different agencies that are required for the project along with the agency contacts are shown in Table 5.11-6.

TABLE 5.11-6
Agency Contacts for Ivanpah SEGS Soils (If Required by BLM)

Issue	Agency	Contact
Approval of Grading Plan and Issuance of Grading Permit	San Bernardino County	Joe Trujillo, County Engineer San Bernardino County Land Use Services Department, Building Safety Division, 385 North Arrowhead Avenue San Bernardino, CA 92415 (909) 387-4246 email: jtrujillo@lusd.sanbercounty.gov

TABLE 5.11-6
Agency Contacts for Ivanpah SEGS Soils (If Required by BLM)

Issue	Agency	Contact
Construction Requirements Pertaining to Soil	Bureau of Land Management	Kathleen O'Connell, Realty Specialist, Lands Department, BLM 1303 South U.S. Highway 95 Needles, CA 92363 (760) 326-7000 email: koconnel@ca.blm.gov

5.11.8 Permit Requirements s and Permit Schedule

Grading or construction permits will likely be required from BLM. It is also possible, though unlikely that permits could be required from San Bernardino County (if specifically requested by BLM). The BLM project requirements will be specified in the Conditions of Approval pending approval of the Applicants right-of-way application. It is anticipated that any required permits for grading can be secured as long as completed applications are provided to the appropriate agency a minimum of six months prior to construction. Table 5.11-7 list the applicable land use permits and permit schedule.

TABLE 5.11-7
Permit Requirements and Permit Schedule for Ivanpah SEGS Soils

Permit	Agency Contact	Schedule
County Grading Permit (only if required)	Joe Trujillo, County Engineer San Bernardino County Land Use Services Department, Building Safety Division, 385 North Arrowhead Avenue San Bernardino, CA 92415 (909) 387-4246 email: jtrujillo@lusd.sanbercounty.gov	Estimated 6 months from submittal of complete application
Construction Requirements Pertaining to Soil	Kathleen O'Connell, Realty Specialist, Lands Department, BLM 101 W. Spikes Road Needles, CA 92363 (760) 326-7000 email: koconnel@ca.blm.gov	Estimated 6 months from approval of the right-of-way application

5.11.9 References

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3650
3320
3320
3660
3660
KERN RIVER GAS TRANSMISSION LINE
NORTH GAS LINE
IVANPAH 3
3000
IVANPAH 2
3520
4703
4703
3000
Colosseum Road
ADMINISTRATION
AND STORAGE
SUBSTATION
Yates Well Road
IVANPAH 1
3000
4122
SOUTH GAS LINE
3000
3000
3000
NOTCOM

LEGEND

- PROPOSED PROJECT SITE
- PAVED ROADS
- DIRT ROADS
- REROUTED COLOSSEUM ROAD
- PROPOSED WATER LINES
- PROPOSED TRANSMISSION LINES
- Existing Transmission Line Corridor
- PROPOSED GAS LINE
- SOIL BOUNDARIES
- 1 - MILE BUFFER

MAP UNIT SYMBOL	SOIL DESCRIPTION
3000	Copperworld association, 30 to 60 percent slopes
3320	Umberci-Rock outcrop association, 30 to 75 percent slopes
3520	Arizo loamy sand, 2 to 8 percent slopes
3660	Colosseum Association, 2 to 4 percent slopes
4122	Popups sandy loam, 4 to 30 percent slopes
4703	Typic Haplosalids, 0 to 2 percent slopes
5000	Copperworld-Lithic Ustic Haplargids association, 30 to 60 percent slopes
NOTCOM	Obsolete term for unmapped areas

SOURCE: NRCS 2007

0 3,000 Feet

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FIGURE 5.11-1
SOIL TYPES
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

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