SECTION 4.4

GEOLOGY AND SOILS

This section describes federal, state and local regulations applicable to geology and soils. It also describes the environmental setting with regard to the soils, seismicity and geologic conditions on and in the vicinity of the Battery Energy Storage System site. A discussion of geology and soil impacts is also provided and mitigation measures are identified to address impacts. The analysis in this section is based on the *Geotechnical Evaluation Report Campo Verde Phase I and Phase II Energy Storage Project* (WTI 2016a), the letter regarding Campo Verde Phase I and Phase II Energy Storage Project Addendum No. 1 dated September 28, 2016 (WTI 2016b) and *Preliminary Geotechnical Investigation: Proposed Mount Signal Solar Farm and Associated Structures West of Drew Road and South of Interstate 8 Imperial County, California* prepared by EGA Consultants (EGA 2011) as referenced. These documents are included in **Appendix E** of the Technical Appendices of this SEIR on the attached CD.

4.4.1 REGULATORY FRAMEWORK

A. STATE

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Zoning Act (Chapter 7.5, Division 2, Public Resources Code, State of California, effective May 4, 1975) provides a statewide mechanism for reducing losses from surface fault rupture. The Act promotes public safety by prohibiting siting of most structures for human occupancy across traces of active faults that constitute a hazard to structures from surface faulting or fault creep. In accordance with the Act, the Office of State Geologist delineated Special Study Zones that encompass potentially and recently active traces of four major faults: San Andreas, Calaveras, Hayward and San Jacinto. The County of Imperial is responsible for enforcing the Act by ensuring that homes, offices, hospitals, public buildings, and other structures for human occupancy that are built on or near active faults or within a special study zone, are designed and constructed in compliance with the County of Imperial Codified Ordinance (Imperial County, Seismic and Public Safety Element).

The Project site is not mapped within an earthquake fault zone according to the Alquist-Priolo maps (WTI 2016a, p. 4).

California Building Code

The California Building Code (CBC) was approved and incorporated into the Uniform Building Code in 1998. In 2007, California adopted statewide, mandatory codes based on the International Code Council's (ICC) Uniform codes. Among other elements, Chapter 16 of this code dictates the design and construction standards applicable to resist seismic shaking of structures. The CBC includes standards used in project investigation, design, and construction (including grading and erosion control). The Project would be subject to the current CBC.

Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act of 1975 acknowledges that mineral extraction is essential to California's economy and that the reclamation of mined lands after extraction is necessary to prevent or minimize adverse effects on the environment and to protect the public health and safety. The Act also classifies mineral resources in the State and provides information to local governments. Local governments are responsible for designating lands that contain regionally significant mineral resources in their local General Plans for preserving such areas from encroachment or conversion to other uses. The law has resulted in the preparation of Mineral Land Classification Maps delineating Mineral Resource Zones (MRZ) for aggregate resources (sand,

gravel, and stone). Mining does occur throughout the County of Imperial as shown on the Active Surface Mining Operations Map (Imperial County 2003). However, the Project site is not located in an area with any MRZ zones.

B. LOCAL

County Land Use Ordinance

Title 9 Division 15 (Geological Hazards) of the County Land Use Ordinance has established procedures and standards for development within earthquake fault zones. Per County regulations, construction of buildings intended for human occupancy which are located across the trace of an active fault are prohibited. An exception exists when such buildings located near the fault or within a designated Special Studies Zone are demonstrated through a geotechnical analysis and report not to expose a person to undue hazard created by the construction. The proposed Project does not include any residential structures nor do any active faults align through the site.

Imperial County General Plan

The Seismic and Public Safety Element of the Imperial County General Plan contains goals and policies to minimize the risks associated with natural and human-made hazards including seismic/geological hazards, flood hazards, and Imperial Irrigation District Lifelines.

Table 4.4-1 analyzes the consistency of the Project with the applicable policies relating to seismic hazards and soil conditions in the Imperial County General Plan. While this EIR analyzes the Project's consistency with the General Plan pursuant to CEQA Guidelines Section 151250, the Imperial County Board of Supervisors ultimately determines consistency with the General Plan.

TABLE 4.4-1
IMPERIAL COUNTY GENERAL PLAN CONSISTENCY ANALYSIS

General Plan Policies	Consistent with General Plan?	Analysis
Seismic and Public Safety Element		
Land Use Planning and Public Safety		
Goal 1: Include public health and safety considerations in land use planning.	Yes	The proposed Project is located in a rural portion of Imperial County. Public health and safety would not be affected in association with development of a battery energy storage system in this area based on its remote location away from population centers. Therefore, the proposed Project is consistent with this goal.
Objective 1.4 Require, where possessing the authority, that avoidable seismic risks be avoided; and that measures, commensurate with risks, be taken to reduce injury, loss of life, destruction of property, and disruption of service.	Yes	The proposed Project is sited in an area subject to seismic shaking. However, no evidence of active faulting was discovered during a site investigation (WTI 2016a, p. 4). The nearest fault (Elisnor Fault, Laguna Salada section) is approximately 5

TABLE 4.4-1
IMPERIAL COUNTY GENERAL PLAN CONSISTENCY ANALYSIS

General Plan Policies	Consistent with General Plan?	Analysis
		miles west of the site. The proposed Project could experience strong ground shaking during an earthquake. However, no habitable structures are proposed and the Battery Energy Storage System would be designed in accordance with all applicable federal, State and local building codes as well as the recommendations included in the Geotechnical Evaluation Report (WTI 2016a). Damage to proposed structures can be mitigated through engineering and compliance with building standards (refer to mitigation measures MM 4.4.1a and MM 4.4.1b; MM 4.4.2a through MM 4.4.2h; MM 4.4.5a and MM 4.4.5b). Therefore, the proposed Project is consistent with this objective.
Objective 1.7 Require developers to provide information related to geologic and seismic hazards when siting a proposed project.	Yes	A Geotechnical Evaluation Report has been prepared by Western Technologies Inc. for the proposed Battery Energy Storage System. The Report was used in the analysis of geology and soils. The Report included recommendations to address potential geologic or seismic hazards that may be associated with the Project site. These standard building requirements and recommendations have been identified in this section as mitigation measures MM 4.4.1a and MM 4.4.1b; MM 4.4.2a through MM 4.4.2h; MM 4.4.5a and MM 4.4.5b. Therefore, the proposed project is consistent with this objective.
Emergency Preparedness		
Objective 2.8 Prevent and reduce death, injuries, property damage, and economic and social dislocation	Yes	The Project site is located in a seismically active area. The Geotechnical Evaluation Report

TABLE 4.4-1
IMPERIAL COUNTY GENERAL PLAN CONSISTENCY ANALYSIS

General Plan Policies	Consistent with General Plan?	Analysis
resulting from natural hazards including flooding, land subsidence, earthquakes, other geologic phenomena, levee or dam failure, urban and wildland fires and building collapse by appropriate planning and emergency measures.		prepared for the Project includes recommendations that all structures be designed in accordance with the CBC. Recommendations of the Report have been included as mitigation measures MM 4.4.1a and MM 4.4.1b to reduce risks associated with seismic hazards. Therefore, the proposed Project is consistent with this objective.
Seismic/Geologic Hazards		
Policy 4 Ensure that no structure for human occupancy, other than one-story wood frame structures, shall be permitted within fifty feet of an active fault trace as designated under the Alquist-Priolo Geologic Hazards Zone Act.	Yes	The proposed Project does not include any habitable structures and is not located within fifty feet of an active fault. Therefore, the proposed Project is consistent with this policy.

4.4.2 ENVIRONMENTAL SETTING

Geology

The Imperial Valley (also known as the Salton Sink, the Salton Basin, and the Salton Trough) is an extension of the Gulf of California, cut off from the Gulf by the Colorado River's delta fan (USGS 2007). The valley basin consists of lacustrine sedimentary fill of sands, clays, and gravels derived from Colorado River mud ranging up to 15,000 feet in thickness. The layers slope gently down-valley, and contain several important aquifers (WTI 2016a, p 4).

Seismicity

The valley is also laced with major members of the San Andreas Fault system. A review of available geologic records indicates that no active faults cross the proposed Project site. According to information published by the United States Geologic Survey, the Imperial Fault, located about 12 miles east of the site, is capable of producing a Magnitude 7.0 earthquake. The Elsinore Fault, (Laguna Salada section) is the nearest active fault zone and is about 5 miles west of the Project site (**Figure 4.4-1**). This fault zone is capable of producing earthquakes of Magnitude 7.5 (WTI 2016a, p. 4).

Groundwater

Groundwater was encountered in Borings 1 and 2 at a depth of 11 to 16 feet below existing site grade at the time of exploration. These observations represent the groundwater conditions at the time of measurements and may not be indicative of other times. Groundwater

levels can be expected to fluctuate with varying seasonal and weather conditions, groundwater withdrawal and recharge, local farm and irrigation practices, and future development (WTI 2016a, p. 4).

Landslides

Geological hazards such as landsliding are not applicable at the proposed Battery Energy Storage System site or adjacent areas. The Project site is level and has no potential for soil landslides and lateral spreading (WTI 2016a, p. 5).

Soil Map Units

Figure 4.4-2 depicts the soil map units within the boundaries of the Project site. Various characteristics of the soils are summarized in **Table 4.4-2,** and briefly described below.

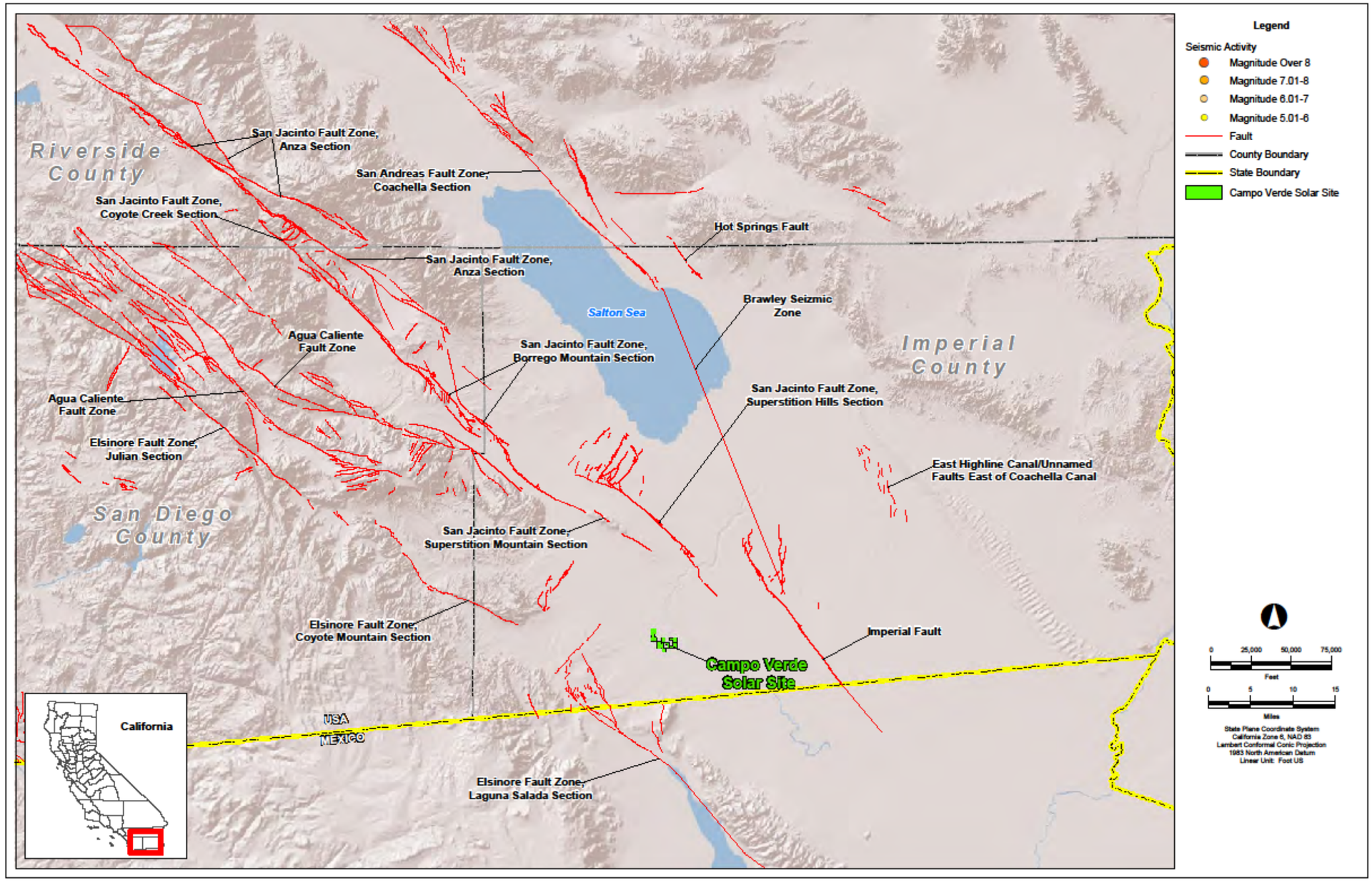
TABLE 4.4-2
SUMMARY OF PROJECT SITE SOIL MAP UNITS

Soil	Texture[1]	Depth of Surface Layer[1]	Wind Erodability Group[2]	Erosion (K) Factor[3]	Erosion Hazard Paths and Trails[4]	Permeability Inches Per Hour[3]
Meloland very fine sandy loam, wet	Very Fine Sandy Loam	12	5	.43	Moderate: Wetness	0.6-2.0
Vint-Indio very sandy loams, wet	Loamy Very Fine Sand	10	3	.32	Slight	2.0 – 6.0

Source: U.S. Department of Agricultural Soil Conservation Service, 1981.
Notes:
N/A = not applicable or not available.
[1] Taken from Table 11, Engineering Index Properties.
[2] Wind erodibility groups range from 1 to 8, with 1 being highly erodible and 8 having low erodibility. Taken from Table 12, Physical and Chemical Properties of Soils.
[3] This is an index of erodibility for standard condition and includes susceptibility of soil to erosion and rate of runoff. Low K values (below 0.15) indicate low erosion potential. High K values (above 0.4) are highly erodible. Taken from Table 12, Physical and Chemical Properties of Soils
[4] Qualitative descriptors of erosion hazard: Slight = little or no erosion is anticipated, Moderate = some erosion anticipated, Severe = significant erosion potential exists. Taken from Table 9, Recreational Development (Paths and Trails).

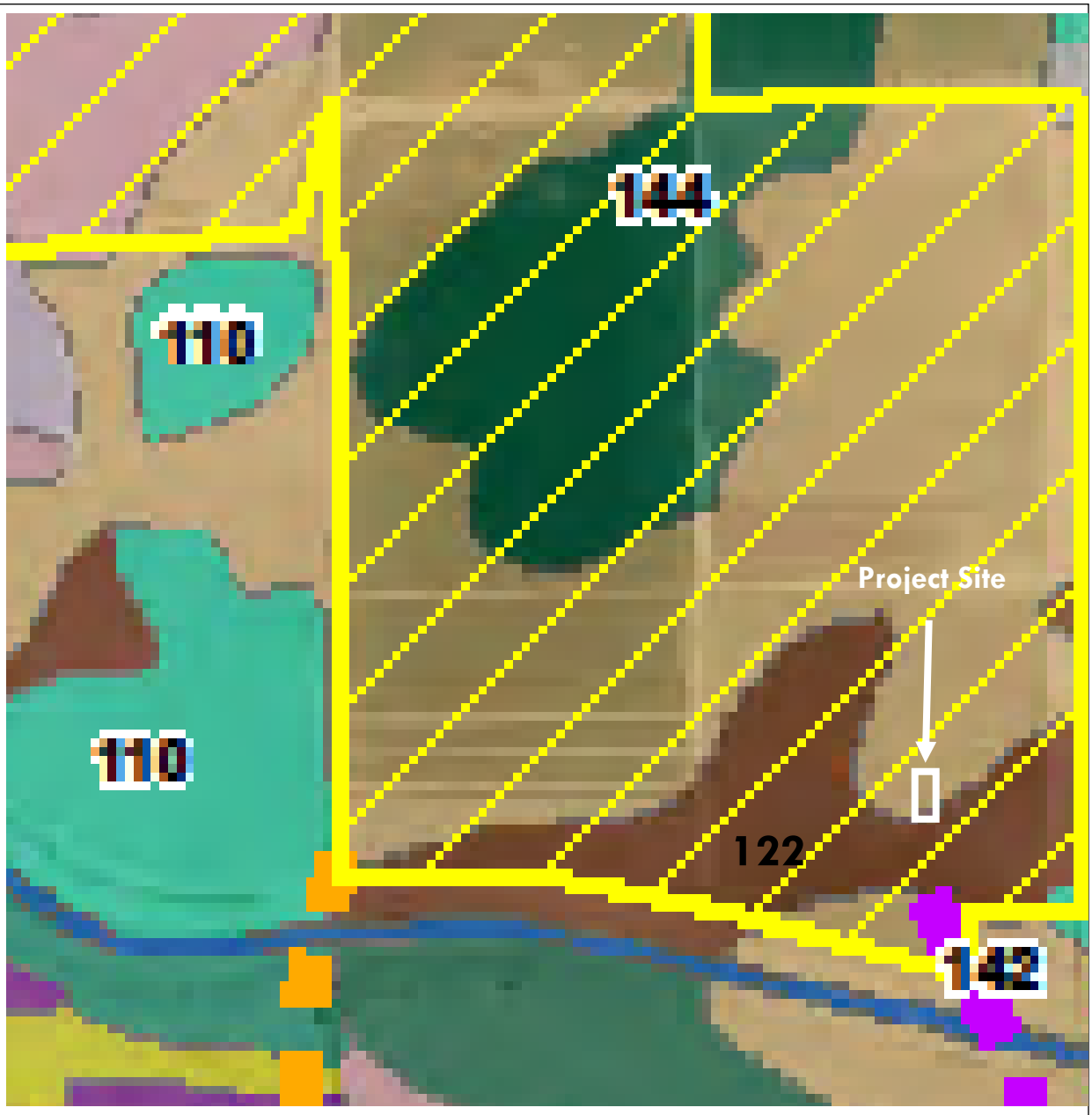
122 - Meloland very fine sandy loam, wet - very deep, nearly level and found on flood plains and alluvial basin floors. Permeability is slow, and available water capacity is high to very high. Surface runoff is low, and the hazard of erosion is slight.

142 - Vint loamy very fine sandy loam, wet - very deep, nearly level soils is on basin floors and flood plains. Permeability of Vint soil is moderately rapid permeability and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.



Source: kp environmental, 2012.

FIGURE 4.4-1
REGIONAL FAULTS AND SEISMICITY



LEGEND

- 110 – Holtville Silty Clay, wet
- 122 – Meloland very fine sandy loam, wet
- 142 – Vint Loamy Very Find Sand, wet
- 144 – Vint and Indio Very Find Sandy Loams, wet

North

Source: Base Map: kp environmental, EGI 2016.

FIGURE 4.4-2
SOILS MAP

Subsurface Soils

Existing subsoils near shallow foundation level exhibited moderate resistance to penetration using test method American Society for Testing and Materials (ASTM) D3550. This corresponds to a moderate bearing capacity for existing soils in their present condition.

Liquefaction

Liquefaction of soils can be caused by strong vibratory motion in response to earthquakes. Research and historical data indicate saturated loose, granular soils are susceptible to liquefaction, whereas cohesive soils such as clays, are not adversely affected by vibratory motion. The previous EGA Report performed a liquefaction analysis for the entire solar farm facility. Their analysis indicated that sandy zones down to a depth of 50 feet may liquefy (WTI 2016a, p. 5).

Subsidence

Subsidence is the gradual, local settling or sinking of the earth's surface with little or no horizontal motion. Subsidence is usually the result of gas, oil, or water extraction, hydro-compaction, or peat oxidation, and not the result of a landslide or slope failure. Ground surface effects related to subsidence are generally restricted to long surface structures such as canals, drains, and sewers, which are sensitive to slight changes in elevation. According to the Imperial County Seismic and Public Safety Element, subsidence from earthquakes and other activities, including geothermal resources development, can disrupt drainage systems and cause localized flooding. Subsidence was not identified in the findings of the Geotechnical Evaluation Report (WTI 2016a, p. 5).

Expansive Soils

Expansive soils are primarily comprised of clay particles. Clay increases in volume when water is absorbed and shrinks when dry. Expansive soils can damage building foundations, concrete flatwork, and asphaltic concrete pavements as a result of swelling forces that reduce soil strength. In general, much of the near surface soils in the agricultural area of the Imperial Valley consist of silty clays and clays which are moderately to highly expansive. Near surface soils are non-plastic to low plasticity. A test performed in accordance with ASTM D4829 (Standard Test Method for Expansion Index of Soils), resulted in an expansion index (EI) value of 0 and may be characterized as low expansive per the 2012 International Building Code (IBC). Slabs-on-grade supported on re-compacted on-site soils have a nil potential for heaving if the water content of the soil increases. Slabs-on-grade may be supported on properly placed and compacted fill or approved on-site soils (WTI 2016a, p. 7).

Differential Settlement

Differential settlement refers to uneven settlement of a slab-on-ground foundation. When differential settlement occurs, some portions of the foundation settle more than other portions. Sandy zones down to a depth of 50 feet may liquefy. The total post-liquefaction settlement is estimated to vary from 0 to ½ inch at the site with ¼ inch post-liquefaction differential settlement. These values should be used for structural design of this Project (WTI 2016a, p. 5).

Soil Corrosivity

Laboratory minimum resistivity and pH tests were conducted on samples of the site soils. The results indicate that the site soils, especially when of elevated moisture content, are potentially corrosive to buried ferrous metals (WTI 2016a, p. 8).

Mineral Resources

Imperial County contains diverse mineral resources. Those with the highest economic value include gold, gypsum, sand, gravel, lime, clay, and stone. Geologic factors restrict mining operations to the relatively few locations where mineral deposits are feasible for extraction. The majority of the mining areas are in the eastern portion of Imperial County as depicted on Figure 5, Mining Resources, of the Imperial County General Plan Conservation and Open Space Element (Imperial County 1993). The Battery Energy Storage System site is disturbed vacant land within the boundaries of the Campo Verde Solar Project site. The Project site appears to contain no mineral resources, and no mining activities occur in the vicinity of, or on, the Battery Energy Storage System site.

4.4.3 IMPACTS AND MITIGATION MEASURES

A. STANDARDS OF SIGNIFICANCE

The impact analysis provided below is based on the following State CEQA Guidelines, as listed in Appendix G. The Project would result in a significant impact to geology and soils if it would result in any of the following:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

   i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42?

   ii) Strong Seismic ground shaking?

   iii) Seismic-related ground failure, including liquefaction and seiche/tsunami?

   iv) Landslides?

b) Result in substantial soil erosion or the loss of topsoil?

c) Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse?

d) Be located on expansive soil, as defined in the latest Uniform Building Code, creating substantial risk to life or property?

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

B. ISSUES SCOPED OUT

Several checklist criteria were eliminated from further evaluation as part of the CEQA Appendix G Environmental Checklist Form and review of the Geotechnical Evaluation Report (WTA 2016a). Criterion "a-i" was scoped out because surface rupture is typically associated with pre-existing fault strands but may occur suddenly during an earthquake or over time in the form of fault creep. Surface rupture is the result of movement on an active fault reaching the surface. The Project

site is not mapped within an earthquake fault zone according to the Alquist-Priolo maps and no evidence of active faulting was found at the Project site during the site investigation (WTI 2016a, p. 4). Therefore, surface rupture is not considered to be a substantial geological hazard and this issue is not discussed further.

Criterion "a-iii" was scoped out because the proposed Battery Energy Storage System site is not located near a large body of water and is not along the coast. The Project site is approximately 100 miles inland from the California coast precluding damage due to seismically induced waves. Therefore, no impact would occur with respect to a tsunami. No retention basins that could be susceptible to seiche are located in the vicinity of the Battery Energy Storage System. Therefore, no impact would occur with regard to seiche and tsunami and neither issue is discussed further.

Criterion "c" with regard to subsidence or collapse was scoped out because subsidence was not identified as a potential geologic issue in the Geotechnical Evaluation Report prepared for the Project site (WTI 2016a). As such, it is not discussed further with regard to the proposed Project. Other geologic hazards such as landsliding do not appear to be evident at the Project site or adjacent areas. Topography for soil landslides, soil creep, or lateral spreading is insufficient. In addition, as identified in the Seismic and Public Safety Element of the County of Imperial General Plan, the hazard of landsliding is unlikely due to the regional planar topography. Thus, no impact is identified for these issue areas.

One additional issue, corrosive soils, was identified in the Geotechnical Evaluation Report and is discussed below.

C. METHODOLOGY

Existing conditions were evaluated based on potential to be affected by construction activities, operation and maintenance activities, and decommissioning of the Project. Construction and operation activities were identified based on information from the Applicant (Southern Power Company 2016). Impacts to geology and soil resources were formulated based on the findings and recommendations of the *Geotechnical Evaluation Report Campo Verde Phase I and Phase II Energy Storage Project* (WTI 2016a) and the letter regarding Campo Verde Phase I and Phase II Energy Storage Project Addendum No. 1 dated September 28, 2016 (WTI 2016b) as referenced. These documents are included in **Appendix E** of the Technical Appendices of this SEIR on the attached CD.

D. PROJECT IMPACTS AND MITIGATION MEASURES

Strong Seismic Ground Shaking

Impact 4.4.1 The Project site is located in a seismically active region and would be subject to strong seismic ground shaking in the event of an earthquake. This is considered a **potentially significant impact.**

One of the seismic hazards most likely to impact the Battery Energy Storage System site is strong ground shaking during an earthquake. The Project site is located in the seismically active Imperial Valley in Southern California and could experience moderate to strong ground motion from earthquakes in the region. Multiple faults are located in the vicinity of the Project site. The closest fault, the Imperial Fault, located approximately 12 miles east of the Project site, is capable of producing a Magnitude 7.0 earthquake. The Elsinore Fault (Laguna Salada section), is the nearest active fault zone located approximately 5 miles west of the Project site (**Figure 4.4-2**). This fault zone is capable of producing earthquakes of Magnitude 7.5.

The amount of ground shaking in an area during an earthquake depends on several factors: 1) proximity of the area to the fault; 2) the depth of focus; 3) the location of the epicenter; and 4) the size (magnitude) of the earthquake. Soil type also plays a role in the intensity of shaking. Bedrock or other dense or consolidated materials are less prone to intense ground shaking than alluvial soils. The Project site is underlain by fill/crop, lacustrine clays, and alluvial soils. Thus, the Project site includes soils that are susceptible to ground shaking.

Imperial County is classified as Seismic Zone 4 by the Uniform Building Code (UBC) (Sections 1626 through 1635). Developments within in Seismic Zone 4 (highest risk on a scale of 0 to 4) are required to incorporate the most stringent earthquake resistant measures. While the Project would not include habitable structures, Phase 1 and Phase 2 of the Battery Energy Storage System could be damaged by strong seismic shaking. Thus, impacts associated with strong seismic shaking are considered **potentially significant** during construction, operation and decommissioning of the proposed Project.

Mitigation Measures

MM 4.4.1 Phase 1 and Phase 2 of the proposed Battery Energy Storage System shall be designed in accordance with seismic considerations contained in the current California Building Code, Uniform Building Code or the standards of care established by the Structural Engineers Association of California and the County of Imperial building requirements.

Timing/Implementation: *Prior to approval of final building plans/As part of Project design.*

Enforcement/Monitoring: *Imperial County Department of Planning and Development Services.*

MM 4.4.1b For structural designs based upon the 2012 International Building Code, the following criteria shall apply. The soil site class is D. S_s, the spectral acceleration for short periods, is 1.500g. S_1, the spectral acceleration for a 1-second period, is 0.600g. F_a and F_v, in accordance with Table 1613.3.3(1) and 1613.3.3(2) are 1.000 and 1.500, respectively.

Timing/Implementation: *Prior to approval of final building plans/As part of project design.*

Enforcement/Monitoring: *Imperial County Department of Planning and Development Services.*

Significance After Mitigation

Implementation of mitigation measures MM 4.4.1a and MM 4.4.1b would reduce potential structural damage caused by strong seismic ground shaking by adhering to the appropriate codes and standards of care. Thus, this impact can be reduced to a **less than significant** level through adherence to applicable codes and standards.

Liquefaction/Unstable Soils

Impact 4.4.2 Soils on the Project site could be subject to liquefaction as well as differential settlement if water infiltrates foundation soils. This is considered a **potentially significant impact.**

According to the Soil Survey of Imperial County, the proposed Project site is covered with two soil types (refer to **Table 4.4-2**) and (**Figure 4.4-2**). Loose, granular soils are susceptible to liquefaction under certain conditions. Surface soils to full depth of boring exploration consist of dense silty sand and stiff to very stiff sandy clay. The near surface soils are non-plastic to low plasticity (WTI 2016a, p. 4). [Note: The boring logs included in the Geotechnical Evaluation Report are indicators of subsurface conditions only at the specific location and date noted. Variations from the field conditions represented by the boring may become evident during construction. If variations appear, WTI should be contacted to re-evaluate the recommendations provided in the Geotechnical Evaluation Report.]

Both Phase 1 and Phase 2 of the proposed Battery Energy Storage can be supported by shallow spread foundations bearing on undisturbed dense native soil and/or properly compacted engineered fill. Liquefaction is not considered to be a hazard in clays. However, sandy zones down to a depth of 50 feet may liquefy. The total post-liquefaction settlement is estimated to vary from 0 to ½ inch at the site with ¼ inch post-liquefaction differential settlement (WTI 2016a, p. 5). Differential settlement of the proposed container for Phase 1 and the building for Phase 2, supported as recommended, is anticipated to be less than ¾ of an inch (WTI 2016a, p. 7, 2016b, p. 1).

It should also be noted that groundwater was encountered in two separate borings at a depth of 11.5 to 16.5 feet below existing site grade in the area of Phase 1 and Phase 2 at the time of exploration. Groundwater levels are prone to fluctuation and may be deeper or shallower depending on weather conditions, groundwater withdrawal and recharge, etc. The presence of water would factor into potential for liquefaction and unstable soils primarily during operation of the Project and to a lesser degree during construction. Liquefaction and unstable soils would not hamper decommissioning activities as the Project would be disassembled and removed from the Project site.

The proposed Battery Energy Storage System will be designed in accordance with a Final Geotechnical Evaluation Report that will be prepared by a licensed professional engineer during the final design phase. This Final Geotechnical Evaluation report will be submitted to the Imperial County Public Works Department, Engineering Division and the Imperial County Planning and Development Services Department for review and approval prior to obtaining building permits as required by the Imperial County requirements.

Mitigation Measures

MM 4.4.2a The structural design of foundations for Phase 1 and Phase 2 shall be based on the total post-liquefaction settlement varying from 0 to ½-inch at the site with ¼-inch post-liquefaction differential settlement.

Timing/Implementation: *Prior to approval of final building plans/As part of project design.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

MM 4.4.2b The final design of Phase 1 and Phase 2 foundations shall include proper drainage to inhibit water infiltration into foundation soils. Drainage shall also be properly managed during construction to avoid water infiltration from any source.

Timing/Implementation: *Prior to approval of final building plans/during construction of Phase 1 and Phase 2 foundations.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

MM 4.4.2c Phase 1 and Phase 2 shall be designed in accordance with the following alternative footing depths and allowable net bearing capacities:

Footing Depth Below Finished Grade (ft) [1]	Allowable Bearing Capacity (psf)
1.5	2000
2.0	2500

Source: WTI 2016a, pp. 6-7.

Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings

The allowable bearing capacities shall apply to dead loads plus design live load conditions. Minimum widths of column and wall footings shall be 24 inches and 16 inches, respectively. A one-third increase in the bearing capacity is allowable for wind or seismic loads.

Timing/Implementation: *Prior to approval of final building plans/As part of project design.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

MM 4.4.2d All footings shall be reinforced to reduce the potential for distress caused by differential foundation movements.

Timing/Implementation: *During construction/As part of project design.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

MM 4.4.2e The geotechnical engineer or geotechnical engineer's representative shall observe the footing excavations prior to placing reinforcing steel and pouring concrete foundations to assess whether the soils exposed are similar to those anticipated for support of the footings. Any soft, loose, or unacceptable soils shall be undercut to suitable materials and backfilled with approved fill materials or lean concrete. Soil backfill shall be properly compacted.

Timing/Implementation: *Prior to placing reinforcing steel and pouring concrete foundations/Geotechnical engineer or geotechnical engineer's representative.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

MM. 4.4.2f Slabs-on-grade shall be designed using a modulus of subgrade reaction (k) of 225 pounds per cubic inch (pci) for the on-site soil and imported fill material based on the soil classification. The slab subgrade shall be prepared in accordance with procedures outlined in the Geotechnical Evaluation Report (WTI 2016a). A minimum 4-inch layer of base course should be provided beneath all slabs to help prevent capillary rise and a damp slab.

Timing/Implementation: *Prior to approval of final building plans/As part of project design.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

MM 4.4.2g All concrete placement and curing operations shall follow the American Concrete Institute manual recommendations. Improper curing techniques and/or high slump (high water-cement ratio) could cause excessive shrinkage, cracking or curling. Concrete slabs shall be allowed to cure adequately before placing vinyl or other moisture sensitive floor covering.

Timing/Implementation: *Prior to approval of final building plans/During concrete placement and curing.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

MM 4.4.2h In areas where sidewalks or paving do not immediately adjoin the structures of the proposed Phase 1 and Phase 2 of the Energy Storage System Project, protective slopes shall be provided with an outfall of 5 percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility trenches shall be well-compacted and free of all construction debris to minimize the possibility of moisture infiltration.

Timing/Implementation: *Prior to approval of final building plans/During construction.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

Significance After Mitigation

Implementation of mitigation measures MM 4.4.2a through 4.4.2h would reduce potential structural damage caused by liquefaction/unstable soils that may be present on the Project site. Through engineering, proper drainage and observation in the field, impacts resulting from construction of Phase 1 and Phase 2 of the Battery Energy Storage System on soils prone to liquefaction can be mitigated to **less than significant**.

Erosion

Impact 4.4.3 Construction of the proposed Battery Energy Storage System would result in ground disturbance and potential for erosion and loss of top soil. Multiple requirements have been established to address erosion during construction, operation and decommissioning of the proposed Project. Therefore, erosion impacts are considered **less than significant**.

Soil erosion could result during construction of the proposed Project in association with grading and earthmoving activities. Because the Project site has been previously leveled at the time the Campo Verde Solar Project was developed, only minor grading would be needed. Existing grasses will be grubbed. Foundations for Phase 1 and 2 of the Battery Energy Storage System will be excavated and trenches will be dug to accommodate placement of wire underground. All excavations are anticipated to be relatively shallow and trenches will be a minimum of 36 inches (3 feet) in depth (Southern Power Company 2016).

During construction, erosion would be controlled in accordance with County standards including preparation, review and approval of a grading plan by the County Engineer and implementation

of a Dust Control Plan (Rule 801) (discussed further in Section 4.1, Air Quality). An NPDES permit *will not b*e required for Phase 1 because less than one acre would be disturbed. A Stormwater Pollution Prevention Plan (SWPPP) will be required for Phase 2 to protect water quality during construction. However, the SWPPP will be exempt for Phase 1 because it is under one acre. Phase 2 is larger than one acre and is located in a zone that previously had a SWPPP when the Campo Verde Solar Project was constructed, therefore it requires a SWPPP.

The generally flat topography of the Project site and the low average annual precipitation for the area would reduce the likelihood of substantial erosion and loss of topsoil. Daily operations and routine maintenance are not anticipated to increase erosion. A gravel road providing access to the Battery Energy Storage System would control erosion caused by vehicles. Likewise, during operation, soil erosion and sedimentation would be controlled in accordance with the Project's Long-Term Site Maintenance Plan. Thus, erosion impacts would be reduced to less than significant levels during operations.

During decommissioning, soil erosion and sedimentation is anticipated to be controlled in accordance with implementation of a Dust Control Plan (Rule 801) and compliance with the NPDES Construction General Permit. These actions would mitigate the potential soil erosion impacts to a **less than significant** level.

Mitigation Measures

None required.

Significance After Mitigation

Not applicable.

Expansive Soils

Impact 4.4.4 Soils on the Project site were tested to determine whether expansive characteristics were present. The soils had an expansion index value of zero and may be characterized as low expansive Therefore, expansive soils impacts associated with construction, operation and decommissioning of the Battery Energy Storage System are considered **less than significant.**

Near surface soils on the Project site are non-plastic to low plasticity (WTI 2016a, p 4). Soils with a high plastic limit tend to be clay, those with a lower plastic limit tend to be silt, and those with a plastic limit of zero (non-plastic) tend to have little or no silt or clay. A test performed in accordance with ASTM D4829 (Standard Test Method for Expansion Index of Soils) resulted in an expansion index value of zero and may be characterized as low expansive per the 2012 International Building Code (IBC). Slabs-on-grade supported on re-compacted on-site soils have a nil potential for heaving if the water content of the soil increases. Slabs-on-grade may be supported on properly prepared on-site soil (WTI 2016a, p. 5). Therefore, impacts associated with expansive soils are considered **less than significant** during construction and operation. The Battery Energy Storage System structures and wiring would be removed during decommissioning of the proposed Project and no expansive soils impacts are anticipated.

Mitigation Measures

None required.

Significance After Mitigation

Not applicable.

Soil Corrosivity

Impact 4.4.5 Soils within the Project site were tested for corrosivity. While the soils do not contain properties that would be corrosive to concrete, metal structures coming in contact with Project site soils could be damaged. This is considered a **potentially significant impact**.

Concrete

Chemical tests were performed on a representative sample of on-site soils to determine the amount of water-soluble sulfates and chlorides. With regard to the "Sulfate" category (which applies to concrete in contact with soil or water containing deleterious amounts of water-soluble sulfate ions), the chemical test results indicate that the soils at the site have a "Not Applicable" severity and corresponding classification of "S0" in Table 4.2.1 (Exposure Categories and Classes) of the American Concrete Institute Building Code Requirements for Structural Concrete 318-11 (ACI 2008). The "S0" exposure class is assigned for conditions where the water-soluble sulfate concentration in contact with concrete is low and injurious sulfate attack is not a concern. The test results indicate that the soils would be classified as negligibly corrosive to concrete (WTI 2016a, p. 5). Laboratory minimum resistivity and pH tests were conducted on a sample of the site soils.

Soil resistivity is a measure of how much the soil resists the flow of electricity. The soil resistivity value is subject to great variation, due to moisture, temperature and chemical content. Typical values range between 0 and 1,000 ohms. Minimum resistivity values of 514 and 934 ohm centimeters were obtained for the Project site soils. These values indicate that the site soils, especially when of elevated moisture content, are potentially corrosive to buried ferrous metals (WTI 2016a, p. 5).

Soil pH is a measure of the acidity and alkalinity in soils. pH levels range from 0 to 14, with 7 being neutral, below 7 acidic and above 7 alkaline. The pH of the soils tested was 8.5, which is within the range of typical values for desert soils (WTI 2016a, p. 5) and trending towards alkaline.

Some types of concrete may not withstand the soil composition. However, Type II Portland cement will be used for all concrete on and below grade in keeping with standard local practice and material availability (WTI 2016a, p. 9). Therefore, concrete corrosivity impacts are considered **less than significant** during both construction and operation of the Project. As part of decommissioning, the concrete foundations will be demolished and removed or used onsite for fill as needed.

Metals

Laboratory minimum resistivity and pH tests were conducted on samples of the Project site soils. The results indicate that the site soils, especially when of elevated moisture content, are potentially corrosive to buried ferrous (i.e. iron) metals. Metal piping or other conduits that would be in contact with native soils as part of construction and operation would be susceptible to corrosion which would present **a potentially significant impact**.

As part of decommissioning, metal structures will be demolished and removed from the Project site. The Battery Energy Storage System site would be reclaimed for agricultural uses cleared of structures with concrete foundations. Therefore, no impacts associated with corrosive soils are anticipated to occur in association with Project decommissioning.

Mitigation Measures

MM 4.4.5 A corrosion expert shall be part of the Project design team to prepare recommendations for corrosion protection of buried utilities and conduits. Buried metal piping or other conduits in contact with the native soils shall be protected from direct contact with the soil. Special protection shall be implemented where dissimilar metals are placed in close proximity or are joined.

Timing/Implementation: *Prior to issuance of building permit/during construction.*

Enforcement/Monitoring: *Imperial County Public Works Department, Engineering Division/Imperial County Department of Planning and Development Services.*

Significance After Mitigation

Implementation of mitigation measure MM 4.4.5 would reduce potential damage to metal caused by corrosive soils present on the Project site. Through use of the proper concrete and protection of metal pipes that will contact native soils, corrosive impacts can be mitigated to **less than significant.**

4.4.4 CUMULATIVE SETTING, IMPACTS AND MITIGATION MEASURES

A. CUMULATIVE SETTING

The geographic scope for the cumulative geology and soils setting is the Imperial Valley portion of the Salton Trough physiographic province of Southern California. In general, geology and soils impacts are site-specific and limited to the boundaries of a proposed project rather than cumulative in nature. Project-specific impacts within the geographic scope are based on the soil characteristics and topography of each site. A list of past, present and probable large-scale solar projects in the vicinity of the Campo Verde Battery Energy Storage System is identified in Table 3.0-1 in Chapter 3.0, Introduction to the Environmental Analysis and Assumptions Used.

B. CUMULATIVE IMPACTS AND MITIGATION MEASURES

Cumulative Exposure to Geologic and Seismic Impacts

Impact 4.4.6 Implementation of the proposed Project, in combination with past, present and probable large-scale solar projects in the vicinity of the Battery Energy Storage System, may result in cumulative exposure to geologic and seismic hazards. However, each project would be subject to compliance with the CBC, UBC, and geotechnical engineering recommendations to reduce impacts on a project-specific basis. Therefore, exposure to geologic and seismic impacts are considered a **less than cumulatively considerable impact.**

Ground Shaking

As discussed above, the Project site is located in a seismically active area which would make it susceptible to seismic ground shaking in the event of an earthquake. Exposure of the site to strong seismic ground shaking is a potentially significant site-specific impact. Mitigation measure MM 4.4.1 requires structures to be designed in conformance with the current California Building Code, current Uniform Building Code or the standards of care established by the Structural Engineers Association of California and the County of Imperial building requirements. Implementation of mitigation measures MM 4.4.1a and MM 4.4.1b would reduce the Project's exposure to damage from seismic ground shaking to less than significant. Furthermore, ground shaking impacts to the proposed Project are not expected to combine with past, present and probable large-scale solar projects in the vicinity of the Campo Verde Battery Energy Storage System Project identified in

Table 3.0-1 in Chapter 3.0, Introduction to the Analysis and Assumptions Used. The proposed Project would have a less than cumulatively considerable contribution to ground shaking impacts and result in a **less than cumulatively considerable impact**.

Liquefaction/Unstable Soils

Development of the proposed Project would be subject to soils susceptible to liquefaction. Such impacts are assessed on a project-by-project basis and are site-specific in nature. Implementation of mitigation measures MM 4.4.2a through 4.4.2h would reduce potential structural damage caused by liquefaction/unstable soils that may be present on the Project site. Through engineering, proper drainage and observation in the field, impacts resulting from constructing Phase 1 and Phase 2 of the Battery Energy Storage System on soils prone to liquefaction can be mitigated to less than significant and would not have a cumulatively considerable contribution to liquefaction impacts potentially occurring at other project site. Furthermore, potential liquefaction impacts present at the Project site are not expected to combine with past, present and probable large-scale projects in the vicinity of the Battery Energy Storage System identified in Table 3.0-1 in Chapter 3.0, Introduction to the Analysis and Assumptions Used. Therefore, the proposed Project would have a less than cumulatively considerable contribution to exposure to expansive soils and result in a **less than cumulatively considerable impact**.

Erosion

Construction soil erosion impacts are considered potentially significant short-term, site-specific impacts under CEQA. Erosion would be controlled on-site with site-specific measures, a grading plan approved by the County Engineer, implementation of a Dust Control Plan (Rule 801), and compliance with the NPDES Construction General Permit. Therefore, soil erosion impacts are not expected to combine with similar impacts of past, present and probable large-scale solar projects in the vicinity of the Battery Energy Storage System. The proposed Project would have a less than cumulatively considerable contribution to soil erosion impacts. Likewise, cumulative impacts associated with soil erosion would be **less than cumulatively considerable.**

Expansive Soils

Development of the proposed Project would not be subject to expansive soils. Such impacts are assessed on a project-by-project basis and are site specific in nature. Thus, the proposed Project would not create any expansive soil impacts nor would expansive soil impacts be cumulative in nature. Therefore, development of the proposed Battery Energy Storage System would have a less than cumulatively considerable contribution to exposure to expansive soils and result in a **less than cumulatively considerable impact**.

Soil Corrosivity

The composition of the native soils on Battery Energy Storage System site represent a potential threat to metal pipes and conduit. The use of the proper protection of metal pipes as described in mitigation measure MM 4.4.5 would reduce potential damage to concrete and metal caused by corrosive soils that may be present on the Project site. Corrosive soils impacts would not combine with past, present and probable large-scale solar projects in the vicinity of the Battery Energy Storage System identified in Table 3.0-1 in Chapter 3.0, Introduction to the Analysis and Assumptions Used. The proposed project would have a less than cumulatively considerable contribution to corrosive soils impacts. Likewise, cumulative impacts associated with corrosive soils would be **less than cumulatively considerable.**

Mitigation Measures

As discussed throughout this analysis, the proposed Project would be subject to all applicable building codes and standards (MM 4.4.1a and MM 4.41b) and required to implement proper engineering, design and materials (MM 4.4.2a, MM 4.4.2b, MM 4.4.2c, MM 4.4.2d, MM 4.4.2e, MM 4.4.2f, MM 4.4.2g, MM 4.4.2h and MM 4.4.5). Therefore, following mitigation, cumulative geological and seismic impacts would be reduced to **less than cumulatively considerable**.

Significance After Mitigation

Project-specific impacts are mitigated on a project-by-project basis. Following implementation of mitigation measures MM 4.4.1, MM 4.4.2a, MM 4.4.2b, MM 4.4.2c, MM 4.4.2d, MM 4.4.2e and MM 4.4.5, geology and soils impacts would be reduced to **less than cumulatively considerable** levels.

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