
4.4 GEOLOGY/SOILS

The following section provides general geologic and soils information for the El Centro area and is based on documents from the City of El Centro, the County of Imperial and California Division of Mines and Geology.

4.4.1 Existing Conditions

Geology

The project area lies within the Imperial Valley portion of the Salton Trough, the dominant landform within the County. The Salton Trough encompasses the Coachella, Imperial and Mexicali valleys and extends north from the Gulf of California. The project lies at the lowest part of the basin at about 25 feet below mean sea level (BMSL). The deepest portion of the trough is covered by the Salton Sea with a water surface level measured at 226 feet BMSL at its highest level in April 1986. The geologic structure of the trough is a result of an evolving "rift" in the earth's crustal plates. As the crust thins due to the "spreading" of the trough, magma rises closer to the surface, heating deep groundwater. Nonmarine and alluvium sediments cover large portions of the area. An unexposed succession of Tertiary- and Quaternary-age sedimentary rocks lies below the alluvial and lake bottom sediments, ranging in depth from 11,000 or greater feet at the margins to more than 20,000 feet in the central portions of the Salton Trough. Basement rock consisting of Mesozoic granite and probably Paleozoic metamorphic rocks are estimated to exist at depths between 15,000-20,000 feet. The valley is drained by an 8,360 square mile watershed, which eventually empties into the Salton Sea.

The Imperial Valley area is subjected to frequent seismic events with related concerns of ground shaking, liquefaction and landslides. Subsidence, a phenomenon associated with groundwater withdrawal and can occur as a result of geothermal operations; however, the potential is considered low to moderate on the valley floor under the current hydrological conditions. Although landslides are a potential hazard, particularly in the western portions of the County, bluff failure and mudslides in the Imperial Valley generally ensue along slopes and embankments of the rivers and canals.

The most noteworthy of the numerous active faults traversing the Salton Trough is the San Andreas. The other two major northwest-trending fault zones bounding the Trough are the San Jacinto on the northwest and the Elsinore on the southwest. More small to moderate earthquakes have occurred in the Imperial Valley area than along any other section of the San Andreas Fault system. Earthquakes of magnitude 6.0 or greater on the Richter scale happen periodically.

The El Centro area is particularly susceptible to strong ground shaking and significant earthquake damage from liquefaction, land subsidence and ground lurching. The Imperial Fault, which has shown surface rupture or displacement recently, is located approximately 5 miles to the east and is the closest fault to the project site. In 1968, it was indicated that the fault had crept horizontally separating in a right-lateral sense. The associated Alquist-Priolo Special Studies Zones extend only slightly further west from the fault toward the project site. Historically, the Imperial Valley is a seismically active area associated with 11 earthquakes occurring between 1938 and 1979 registering from point 4.3 and 6.4 on the Richter scale (Table 4.4-1).

Location	Date	Time	Magnitude
Superstition Hill/Imperial Valley	November 24, 1987	06:15 PST	6.6
Imperial Valley	October 16, 1979	06:58 PST	5.0
Imperial Valley	October 15, 1979	23:19 PST	5.0
Imperial Valley	October 15, 1979	23:16 PST	6.4
Imperial Valley	January 23, 1975	17:02 PST	4.8
Imperial Valley	December 6, 1974	12:13 PST	4.8
Imperial County	December 16, 1955	21:17 PST	4.3
Imperial County	December 16, 1955	22:07 PST	5.2
Imperial Valley	June 13, 1953	20:17 PST	5.5
Imperial Valley	January 23, 1951	23:17 PST	5.8
Imperial Valley	May 19, 1940	20:37 PST	6.9
Imperial Valley	June 5, 1938	18:42 PST	4.8
Imperial Valley	April 13, 1938	11:29 PST	4.5

Source: Institute for Crustal Studies, University of California, Santa Barbara: Strong Motion Database, 2001

Other faults within the region of El Centro consist of the Wienert Fault, the Superstition Hills Fault, the Superstition Fault Zone, and the Brawley Fault Zone. The site could also be subjected to moderate to severe ground shaking in the event of an earthquake on any of the faults in the southern California and northern Baja California area. Earthquakes within Imperial Valley are unavoidable. However, the seismic risk associated with the project is not considered different from that of surrounding developments.

Thermal water of sufficient temperature for direct heat application underlay the Salton Trough at shallow depths. Distributed throughout the Trough are areas of hotter fluids suitable for electrical generation. The United States Geological Survey (USGS) has designated nine Known Geothermal Resources Areas (KGRA) throughout Imperial County. The County has established four Geothermal Overlay ("G") Zones. The areas vary in temperature, pressure and chemical composition.

Due to the poor groundwater quality, little use is made of this resource. This condition plus irrigation practices employing imported water in the Imperial Valley result in groundwater basin recharge exceeding extraction and creates rising not falling groundwater levels.

Soils

Soils are discussed in this section in terms of the overall soils regime in the geologic setting of the Salton Trough. Considering that soils have an agricultural importance, further discussion is provided in Section 4.1.

Ancient lakebed sediments, alluvial channels and dune sands occur in the Salton Trough. Clay and silt deposits of the lakebed cover the central portion basin with shoreline deposits predominantly of unconsolidated sand and gravel, grading into the clays and silts around the prehistoric lake edge. Lakebeds are generally less than 100 feet thick. East and west of the central portion of the Trough dissected, flat-lying alluvium is found. These poorly consolidated silts, sands and gravels form thin veneers of desert pavement between washes. Sand dunes up to 200 feet thick occur on mesa areas to the east and west sides of Imperial Valley.

Soils in the project area are underlain by Late Pleistocene to Holocene lacustrine deposits associated with ancient Lake Cahuilla. These sediments are typically unconsolidated to poorly consolidated and porous, consisting generally of clay, silt and sand. Clay and silt soils are expected to exhibit a medium to high expansion potential. Near surface soils are generally soft and/or loose due to recent agricultural processing. The majority of the project site is covered by soils generally identified as Imperial, described as nearly level, moderately well drained silty clay in lacustrine basin. Some of the soils in the Imperial Valley area have a high expansion or shrink-swell potential. These are generally found where fine-grained clayey sediments occur. The project site is outside areas identified as having a high potential for liquefaction and moderate to high potential for landslides and slope stability problems.

4.4.2 Impact Significance Criteria

A significant geologic impact would occur if:

- Development of any portion of the project site will be in violation of State Alquist-Priolo Act restrictions for designated zones;
- Proposed uses will result in unacceptable risks of injury, loss of life, destruction of property and disruption of services due to seismic activity;
- Development will occur in the vicinity of geothermal extraction/injection activities and be subject to elevation changes;
- Areas of construction are underlain by expansive soils (high shrink-swell potential); and
- The project site is subject to landslides or liquefaction in areas proposed for development.

4.4.3 Impact Analysis

Earthquakes in the Imperial Valley are unavoidable, and the primary seismic danger in El Centro results from ground shaking. Building plans for human occupancy structures need to be designed in conformance with the City's Seismic Safety Emergency Plan in order to reduce bodily injury and property damage during earthquakes. The project property is outside the limits of the Alquist-Priolo Special Studies Zones of the Imperial Fault. However, the site lies within six miles of a Type A fault overlying stiff soils. The proposed project site is susceptible to potentially strong seismic ground shaking based on the location of the proposed project. Design will be in accordance with the Uniform Building Code in order to minimize any potential impacts. Therefore, there would not be a significant impact associated with seismic activity.

Geotechnical reports conducted in the project vicinity have identified the risk for landslides to be low within the project area. Seismically induced slumps and incipient lateral spreading have been identified on canal banks in the vicinity of the project. The flat topography indicates that the potential for such events to affect the proposed development is low. The canal will be undergrounded, thereby minimizing any hazards associated with landslides along the banks of the canal. The proposed project will increase the sealed surface area of the site and require grading. Landscaping of the site and use of standard construction techniques such as watering and other Best Management Practices (BMPs) will reduce the impact to below the level of significant.

Geotechnical reports conducted in the surrounding area, found the region to be potentially susceptible to liquefaction. Soil constraints may require special consideration during the construction stage.

Construction on expansive soils, if standard compensating grading and construction measures are not used, can result in damage from differential ground movement. Design will be in accordance with the Uniform Building Code in order to minimize any potential impacts. Therefore, there would not be a significant impact associated with unstable soils.

4.4.4 Significant Impacts

No geotechnical conditions have been identified to preclude development of the project as planned. However, potentially expansive soils may exist on the site, which will not present a significant constraint to development if standard UBC construction techniques are implemented at the detailed design and construction stages. Therefore, no significant impacts are anticipated.

4.4.5 Mitigation Measures

All site preparation and construction shall comply with the current seismic design provision for Seismic Zone 4 of the UBC. Therefore, no significant impacts have been identified and mitigation is not required.

4.4.6 Impacts After Mitigation

No significant geology/soils impacts have been identified, therefore, no mitigation measures are required.