# 5.4 Geologic Hazards and Resources

This section evaluates the effect of geologic hazards on the Chula Vista Energy Upgrade Project (CVEUP) and geologic resources of commercial, recreational, or scientific value at the project site. Section 5.4.1 describes the existing environment that could be affected, including regional and local geology and geologic hazards. Section 5.4.2 identifies potential environmental effects from project development. Section 5.4.3 discusses potential cumulative effects. Section 5.4.4 discusses possible mitigation measures. Section 5.4.5 presents the laws, ordinances, regulations, and standards (LORS) applicable to geologic hazards and resources. Section 5.4.6 describes the required permits. Section 5.4.7 provides agency contacts. Section 5.4.8 provides the references used to develop this section.

## 5.4.1 Affected Environment

The CVEUP site is a 3.8-acre parcel located on Main Street in Chula Vista, San Diego County, California. The site is relatively flat and gently slopes to the south toward the Otay River Valley.

A site-specific geotechnical investigation was performed in November 2006 at the project site by Ninyo & Moore. The scope of the study included an evaluation of geotechnical data to develop recommendations for site-specific grading, foundation design, and mitigation of geotechnical constraints. A copy of the geotechnical report is included as Appendix 5.4A.

### 5.4.1.1 Regional Geology

The project area is situated in the Peninsular Ranges Geomorphic Province. This province encompasses an area that extends approximately 900 miles from the Transverse Ranges and the Los Angeles Basin south to the southern tip of Baja California, and varies in width from approximately 30 to 100 miles (Norris and Webb, 1990). The province is characterized by mountainous terrain on the east composed mostly of Mesozoic igneous and metamorphic rocks, and relatively low-lying coastal terraces to the west underlain by late Cretaceous, Tertiary, and Quaternary age sedimentary rocks. Most of the coastal region of the County of San Diego, including the CVEUP site, is located within this coastal region and is underlain by sedimentary rock.

The Peninsular Ranges are traversed by several major active faults. The Newport-Inglewood, Whittier-Elsinore, San Jacinto, and San Andreas faults are major active fault systems located north-northeast of the site and the Rose Canyon, Coronado Bank, and San Diego Trough are active faults located to the west. Major tectonic activity associated with these and other faults within this regional tectonic framework is marked by right-lateral and strike-slip movement.

### 5.4.1.2 Local Geology

The project site is located in an area of relatively flat topography inland of San Diego Bay. The geology within a 2-mile radius of the site is shown on Figure 5.4-1. The geologic units that are present within this 2-mile area are described below with details provided by *Geology of the National City, Imperial Beach, and Otay Mesa Quadrangles, Southern San Diego County Metropolitan Area California* (California Geologic Survey, formerly Division of Mines and

Geology, 1977). Groundwater at the site has been detected at a depth of between 32 and 34 feet below ground surface (Ninyo & Moore, 2006).

**Young alluvial flood plain deposits (Holocene and late Pleistocene)**—These deposits consist of mostly poorly consolidated, poorly sorted, permeable flood plain deposits.

**Old alluvial flood plain deposits undivided (late to middle Pleistocene)**—These deposits consist of fluvial sediments deposited on canyon floors that are moderately well consolidated, poorly sorted, permeable, commonly slightly dissected gravel, sand, silt, and clay-bearing alluvium.

**Old paralic deposits, Unit 6 (late to middle Pleistocene)**—These are mostly poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone, and conglomerate. They rest on the 72- to 75-foot-thick Nestor terrace.

**Very old paralic deposits undivided (middle to early Pleistocene)**—These are mostly poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone, and conglomerate. These deposits rest on the now emergent wave cut abrasion platforms preserved by regional uplift.

**San Diego Formation (early Pleistocene and late Pliocene)**—The San Diego Formation consists of predominantly yellowish-brown and gray, fine- to medium-grained, poorly indurated fossiliferous marine sandstone (Tsdss) and reddish-brown, transitional marine and nonmarine pebble and cobble conglomerate (Tsdcg). In part of the area, the sandstone and conglomerate are undivided (Tsd).

**Otay Formation (late Oligocene)**—The Otay Formation consists of light-gray and light-brown, medium- and coarse-grained, nonmarine arkosic sandstone intertongued with light-brown siltstone and light-gray claystone. Much of the claystone is composed of light-gray bentonites that occur in beds up to 3 feet in thickness.

#### 5.4.1.3 Project Site Stratigraphy

The CVEUP site is underlain with up to approximately 25 feet of undocumented artificial fill materials that consist of medium dense to very dense silty to clayey sand with gravel and cobbles, stiff to hard clayey silt and silty sandy gravelly clay, and buried construction debris. This fill is underlain with alluvium to a depth of approximately 28 to 30 feet below ground surface. The alluvium consists of dense to very dense clayey sand and clayey gravel. Below this are terrace deposits that consist of medium dense to dense silty sand and sandy silt with hard gravelly clay (Ninyo & Moore, 2006).

#### 5.4.1.4 Faulting

The seismicity of the San Diego area has been characterized as a broad scattering of small magnitude earthquakes. Major known active faults in the region consist generally of en echelon, northwest-striking, right-lateral, strike-slip faults. These include the San Andreas, Elsinore, and San Jacinto faults located northeast of the site, and the Rose Canyon and Coronado Bank faults, located to the west of the site (Ninyo & Moore, 2006).

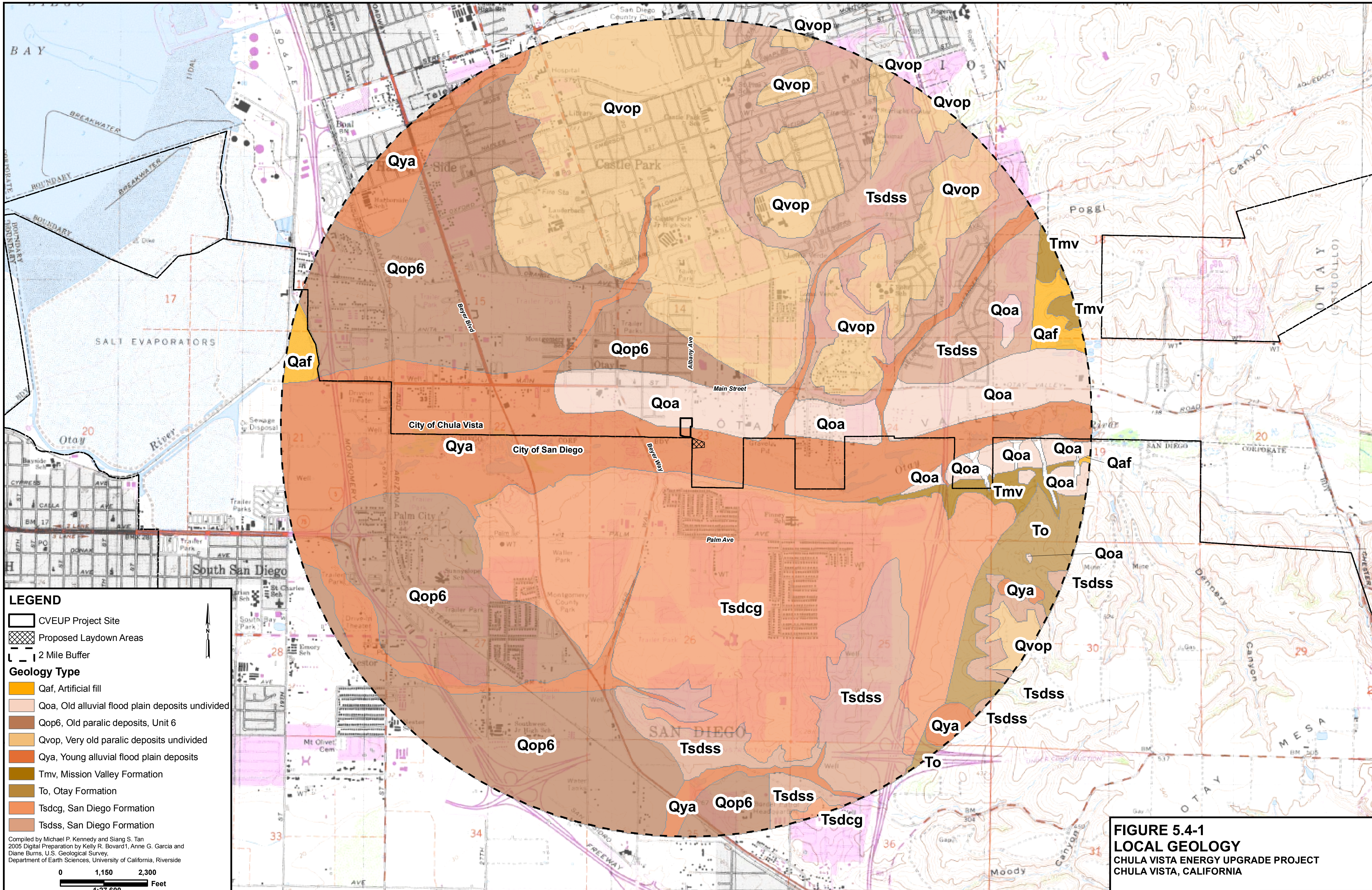


**FIGURE 5.4-1**
**LOCAL GEOLOGY**
**CHULA VISTA ENERGY UPGRADE PROJECT**
**CHULA VISTA, CALIFORNIA**

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The site does not lie within or adjacent to an Alquist-Priolo Earthquake Fault Zone, but two major zones of seismic activity are located within 20 miles of the site and include the Rose Canyon and Coronado Bank fault zones. The Rose Canyon fault zone represents a significant seismic hazard to the coastal metropolitan region of San Diego. The Rose Canyon Fault Zone is complex and is composed of many structurally related fault segments that have been the location of repeated small magnitude earthquakes. In 1985, a series of earthquakes, up to magnitude (M) 4.7, were measured and traced to this zone. Some sections within this fault zone exhibit evidence of Holocene displacement (Jennings, 1994). The major fault associated with this zone is the Rose Canyon Fault, which has an estimated maximum credible earthquake (MCE) magnitude of 7.2 (Blake, 2004). This fault is located approximately 5.3 miles west of the CVEUP site (Blake, 2004). According to the California Department of Transportation (Caltrans) seismic hazard map (Caltrans, 1996), a splay of the Rose Canyon Fault is located approximately 2.2 miles west of the site.

The Coronado Bank Fault Zone is located approximately 14 miles west of the site. The major fault associated with this zone is the Coronado Bank Fault, which, like the Rose Canyon Fault, has exhibited Holocene displacement (Jennings, 1994). This fault has an estimated MCE magnitude of 7.6 (Blake, 2004). The location of these faults relative to the project site is shown on Figure 5.4-2.

#### 5.4.1.5 Potential Geologic Hazards

The following subsections discuss the potential geologic hazards that might occur in the project area.

##### 5.4.1.5.1 Ground Rupture

Ground rupture is caused when an earthquake event along a fault creates rupture at the surface. Since no known active faults cross the project site, the likelihood of ground rupture to occur is considered low.

##### 5.4.1.5.2 Seismic Shaking

The project area has experienced seismic activity with strong ground motion during past earthquakes, and it is likely that strong earthquakes causing seismic shaking will occur in the future. The significant geologic hazard at the CVEUP site is strong ground-shaking due to an earthquake. Ground shaking of a magnitude 6 earthquake or greater could occur from earthquakes within a 100-mile radius of the site (Blake, 2004).

The earthquake hazard for a particular site is traditionally quantified in reference to two different levels of seismic ground motion:

- A design basis earthquake (DBE) would produce ground motions associated with a 500-year mean return period event and this level of ground motion would have a 10 percent probability of exceedance within 50 years.
- A maximum credible earthquake (MCE) would produce ground motions associated with a 2,500-year mean return period and would have a 2 percent probability of exceedance within 50 years.

The MCE is thus a lower probability event and represents a larger magnitude of ground shaking than the DBE. The California Building Code (CBC, 2001) is inherently based on a

DBE level event, with special provisions to provide for collapse prevention under the MCE scenario.

The controlling fault potentially impacting the CVEUP site is the Rose Canyon Fault. This fault is capable of generating a peak bedrock acceleration (PBA) of 0.43g (Blake, 2004) based on the MCE event. According to the site-specific geotechnical study conducted by Ninyo & Moore (2006) for the project site, the estimated peak horizontal ground acceleration would be 0.47g. According to the Caltrans Seismic Hazard Map, a PBA of 0.55g based on the MCE event would be possible in the general project area, due to a splay of the Rose Canyon Fault. The PBA associated with the DBE event is estimated at 0.23g (Blake, 2004).

#### 5.4.1.5.3 Liquefaction

During strong ground earthquake, loose, saturated, cohesionless soils can experience a temporary loss of shear strength and act as a fluid. This phenomenon is known as liquefaction. Liquefaction is dependent on the depth to water, grain size distribution, relative density of the soils, degree of saturation, and intensity and duration of the earthquake. The potential hazard associated with liquefaction is seismically induced settlement. The static groundwater depth at the time of the subsurface investigation conducted by Ninyo & Moore (Ninyo and Moore, 2006) was approximately 32 to 34 feet below ground surface at the project site, and the soil units below groundwater consist of generally dense terrace deposits considered to be unsusceptible to liquefaction (Ninyo & Moore, 2006). In addition, the project site is not within an area identified to have a potential for liquefaction (City of Chula Vista, 2005). Therefore, the likelihood that liquefaction will occur is considered low.

#### 5.4.1.5.4 Mass Wasting

Mass wasting depends on steepness of the slope, underlying geology, surface soil strength, and moisture in the soil. Significant excavating, grading, or fill work during construction might introduce mass wasting hazards at the project site. Because the site is relatively flat and no significant excavation is planned during site construction, the potential for direct impact from mass wasting at the site is considered low to negligible.

#### 5.4.1.5.5 Subsidence

Subsidence can be a natural or man-made phenomenon resulting from tectonic movement, consolidation, fluid removal (oil, gas, or water), or rapid sedimentation or oxidation of organic-rich soil. Organic soils with significant collapse potential were not encountered during the geotechnical investigation of the site (Ninyo & Moore, 2006). Also, subsidence has not been identified as a geologic hazard at the site (City of Chula Vista, 2005). The potential for subsidence as a hazard that could affect the project site is considered low.

#### 5.4.1.5.6 Expansive Soils

Expansive soils shrink and swell with wetting and drying. The shrink-swell capacity of expansive soils can result in differential movement beneath foundations. Site-specific borings advanced in the vicinity of the project site have identified sand and gravel near the surface at the site. Expansion potential was tested and the results showed a “low” potential for expansion (Ninyo & Moore, 2006). The location tested is considered representative of the anticipated foundation-bearing soils found on the site. Therefore, special provisions are not required to safeguard against potential damage due to expansive soils.

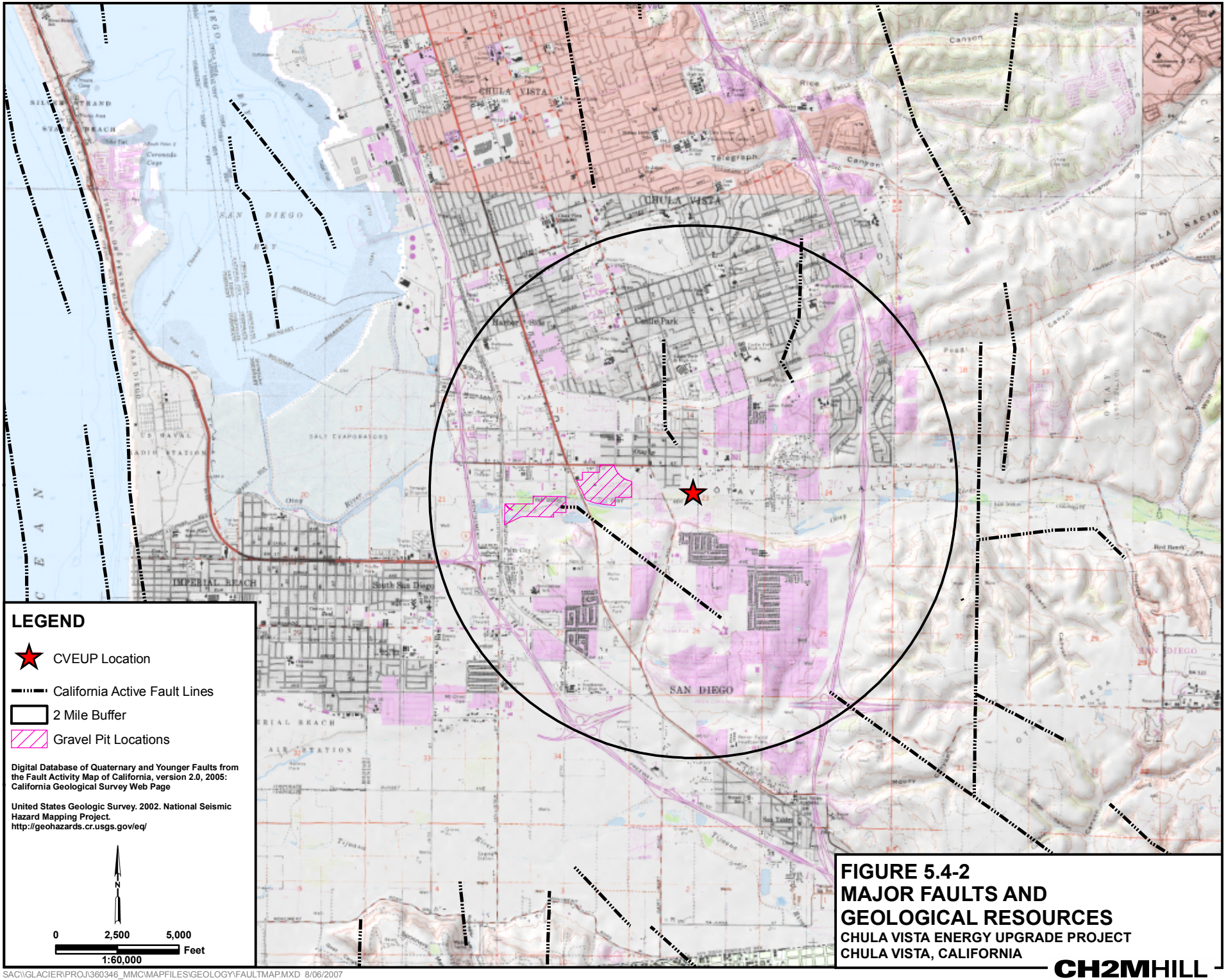


**FIGURE 5.4-2**
**MAJOR FAULTS AND GEOLOGICAL RESOURCES**
**CHULA VISTA ENERGY UPGRADE PROJECT**
**CHULA VISTA, CALIFORNIA**

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#### 5.4.1.5.7 Flooding

The Federal Emergency and Management Administration (FEMA) maintains a collection of Flood Insurance Rate Maps (FIRM), which cover the entire United States. These maps identify those areas that may be subjected to 100-year and 500-year floods. The Flood and Dam Inundation Hazards Map, Figure 9-8 of General Plan (City of Chula Vista, 2005), presents the 100-year flood areas in Chula Vista, defined by FEMA. Based on review of this map, the project site is not mapped within a 100-year flood plain. However, the site is located in potential zones of inundation that would occur if there were a failure of the Sweetwater Dam, Upper Otay Dam, or Savage Dam, according to the Flood and Dam Inundation Hazards Map (City of Chula Vista, 2005).

### 5.4.1.6 Geologic Resources of Recreational, Commercial, or Scientific Value

There are no known geologic resources that provide a significant scientific or recreational value in the vicinity of the site. According to maps of the State of California Division of Oil, Gas and Geothermal Resources (CDOGGR, 2005), geologic resources of commercial value, such as oil and gas, are not present within 2 miles of the project site. There are no oil or gas extraction facilities at or near the project site.

Mineral resources of significance near the proposed site are limited to sand and gravel deposits north of the Otay River Valley. According to the General Plan (City of Chula Vista, 2005), the project site is not identified as a Mineral Resource Zone (MRZ)-2 area, where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists.

## 5.4.2 Environmental Consequences

The potential environmental effects from construction and operation of the CVEUP on geologic resources and risks to life and property from geologic hazards are presented in the following sections.

### 5.4.2.1 Significance Criteria

According to Appendix G of the California Environmental Quality Act statues, the project would have a significant
environmental impact in terms of geologic hazards and resources if it would do the following:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault (Alquist-Priolo Fault Zone)
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
- 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 offsite landslide, lateral spreading, subsidence, liquefaction, or collapse
- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state

- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local plan, specific plan, or other land use plan

The potential for land subsidence, either seismically induced or by proposed building load factors and liquefaction hazards, is further evaluated in a geotechnical investigation (attached to Appendix 5.4A).

#### 5.4.2.2 Geologic Hazards

There is significant potential for seismic ground shaking to affect the project site in the event of a large-magnitude earthquake occurring on fault segments located near the project. The project, however, is not located within an Alquist-Priolo Earthquake Fault Zone or within the trace of any known active fault. The project would thus not be likely to cause direct human exposure to ground rupture. Seismic hazards and potential adverse foundation conditions will be minimized by conformance with the recommended seismic design criteria of the CBC Seismic Zone 4 requirements. In addition, as stated previously, the probability of liquefaction, mass wasting, subsidence, or flooding occurring at the project site is low.

The project structures, equipment, and natural gas compressor station will be designed in accordance with CBC Seismic Zone 4 requirements. Compliance with the CBC Seismic Zone 4 requirements will minimize the exposure of people to the risks associated with large seismic events. In addition, major structures will be designed to withstand the strong ground motion of a DBE, which is the probabilistic earthquake that is used for evaluating the earthquake resistance of a particular structure.

#### 5.4.2.3 Geologic Resources

There are no known geologic resources of recreational or scientific value at the project site or in the project vicinity. There are no oil and gas extraction facilities at or near the CVEUP site. The project would have no effect on oil and gas production or on other geologic resources of commercial value or on the availability of such resources.

### 5.4.3 Cumulative Effects

A cumulative impact 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; California Code of Regulations, tit. 14, §§ 15064(h), 15065(c), 15130, and 15355).

Applications for 26 proposed projects have been filed in the City of Chula Vista. These are mostly residential development projects, with some commercial developments, and one warehouse development and one manufacturing development. One of these projects, a proposed sewing manufacturing and wholesale sales business, is located within 1,000 feet of the CVEUP.

As described above, the CVEUP will not cause any adverse impacts to geological resources and will not cause an exposure of people or property to geological hazards. There are no minor impacts, in addition, that could combine cumulatively with those of other projects.

## 5.4.4 Mitigation Measures

Mitigation measures proposed for the project are as follows:

- Structures will be designed to meet seismic requirements of the 2001 CBC. Moreover, the design of plant structures and equipment will be in accordance with CBC Seismic Zone 4 requirements to withstand the ground motion of a DBE. In addition, special design considerations will be made for constructed facilities, if warranted, by the findings from the geotechnical investigation.
- A geotechnical engineer will be assigned to the project to carry out the duties required by the CBC to assess geologic conditions during construction and approve actual mitigation measures used to protect the facility from geologic hazards.

With the implementation of these mitigation measures, the CVEUP will not result in significant direct, indirect, or cumulative geology-related impacts.

## 5.4.5 Laws, Ordinances, Regulations, and Standards

The LORS that may apply to geologic resources and hazards are summarized in Table 5.4-1. The local LORS discussed in this section are certain ordinances, plans, or policies of the City of Chula Vista.

TABLE 5.4-1
Laws, Ordinances, Regulations, and Standards for Geologic Hazards and Resources

| Jurisdiction | Authority | Administering Agency | Compliance |
|---|---|---|---|
| State/Local | California Building Code (CBC), 2001 | California Building Standards Commission, State of California, and City of Chula Vista Building Department | Acceptable design criteria for structures with respect to seismic design and load-bearing capacity. |
| State/Local | Alquist Priolo Earthquake Fault Zoning Act | Title 14, Division 2, Chapter 8, Subchapter 1, Article 3, California Code of Regulations | Identifies areas subject to surface rupture from active faults. |
| State /Local | The Seismic Hazards Mapping Act | Title 14, Division 2, Chapter 8, Subchapter 1, Article 10, California Code of Regulations | Identifies non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides. |
| Local | City of Chula Vista General Plan | City of Chula Vista | Compliance with the Environmental Element (Natural Hazards) section of the General Plan. |

## 5.4.6 Permits Required

Compliance of building construction to Uniform Building Code standards is covered under engineering and construction permits for the project that are within the exclusive

jurisdiction of the California Energy Commission (CEC). There are no other permit requirements that specifically address geologic resources and hazards.

## 5.4.7 Involved Agencies and Agency Contacts

No permits are required for compliance with geologic LORS. Compliance with building standards and building structures are within the exclusive jurisdiction of the CEC. However, the City of Chula Vista Planning and Building Department is responsible for enforcing compliance with local building standards, including the CBC (Table 5.4-2).

TABLE 5.4-2
Agency Contact for Geologic Hazards and Resources

| Issue | Contact Agency | Title | Telephone |
|---|---|---|---|
| Building Permit | Don Johnson<br>City of Chula Vista | Development Services Counter Manager | (619) 409-3844 |

## 5.4.8 References

Blake, T.F. 2004. EQSEARCH, A Computer Program for the Estimation of Peak Acceleration from California Earthquake Catalogs.

California Department of Transportation (Caltrans). 1996, errata 2004, 2006. California Seismic Hazard Map, Office of Earthquake Engineering.

California Division of Oil, Gas, and Geothermal Resources (CDOGGR). 2005. Oil and Gas Field Maps. http://www.consrv.ca.gov/dog.

California Building Standards Commission. 2001 California Building Code, California Code of Regulations, Based on 1997 Uniform Building Code.

California Geologic Survey (formerly California Division of Mines and Geology). 1997. Kennedy, Michael and Tan, Siang. *Geology of the National City, Imperial Beach, and Otay Mesa Quadrangles, Southern San Diego Metropolitan Area, California.*

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Norris, R. M. and R. W. Webb. 1990. *Geology of California.* Second Edition. John Wiley and Sons. New York.