# 2.6 Geology and Soils

This section of the EIR describes the existing geology, soils, and seismic conditions in San Diego County and analyzes the potential physical environmental impacts to people and property related to seismic hazards, underlying soil characteristics, slope stability, erosion, and excavation and export of soils. The General Plan Update would have the potential to expose people or structures to substantial adverse impacts, including the risk of loss, injury, or death, from seismic related hazards. It would also have the potential to expose people or property to hazardous conditions associated with soil erosion, topsoil loss, exposed soils, or improper wastewater disposal. Potential impacts to unique geologic features are also discussed in this section. Potential impacts of soil conditions on air and water quality as a result of construction-related activities are discussed in Section 2.3, Air Quality, Section 2.8, Hydrology and Water Quality, and Section 2.17, Global Climate Change. This section is based on the review of the County of San Diego General Plan Conservation and Open Space Background Report (DPLU 2007b), County of San Diego General Plan Safety Element Background Report (DPLU 2007e), County of San Diego Guidelines for Determining Significance, Geologic Hazards (DPLU 2007k), and County of San Diego Guidelines for Determining Significance, Unique Geology (DPLU 2007q).

A summary of the geology and soils impacts identified in Section 2.6.3 is provided below.

**Geology and Soils Summary of Impacts**

| Issue Number | Issue Topic | Project Direct Impact | Project Cumulative Impact | Impact After Mitigation |
|---|---|---|---|---|
| 1 | Exposure to Seismic-Related Hazards | Less Than Significant | Less Than Significant | Less Than Significant |
| 2 | Soil Erosion or Topsoil Loss | Less Than Significant | Less Than Significant | Less Than Significant |
| 3 | Soil Stability | Less Than Significant | Less Than Significant | Less Than Significant |
| 4 | Expansive Soils | Less Than Significant | Less Than Significant | Less Than Significant |
| 5 | Waste Water Disposal Systems | Less Than Significant | Less Than Significant | Less Than Significant |
| 6 | Unique Geologic Features | Less Than Significant | Less Than Significant | Less Than Significant |

## 2.6.1 Existing Conditions

Natural geologic processes that represent an existing or future hazard to life, health, or property are called geologic hazards. Natural geologic hazards that affect people and property in San Diego County include earthquakes (which can cause surface fault rupture, ground shaking, and liquefaction), expansive soils, weathering, and mass wasting phenomena such as landslides or rockfalls. San Diego County contains active faults, steep topography, and other geological characteristics that pose public safety concerns and constrain physical development.

### *2.6.1.1 General Geologic Setting*

San Diego County is located along the Pacific Rim, an area characterized by island arcs with subduction zones forming mountain ranges and deep oceanic trenches, active volcanoes, and earthquakes. The USGS defines a subduction zone as any area where one lithospheric plate sinks under another (USGS 2008c). This occurs when plates move toward each other, or converge. During the Mesozoic Era subduction of the ancient oceanic plate under the continental plate created an archipelago of volcanic islands in the San Diego area. The heat caused by the subduction produced massive volumes of magma that either erupted at the surface forming volcanic rocks or congealed deep in the Earth's crust to form plutonic rocks (e.g., granite). This resulted in the creation of the plutonic rocks now exposed in the mountainous central part of the County. Subsequent heating also metamorphosed the volcanic and sedimentary rocks of the arc as well as the older Paleozoic rocks, forming the foothills of the western part of the ranges. Continuing subduction of the oceanic plate under the continent caused uplifting and erosion that unroofed the deeply buried plutonic rocks to form a steep and rugged, mountainous coastline. Younger Mesozoic and Cenozoic sedimentary rocks have buried these older rocks west of the mountains, while a thick accumulation of Cenozoic sedimentary rocks including layers of lava and ash has filled the basins east of the mountains.

During the Cenozoic Era, a tectonic spreading center began to separate the southwestern part of North America, including San Diego County, from the rest of the continent. The spreading center formed the Gulf of California and the Salton Trough Region. The slow northwestward movement of San Diego County caused intermittent uplift with subsequent erosion, as well as down warping with subsequent deposition of thick accumulations of sediments. Recorded in these Cenozoic sedimentary rocks are conditions of higher rainfall and subtropical climates that supported coastal rain forests with exotic faunas and floras, periods of extreme aridity and volcanism, sea level fluctuations (oceanic inundations and retreats), a great Eocene river and delta, and the formation of new seaways.

As a result of this geologic history, four general rock types are found within the County: 1) Cretaceous Age crystalline and Upper Jurassic metavolcanics; 2) Mesozoic Age metamorphic rocks; 3) Tertiary Age sedimentary rocks; and 4) recent alluvium. Cretaceous Age crystalline rocks, including granites, diorites, and gabbros and Upper Jurassic metavolcanics underlie most of the mountainous terrain in the central portion of the County. These rocks are associated with the Peninsular Ranges batholith of southern California and Baja California. Mesozoic Age metamorphic rocks include marble, schist, and gneiss outcrops that are found in the western foothills and mountains of the Peninsular Ranges and in the desert east of the mountains. Tertiary Age sedimentary rocks include sandstone, conglomerate, and mudstone and are found in the western portion of the County, as well as in the eastern portion of the desert basin. Deposits of recent alluvium, including sand, gravel, silt, and clay are found in river and stream valleys, around lagoons, in intermountain valleys, and in the desert basins.

Additionally, the Natural Resources Inventory (NRI) of San Diego County identified 67 unique geologic features in the entire County, primarily for scientific research purposes (DPLU 2007q). The NRI was prepared by the County in the early 1970s, and has subsequently been updated. The locations of the features were obtained from published reports and interviews with geologists and paleontologists who did field work in San Diego County up to the early 1970s. The NRI includes stratigraphic formations, igneous rocks, fossil locations, and structural features. The County has a focused list of 19 features located in the unincorporated County. This list is provided in Table 2.6-1 and includes reasoning for each feature's uniqueness. What makes a geologic feature unique can vary considerably. A unique feature may be the best example of its kind locally or regionally, it may illustrate a geologic principle, it may provide a key piece of geologic information, it may be the "type locality" of a fossil or formation, or it may have high aesthetic appeal. Unique geologic features may be exposed or created from natural weathering and erosion processes or from man-made excavations. Geologic formations, their structure, and the fossils within them provide information about past environments. Therefore, rocks provide aesthetic, scientific, educational, and recreational value. They also allow us to develop our knowledge of history beyond the written record.

San Diego County has three distinctive geographic regions that are, from west to east:

- The low-lying Coastal Plain,
- The mountainous Peninsular Range, and
- The Desert Basin (Salton Trough).

**The Coastal Plain**

The Coastal Plain ranges in elevation from sea level to approximately 600 feet AMSL and lies mostly within incorporated cities in San Diego County, with the exception of the lower elevation foothills of the San Dieguito CPA.

The Coastal Plain Region is an area characterized by interbedded marine and nonmarine sedimentary rock units deposited over the last 75 million years. The sedimentary rocks overlie a buried topography of plutonic crystalline rocks typically composed of granite or granodiorite. Many of the level surfaces in the coastal areas, including most of the mesa tops and coastal benches, are elevated marine terraces, and these, as well as the broad, level floodplains of river valleys, are characteristic features of the Coastal Plain Region. Many sedimentary units are within the Coastal Plain Region, including:

- Unnamed Quaternary River Terrace deposits representing the sediments of ancient river courses;
- Lagoonal and non-marine terrace deposits of the Bay Point Formation and marine and non-marine deposits of the Lindavista Formation;
- Marine deposits of the San Diego Formation;
- Fluvial sedimentary rocks of the Otay Formation;
- Non-marine and lagoonal sedimentary rocks of the Friars Formation and member C of the Santiago Formation; and
- Other formations, including the Capistrano, San Mateo, San Onofre Breccia, Monterey, Sweetwater, Mission Valley, Stadium Conglomerate, Ardath Shale, Torrey Sandstone, Delmar, Point Loma, and Lusardi Formations.

**Peninsular Range**

The lower Peninsular Range Region in San Diego County is made up of foothills that span in elevation from 600 to 2,000 feet AMSL. It is characterized by rolling to hilly uplands that contain frequent narrow, winding valleys. This area is traversed by several rivers as well as a number of intermittent drainages. The foothills are developed with various urban, suburban, and rural land uses, including the communities of Bonsall, Fallbrook, Ramona, Lakeside, Crest/Dehesa, Valle de Oro, Spring Valley, and Otay.

The higher elevations of 2,000 to 6,000 feet AMSL are dominated by steep mountains typically covered with granitic boulders and chaparral vegetation on the western slopes, evergreen and temperate forests at and near the top, and desert chaparral on the eastern slopes. The largely undeveloped mountain areas of San Diego County surround scattered rural communities, including Alpine, Pine Valley, Jamul/Dulzura, Campo, and Julian.

The Peninsular Ranges Region is primarily underlain by plutonic igneous rocks that formed from the cooling of molten magmas deep within the earth's crust. These magmas were generated during subduction of an oceanic crustal plate that was converging on the North American Plate between 120 and 90 million years ago (mya). Over this long period of time, extensive masses of plutonic rocks accumulated within the crust. Intense heat associated with these plutonic intrusions metamorphosed the ancient sedimentary rocks that were already there. These metasediments are now preserved in the Peninsular Ranges Region as marbles, slates, schist, quartzites, and gneiss. Younger under-formed sedimentary rocks occur in various areas of the Peninsular Ranges Region. The Peninsular Ranges Region contains Quaternary alluvial and alluvial fan deposits in many of the mountain valleys. Some of the more southern mountain valleys contain Quaternary peat deposits.

Sedimentary units in the Peninsular Ranges Region include:

- Sedimentary rock (sandstone, siltstone and conglomerate), including the Pauba Formation and the Temecula Arkose, that have filled the Warner Basin with up to 1,000 feet of upper Pliocene and lower to upper Pleistocene sediments;
- Table Mountain Gravels; and
- Jurassic metasedimentary rocks mapped as the Santiago Peak Volcanics.

**The Desert Basin (Salton Trough)**

The far eastern portion of San Diego County is a desert climate. Elevations range from sea level to 3,000 feet AMSL and the terrain includes mountains, alluvial fans, and desert floor. Most of the region is within the Anza-Borrego Desert State Park. Development within this area includes the small desert communities of Borrego Springs, Ocotillo Wells, and Shelter Valley.

The desert is undergoing active deformation related to faulting along the San Jacinto and Elsinore fault zones, which are related to the San Andreas Fault system, and described below. Since the early Miocene (~24 mya), the Salton Trough has been filling with sediments, which are now up to five miles thick. The major source of the sediments on the San Diego County side of the trough is erosion of the Peninsular Ranges. Dry lake beds, filled with sediments, are notable features of the region.

Sedimentary units in the Salton Trough Region include:

- The Ocotillo Conglomerate and the Borrego Formation;
- Imperial Group;
- The Palm Spring Group consisting of five formations (Arroyo Diablo Formation, Olla Formation, Tapiado Claystone, Hueso Formation, and Canebrake Conglomerate);
- Other formations, including the Brawley and Split Mountain Formations, the Canebrake Conglomerate, and the Alverson Volcanics; and
- Later Quaternary alluvium, and older terraces, fanglomerates, and valley-fill alluvium.

### 2.6.1.2 Faults and Seismicity

**Regional Seismic Setting**

The faulting and seismicity of southern California is dominated by the compressionary regime associated with the “Big Bend” of the San Andreas Fault Zone. The San Andreas Fault Zone separates two of the major tectonic plates that comprise the earth’s crust. West of the San Andreas Fault Zone lies the Pacific Plate which is moving in a northwesterly direction relative to the North American Plate, which is located east of the San Andreas Fault Zone. This relative movement between the two plates is the driving force of fault ruptures on the west coast of California. The San Andreas Fault generally trends northwest to southeast and is located to the northeast of San Diego County. A series of sub-parallel faults are located to the west of the San Andreas Fault Zone including the active San Jacinto, Elsinore, and Rose Canyon Fault Zones which each traverse through San Diego County. North of the Transverse Ranges Province, located generally between Santa Barbara and Joshua Tree, the San Andreas fault trends more in an east to west direction (the Big Bend), causing the fault’s right-lateral strike-slip movement to produce north-south compression between the two plates. This compression has produced rapid uplift of many of the mountain ranges in southern California. This crustal shortening is accommodated by faulting (mainly reverse faulting) and causes a large potential for seismicity throughout most of southern California. Faults of the northern Peninsular Ranges Province generally reflect reverse as well as strike-slip faulting patterns, since the province is in a transitionary position between areas dominated by strike-slip movement and by compression.

**Magnitude Scales**

The strength of an earthquake is generally expressed in two ways: magnitude and intensity. The magnitude is a measure that depends on the seismic energy radiated by the earthquake as recorded on seismographs. An earthquake’s magnitude is expressed in whole numbers and decimals (such as 6.8). The intensity at a specific location is a measure that depends on the effects of the earthquake on people or buildings. Intensity is expressed in Roman Numerals or whole numbers (example: VI or 6). Although there is only one magnitude for a specific earthquake, there may be many values of intensity (damage) for that earthquake at different sites.

Several magnitude scales have been developed by seismologists. The original is the Richter magnitude, developed in 1932 by the late Dr. Charles F. Richter who was a professor at the California Institute of Technology. The Richter scale quantifies the magnitude and intensity of an earthquake through logarithmic equations. The most commonly used scale today is the Moment magnitude (Mw) scale, jointly developed in 1978 by Dr. Thomas C. Hanks of the USGS and Dr. Hiroo Kanamori, a professor at CalTech. Moment magnitude is related to the physical size of fault rupture and the movement (displacement) across the fault, and as such is a more uniform measure of the strength of an earthquake.

Another measure of earthquake size is seismic moment. The seismic moment determines the energy that can be radiated by an earthquake and hence the seismogram recorded by a modern seismograph. The moment magnitude of an earthquake is defined relative to the seismic moment for that event.

It is important to recognize that earthquake magnitude varies logarithmically with the wave amplitude or seismic moment recorded by a seismograph. Each whole number step in magnitude represents an increase of ten times in the amplitude of the recorded seismic waves, and the energy release increases by a factor of about 31 times. The size of the fault rupture and the fault's displacement (movement) also increase logarithmically with magnitude.

Magnitude scales have no fixed maximum or minimum. Observations have placed the largest recorded earthquake (off-shore from Chile in 1960) at moment magnitude 9.6 and the smallest at -3. Earthquakes with magnitudes smaller than about 2 are called microearthquakes.

Magnitudes are not used to directly estimate damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude as an earthquake that occurs in a barren, remote area that does nothing more than frighten the wildlife.

**Earthquake Intensity**

The first scale to reflect earthquake intensities (damage) was developed by de Rossi of Italy and Forel of Switzerland in the 1880s and is known as the Rossi-Forel Intensity scale. This scale, with values from I to X, was used for about two decades. A need for a more refined scale increased with the advancement of the science of seismology. In 1902, the Italian seismologist, Mercalli, devised a new scale on a I to XII range. The Mercalli intensity scale was modified in 1931 by American seismologists Harry O. Wood and Frank Neumann to take into account modern structural features. Table 2.6-2 lists the measurements/values in the Modified Mercalli Intensity (MMI) scale.

The MMI scale measures the intensity of an earthquake's effects in a given locality, and is perhaps much more meaningful to the layperson because it is based on observations of earthquake effects at specific places. It should be noted that because the data used for assigning intensities are obtained from direct accounts of the earthquake's effects at numerous towns, considerable time (weeks to months) is sometimes needed before an intensity map can be assembled for a particular earthquake.

On the MMI scale, values range from I to XII. The most commonly used adaptation covers the range of intensities from the conditions of I, not felt except by very few, favorably situated, to XII, damage total, lines of sight disturbed, objects thrown into the air. While an earthquake has only one magnitude, it can have much intensity, which typically decreases with distance from the epicenter.

It is difficult to compare magnitude and intensity because intensity is linked with the particular ground and structural conditions of a given area, as well as distance from the earthquake epicenter, while magnitude depends on the energy released by earthquake faulting. However, there is an approximate relation between magnitude and maximum expected intensity close to the epicenter. Table 2.6-3 compares magnitude and intensity values. The areas shaken at or above a given intensity increase logarithmically with earthquake magnitude.

**Local Faults and Seismicity**

As shown in Figure 2.6-1, numerous faults have been mapped in San Diego County. Each fault is classified based on its most recent movement as indicated below:

- Historic (movement within the last 200 years)
- Holocene (movement within the past 11,000 years)
- Late-Quaternary (movement within the past 700,000 years)
- Quaternary (age undifferentiated within the past 1.6 million years)
- Pre-Quaternary (movement older than 1.6 million years)

Several major active faults and fault zones are present within San Diego County, as described below in Table 2.6-4 and shown on Figure 2.6-1. These active fault zones are San Jacinto Fault Zone, including Coyote Creek Fault; Elsinore Fault Zone and the nearby Earthquake Valley Fault; and the Rose Canyon Fault Zone, including a series of unnamed faults trending from downtown San Diego across San Diego Bay to the City of Coronado. The San Andreas Fault Zone is not located within San Diego County, but is included in this discussion because it is a major fault zone with a length of roughly 900-miles in California. A portion of the fault zone traverses through Imperial County, adjacent to San Diego County.

## *2.6.1.3 Seismic Hazards*

Earthquake-related geologic hazards pose a significant threat to San Diego County and can impact extensive regions of land. Earthquakes can produce fault rupture and strong ground shaking, and can trigger landslides, rockfalls, soil liquefaction, tsunamis, and seiches. In turn, these geologic hazards can lead to other hazards such as fires, dam failures, and toxic chemical releases.

Primary effects of earthquakes include violent ground motion, and sometimes permanent displacement of land associated with surface rupture. Earthquakes can snap and uproot trees, or knock people to the ground. They can also shear or collapse large buildings, bridges, dams, tunnels, pipelines and other rigid structures, as well as damage transportation systems, such as highways, railroads and airports.

Secondary effects of earthquakes include near-term phenomena such as liquefaction, landslides, fires, tsunamis, seiches, and floods. Long-term effects associated with earthquakes include phenomena such as regional subsidence or emergence of landmasses and regional changes in groundwater levels.

The number of people potentially exposed to various hazards in the unincorporated areas of the County was identified in the Multi-jurisdictional Hazard Mitigation Plan, San Diego, CA (URS 2004). The analysis demonstrates that earthquake-related hazards pose a significant threat to unincorporated County residents. When groundshaking, liquefaction and landslide hazards are combined, it is estimated approximately 410,000 people have the potential to be exposed to earthquake hazards in the urbanized areas of the County, while 33,000 people have the potential to be exposed to this hazard in the rural areas.

**Fault Rupture**

During earthquakes, the ground can rupture at or below the surface. Ground rupture occurs when two lithospheric plates heave past each other, sending waves of motion across the earth. The lithosphere is approximately 75 miles thick and consists of the upper continental and oceanic crusts and the rigid mantle layer that is directly beneath the crust. Earthquakes can cause large vertical and/or horizontal displacement of the ground along the fault. Ground rupture can completely demolish structures by rupturing foundations or by tilting foundation slabs and walls, as well as damage buried and above ground utilities. Drinking water can be lost, and the loss of water lines or water pressure can affect emergency services, including fire fighting ability. Research of historical earthquakes has shown that, although only a few structures have been ripped apart by fault rupture, this hazard can produce severe damage to structures built across active fault lines.

In San Diego County, the preceding century of relative stillness led to a misconception that there is no serious earthquake hazard in the County. However, in 1992, the Joshua Tree and Landers earthquakes together ruptured the ground for a total of nearly 60 miles. Rupture from the Landers earthquake alone was 40 miles, and the maximum observed fault movement was 20 feet. Rupture occurred on five different faults in this earthquake. These five were the Johnson Valley, Landers, Homestead Valley, Emerson, and Camp Rock faults. Before this, the scientific community had thought that fault rupture was confined to single faults or even to individual segments of faults. The northeastern corner of San Diego County is 45 miles south of the Landers epicenter, and downtown San Diego is 70 miles away from it.

**Alquist-Priolo (AP) Earthquake Fault Zones**

In 1972, the state passed the AP Earthquake Zoning Act to help identify areas subject to severe ground shaking. It also regulated the siting of buildings with regard to surface fault rupture following the 1971 San Fernando Earthquake. Earthquake faults are categorized as active, potentially active, and inactive. A fault is classified as active if it is included as an AP Earthquake Fault Zone (movement within the past 11,000 years). The purpose of this Act is to prohibit the placement of most structures for human occupancy across the traces of active faults; thereby mitigating the hazard of fault ruptures. AP Zones serve as an official notification of the probability of ground rupture for future earthquakes. Where such zones are designated, no building may be constructed on the trace of the fault.

The AP Zones that the State of California has designated along active faults in the unincorporated portion of the San Diego County are:

- Elsinore Fault: North of Pala, Palomar Mountain, Pauma Valley, Lake Henshaw, Julian, Banner Canyon, Mason Valley, Vallecito Valley, and Carrizo Valley.
- Earthquake Valley Fault: San Felipe Valley and Sentenac Canyon.
- San Jacinto Zone - Coyote Creek Fault: Borrego Valley and Ocotillo Wells.

Additionally, many of the County's faults are classified as potentially active or inactive. Faults showing movement within 1.6 million years (Quaternary) are considered potentially active, and faults showing movement greater than 1.6 million years (Pre-quaternary) as inactive. As new geologic information becomes available, the County may also zone other faults as active, if necessary.

The unincorporated County's more urbanized areas are located away from active fault zones, which are the San Jacinto Fault and Elsinore Fault Zones, the two predominant faults in the unincorporated County. However, these earthquake faults are located near three of the County's rural communities: Borrego Springs, Julian, and Pala/Pauma Valley. The date of the last major event to occur on each of these two faults, and the Rose Canyon Fault, which is located in the City of San Diego, is presented in Table 2.6-5. This table also estimates the maximum magnitude of a future event on each fault. These three faults are discussed in greater detail below.

### *Elsinore Fault Zone*

The Elsinore fault zone crosses eastern San Diego County on an approximately 124-mile path from the Mexican border to the northern end of the Santa Ana Mountains in Los Angeles County. Near its northwestern end in Riverside County, the fault splits into the Whittier and Chino faults. The maximum probable earthquake for the Elsinore fault zone is estimated at a magnitude of 6.5 to 7.3 on the Richter scale, with a recurrence interval of 60 years. The largest historical earthquake on record on the Elsinore fault is a magnitude 6.0 event in 1910. No surface rupture was found resulting from this earthquake. Within this fault zone, the State has designated areas near Pala, Palomar Mountain, Pauma Valley, Lake Henshaw, Julian, Banner Canyon, Mason Valley, Vallecito Valley, and Carrizo Valley as Fault Rupture Zones. In addition, the faults that flank the Agua Tibia Mountains are areas of potential seismic activity.

An approximately 12-mile wide zone on the northeast flank of the Elsinore fault is occupied by four major fault zones. These are the Agua Tibia-Earthquake Valley zone, Aguanga-San Felipe zone, Agua Caliente fault zone, and the Hot Springs fault zone. Of these zones, only the Agua Tibia-Earthquake Valley fault has shown surface displacement during the last 11,000 years. Therefore, this fault zone is classified as a State designated earthquake Fault Rupture Zone (an area of ground ruptures due to fault activities within the past 11,000 years).

### *San Jacinto Fault Zone*

The San Jacinto fault zone is a complex fault system that is approximately 6 miles wide and 155 miles long, extending from its junction with the San Andreas zone in the San Gabriel Mountains to the northern edge of the Gulf of California. This zone, which is characterized by straightness, continuity, and high seismicity, is the most active of the southern California Plate boundary faults. It has had 10 earthquakes of magnitude 6.0 or greater since 1890. The San Jacinto fault trends from the northwest to the southeast across the northeastern corner of the County, where its zone includes the Coyote Creek, Clark, San Felipe Hills, Borrego Mountain, and many smaller, unnamed Quaternary faults. Within this zone, the State has designated the Coyote Creek fault as a Fault Rupture Zone. In addition, the Coyote Mountain fault and other adjacent young faults are areas of potential seismic activity.

### *Rose Canyon Fault Zone*

The Rose Canyon fault zone is about 19 miles in length and extends through the City of San Diego, La Jolla and Linda Vista communities. It has a slip rate category of approximately 1.1 mm/yr. According to the California Department of Conservation (CDOC), no historic rupture has occurred on this fault; however, data suggests that there have been a minimum of three surface fault-rupture events in the last approximately 8,100 years. The last large earthquake is estimated to have occurred between 225 and 500 years ago. The faults in this zone typically dip to the east.

**County Special Studies Zones**

The AP Act provides for a city or county to establish more restrictive policies than those within the AP Act, if desired. "Special Study Zones," which are late-Quaternary faults mapped by the California Division of Mines and Geology (DMG), have been designated by the County. Late-Quaternary faults (movement during the past 700,000 years) were mapped based on geomorphic evidence similar to that of Holocene faults except that tectonic features are less distinct. As indicated by the DMG, these faults may be younger, but the lack of younger overlying deposits precludes more accurate age classification. Traces of faults within "Special Study Zones" are treated by the County as active unless a fault investigation can prove otherwise. Figure 2.6-2 depicts Special Study Zones within the unincorporated portion of the County.

## Ground Shaking

Ground shaking is the earthquake effect that produces the vast majority of damage. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. Earthquakes, or earthquake induced landslides, can cause damage near and far from fault lines. The potential damage to public and private buildings and infrastructure can threaten public safety and result in significant economic loss. Ground shaking is the most common effect of earthquakes that adversely affects people, animals, and constructed improvements. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. Seismic waves propagating through the earth's crust are responsible for the ground vibrations normally felt during an earthquake. Seismic waves can vibrate in any direction, and at different frequencies, depending on the frequency content of the earthquake rupture mechanism and the path and material through which the waves are propagating. The earthquake rupture mechanism is the distance from the earthquake source, or epicenter, to an affected site.

The California Building Code (CBC) defines different Seismic Design Categories based on building occupancy type and the severity of the probable earthquake ground motion at the site. There are six Seismic Design Categories and designated as Categories A through F, with Category A having the least seismic potential and Category F having the highest seismic potential. All of San Diego County is located within Seismic Design Categories E and F.

## Liquefaction

Liquefaction occurs primarily in saturated, loose, fine to medium-grained soils in areas where the groundwater table is generally 50 feet or less below the surface. When these sediments are shaken during an earthquake, a sudden increase in pore water pressure causes the soils to lose strength and behave as a liquid. In general, three types of lateral ground displacement are generated from liquefaction: 1) flow failure, which generally occurs on steeper slopes; 2) lateral spread, which generally occurs on gentle slopes; and 3) ground oscillation, which occurs on relatively flat ground. In addition, surface improvements on liquefiable areas may be prone to settlement and related damage in the event of a large earthquake on a regionally active fault. The primary factors that control the type of failure that is induced by liquefaction (if any) include slope, and the density, continuity, and depth of the liquefiable layer.

Adverse effects of liquefaction include:

- Loss of bearing strength so that the ground loses its ability to support structures. Structures can be left leaning or they can collapse.
- Lateral spreading where the ground can slide on a buried liquefied layer. Buildings, roads, pipelines and other structures can be damaged.
- Sand boils of sand-laden water can be ejected from a buried liquefied layer and erupt at the surface. The surrounding ground often fractures and settles.
- Ground oscillation so that the surface layer, riding on a buried liquefied layer, is thrown back and forth by the shaking and can be severely deformed. Land containing walkways, roads, highways, and structures can all be shaken, broken, damaged and/or destroyed.
- Flotation to the surface of light-weight structures that are buried in the ground (e.g., pipelines, sewers, and nearly empty fuel tanks).
- Settlement when liquefied ground re-consolidates following an earthquake.

Liquefaction is not known to have occurred historically in San Diego County, although liquefaction has occurred in the Imperial Valley in response to earthquakes with a magnitude of 6 or higher. Historically, seismic shaking levels within the County have not been sufficient to trigger liquefaction. However, portions of the unincorporated County would be susceptible to liquefaction from ground shaking during larger seismic events. During an earthquake, the solid particles in a shallow sedimentary layer tend to decrease in volume due to ground shaking, causing a reduction in soil strength. Liquefaction only occurs if the sediment is: 1) sand sized; 2) loosely consolidated; 3) saturated; and 4) subject to vibration. Liquefaction occurs primarily in saturated, loosely consolidated, and fine to medium-grained sandy soils in areas where the groundwater table is generally 50 feet or less below the surface and is subject to vibration. Other important factors contributing to liquefaction include the earthquake's magnitude and the duration of the shaking.

Within the County, there may be a potential for liquefaction in areas with loose sandy soils combined with a shallow groundwater table, which typically are located in alluvial river valleys/basins and floodplains. The extent of risk areas within the County with a potential for liquefaction hazard was mapped in the Multi-Jurisdictional Hazard Mitigation Plan, San Diego, CA (URS 2004).

Figure 2.6-3 depicts areas with the potential for liquefaction in the County, which includes the data from above and also includes mapped Quaternary Alluvium and hydric soils (soils that are often saturated and/or characteristic of wetlands). Table 2.6-6 provides a list of hydric soils in San Diego County based on the USDA Soil Survey categories.

Primary areas for potential liquefaction hazard include the lower San Dieguito, Sweetwater, and San Luis Rey River Valleys, Jacumba, Borrego Valley near the Borrego Sink, and parts of Ramona CPA.

**Landslides**

A landslide is the down slope movement of soil and/or rock. Landslides can range in speed from very rapid to an imperceptible slow creep. Landslides can be caused by ground shaking from an earthquake or water from rainfall, septic systems, landscaping, or other origins that infiltrate slopes with unstable material. Boulder-strewn hillsides can pose a boulder-rolling hazard from ground shaking, blasting or a gradual loosening of their contact with the surface. The likelihood of a landslide depends on an area's geologic formations, topography, ground shaking potential, and influences of man. Improper or excessive grading can increase the probability of a landslide. Land alterations such as excavation, filling, removing of vegetative cover, and introducing the concentration of water from drainage, irrigation or septic systems may contribute to the instability of a slope and increase the likelihood of a landslide. Undercutting support at the base of a slope, or adding too much weight to the slope, can also produce a landslide.

Significant landslides have occurred within incorporated portions of the County along coastal bluffs and in other areas. Previous landslides and landslide-prone sedimentary formations are mostly located in the western portion of the unincorporated County. Landslides have also occurred in the granitic terrain in the eastern portion of the County, although they are less prevalent. Reactivations of existing landslides can be triggered by situations such as heavy rainfall or irrigation, seismic shaking, and/or grading. The entire County was screened to profile the risk of landslides in the Multi-jurisdictional Hazard Mitigation Plan, San Diego County (URS 2004). The Multi-jurisdictional Hazard Mitigation Plan estimated high and moderate risk assessments for urban and rural areas of the unincorporated County. The western portion of the County (encompassing primarily incorporated jurisdictions) is based on soil-slip susceptibility data provided by USGS, while the eastern portion of the county shows landslide susceptibility based on the Federal Emergency Management Agency (FEMA) natural hazard GIS database (HAZUS). The County also identifies gabbroic soils on slopes greater than 15 percent in grade as slide-prone material. Figure 2.6-4 combines data from the sources listed below to identify unincorporated areas having the highest landslide risk potential:

- Steep Slopes (greater than 25 percent)
- Soil Series Data (SANDAG based on USGS 1970s series)
- Soil-slip susceptibility from USGS
- Division of Mines and Geology Landslide Hazard Zone Maps
- Gabbroic soils on slopes steeper than 15 percent in grade

The analysis indicated that significantly fewer people are exposed to rain-induced landslide hazards than the seismically induced landslide hazards described above. The Multi-jurisdictional Hazard Mitigation Plan (URS 2004) estimated that high-risk landslide areas could potentially affect only 11,000 people in the urbanized areas, 3,000 people in the rural areas, and less than 100 commercial buildings and other critical facilities. Moderate-risk landslide areas could potentially affect many more people, but are still not comparable to numbers of people potentially exposed to earthquake hazards.

An example of a typical adverse effect of landslides is the loss of human-made structures, utilities and roads and/or loss of life by a landslide or rockfall that originated on an unstable area upslope of a home. Adverse effects vary with the size or volume of individual landslides/rockfall events and density of development below. The magnitude of such events can range from movement as small as a single boulder to massive movement of millions of cubic yards of material.

**Subsidence and Settlement**

Subsidence, which can be caused by groundwater depletion, seismic activity, and other factors, refers to elevation changes of the land whether slow or sudden. Subsidence can cause a variety of problems including broken utility lines, blocked drainage, or distorted property boundaries and survey lines. According to The Multi-jurisdictional Hazard Mitigation Plan (URS 2004), the underlying geologic formations in the County are mostly granitic which have a very low potential of subsidence. Borrego Valley has recorded minor subsidence that has not caused damage. This subsidence was caused by groundwater depletion (Van Zandt 2004).

**Expansive Soils**

Certain types of clay soils expand when they are saturated and shrink when dried. These are called expansive soils, and can pose a threat to the integrity of structures built on them without proper engineering. Expansive soils are derived primarily from weathering of feldspar minerals and volcanic ash. As shown in Figure 2.6-5, areas of highly expansive soils within San Diego County occur predominately in the coastal plains, an area of dissected marine terraces and uplands. They can also be found in valleys and on slopes in the foothills and mountains of the Peninsular Ranges Region and, to a lesser extent, in the desert. In the foothills, soils having a high expansion potential occur near Ramona, Escondido, Rainbow, and areas northeast of Vista. Other areas having high shrink-swell soils are Guatay and Pine Valley.

The expansion and contraction of the soil varies with the soil moisture content (wet or dry), and can be aggravated by the way a property is maintained or irrigated. Human activities can increase the moisture content of the soils, and the threat of expansive soil damage. For example, a subdivision of homes that continually irrigates the landscaping or removes significant amounts of native vegetation could create this condition.

Table 2.6-7 is a list of clay soils in San Diego County based on the USDA Soil Survey categories.

**Seiches and Tsunamis**

A seiche is a standing wave in a completely or partially enclosed body of water. It is an unlikely hazard in the unincorporated County because its water bodies are not big enough to pose a significant threat to public safety, and because most water bodies are reservoirs located in areas with very low development potential. A seiche can occur from seismic ground shaking or by the sudden movement of a landslide into a reservoir. A seiche could result in localized flooding or damage to low lying areas adjacent to large bodies of water. Areas located along the shoreline of lakes or reservoirs are susceptible to inundation by a seiche. The size of a seiche and affected inundation area is dependant on different factors including size and depth of the water body, elevation, source, and if man made, the structural condition of the body of water in which the seiche occurs.

A tsunami is a series of large waves that are caused by a sudden disturbance that displaces water. Triggers for a tsunami include earthquakes, submarine landslides, volcanic eruptions, or meteor impacts. The County's coastline is largely within incorporated cities and on Camp

Pendleton and tsunamis would not affect lands in the unincorporated County. Impacts from tsunamis and seiches are addressed in Section 2.8, Hydrology and Water Quality.

### *2.6.1.4 Soil Erosion*

Erosion of soils can occur from both wind and water sources. Wind erosion physically removes the lighter, less dense soil constituents such as organic matter, clays and silts, which are often the most fertile part of the soil. Surface water runoff erodes agricultural land and undercuts roadbanks, landfills, and riverbanks. Wind moves exposed loose soils off site and can contribute to reduced air quality. Eroded materials fill reservoirs, ponds, and drainage ditches and silt up harbors, streams, and rivers. To generally describe soils in the County, soils are divided into associations (USDA 1973). A soil association normally consists of one or more major soils and at least one minor soil, and is named for the major soils. Soils in an association typically differ in slope, depth, stoniness, drainage, and other characteristics that affect management. The San Diego area has been divided into 34 soil associations, as shown on maps and information available at the San Diego County Planning Department and within the USDA San Diego County Soil Survey. These soils have variable susceptibility to erosive forces, depending on their individual characteristics.

## 2.6.2 Regulatory Framework

### *2.6.2.1 Federal*

**U.S. Geological Survey (USGS) Landslide Hazard Program**

In fulfillment of the requirements of Public Law 106-113, the USGS created the Landslide Hazard Program in the mid-1970s. According to USGS, the primary objective of the National Landslide Hazards Program (LHP) is to reduce long-term losses from landslide hazards by improving our understanding of the causes of ground failure and suggesting mitigation strategies (USGS 2008a). The Federal government takes the lead role in funding and conducting this research, whereas the reduction of losses due to geologic hazards is primarily a State and local responsibility. In San Diego County, the Unified Disaster Council (UDC) is the governing body of the Unified San Diego County Emergency Services Organization. The primary purpose of the UDC and the Emergency Services Organization is to provide for the coordination of plans and programs designed for the protection of life and property in the County of San Diego.

### *2.6.2.2 State*

**Alquist-Priolo (AP) Earthquake Fault Zoning Act**

The California Legislature passed this law in 1972 to help identify areas subject to severe ground shaking. This State law requires that proposed developments incorporating tracts of four or more dwelling units investigate the potential for ground rupture within AP zones. These zones serve as an official notification of the probability of ground rupture during future earthquakes. Where such zones are designated, no building may be constructed on the line of the fault, and before any construction is allowed, a geologic study must be conducted to determine the locations of all active fault lines in the zone.

**California Building Code (CBC)**

The CBC, adopted in 2008 and effective January 1, 2008), is based largely on the 2006 International Building Code (IBC). The CBC includes the addition of more stringent seismic provisions for hospitals, schools, and essential facilities. The CBC contains specific provisions for structures located in seismic zones. Buildings within San Diego County must conform to Seismic Design Category D and E requirements. Also, California law requires all cities and counties in Seismic Zone 4 (as defined in pre-1997 versions of the code) to identify unreinforced masonry (URM) buildings in their jurisdiction, which are not designed to withstand an earthquake. According to information received from the Seismic Safety Commission, the unincorporated County contains only 38 URM buildings (see Table 2.6-8). Most of the structures are located in Fallbrook and Ramona.

**Seismic Hazards Mapping Act**

This Act was passed by the State in 1990, to address non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides. No seismic hazard mapping has been completed by the State for San Diego County. Guidelines for Evaluation and Mitigating Seismic Hazards in California (Special Publication 117) were adopted by the State Mining and Geology Board on March 13, 1997 (revised and re-adopted on September 11, 2008 as Special Publication 117a) in accordance with the Seismic Hazards Mapping Act of 1990. The publication contains the guidelines for evaluating seismic hazards other than surface fault rupture (landslides and liquefaction), and for recommending mitigation measures to minimize impacts. A lead agency may determine when the investigation required by the guidelines and the Seismic Hazards Mapping Act would occur for a project. Investigation can occur before, during, or after the CEQA process.

**State Water Code Section 13282**

On-site wastewater treatment systems (OWTS) discharge pollutants to groundwater, and therefore are regulated by the State Water Code. Section 13282 of the Water Code, allows the RWQCB to authorize a local public agency to issue permits for and to regulate OWTS "to ensure that systems are adequately designed, located, sized, spaced, constructed and maintained." The San Diego RWQCB, with jurisdiction over San Diego County, authorizes the County Department of Environmental Health (DEH) to issue certain OWTS permits.

### *2.6.2.3 Local*

**County Special Studies Zones**

The AP Act provides that a city or county may establish more restrictive policies than those within the AP Act, if desired. The County established Special Study Zones that include late-Quaternary faults mapped by the DMG in the County. Late-Quaternary faults (movement during the past 700,000 years) were mapped based on geomorphic evidence similar to that of Holocene faults except that tectonic features are less distinct. As indicated by the DMG, these faults may be younger, but the lack of younger overlying deposits precludes more accurate age classification. Traces of faults within "Special Study Zones" are treated by the County as active unless a fault investigation can prove otherwise. Before any construction is allowed, a geologic study must be conducted to determine if any active fault lines are located on or within the vicinity of the project site.

**On-Site Wastewater System Groundwater Separation Policy**

The purpose of this County DEH policy is three-fold. It serves to: 1) protect groundwater quality by ensuring proper treatment of sewage effluent prior to its entering into groundwater, 2) protect the public health from failing on-site wastewater systems caused by high groundwater; and 3) provide a methodology for the evaluation of potential building sites using on-site wastewater systems.

**San Diego County Code**

Chapter 6, Division 1 of Title 5 of the San Diego County Code (1990) addresses hazard risks associated with URM buildings by requiring owners to submit a structural analysis and to either make structural improvements to the buildings or demolish them. Currently, the County requires compliance with this code whenever permits are requested for a property where a URM structure is located.

Section 68.301 of the County Code is the OWTS Ordinance, which establishes the requirements for OWTS in the County. It also makes it unlawful for any person to cause, suffer or permit the disposal of sewage, human excrement or other liquid wastes, in any place or manner except through and by means of an approved plumbing and drainage system and an approved sewage disposal system installed and maintained in accordance with the provisions of Division 3, of Title 5 of the County Plumbing Code and OWTS Ordinance.

Section 68.601 of the County Code pertains to Septic Tank and Cesspool Cleaners. This code section establishes processes, fees, and requirements for the examination, cleaning, and collection of sewage from septic tanks and cesspools.

**San Diego County Zoning Ordinance Fault Displacement Area Regulations**

The County Zoning Ordinance Sections 5400 through 5406 implement the requirements of the AP Act. The provisions of Sections 5400 through 5406 outline the allowable development, permitting requirements, and construction limitations within Fault Rupture Zones, as designated by the AP Act. For non-discretionary permits (such as building permits), the Department of Planning and Land Use, Building Division requires any above-surface structure to conform to the seismic requirements of the CBC and to incorporate design recommendations contained within the soils and geologic report as required per code. The County prohibits any buildings or structures to be used for human occupancy to be constructed over or within 50 feet of the trace of known fault (Section 5406, Zoning Ordinance). The County generally requires geologic reports for development proposed in AP Zones (Section 5406 b., Zoning Ordinance).

Other specific zoning ordinance sections do the following:

- Prohibit construction of essential facilities and high occupancy structures in special studies zones as defined under the AP Act or in special studies zones defined by the County of San Diego (Section 5404, Zoning Ordinance).

- Require a geologic report for other development proposed in special studies zones as defined under the AP Act or in special studies zones defined by the County of San Diego (Section 5406, Zoning Ordinance).
- Prohibit new construction of structures to be used for hazardous waste storage and/or human or animal occupancy over or within 50-feet of the trace of an active known fault, with the exception of single family wood frame dwellings not exceeding two stories in height, built or located as part of a development of less than four dwellings and mobile homes wider than eight feet (Section 5406 c & d, Zoning Ordinance).
- Delineate special studies zones along active faults as new geologic information becomes available. These special study zones shall be administered in the same manner as those delineated by the State of California.

**County of San Diego Code of Regulatory Ordinances Sections 87.401-87.430, Grading Ordinance, Design Standards and Performance Requirements**

Chapter 4 of the County Grading Ordinance (which commences at Section 87.101 of the County Code) includes requirements for the maximum slope allowed for cut and fill slopes, the requirement for drainage terraces on cut or fill slopes exceeding 40 feet in height, expansive soil requirements for cuts and fills, minimum setback requirements for buildings from cut or fill slopes, and reporting requirements including a soil engineer's report and a final engineering geology report by an engineering geologist, which includes specific approval of the grading as affected by geological factors.

## 2.6.3 Analysis of Project Impacts and Determination of Significance

### *2.6.3.1 Issue 1: Exposure to Seismic-Related Hazards*

**Guidelines for Determination of Significance**

Based on Appendix G of the CEQA Guidelines and the County of San Diego Guidelines for Determining Significance, Geologic Hazards, the proposed County General Plan Update would have a significant impact if it would expose people or structures to potential substantial adverse impacts, including the risk of loss, injury, or death involving rupture of a known earthquake fault, as delineated on the most recent AP Earthquake Fault Zoning Map issued by the State Geologist or based on other substantial evidence of a known fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction or landslides.

Specifically, the proposed project would result in a significant impact from fault rupture if:

a. The project proposes any building or structure to be used for human occupancy over or within 50 feet of the trace of an AP Fault or County Special Study Zone Fault.

b. The project proposes the following uses within an AP Zone which are prohibited by the County:

i. Uses containing structures with a capacity of 300 people or more. Any use having the capacity to serve, house, entertain, or otherwise accommodate 300 or more persons at any one time.

ii. Uses with the potential to severely damage the environment or cause major loss of life. Any use having the potential to severely damage the environment or cause major loss of life if destroyed, such as dams, reservoirs, petroleum storage facilities, and electrical power plants powered by nuclear reactors.

iii. Specific civic uses. Police and fire stations, schools, hospitals, rest homes, nursing homes, and emergency communication facilities.

The proposed project would result in a significant impact from ground shaking if the project site is located within Seismic Design Category E and F of the CBC and the project does not conform to the CBC.

The proposed project would have the potential to expose people or structures to substantial adverse effects from liquefaction if:

a. The project site contains potentially liquefiable soils;

b. The potentially liquefiable soils are saturated or have the potential to become saturated; or

c. In-situ soil densities are not sufficiently high to preclude liquefaction.

The proposed project would result in a significant impact from landslide risk if:

a. The project site would expose people or structures to substantial adverse effects, including the risk of loss, injury, or death involving landslides;

b. The project is located on a geologic unit or soil that is unstable, or would become unstable as a result of the project, potentially resulting in an on- or off-site landslide; or

c. The project site lies directly below or on a known area subject to rockfall which would result in collapse of structures.

**Impact Analysis**

Natural geologic processes that represent a hazard to life, health, or property are considered geologic hazards. Natural geologic hazards that affect people and property in San Diego County include earthquakes, which can cause surface fault rupture, ground shaking, landslides and liquefaction. As discussed below, these seismic hazards pose a high potential for causing widespread damage.

Future development in the unincorporated County must address seismic hazards. Seismic hazard regulations are in place at the State and County levels that reduce risks associated with seismic-related hazards through avoidance or building standards. These adopted guidelines include the AP Earthquake Fault Zoning Act and Special Publication 117, as described above in Section 2.6.2, Regulatory Framework.

The CBC contains specific provisions for structures located in seismic zones. To ensure that these safety measures are met, the CBC employs a permit system based on hazard classification. The CBC also includes the addition of more stringent seismic provisions for hospitals, schools, and essential facilities. Buildings within San Diego County must conform to the Seismic Design Category E and F requirements of the CBC, which are the requirements for the most active seismic zone.

The various types of geologic hazards are described in greater detail below.

**Fault Rupture**

During earthquakes, the ground can rupture at or below the surface. Ground rupture occurs when two lithosphere plates heave past each other, sending waves of motion across the earth. Ground rupture can completely demolish structures by rupturing foundations or by tilting foundation slabs and walls, as well as damage buried and above ground utilities. Drinking water can be lost, and the loss of water lines or water pressure can affect emergency services, including fire fighting ability. The AP Earthquake Fault Zoning Act identifies areas that are subject to fault rupture. Active faults in the region that could result in fault rupture include segments of the San Jacinto, Elsinore, and Rose Canyon Fault Zones described above. The entirety of each of these fault zones in San Diego County is located in either an AP Fault Zone or a County Special Studies Zone, as shown in Figure 2.6-2. County Special Studies Zones are late-Quaternary faults mapped by the DMG that are not included in AP Fault Zones. However, the County considers them to be active unless a geological investigation can prove otherwise. The San Jacinto Fault Zone is located in the Desert Subregion. The Elsinore Fault Zone traverses the Pala/Pauma, North Mountain, Julian, Desert, Central Mountain, Rainbow, Ramona, Valley Center, and Mountain Empire Subregions and CPAs. The Rose Canyon Fault Zone traverses a portion of the County Islands CPA.

Land uses proposed within fault zones, AP Zones and County special study fault zones in the County and in each affected CPA and Subregion are provided in Table 2.6-9 and Table 2.6-10, respectively. Under the General Plan Update, designated land uses along the San Jacinto Fault Zone would be primarily rural and semi-rural residential land uses located in the Desert Subregion and Anza-Borrego Desert State Park. Land uses proposed under the General Plan Update along the Elsinore Fault Zone would be primarily rural residential and open space uses located in the Pala/Pauma Valley Subregion, North Mountain CPA and Rainbow CPA. Therefore, based on the land use designations identified in the proposed General Plan Update, the project would have the potential to result in development within 50 feet of an active fault. Additional faults exist throughout the County, but are not designated as having a high risk of fault rupture. However, as new geologic information becomes available, the County may identify other faults as being active and posing a significant risk.

**Seismic Ground Shaking**

Ground shaking is the most common effect of earthquakes that adversely affects people and constructed improvements. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. Seismic waves propagating through the earth's crust are responsible for the ground vibrations normally felt during an earthquake. The CBC defines different regions of the U.S. and ranks them according to their seismic hazard potential. All of San Diego County is located within Seismic Design Categories E and F, which have the highest seismic potential. Therefore, exposure to seismic ground shaking is potentially significant in all areas of the unincorporated County.

### Liquefaction

Liquefaction occurs primarily in saturated, loose, fine to medium-grained soils in areas where the groundwater table is generally 50 feet or less below the surface. When these sediments are shaken during an earthquake, a sudden increase in pore water pressure can cause the soils to lose strength and behave as a liquid. Liquefaction is not known to have occurred historically in San Diego County; however, portions of the unincorporated County would have the potential to be susceptible to liquefaction from ground shaking during larger seismic events. There may be a potential for liquefaction in areas with loose sandy soils combined with a shallow groundwater table, which typically are located in alluvial river valleys/basins and floodplains. Figure 2.6-3 depicts areas with the potential for liquefaction to occur in the County. Every CPA and Subregion contains some areas at risk for liquefaction. CPAs and Subregions with large areas at risk for liquefaction include Pala/Pauma Valley, Ramona, North Mountain, Valley Center, Mountain Empire, and the Desert, including the Borrego Springs area. However, liquefaction risk has diminished within Borrego Springs over the past 50 years due to groundwater extraction which has caused the depth to groundwater in most areas to be greater than 50 feet below the ground surface. Table 2.6-11 provides the acreage of proposed land use designations on potentially liquefiable soils in the County and Table 2.6-12 provides the acreages in individual CPAs and Subregions. The majority of land uses that are proposed to be located on potentially liquefiable soils are semi-rural or rural development, open space, or areas located within a National or State Park.

### Landslides

Landslides can be caused by ground shaking from an earthquake or water from rainfall, septic systems, landscaping, or other origins that infiltrate slopes with unstable material. Boulder-strewn hillsides can pose a boulder-rolling hazard from ground shaking, blasting or a gradual loosening of their contact with the surface.

Previous landslides and landslide-prone sedimentary formations are mostly located in the western portion of the unincorporated County. Landslides have also occurred in the granitic terrain in the eastern portion of the County, although they are less prevalent than in the west. Reactivations of existing landslides can be triggered by seismic shaking.

Figure 2.6-4 identifies the unincorporated areas with the highest landslide potential. Areas of landslide risk are located in every CPA and Subregion in the County. However, areas identified as high risk are located in the CPAs and Subregions of Pendleton/De Luz, Otay, Jamul/Dulzura, North Mountain, Mountain Empire, Pala/Pauma Valley, San Dieguito, and the Desert. Areas with moderate risk have been identified in Pendleton/De Luz, Fallbrook, Valley Center, Bonsall, North County Metro, Ramona, San Dieguito, Lakeside, Otay, Pala/Pauma Valley, Mountain Empire, and the Desert. The General Plan Update primarily proposes low-density land use designations in areas of high-to-moderate susceptibility to landslides. One exception is the San Dieguito CPA, where some areas with potentially high/moderate susceptibility to landslides are proposed for Semi-Rural Residential use; however, this designation primarily reflects the existing development pattern in San Dieguito CPA and geotechnical investigations are conducted as part of the regulatory process, as noted below.

**Federal, State and Local Regulations and Existing Regulatory Processes**

Seismic hazard regulations are in place at the State and County levels that reduce risks associated with seismic-related hazards, such as seismic groundshaking, through avoidance or building standards. These adopted guidelines include the AP Earthquake Fault Zoning Act and Special Publication 117a, as described above in Section 2.6.2, Regulatory Framework.

The CBC contains specific provisions for structures located in seismic zones. To ensure that these safety measures are met, the CBC employs a permit system based on hazard classification. The CBC, which was updated in 2007, is based largely on the IBC but includes the addition of more stringent seismic provisions for hospitals, schools, and essential facilities. Buildings within San Diego County must conform to the Seismic Design Categories E and F structural design requirements of the CBC, which are the requirements for the most active seismic zone. This is assured through the County's building permit process.

***Fault Rupture***

As noted above, the AP Earthquake Fault Zoning Act identifies areas that are subject to fault rupture. A Geotechnical investigation hazard assessment is required under the AP Earthquake Fault Zoning Act for project sites within AP Fault Zones. The geologic investigation must conform to California Geologic Survey's Guidelines for Evaluating the Hazard of Surface Fault Rupture (2002) and the California Board of Geologist and Geophysicists Geologic Guidelines for Earthquake and/or Fault Hazard Reports (1986). A hazard assessment for project sites within zones of required investigation are required to determine: 1) the location or absence of hazardous faults on or adjacent to the site, and the ages of past rupture events; 2) the distribution of primary and secondary faulting; 3) the probability of, or relative potential for, future surface displacement; and 4) the degree of confidence in and limitations of these conclusions.

Section 5400 of the County Zoning Ordinance, Fault Displacement Area Regulations, implements the AP Earthquake Fault Zoning Act, including the above mentioned required geotechnical investigation for projects located in an AP Fault Zone or a County Special Study Zone. In addition to the required geotechnical investigation, Section 5400 prohibits certain uses within fault displacement areas, including structures with a capacity of 300 persons or more or schools, and prohibits construction of a structure built for human occupation within 50 feet of an active fault. Uses that are allowed within fault displacement areas must obtain a MUP from the County and are required to be constructed to sustain earthquake forces by complying with the CBC and incorporating all design recommendations contained in the required geotechnical investigation. Examples of design recommendations included in geotechnical investigations may include strengthening of foundations, engineering designs and flexible utility connections. However, design recommendations contained in geotechnical investigations vary based upon the location and design of the individual project.

Faults are mapped in the County's GIS system and all permits are reviewed for proximity to these faults.

***Seismic Ground Shaking***

Construction standards have been developed to ensure structures can withstand seismic events, including structural engineering requirements that have been incorporated into the CBC, which lower the associated risks of seismic shaking. The CBC includes specific Seismic Hazards Standards for construction within areas of high seismic activity. Effective design measures include constructing earth fills to partially absorb underlying ground movements; isolating foundations from the underlying ground movements; and designing strong, ductile foundations that can accommodate some deformation without compromising the functionality of the structure (Bray 2006). Any above-ground structure is required to comply with the structural parameters set forth within the most current edition of the CBC in order to anticipate and avoid the potential for adverse impacts from seismic ground shaking. This is assured through the County's building permit process.

***Liquefaction***

If a project site is located within a potential liquefaction area, feasible designs measures exist that can mitigate the liquefaction hazard. Examples of design measures that may reduce a liquefaction hazard to an acceptable level include slope stabilization methods (such as buttress fills, subdrains, soil nailing, and crib walls) or strengthening the design of the structure through techniques such as reinforced foundations. Prior to issuance of building permits, DPLU requires projects in a potential liquefaction area to prepare a geotechnical study (a requirement of the CBC). The geotechnical study required for project sites within areas of required investigation must demonstrate that liquefaction at a proposed site poses a sufficiently low hazard as to satisfy the defined acceptable level or risk criteria, or propose mitigation suitable to effectively reduce the hazards to acceptable levels. The study provides specifications on a foundation design to preclude substantial damage to proposed structures due to liquefaction. Any site-specific engineering designs suggested in a geotechnical study would be reviewed and approved by the County. The scope and type of mitigation measures and site-specific engineering designs proposed in a required geotechnical study would depend on the site conditions present and the nature of the individual project.

***Landslides***

On a project-by-project basis, the County DPLU may require projects located on or within 500 feet of a landslide susceptibility area, as shown on Figure 2.6-4, to prepare a geologic reconnaissance report as part of CEQA review. The intent of the reconnaissance report is to evaluate whether there are any risks to people or property from landslides or rockfall. If a potentially significant impact is identified, feasible mitigation or design measures, would be identified that would reduce potentially significant impacts. The specific requirements to be included in a geologic reconnaissance report are determined by the County on a project-by-project basis. However, the County requires all reconnaissance reports to conform to the California Board of Geologists and Geophysicists Guidelines for Engineering Geologic Reports (1986) and to be completed by a Certified Engineering Geologist. At a minimum, the geologic reconnaissance report should include a review of topographic maps, geologic and soil engineering maps and reports (if available), stereoscopic aerial photograph review, and other published and non-published references. The County suggests that aerial photographs be used in identifying potential landslide features in addition to sets of stereoscopic aerial photographs that pre-date the current condition of the project site area. A field visit is often required to confirm information in questionable areas, address the potential risk of rockfall to the project site, and observe surface features and details that would not be determined from other data sources. Although engineering design recommendations are generally not a required component of a geologic reconnaissance report, feasible measures to mitigate potential impacts from landslides or rockfall to levels below significance are required to be discussed where appropriate. Examples of mitigation measures may include techniques such as buttressing landslides or installing special drainage devices, while environmental design considerations may include techniques such as placing a structure to best take advantage of the site geologic conditions. The scope and type of mitigation measures and environmental design considerations proposed in a required geotechnical study depends on the site conditions present and the nature of the individual project.

As discussed in the County's Guidelines for Determining Significance, Geologic Hazards, the County endorses three mitigation techniques for reducing landslide impacts: 1) avoiding the hazard; 2) protecting the site from the hazard; and 3) reducing the hazard to an acceptable level. Examples of County endorsed mitigation methods include building developments sufficiently far away from the landslide threat so that it would not be affected if the slope fails; requiring catchments and/or protective structures such as basins, embankments, diversion or barrier walls, and fences; eliminating or reducing the slope, removing the unstable soil and rock materials, or applying one or more appropriate slope stabilization methods (such as buttress fills, sub drains, soil nailing, or crib walls). For deep-seated slope instability, strengthening the design of the structure (e.g., reinforced foundations) is not considered by the County to be an adequate mitigation measure. Implementation of the General Plan Update would continue to require all projects within the County comply with County landslide standards.

**Proposed General Plan Update Goals and Policies**

The proposed General Plan Update addresses geologic hazards in the Safety Element. This element includes Policy S-7.1 which requires new development to be located in areas for which the risk to people or property is at a minimum. This policy implements Safety Element Goal S-7, which is to minimize personal injury and property damage resulting from seismic hazards. All development would be required to include engineering measures to reduce risk in accordance with the CBC and other established standards in areas subject to severe ground shaking, liquefaction, subsidence, or other types of ground failure associated with seismic events.

General Plan Update Policy S-8.1 would require that new development be directed away from areas with high landslide potential when engineering solutions have been determined by the County to be infeasible. Policy S-8.2 would prohibit development from causing or contributing to slope instability. These policies are related to the Safety Element Goal S-8, which is to minimize personal injury and property damage caused by mudslides, landslides or rock falls.

General Plan Update Policies S-7.1, S-7.2, S-7.3 and S-7.4 require components of the AP Earthquake Fault Zoning Act and County Special Studies Zone regulations to be implemented, including the requirement that development must be located 50 feet away from an active or potentially active fault, and the avoidance of certain uses within AP Fault Zones or County Special Studies Zones. These policies implement Safety Element Goal S-7, which is to minimize personal injury and property damage resulting from seismic hazards.

**Summary**

Implementation of the proposed General Plan Update would designate land uses, which would allow development to occur in areas with geological risks such as seismically induced ground shaking, liquefaction, and landslides. However, future development would be required to comply with all relevant federal, State and local regulations and building standards, including the CBC and County required geotechnical reconnaissance reports and investigations. Therefore, impacts from seismically induced fault rupture, ground shaking, liquefaction, and landslides would be less than significant.

### *2.6.3.2 Issue 2: Soil Erosion or Topsoil Loss*

**Guidelines for Determination of Significance**

Based on Appendix G of the CEQA Guidelines, the proposed County General Plan Update would have a significant impact if it would result in substantial soil erosion or the loss of topsoil.

**Impact Analysis**

Topsoil is the uppermost layer of soil, usually comprised of the top six to eight inches below the ground surface. It has the highest concentration of organic matter and microorganisms, and is where most biological soil activity occurs. Plants generally concentrate their roots in, and obtain most of their nutrients from, this layer of soil. Topsoil erosion is of concern when the topsoil layer is blown or washed away. This creates an environment that doesn't support the plants and animals otherwise present in topsoil and disrupts the food chain and local ecosystem. It can also increase the rate of pollutants that become airborne or are delivered to watersheds. Where levees are used, wetlands and estuarine shorelines may also be deprived of enriching sediments that would normally be deposited by natural floodwaters topping a channel's banks.

Implementation of the General Plan Update would allow the development of designated land uses that would have the potential to expose topsoil to erosion from water or wind resulting from construction or operational activities. Development of land uses would expose topsoil to erosion during earthmoving and grading activities. Land uses proposed under the General Plan Update that would allow for development that generally requires intensive construction activities include, village residential, semi-rural residential and village mixed core. Additionally, the development of land uses would result in a permanent increase in impermeable areas, which would increase surface water runoff and associated erosion. Erosion from water runoff is discussed in greater detail in Section 2.8, Hydrology and Water Quality, Issue 3: Erosion or Siltation. As described in this section, projects that result in channel modification and hydromodification, which is the alteration of the natural flow of water through a landscape, as well grading and excavation during construction, would have the potential to result in an increase in erosion or topsoil loss from runoff. Additionally, removal of vegetation during or after construction that would expose topsoil to wind may result in topsoil being blown away. Some components of topsoil may also become airborne and contribute to air pollution in the form of particulate matter. Project related airborne pollutants, including particulate matter, are discussed in Section 2.3, Air Quality.

**Federal, State and Local Regulations and Existing Regulatory Processes**

All construction activities occurring under the General Plan Update would be required to comply with CBC and the County of Grading Ordinance, both of which would ensure implementation of appropriate measures during grading and construction activities to reduce soil erosion. The County Grading Ordinance also requires all clearing and grading to be carried out with dust control measures including watering, application of surfactants, shrouding, control of vehicle speeds, paving of access areas, or other operational or technological measures that would reduce potential for erosion from wind.

Construction occurring under the proposed General Plan Update would be required to comply with the National Pollutant Discharge Elimination System (NPDES) permit program, which requires stormwater pollution prevention plans (SWPPPs) to be prepared and best management practices (BMPs) to be identified for construction sites greater than one acre. Implementation of appropriate BMPs would protect water quality by controlling storm water runoff and ensuring that the quality of storm water flows meets the applicable requirements of the RWQCB. County building and grading inspectors ensure that BMPs are in place and effective per the County Grading Ordinance and the Watershed Protection Ordinance (WPO).

**Proposed General Plan Update Goals and Policies**

As described in Section 2.8.3.3, Issue 3: Erosion or Siltation, the General Plan Update would result in a potentially significant impact associated with erosion or topsoil loss. However, General Plan Update policies within the Land Use Mobility, Conservation and Open Space, and Safety Elements, along with related implementation measures, would reduce impacts associated with soil erosion to below a significant level. These policies and mitigation measures are identified in Section 2.8.6, Hydrology and Water Quality, Mitigation. Additionally, as described in Section 2.9.3.2, Issue 2: Conflicts with Land Use Plans, Policies, and Regulations, the proposed General Plan Update includes Policy LU-6.5 that requires new development to use low impact development techniques. This would reduce the potential for erosion to occur because low impact development minimizes the alteration of site drainage from pre-project conditions. This policy is identified in Section 2.9.6, Land Use, Mitigation.

**Summary**

Compliance with the policies and mitigation measures identified in Sections 2.8, Hydrology and Water Quality, and 2.9, Land Use, as well as all applicable regulations including the NPDES, CBC, and the County Grading Ordinance, would prevent potential impacts to soil erosion or the loss of topsoil to below a significant level.

### *2.6.3.3 Issue 3: Soil Stability*

**Guidelines for Determination of Significance**

Based on Appendix G of the CEQA Guidelines and the County of San Diego Guidelines for Determining Significance, Geologic Hazards, the proposed County General Plan Update would have a potentially significant impact if it would 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 landslide, lateral spreading, subsidence, liquefaction, or collapse.

**Impact Analysis**

The proposed General Plan Update would result in a significant impact if future development would be located in geologically hazardous areas, as described above under Guidelines for Determining Significance. The soil stability risks that can cause such geologic hazards are addressed individually below.

**Landslide, Lateral Spreading, or Collapse**

Landslides can be caused by ground shaking from an earthquake or water from rainfall, septic systems, landscaping, or other origins that infiltrate slopes with unstable material. Boulder-strewn hillsides can pose a boulder-rolling hazard from ground shaking, blasting or a gradual loosening of their contact with the surface.

Previous landslides and landslide-prone sedimentary formations are mostly located in the western portion of the unincorporated County. Landslides have also occurred in the granitic terrain in the eastern portion of the County, although they are less prevalent than in the west. Reactivations of existing landslides can be triggered by seismic shaking.

Figure 2.6-4 identifies the unincorporated areas with the highest landslide potential. Areas of landslide risk are located in every CPA and Subregion in the County. However, areas identified as high risk are located in the CPAs and Subregions of Pendleton/De Luz, Otay, Jamul/Dulzura, North Mountain, Mountain Empire, Pala/Pauma Valley, San Dieguito, and the Desert. Areas with moderate risk have been identified in Pendleton/De Luz, Fallbrook, Valley Center, Bonsall, North County Metro, Ramona, San Dieguito, Lakeside, Otay, Pala/Pauma, Mountain Empire, and the Desert. The General Plan Update primarily only proposes low-density land use designations in areas of high-to-moderate susceptibility. One exception is the San Dieguito CPA, where some areas with potentially high/moderate susceptibility to landslides are proposed for Semi-Rural Residential use.

Lateral spreading is shallow, water-saturated landslide deformation often triggered from seismically induced liquefaction. The County has had no known cases of lateral spreading resulting in damage to property or structures.

**Subsidence**

Subsidence refers to elevation changes of the land whether slow or sudden. Subsidence can cause a variety of problems including broken utility lines, blocked drainage, or distorted property boundaries and survey lines. According to the Multi-jurisdictional Hazard Mitigation Plan (URS 2004), the underlying geologic formations in the County are mostly granitic which have a very low potential of subsidence. Borrego Valley has recorded some minor subsidence that has not caused damage. This subsidence was caused by groundwater depletion (Van Zandt 2004). Therefore, the General Plan Update is not anticipated to result in a potentially significant impact resulting from locating structures in areas at risk for subsidence.

**Liquefaction**

As described above in Issue 1, liquefaction is not known to have occurred historically in San Diego County; however, there may be a potential for liquefaction in areas with loose sandy soils combined with a shallow groundwater table, which typically are located in alluvial river valleys/basins and floodplains. Figure 2.6-3 depicts areas with the potential for liquefaction in the County. Every CPA and Subregion contains some areas at risk for liquefaction. CPAs and Subregions with large areas at risk are Pala/Pauma Valley, Ramona, North Mountain, Valley Center, Mountain Empire, and the Desert Subregion, including the Borrego Springs area. Table 2.6-11 and Table 2.6-12 provide the acreage of proposed land uses on potentially liquefiable soils.

**Federal, State and Local Regulations and Existing Regulatory Processes**

***Landslide, Lateral Spreading, or Collapse***

On a project-by-project basis, the County of San Diego may require that project sites located on or within 500 feet of a landslide susceptibility area, as shown on Figure 2.6-4, prepare a geologic reconnaissance report, and thus may require a geotechnical investigation that would make recommendations to minimize hazards associated with landslides. Additionally, the San Diego County Grading Ordinance includes requirements to ensure soil stability during grading and construction, including requirements for steepening of slopes.

***Subsidence***

As discussed above, the County relies on the Multi-Jurisdictional Hazard Mitigation Plan (URS 2004) to determine the potential for subsidence. With the exception of Borrego Springs where minor subsidence has occurred, the potential for subsidence in the unincorporated area is extremely low.

***Liquefaction***

As discussed in Issue 1 above, for future development under the General Plan Update within a potential liquefaction area, feasible foundation designs exist that can mitigate the liquefaction hazard. Prior to issuance of building permits, DPLU requires projects in a potential liquefaction area to prepare a geotechnical study. The study provides specifications on a foundation design to preclude substantial damage to proposed structures due to liquefaction.

**Proposed General Plan Update Goals and Policies**

As described above in Issue 1 above, General Plan Update Policy S-8.1 requires that new development be directed away from areas with high landslide potential when engineering solutions have been determined by the County to be infeasible. Additionally, the County of San Diego requires that project sites located on or within 500 feet of a landslide susceptibility area, as shown on Figure 2.6-4, prepare a geologic reconnaissance report and may require a geotechnical investigation that would make recommendations to minimize hazards associated with landslides.

**Summary**

Build-out of the proposed General Plan Update would have the potential to result in hazards associated with on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. However, future development under the General Plan Update would be required to comply with federal, State and local building standards and regulations, including the CBC and County-required geotechnical reconnaissance reports and investigations. Compliance with such regulations would reduce impacts associated with on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse to a less than significant level.

## *2.6.3.4 Issue 4: Expansive Soils*

**Guidelines for Determination of Significance**

Based on Appendix G of the CEQA Guidelines and the County of San Diego Guidelines for Determining Significance, Geologic Hazards, the proposed County General Plan Update would have a significant impact if it would be located on expansive soil, as defined in Section 1802A.3.2 of the CBC, creating substantial risks to life or property.

## Impact Analysis

Certain types of clay soils expand when they are saturated and shrink when dried. These are called expansive soils, and can pose a threat to the integrity of structures built on them without proper engineering. If the moisture content and/or soil type differs at various locations under the foundation of a structure, localized or non-uniform movement may occur. This movement can cause damage to the foundation and building structural system, evidenced by cracking of the slab or foundation, cracking in the exterior or interior wall coverings (indicating movement of support framing), uneven floors, and/or misaligned doors and windows.

As shown in Figure 2.6-5, areas of highly expansive soils within San Diego County occur predominately in the coastal plains. They can also be found in valleys and on slopes in the foothills and mountains of the Peninsular Range and, to a lesser extent, in the Desert Region. In the foothills, soils having a high expansion potential occur near the Ramona CPA, North County Metro Subregion, Rainbow CPA, and Bonsall CPA. Other areas having high shrink-swell soils are Guatay and Pine Valley in the Central Mountain Subregion. As shown in Figure 2.6-5, areas of potentially expansive soils are located throughout the County, with the highest concentrations of expansive soils located in the western areas. Tables 2.6-13 and 2.6-14 provide the acreages of proposed General Plan Update land use designations in the County and within each CPA and Subregion, respectively that would be located on potentially expansive soils. Under the proposed General Plan Update, land uses that would have the largest acreages proposed on potentially expansive soils include semi-rural residential (65,586 acres); village residential (34,783 acres); and rural lands (26,995 acres). All of these land uses would allow for the development of homes and/or other structures which would have the potential to be adversely impacted by expansive soils.

### Federal, State and Local Regulations and Existing Regulatory Processes

Construction standards have been developed to ensure structures can withstand changes in the integrity of the soil. Structural engineering standards have been incorporated into the CBC. If the area is located within a zone that has high shrink-swell soils, compliance with the structural and engineering standards set forth within the CBC are required as project design considerations through the County's building permit process. Such standards require that all development adhere to strict guidelines for construction on soils that are within a high shrink/swell category as defined by the U.S. Department of Agriculture, San Diego Soil Survey. The CBC also contains construction and engineering standards for projects located in areas that have high shrink-swell soils. The provisions of the CBC require that a geotechnical investigation be performed to provide data for the architect and/or engineer to responsibly design the project.

### Proposed General Plan Update Goals and Policies

The proposed General Plan Update addresses geologic hazards, such as expansive soils, in the Safety Element. This element includes Policy S-7.2 which requires new development to be located in areas for which the risk to people or property is minimized while requiring all development to include engineering measures to reduce risk in accordance with the CBC, IBC, and other geologic hazard safety standards, including design and construction standards that regulate land use in areas known to have or potentially have significant geologic hazards.

**Summary**

The General Plan Update would designate land uses that would allow for the development of structures on potentially expansive soils. Therefore, future construction projects in San Diego County would be affected by expansive soils. However, projects would be required to comply with all applicable federal, State and local regulations, including the IBC and CBC. Compliance with such regulations would reduce potentially significant impacts to below a level of significance.

### *2.6.3.5 Issue 5: Waste Water Disposal Systems*

**Guidelines for Determination of Significance**

Based on Appendix G of the CEQA Guidelines, the proposed County General Plan Update would have a significant impact if it would 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.

**Impact Analysis**

As described in Section 2.16, Utilities and Service Systems, wastewater districts are generally responsible for providing collection, transmission, and disposal of sewage. There are 24 wastewater districts that serve the unincorporated County, as shown in Figure 2.16-2. Unincorporated areas not serviced by wastewater districts typically utilize septic systems, or OWTS, for wastewater disposal. The most common type of septic system found in San Diego County consists of a septic tank connected to leach lines. Many regions of the County rely on OWTS rather than sewer connections, including areas in the CPAs and Subregions of North Mountain, Ramona, Rainbow, San Dieguito, Spring Valley, Sweetwater, Valley Center, Alpine, Bonsall, Fallbrook, Central Mountain, North County Metro, Mountain Empire, Julian, Desert, and Crest/Dehesa.

Several issues associated with septic tanks have previously been identified in the unincorporated County. Rainbow Valley and portions of the Ramona basin have experienced groundwater levels that are too high to allow new development based on the use of septic tank disposal systems. Similarly, areas of Valley Center have experienced a building moratorium due to the high groundwater levels which cause failing septic systems. In the San Dieguito CPA, the proximity of the Del Dios area to the potable water supply in Lake Hodges has limited the use of septic tanks. The General Plan Update includes residential and other land use designations in these areas, as well as in all other CPAs and Subregions that rely on OWTS. The General Plan Update generally proposes semi-rural and rural land uses with potential lot sizes large enough to support OWTS; however, project-specific analyses would be required for all future development to determine the capability of a site to support an OWTS.

**Federal, State and Local Regulations and Existing Regulatory Processes**

Discharged wastewater must conform to the RWQCB's applicable standards, including the Regional Basin Plan and the California Water Code. On-site wastewater treatment systems (OWTS) discharge pollutants to groundwater, and therefore are regulated by the State Water Code. California Water Code Section 13282 allows RWQCBs to authorize a local public agency to issue permits for OWTS “to ensure that systems are adequately designed, located, sized, spaced, constructed and maintained.” The San Diego RWQCB and Colorado River Basin RWQCB have authorized the DEH to issue certain OWTS permits throughout the County and within the incorporated cities.

Project specific analyses would be required for future developments that would rely on OWTS in order to determine if the site is capable of supporting an OWTS. A permit must be obtained to install any new OWTS. The County DEH has several policies in place for the permitting of septic systems. The DEH published the Design Manual for On-Site Wastewater Treatment Systems on June 26, 2008. This document describes how OWTS are reviewed and permits are issued in San Diego County. The document also includes design criteria for these systems.

Soil permeability determines the degree to which soil can accept sewage discharge over a period of time. Permeability is measured by percolation rate, which is measured in minutes per inch (MPI). The first step in obtaining a permit is a percolation test that determines if soil is capable of supporting OWTS. Additionally, several other factors are considered by the DEH. The distance between the bottoms of the OWTS leach field and groundwater is a factor. All conventional OWTS in the County require at least 5 feet of unsaturated soil between the bottom of the sewage disposal system and the highest anticipated groundwater level for the site. Anticipated peak daily flow is also considered and is often a factor in the number of bedrooms proposed by residential projects. The area available on a parcel that meets all setback requirements to structures, easements, watercourses, or other geologic limiting factors for the design of an OWTS determines whether a site is large enough to accommodate all design features required for an OWTS in the County. Future development that would require OWTS would also be required to comply with the County’s On-Site Wastewater System Groundwater Separation Policy and County Code Sections 68.301 and 68.601, described above in Section 2.6.2, Regulatory Framework.

Alternative wastewater disposal systems are not approved for new development by DEH at this time. However, the California Water Board is preparing Statewide on-site wastewater treatment system regulations as required by Assembly Bill (AB) 885 (and the related California Water Code sections). Once adopted, the County DEH will rely on the new regulations to permit alternative OWTS.

**Summary**

Implementation of the proposed General Plan Update would designate land uses that have the potential to allow development to occur in areas where soils are incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems. However, all future development projects would be required to comply with all applicable federal, State and local regulations related to septic tanks and waste water disposal, including County DEH standards. Compliance with such regulations would reduce the potential for septic systems to be located in soils incapable of supporting such systems. Therefore, impacts would be less than significant.

### 2.6.3.6 Issue 6: Unique Geologic Features

**Guidelines for Determination of Significance**

Based on Appendix G of the CEQA Guidelines and the County of San Diego Guidelines for Determining Significance, Unique Geology, the proposed County General Plan Update would have a significant impact if it would directly or indirectly destroy a unique geologic feature. Specifically, the project would result in significant impact if it would materially impair a unique geologic feature by destroying or altering those physical characteristics that convey the uniqueness of the resource. A geologic feature is unique if it meets one of the following criteria:

a. Is the best example of its kind locally or regionally;
b. Embodies the distinctive characteristics of a geologic principle that is exclusive locally or regionally;
c. Provides a key piece of geologic information important in geology or geologic history;
d. Is a "type locality" of a formation;
e. Is a geologic formation that is exclusive locally or regionally;
f. Contains a mineral that is not known to occur elsewhere in the County; or
g. Is used repeatedly as a teaching tool.

**Impact Analysis**

Table 2.6-1 provides a focused list of known unique geologic features in San Diego County. This list includes sites listed in the NRI and is not a comprehensive list of unique features in the County. Nearly all of the known features in Table 2.6-1 are located in areas that would not be disturbed by development (*e.g.,* open space, parks, roadway right-of-way, etc.).

Additional unlisted or previously unknown unique geologic features that meet the criteria listed above may be present throughout the County, especially in areas that currently contain little development. Unique features such as mima mounds, migmatites, and exposures of the Sweetwater and La Nacion Faults are not included in the NRI. It is important for newly discovered unique features to be protected from destruction so that their importance and ability to meet the above criteria can be evaluated. Future development under the General Plan Update may result in direct or indirect impacts to unique geologic features and would need to be evaluated on a project-specific basis. Direct impacts may result if construction of new development would destroy the resource. Indirect impacts would occur if land uses result in alteration of the physical characteristics of the resource that make it unique, such as increased runoff that would erode the feature.

**Federal, State and Local Regulations and Existing Regulatory Processes**

There are no specific relevant codes and regulations related to the protection of unique geologic features. However, development projects in San Diego County are screened for potential occurrence of such features and the County Guidelines for Determining Significance, Unique Geology, are applied if/when any such occurrences are identified. In addition, the County may require that a geologic reconnaissance report be prepared by a California Professional Geologist to evaluate impacts to unique geologic features.

**Proposed General Plan Update Goals and Policies**

The proposed General Plan Update includes Goal COS-9 in the Conservation and Open Space Element, which requires the conservation of unique geologic features. Policy COS-9.2 supports this goal by requiring that future development minimizes impacts to unique geologic features.

**Summary**

Implementation of the proposed General Plan Update would designate land uses that would allow development in areas that may have the potential to materially impair a unique geologic feature by destroying or altering the physical characteristics that convey the uniqueness of the resource. However, future development would be required to follow all applicable regulatory processes, including compliance with the County's Guidelines for Determining Significance, which could require the completion of a geological reconnaissance report to evaluate the significance of unique geologic features on a given project site. In addition, most of the known features in the unincorporated County are in locations that would not be affected by future development of the General Plan Update. Given the existing conditions and regulatory processes, and the fact that unique geologic resources are such a rarity in San Diego County, potential impacts to unique geologic features would be less than significant.

## 2.6.4 Cumulative Impacts

The geographic scope of the cumulative impact analysis for geology is limited to the immediate area of the geologic constraint, with the exception of some geologic impacts that are regional, such as earthquake risk.

### *2.6.4.1 Issue 1: Exposure to Seismic Related Hazards*

Most of Southern California is located in an area of a relatively high seismic activity, including cumulative projects in the San Diego region. Some cumulative projects, such as those located in adjacent city and county jurisdictions would be subject to the CBC, which contains requirements for development in areas subject to Seismic Design Categories E and F. Additionally, cumulative projects, such as development consistent with surrounding jurisdictions general plans and projects not included in the proposed General Plan Update would be subject to the AP Earthquake Fault Zone Act, which restricts development on active fault traces. Other jurisdictions (special districts, sovereign tribal nations) in the region have policies and guidelines in place to reduce seismic-related risks, and cumulative projects in these jurisdictions would be subject to these and other applicable State and/or federal regulations. Some cumulative projects, such as those occurring within Mexico, would not be subject to such regulations. However, the geographic scope of cumulative impact analysis for seismic-related hazards is limited to the immediate area of the geologic constraint because additional development does not compound risks from seismic hazards. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

### 2.6.4.2 Issue 2: Soil Erosion or Topsoil Loss

Cumulative projects would have the potential to result in substantial soil erosion or the loss of topsoil through construction activities such as grading and excavation that may result in hydromodification or exposure of topsoil to wind that would result in topsoil being washed or blown away. Cumulative projects, such as development proposed under surrounding jurisdictions general plans and projects not included in the proposed General Plan Update, would result in sedimentation to stream courses which would result in a potentially significant cumulative impact. Most cumulative projects are subject to State and local runoff and erosion prevention requirements, including the applicable provisions of the CBC, SWRCB general construction permit, BMPs, Phases I and II of the NPDES permit program, and the County Grading Ordinance. These measures are required to be implemented as conditions of approval for future development projects and are subject to continuing enforcement. Some cumulative projects, such as those located on tribal lands or within Mexico, would not be subject to State and local regulations. However, the geographic scope of cumulative impact analysis for soil erosion and topsoil loss is limited to the immediate area of the geologic constraint because additional development would not compound risks from top soil loss at a specific project site. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

### 2.6.4.3 Issue 3: Soil Stability

Cumulative projects would have the potential to be located on geologic units or soils that are unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. It is anticipated that some cumulative projects, such as those allowable under adjacent jurisdictions general plans and on tribal lands, would be required to undergo analysis of geological and soil conditions applicable to the development site in question during CEQA and/or NEPA environmental review and comply with all applicable regulations to reduce risks, including the CBC. Cumulative project compliance with applicable regulations would ensure that a significant cumulative impact would not occur. Other cumulative projects, such as those located on tribal lands or within Mexico, would not be subject to such regulations. However, the geographic scope of cumulative impact analysis for soil stability is limited to the immediate area of the geologic constraint because additional development would not compound risks from soil instability since they are site specific. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

### 2.6.4.4 Issue 4: Expansive Soils

Cumulative projects would have the potential to be located on expansive soil, as defined in Section 1802A.3.2 of the CBC, creating substantial risks to life or property. Some cumulative projects such as those located in adjacent city and county jurisdictions would be subject to construction standards have been developed to ensure structures can withstand changes in the integrity of the soil and structural engineering standards have been incorporated into the CBC. However, other cumulative projects such as those occurring on tribal lands or within Mexico would not be subject to such regulations. However, the geographic scope of cumulative impact analysis for expansive soils is limited to the immediate area of the geologic constraint because additional development does not compound risks from expansive soils since they are site specific. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

### *2.6.4.5 Issue 5: Waste Water Disposal Systems*

Many cumulative projects would be located in areas served by municipal sewer systems and would not require OWTS. However, some cumulative projects, such as development proposed on tribal lands, in Mexico or on federal and State-operated lands, would be located in areas where sewers are not available and would have the potential to contain soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems. While it is anticipated that most adjacent jurisdictions have permit requirements for OWTS in place for the purpose of public health and safety, it is possible that some do not, such as project in Mexico or on tribal lands. However, the geographic scope of cumulative impact analysis for waste water disposal systems is limited to the immediate area of the geologic constraint because additional development does not compound risks from soil incapable of supporting a wastewater disposal system since they are site specific. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

### *2.6.4.6 Issue 6: Unique Geologic Features*

Construction and operation of cumulative projects, such as development proposed under surrounding jurisdictions general plans and projects not included in the proposed General Plan Update would have the potential to materially impair a unique geologic feature by destroying or altering the physical characteristics that convey the uniqueness of the resource. While it is anticipated that most development in adjacent jurisdictions would be subject to protections for unique geologic features established through the jurisdiction's general plan or other regulations, it is possible that some do not, such as projects located within Mexico or on tribal lands. However, the geographic scope of cumulative impact analysis for unique geologic features is limited to the immediate area of the geologic feature because additional development does not compound risks to unique geologic features. Therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project, in combination with other cumulative projects, would not contribute to a potentially significant cumulative impact.

## 2.6.5 Significance of Impacts Prior to Mitigation

The proposed project would not result in potentially significant direct or cumulative impacts associated with the exposure to seismic related hazards, soil erosion of topsoil loss, soil stability, expansive soils, waste water disposal systems, and unique geologic features.

## 2.6.6 Mitigation

Impacts associated with exposure to seismic-related hazards, soil erosion of topsoil loss, soil stability, expansive soils, waste water disposal systems, and unique geologic features would be less than significant. As such, mitigation is not required.

## 2.6.7 Conclusion

The discussion below provides a synopsis of the conclusion reached in each of the above impact analyses.

### *2.6.7.1 Issue 1: Exposure to Seismic-Related Hazards*

Implementation of the proposed General Plan Update would designate land uses, which would allow development to occur in areas with geological risks, such as seismically induced ground shaking, liquefaction, and landslides. However, future development would be required to comply with all relevant federal, State and local regulations and building standards, including the CBC and the County required geotechnical reconnaissance reports and investigations. Therefore, direct impacts from seismically induced ground shaking, liquefaction, and landslides would be considered less than significant. In addition, the proposed project would not contribute to a significant cumulative impact associated with seismic-related hazards.

### *2.6.7.2 Issue 2: Soil Erosion or Topsoil Loss*

The land uses proposed under the General Plan Update would allow construction and operational activities that would have the potential to expose topsoil to erosion from water or wind. This is considered a potentially significant impact. However, compliance with existing applicable regulations including the NPDES, CBC, and the County Grading Ordinance, would reduce potential impacts to below a significant level. Additionally, the proposed project would not contribute to a potentially significant cumulative impact to soil erosion or topsoil loss.

### *2.6.7.3 Issue 3: Soil Stability*

The proposed General Plan Update would have the potential to result in hazards associated with on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. However, future development associated with the land uses designated in the proposed General Plan Update would be required to comply with all applicable federal, State and local building standards and regulations, including the CBC and County required geotechnical reconnaissance reports and investigations. Compliance with such regulations would reduce impacts associated with on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse to a level less than significant. Additionally, the proposed project would not contribute to a potentially significant cumulative impact associated with soil stability.

### *2.6.7.4 Issue 4: Expansive Soils*

The General Plan Update would designate land uses that would allow for the development of structures on potentially expansive soils. Future projects located in areas with expansive soils would be required to comply with all applicable federal, State and local regulations, including the IBC and CBC. Compliance with such regulations would reduce impacts to a below a level of significance. Therefore, the proposed General Plan Update would not create substantial risks to life or property due to expansive soils. Additionally, the proposed project would not contribute to a potentially significant cumulative impact associated with expansive soils.

### 2.6.7.5 Issue 5: Waste Water Disposal Systems

Implementation of the proposed General Plan Update would designated land uses that have the potential to allow development in areas where soils are incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems. However, future development projects would be required to comply with all applicable federal, State and local regulations related to septic tanks and waste water disposal, including County DEH standards. Compliance with such regulations would reduce the potential for septic systems to be located in soils incapable of supporting such systems. Therefore, impacts would be less than significant. Additionally, the proposed General Plan Update would not contribute to a potentially significant cumulative impact related to waste water disposal systems.

### 2.6.7.6 Issue 6: Unique Geologic Features

Implementation of the proposed General Plan Update would designate land uses that would allow development in areas that may have the potential to materially impair a unique geologic feature by destroying or altering the physical characteristics that convey the uniqueness of the resource. However, any future development would be required to follow applicable federal, State and local regulations, including completion of a County required geological reconnaissance report. Compliance with such regulations would reduce impacts to unique geologic features to a less than significant level. In addition, the proposed General Plan Update would not contribute to a potentially significant cumulative impact associated with impacts to unique geologic features.

## Table 2.6-1. Unique Geologic Features in Unincorporated San Diego County

| Geologic Feature | Reason for Uniqueness | Locality |
|---|---|---|
| Borrego Badlands (Borrego Formation) | Exposures of wind and water erosion features that are unusual in San Diego County | Imperial Valley, Anza-Borrego State Park east of Borrego Springs, Ocotillo Wells south of Route 78 near the Imperial County border |
| Ocotillo conglomerate in the Northern Borrego Badlands | Exposures of wind and water erosion features that are unusual in San Diego County | Near Ocotillo Wells |
| San Onofre breccia | The only exposure of these rocks in San Diego County. During the middle Miocene, from Oceanside north to the Orange County line, exotic breccia was deposited along an ancient beach. These rocks, the San Onofre breccia, had their origin in the west, from an unknown island in the Pacific Ocean. The unit contains clasts of metamorphic rocks, predominantly blue-gray glaucophane schist that is relatively rare in southern California. Layering of the clasts indicates they came from the west, fossils indicate they came from shallow marine waters, and angularity indicates they came from nearby. Deposited 100 mya. (Bergen et al. 1996) | San Onofre Hills |
| Monterey shale | Only place this rock is exposed | Along sea cliffs southeast of San Onofre |
| Petrified forest with logs in place. Exposures of the prebatholithic volcanics and sedimentary rocks containing leaf imprints | Petrified wood is extremely rare in the County | Lusardi Canyon near Rancho Santa Fe, near junction with San Dieguito River |
| Folded slates – steep dips and primary structures. | Probably the County's best location for viewing these types of features | Lusardi Canyon near Rancho Santa Fe, near junction with San Dieguito River |
| Unusual occurrence of orbicular gabbro, where the orbicles are the result of banding around xenoliths in the original rock | An unusual occurrence of orbicular gabbro | Dehesa Road, west of the Harbison Canyon Road intersection |
| Stonewall quartz diorite | Oldest igneous rock in the County | Stonewall Peak; Cuyamaca Region |
| A major bend in the Elsinore fault that includes augen gneiss | Unusual occurrence. Augen gneiss is a coarse-grained gneiss, interpreted as resulting from metamorphism of granite, which contains characteristic elliptic or lenticular shear bound feldspar porphyroclasts, normally microcline, within the layering of the quartz, biotite and magnetite bands | Overland Stage Route west of Vallecito |
| Dos Cabazas marble | Unusual tight folding in marble, alternating bands of calcite, finely disseminated graphite and garnet. Some schist and green diopside. Only place in the County to find Wollastonite. | Vicinity San Diego and Arizona Eastern Railroad to west of the Imperial County Line. |

**Table 2.6-1 (Continued)**

| Geologic Feature | Reason for Uniqueness | Locality |
|---|---|---|
| Stratigraphic relationship between Jacumba volcanic rocks (Alverson andesite) and "Table Mountain gravels"; reworked younger gravels well exposed | Indications of volcanism and rifting from 18 mya | Table Mountain, north of Jacumba |
| Los Pinos Mountain | Only accessible gabbro pluton. Has unique comb layers and orbicular structures | Los Pinos Mountain, approximately two miles northwest of Morena Reservoir |
| A combination of gem-bearing dikes and geologic features such as migmatites, folds, and metamorphic rocks intruded by granite | Educational field trips visit this location | Sacatone Springs, Mount Tule |
| Contact zone in road cuts | Major divide between rocks that are older than 105 my and those that are younger than 95 my. Educational field trips visit this location. | Highway 80 and Interstate 8 just west of the intersection with Kitchen Creek Road |
| Andalusite-bearing schist | Only occurrence in San Diego County | Sunrise Highway (S-1) east of Lake Cuyamaca |
| Ridge between Blair and Little Blair Valleys | Intermontane basins, exposures of pegmatite dikes, prebatholithic rocks, and La Posta granites | Blair Valley and Little Blair Valley east of S-2 in Anza-Borrego State Park |
| Potrero Peak gabbro | Contains orbicular structures | Potrero Peak located east of S-94 in the unincorporated community of Potrero |
| Orbicular diorite and abandoned W-bearing rocks | Contains orbicular structures. Orbicular structures are unusual to find | Northeast of the intersection of Buckman Springs Road and Interstate 8 |
| Piñon Mountains | Only exposures of a detachment fault and associated alteration in San Diego County | Anza-Borrego State Park |

Source: DPLU 2007q

## Table 2.6-2. Modified Mercalli Intensity Scale

| MMI Scale Number | Description of Effect |
|---|---|
| I | Not felt except by a very few under especially favorable circumstances. |
| II | Felt only be a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. |
| III | Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated. |
| IV | During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably. |
| V | Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. |
| VI | Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight. |
| VII | Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars. |
| VIII | Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed. |
| IX | Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. |
| X | Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. |
| XI | Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bend greatly. |
| XII | Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air. |

Source: USGS 2008b

## Table 2.6-3. Comparison of Richter Magnitude and Modified Mercalli Intensity (MMI)

| Richter Magnitude | Expected MMI Value | Effect at Site |
|---|---|---|
| 2 | I – II | Usually detected only by instruments |
| 3 | III | Felt indoors |
| 4 | IV – V | Felt by most people; slight damage |
| 5 | VI – VII | Felt by all; many frightened and run outdoors; damage minor to moderate |
| 6 | VII – VIII | Everybody runs outdoors; damage moderate to major |
| 7 | IX – X | Major damage |
| 8 | X – XII | Total and major damage |

Source: USGS 2008b

## Table 2.6-4. Active Faults in and Adjacent to San Diego County

| Fault Name | General Information | Most Recent Activity |
|---|---|---|
| San Jacinto Fault Zone | 130.5 miles in length and extends through the Borrego Springs and Ocotillo Wells areas. Right-lateral strike-slip fault, minor right reverse. Most recent surface rupture was on the Coyote Creek fault, discussed below. Slip rate is typically between 7 and 17 millimeters per year (mm/yr) and the interval between surface ruptures is 100 to 300 years per segment. | Historic movement |
| Coyote Creek Fault | Right-lateral strike-slip fault extending 50 miles through Borrego Springs, Borrego, and Ocotillo Wells. Most recent surface rupture was on April 8, 1968 on the southern half. Slip rate is between 2 and 6 mm/yr. | Historic movement |
| Elsinore Fault Zone | About 112 miles in length, extending through Julian in San Diego County, and north of the County through the Temecula and Lake Elsinore areas. The Elsinore fault is one of the largest in southern California. Last major rupture was May 15, 1910, with an interval of roughly 250 years between major ruptures. Slip rate category: 4.0 mm/yr. At its southern end, the Elsinore fault is cut by the Yuha Wells fault. The continuation of the Elsinore fault, south of the Yuha Wells fault, is known as the Laguna Salada fault. | Historic movement |
| Rose Canyon Fault Zone | About 19 miles in length and extends through from the City of Coronado across San Diego Bay to the City of San Diego, La Jolla and Linda Vista communities. Slip rate category: 1.1 mm/yr; could be greater if unmeasured parallel segments carry a significant amount of slip. The faults in this zone typically dip to the east. | Holocene active in some parts, otherwise, Late Quaternary active. |
| Earthquake Valley Fault | About 16 miles in length, extending through San Felipe and Julian. Right-later strike slip fault with a slip rate of between 1 and 3 mm/yr. | Holocene active |
| San Andreas Fault Zone | Right-lateral strike-slip fault, 746 miles in length, extending generally north-south through the length of California, terminating in southern California, east of San Diego County, near the Salton Sea. Last major rupture was January 9, 1857 on the northern segment of the fault and slip rate is about 20 to 35 mm/yr. | Historic movement |

Source: SCEDC 2008

### Table 2.6-5. Alquist-Priolo Designated Earthquake Faults in San Diego County

| Fault | Location | Date of Most Recent Event (magnitude) | Estimated Maximum Magnitude(1) |
|---|---|---|---|
| Elsinore | Lake Henshaw, east of Julian (2) | May 15, 1910 (6.0) | 6.5 – 7.3(3) |
| San Jacinto | East side of Borrego Valley | April 8, 1968 (6.5) | 6.4 – 7.3(2) |
| Rose Canyon | Offshore from La Jolla Shores into San Diego Bay | Holocene active, no rupture in the last 200 years | 6.2 – 7.0(3) |

(1) Richter scale
(2) Temescal Valley earthquake on portion of fault in Riverside County
(3) Faults and Earthquakes in San Diego County, Thomas A. Demere, Ph.D., San Diego Natural History
Source: SCEDC 2008

### Table 2.6-6. Hydric Soils in San Diego County

| Category | Soil Type and Slope |
|---|---|
| ChA | Chino fine sandy loam, 0 to 2 percent slopes |
| CkA | Chino silt loam, saline, 0 to 2 percent slopes |
| InA | Indio silt loam, 0 to 2 percent slopes |
| IoA | Indio silt loam, saline, 0 to 2 percent slopes |
| IsA | Indio silt loam, dark variant |
| Lu | Loamy alluvial land |
| MoA | Mecca sandy loam, saline, 0 to 2 percent slopes |
| MxA | Mottsville loamy coarse sand, wet, 0 to 2 percent slopes |
| Rm | Riverwash |
| Tf | Tidal flats |
| TuB | Tujunga sand, 0 to 5 percent slopes |
| VaA | Visalia sandy loam, 0 to 2 percent slopes |

Source: DPLU 2007k

### Table 2.6-7. Clay Soils in San Diego County

| Category | Soil Type |
|---|---|
| Altamont | AtC, AtD, AtD2, AtE, AtE2, AtF |
| Auld | AwC, AwD, AyE |
| Boomer | BoC, BoE, BrE, BrG |
| Bosanko | BsC, BsD, BsE, BtC |
| Diablo | DaC, DaD, DaE, DaE2, DaF |
| Diablo-Olivenhain | DoE |
| Huerhuero | HrC |
| Las Posas | LpB, LpC, Lc2, Ld2, Le2, LrE, LrE2, LrG |
| Linne | LsE, LsF |
| Olivenhain | OhC |
| Redding | RdC, ReE |
| Salinas | SbA, SbC, ScA, ScB |
| Stockpen | SuA, SuB |

Source: DPLU 2007m

### Table 2.6-8. Inventory of Unreinforced Masonry Buildings in San Diego County

| CPA | No. of Buildings |
|---|---|
| Alpine | 2 |
| Campo | 2 |
| Fallbrook | 14 |
| Jacumba | 3 |
| Julian | 2 |
| Lakeside | 4 |
| Ramona | 10 |
| Wynola (Julian) | 1 |
| **Total** | **38** |

Source: DPLU 2007e

### Table 2.6-9. Land Use Designations within Fault Zones[1]

| Proposed Land Use | Total Acres Within AP Zone |
|---|---|
| Commercial | 13,746 |
| Industrial | 61,421 |
| National Forest and State Parks | 59,112 |
| Open Space | 69,258 |
| Public/Semi-Public Facilities | 23,476 |
| Rural Lands | 242,793 |
| Semi-rural Residential | 65,332 |
| Specific Plan Area | 2,518 |
| Tribal Lands | 36,277 |
| Village Residential | 10,586 |

(1) Information in this table contains mapped faults, AP zones, County special study fault zones, and near source shaking zones.

Source: DPLU GIS 2008

## Table 2.6-10. Land Use Designations within Fault Zones[1] by CPA or Subregion

| CPA or Subregion | Proposed Land Use | Total Acres With AP Zone |
|---|---|---|
| Central Mountain | National Forest and State Parks | 9,099 |
| | Open Space | 1 |
| | Rural Lands | 102,477 |
| | Semi-rural Residential | 123 |
| | **Central Mountain Total** | **111,700** |
| County Islands | Public/Semi-Public Facilities | 123 |
| | Village Residential | 31 |
| | **County Islands Total** | **155** |
| Desert | Commercial | 2,673 |
| | Industrial | 5,294 |
| | National Forest and State Parks | 28,466 |
| | Open Space | 9,302 |
| | Public/Semi-Public Facilities | 6,706 |
| | Rural Lands | 23,374 |
| | Semi-rural Residential | 29,158 |
| | Specific Plan Area | 2,518 |
| | Village Residential | 8,261 |
| | **Desert Total** | **115,751** |
| Julian | Commercial | 9,781 |
| | Industrial | 56,127 |
| | National Forest and State Parks | 2,171 |
| | Open Space | 11,956 |
| | Public/Semi-Public Facilities | 4,335 |
| | Rural Lands | 16,711 |
| | Semi-rural Residential | 24,629 |
| | Village Residential | 201 |
| | **Julian Total** | **125,909** |
| Mountain Empire | National Forest and State Parks | 698 |
| | Open Space | 9,118 |
| | **Mountain Empire Total** | **9,816** |
| North Mountain | Commercial | 1,051 |
| | National Forest and State Parks | 18,678 |
| | Open Space | 37,126 |
| | Public/Semi-Public Facilities | 1,325 |
| | Rural Lands | 79,527 |
| | Semi-rural Residential | 4,401 |
| | Tribal Lands | 25,827 |
| | Village Residential | 334 |
| | **North Mountain Total** | **168,269** |

**Table 2.6-10 (Continued)**

| CPA or Subregion | Proposed Land Use | Total Acres With AP Zone |
|---|---|---|
| Pala/Pauma Valley | Commercial | 241 |
| | Open Space | 1,463 |
| | Public/Semi-Public Facilities | 10,622 |
| | Rural Lands | 7,549 |
| | Semi-rural Residential | 6,676 |
| | Tribal Lands | 10,084 |
| | Village Residential | 1,759 |
| | **Pala/Pauma Total** | **38,395** |
| Rainbow | Open Space | 292 |
| | Public/Semi-Public Facilities | 364 |
| | Rural Lands | 9,359 |
| | Semi-rural Residential | 241 |
| | **Rainbow Total** | **10,256** |
| Ramona | Rural Lands | 3,764 |
| | Tribal Lands | 365 |
| | **Ramona Total** | **4,129** |
| Valley Center | Rural Lands | 32 |
| | Semi-rural Residential | 104 |
| | **Valley Center Total** | **136** |

(1) Information in this table contains mapped faults, AP zones, County special study fault zones, and near source shaking zones.
Note: Data has been rounded to nearest whole number.
Source: DPLU GIS 2008

**Table 2.6-11. Proposed Land Use Designation in Areas with Potential Liquefaction Hazards**

| Proposed Land Use | Acres on Potentially Liquefiable Soil |
|---|---|
| Commercial | 5,894 |
| Industrial | 2,194 |
| Military Installations | 46 |
| National Forest and State Parks | 6,323 |
| Office Professional | 142 |
| Open Space | 51,909 |
| Public/Semi-Public Facilities | 8,620 |
| Rural Lands | 18,223 |
| Semi-rural Residential | 100,317 |
| Specific Plan Area | 5,058 |
| Tribal Lands | 1,318 |
| Village Core Mixed Use | 95 |
| Village Residential | 8,988 |
| **Countywide Total** | **209,127** |

Source: DPLU GIS 2008

**Table 2.6-12. Proposed Land Use Designations in Areas with Potential Liquefaction Hazards by Community**

| CPA or Subregion | Proposed Land Use | Acres with Potential Liquefaction Hazard |
|---|---|---|
| Alpine | National Forest and State Parks | 3 |
| | Open Space | 17 |
| | Rural Lands | 67 |
| | Tribal Lands | 199 |
| | Village Residential | 204 |
| | **Alpine Total** | **490** |
| Bonsall | Commercial | 1,764 |
| | Office Professional | 16 |
| | Open Space | 400 |
| | Public/Semi-Public Facilities | 222 |
| | Rural Lands | 575 |
| | Semi-rural Residential | 3,377 |
| | Specific Plan Area | 34 |
| | Village Residential | 893 |
| | **Bonsall Total** | **7,281** |
| Central Mountain | Commercial | 832 |
| | National Forest and State Parks | 1,104 |
| | Office Professional | 1 |
| | Open Space | 174 |
| | Public/Semi-Public Facilities | 1,429 |
| | Rural Lands | 1,348 |
| | Semi-rural Residential | 1,878 |
| | Tribal Lands | 371 |
| | Village Residential | 659 |
| | **Central Mountain Total** | **7,796** |
| County Islands | Public/Semi-Public Facilities | 44 |
| | Rural Lands | 181 |
| | Village Residential | 65 |
| | **County Islands Total** | **290** |
| Crest/Dehesa | Commercial | 59 |
| | Open Space | 18 |
| | Public/Semi-Public Facilities | 65 |
| | Rural Lands | 401 |
| | Semi-rural Residential | 3,140 |
| | Specific Plan Area | 30 |
| | Tribal Lands | 8 |
| | **Crest/Dehesa Total** | **3,721** |

**Table 2.6-12 (Continued)**

| CPA or Subregion | Proposed Land Use | Acres with Potential Liquefaction Hazard |
|---|---|---|
| Desert | Commercial | 123 |
| | Industrial | 13 |
| | National Forest and State Parks | 2,428 |
| | Open Space | 159 |
| | Public/Semi-Public Facilities | 417 |
| | Rural Lands | 1,532 |
| | Semi-rural Residential | 567 |
| | Specific Plan Area | 89 |
| | Tribal Lands | 10 |
| | Village Residential | 111 |
| | **Desert Total** | **5,449** |
| Fallbrook | Commercial | 664 |
| | Industrial | 63 |
| | Open Space | 2,077 |
| | Public/Semi-Public Facilities | 271 |
| | Rural Lands | 819 |
| | Semi-rural Residential | 3,611 |
| | Specific Plan Area | 2,356 |
| | Village Core Mixed Use | 31 |
| | Village Residential | 550 |
| | **Fallbrook Total** | **10,442** |
| Jamul/Dulzura | Commercial | 53 |
| | Open Space | 3,154 |
| | Public/Semi-Public Facilities | 1,709 |
| | Rural Lands | 2,032 |
| | Semi-rural Residential | 1,362 |
| | Specific Plan Area | 12 |
| | **Jamul/Dulzura Total** | **8,322** |
| Julian | Commercial | 154 |
| | Industrial | 43 |
| | Open Space | 431 |
| | Public/Semi-Public Facilities | 367 |
| | Rural Lands | 1,220 |
| | Semi-rural Residential | 2,554 |
| | **Julian Total** | **4,768** |
| Lakeside | Commercial | 1,398 |
| | Industrial | 343 |
| | Office Professional | 1 |
| | Open Space | 1,902 |
| | Public/Semi-Public Facilities | 193 |
| | Rural Lands | 620 |

**Table 2.6-12 (Continued)**

| CPA or Subregion | Proposed Land Use | Acres with Potential Liquefaction Hazard |
|---|---|---|
| | Semi-rural Residential | 27,638 |
| | Specific Plan Area | 432 |
| | Village Residential | 849 |
| | **Lakeside Total** | **33,376** |
| Mountain Empire | Commercial | 67 |
| | National Forest and State Parks | 255 |
| | Open Space | 7,338 |
| | Public/Semi-Public Facilities | 1,345 |
| | Rural Lands | 3,251 |
| | Semi-rural Residential | 15,713 |
| | Specific Plan Area | 129 |
| | Tribal Lands | 259 |
| | Village Residential | 242 |
| | **Mountain Empire Total** | **28,599** |
| North County Metro | Commercial | 13 |
| | Open Space | 363 |
| | Public/Semi-Public Facilities | 147 |
| | Rural Lands | 1,462 |
| | Semi-rural Residential | 3,781 |
| | Village Residential | 66 |
| | **North County Metro Total** | **5,832** |
| North Mountain | Commercial | 36 |
| | National Forest and State Parks | 982 |
| | Open Space | 1,332 |
| | Public/Semi-Public Facilities | 22 |
| | Rural Lands | 1,249 |
| | Semi-rural Residential | 3,295 |
| | Specific Plan Area | 550 |
| | Tribal Lands | 182 |
| | Village Residential | 8 |
| | **North Mountain Total** | **7,656** |
| Otay | Open Space | 1,034 |
| | Public/Semi-Public Facilities | 5 |
| | **Otay Total** | **1,039** |
| Pala/Pauma Valley | Commercial | 219 |
| | Open Space | 18,149 |
| | Public/Semi-Public Facilities | 76 |
| | Rural Lands | 1,480 |
| | Semi-rural Residential | 2,968 |

**Table 2.6-12 (Continued)**

| CPA or Subregion | Proposed Land Use | Acres with Potential Liquefaction Hazard |
|---|---|---|
| | Tribal Lands | 67 |
| | Village Residential | 199 |
| | **Pala/Pauma Total** | **23,158** |
| Pendleton/De Luz | Military Installations | 46 |
| | National Forest and State Parks | 1,551 |
| | Open Space | 869 |
| | Public/Semi-Public Facilities | 12 |
| | Rural Lands | 155 |
| | Semi-rural Residential | 2 |
| | **Pendleton/De Luz Total** | **2,635** |
| Rainbow | Industrial | 49 |
| | Public/Semi-Public Facilities | 677 |
| | Rural Lands | 12 |
| | Semi-rural Residential | 1,258 |
| | Village Residential | 49 |
| | **Rainbow Total** | **2,045** |
| Ramona | Commercial | 164 |
| | Industrial | 797 |
| | Office Professional | 5 |
| | Open Space | 1,674 |
| | Public/Semi-Public Facilities | 847 |
| | Rural Lands | 341 |
| | Semi-rural Residential | 12,971 |
| | Specific Plan Area | 10 |
| | Tribal Lands | 195 |
| | Village Residential | 966 |
| | **Ramona Total** | **17,970** |
| San Dieguito | Commercial | 1 |
| | Office Professional | 2 |
| | Open Space | 11,520 |
| | Public/Semi-Public Facilities | 214 |
| | Rural Lands | 629 |
| | Semi-rural Residential | 145 |
| | Specific Plan Area | 118 |
| | **San Dieguito Total** | **12,629** |
| Spring Valley | Commercial | 26 |
| | Industrial | 411 |
| | Office Professional | 7 |
| | Open Space | 153 |
| | Public/Semi-Public Facilities | 117 |
| | Specific Plan Area | 185 |

**Table 2.6-12 (Continued)**

| CPA or Subregion | Proposed Land Use | Acres with Potential Liquefaction Hazard |
|---|---|---|
| | Specific Plan Area | 3 |
| | Village Residential | 67 |
| | **Spring Valley Total** | **968** |
| Sweetwater | Commercial | 111 |
| | Office Professional | 110 |
| | Open Space | 610 |
| | Public/Semi-Public Facilities | 177 |
| | Semi-rural Residential | 2,965 |
| | Village Residential | 1,591 |
| | **Sweetwater Total** | **5,564** |
| Valle De Oro | Open Space | 185 |
| | Public/Semi-Public Facilities | 158 |
| | Rural Lands | 175 |
| | Semi-rural Residential | 1,325 |
| | Specific Plan Area | 352 |
| | Village Residential | 1,720 |
| | **Valle De Oro** | **3,915** |
| Valley Center | Commercial | 210 |
| | Industrial | 476 |
| | Open Space | 350 |
| | Public/Semi-Public Facilities | 106 |
| | Rural Lands | 674 |
| | Semi-rural Residential | 11,767 |
| | Specific Plan Area | 758 |
| | Tribal Lands | 27 |
| | Village Core Mixed Use | 64 |
| | Village Residential | 749 |
| | **Valley Center Total** | **15,181** |
| | **Unincorporated Countywide Total** | **231,964** |

Note: Data has been rounded to nearest whole number.
Source: DPLU GIS 2008

**Table 2.6-13. Proposed Land Use Designations in Areas with Potential Expansive Soils Hazard**

| Proposed Land Use Designation | Acres on Potentially Expansive Soil |
|---|---|
| Commercial | 5,334 |
| Industrial | 2,100 |
| Military Installations | 3,538 |
| National Forest and State Parks | 9,135 |
| Office Professional | 1,599 |
| Open Space | 10,351 |
| Public/Semi-Public Facilities | 10,595 |
| Rural Lands | 26,995 |
| Semi-rural Residential | 65,586 |
| Specific Plan Area | 7,128 |
| Tribal Lands | 1,294 |
| Village Core Mixed Use | 36 |
| Village Residential | 34,783 |
| **Countywide Total** | **178,474** |

Note: Data has been rounded to nearest whole number.
Source: DPLU GIS 2008

## Table 2.6-14. Proposed Land Use Designations in Areas with Potential Expansive Soils Hazard by Community

| CPA or Subregion | Proposed Land Use Designation | Acres with Potential Expansive Soil Hazard |
|---|---|---|
| Alpine | Industrial | 21 |
| | National Forest and State Parks | 124 |
| | Open Space | 14 |
| | Public/Semi-Public Facilities | 56 |
| | Rural Lands | 56 |
| | Semi-rural Residential | 70 |
| | Tribal Lands | 203 |
| | Village Residential | 77 |
| | **Alpine Total** | **621** |
| Bonsall | Commercial | 29 |
| | Office Professional | 4 |
| | Open Space | 261 |
| | Public/Semi-Public Facilities | 147 |
| | Rural Lands | 157 |
| | Semi-rural Residential | 35,071 |
| | Specific Plan Area | 2,266 |
| | Village Residential | 17,623 |
| | **Bonsall Total** | **55,558** |
| Central Mountain | National Forest and State Parks | 8,261 |
| | Open Space | 4 |
| | Public/Semi-Public Facilities | 7 |
| | Rural Lands | 38 |
| | Semi-rural Residential | 14 |
| | Tribal Lands | 5 |
| | Village Residential | 3 |
| | **Central Mountain Total** | **8,332** |
| County Islands | Public/Semi-Public Facilities | 38 |
| | Rural Lands | 4 |
| | Village Residential | 152 |
| | **County Islands Total** | **194** |
| Crest/Dehesa | Commercial | 28 |
| | Open Space | 139 |
| | Public/Semi-Public Facilities | 242 |
| | Rural Lands | 3,130 |
| | Semi-rural Residential | 2,508 |
| | Specific Plan Area | 92 |
| | **Crest/Dehesa Total** | **6,139** |
| Desert | Commercial | 163 |
| | National Forest and State Parks | 208 |
| | Open Space | 6 |
| | Public/Semi-Public Facilities | 1,469 |

**Table 2.6-14 (Continued)**

| CPA or Subregion | Proposed Land Use Designation | Acres with Potential Expansive Soil Hazard |
|---|---|---|
| | Rural Lands | 1,389 |
| | Semi-rural Residential | 1,344 |
| | Specific Plan Area | 189 |
| | Village Residential | 27 |
| | **Desert Total** | **4,795** |
| Fallbrook | Commercial | 235 |
| | Industrial | 375 |
| | Office Professional | 1 |
| | Open Space | 1,787 |
| | Public/Semi-Public Facilities | 217 |
| | Rural Lands | 574 |
| | Semi-rural Residential | 1,116 |
| | Specific Plan Area | 157 |
| | Village Core Mixed Use | 11 |
| | Village Residential | 379 |
| | **Fallbrook Total** | **4,851** |
| Jamul/Dulzura | Commercial | 52 |
| | National Forest and State Parks | 12 |
| | Office Professional | 2 |
| | Open Space | 444 |
| | Public/Semi-Public Facilities | 49 |
| | Rural Lands | 845 |
| | Semi-rural Residential | 520 |
| | Specific Plan Area | 4 |
| | Tribal Lands | 7 |
| | **Jamul/Dulzura Total** | **1,935** |
| Julian | Open Space | 3 |
| | Rural Lands | 4 |
| | **Julian Total** | **7** |
| Lakeside | Commercial | 65 |
| | Industrial | 25 |
| | Office Professional | 18 |
| | Open Space | 825 |
| | Public/Semi-Public Facilities | 159 |
| | Rural Lands | 509 |
| | Semi-rural Residential | 880 |
| | Specific Plan Area | 222 |
| | Village Residential | 507 |
| | **Lakeside Total** | **3,210** |

**Table 2.6-14 (Continued)**

| CPA or Subregion | Proposed Land Use Designation | Acres with Potential Expansive Soil Hazard |
|---|---|---|
| Mountain Empire | Commercial | 66 |
| | Industrial | 44 |
| | National Forest and State Parks | 74 |
| | Open Space | 461 |
| | Public/Semi-Public Facilities | 288 |
| | Rural Lands | 3,183 |
| | Semi-rural Residential | 442 |
| | Specific Plan Area | 13 |
| | **Mountain Empire Total** | **4,571** |
| North County Metro | Commercial | 1,171 |
| | Industrial | 600 |
| | Office Professional | 1,264 |
| | Open Space | 897 |
| | Public/Semi-Public Facilities | 1,899 |
| | Rural Lands | 6,904 |
| | Semi-rural Residential | 12,547 |
| | Specific Plan Area | 2,135 |
| | Village Residential | 9,702 |
| | **North County Metro Total** | **37,119** |
| North Mountain | National Forest and State Parks | 325 |
| | Open Space | 11 |
| | Rural Lands | 1,126 |
| | **North Mountain Total** | **1,462** |
| Otay | Open Space | 283 |
| | Public/Semi-Public Facilities | 230 |
| | Rural Lands | 191 |
| | Specific Plan Area | 469 |
| | **Otay Total** | **1,173** |
| Pala/Pauma Valley | Open Space | 43 |
| | Public/Semi-Public Facilities | 206 |
| | Rural Lands | 1,508 |
| | Semi-rural Residential | 146 |
| | Tribal Lands | 703 |
| | **Pala/Pauma Total** | **2,606** |
| Pendleton/De Luz | Military Installations | 3,538 |
| | National Forest and State Parks | 131 |
| | Rural Lands | 2,126 |
| | Semi-rural Residential | 171 |
| | **Pendleton/De Luz Total** | **5,966** |

**Table 2.6-14 (Continued)**

| CPA or Subregion | Proposed Land Use Designation | Acres with Potential Expansive Soil Hazard |
|---|---|---|
| Rainbow | Commercial | 8 |
| | Industrial | 12 |
| | Open Space | 19 |
| | Public/Semi-Public Facilities | 488 |
| | Rural Lands | 1,459 |
| | Semi-rural Residential | 1,081 |
| | Village Residential | 8 |
| | **Rainbow Total** | **3,075** |
| Ramona | Commercial | 499 |
| | Industrial | 450 |
| | Office Professional | 30 |
| | Open Space | 2,368 |
| | Public/Semi-Public Facilities | 2,835 |
| | Rural Lands | 1,971 |
| | Semi-rural Residential | 3,395 |
| | Specific Plan Area | 103 |
| | Tribal Lands | 49 |
| | Village Residential | 494 |
| | **Ramona Total** | **12,194** |
| San Dieguito | Commercial | 12 |
| | Open Space | 1,486 |
| | Public/Semi-Public Facilities | 950 |
| | Rural Lands | 942 |
| | Semi-rural Residential | 4,675 |
| | Specific Plan Area | 1,071 |
| | Village Core Mixed Use | 20 |
| | Village Residential | 1,103 |
| | **San Dieguito Total** | **10,259** |
| Spring Valley | Commercial | 2,712 |
| | Industrial | 473 |
| | Office Professional | 65 |
| | Open Space | 107 |
| | Public/Semi-Public Facilities | 148 |
| | Semi-rural Residential | 210 |
| | Specific Plan Area | 13 |
| | Village Residential | 2,499 |
| | **Spring Valley Total** | **6,227** |
| Sweetwater | Commercial | 39 |
| | Open Space | 943 |
| | Public/Semi-Public Facilities | 729 |
| | Rural Lands | 12 |

**Table 2.6-14 (Continued)**

| CPA or Subregion | Proposed Land Use Designation | Acres with Potential Expansive Soil Hazard |
|---|---|---|
| | Semi-rural Residential | 410 |
| | Village Residential | 563 |
| | **Sweetwater Total** | **2,696** |
| Valle De Oro | Commercial | 142 |
| | Industrial | 19 |
| | Open Space | 150 |
| | Public/Semi-Public Facilities | 246 |
| | Semi-rural Residential | 92 |
| | Specific Plan Area | 72 |
| | Village Residential | 361 |
| | **Valle De Oro Total** | **1,082** |
| Valley Center | Commercial | 114 |
| | Industrial | 81 |
| | Office Professional | 216 |
| | Open Space | 100 |
| | Public/Semi-Public Facilities | 192 |
| | Rural Lands | 867 |
| | Semi-rural Residential | 894 |
| | Specific Plan Area | 322 |
| | Tribal Lands | 209 |
| | Village Core Mixed Use | 5 |
| | Village Residential | 1,285 |
| | **Valley Center Total** | **4,285** |
| | **Unincorporated Countywide Total** | **178,475** |

Note: Data has been rounded to nearest whole number.
Source: DPLU GIS 2008

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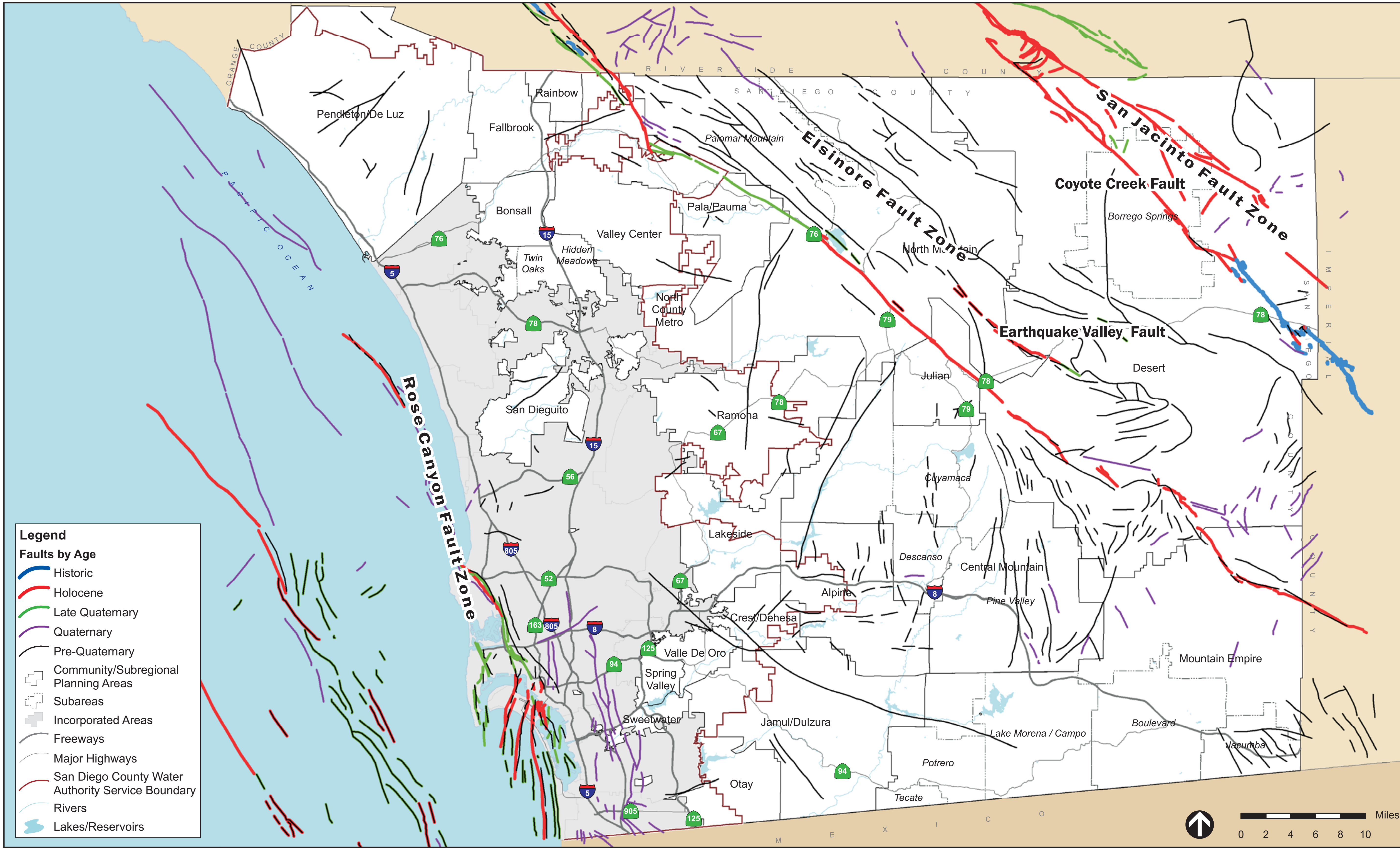
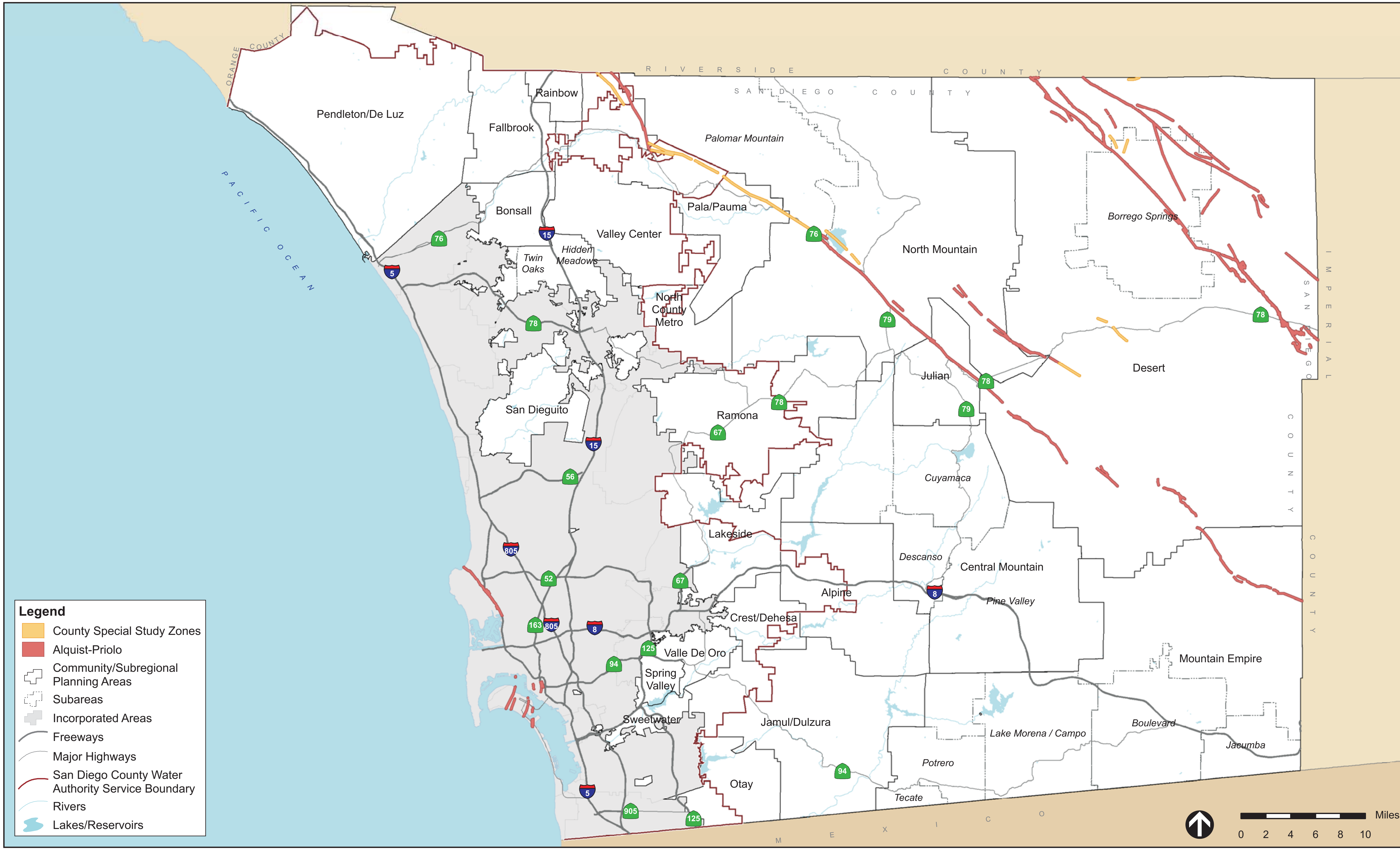



Source: County of San Diego, 2007

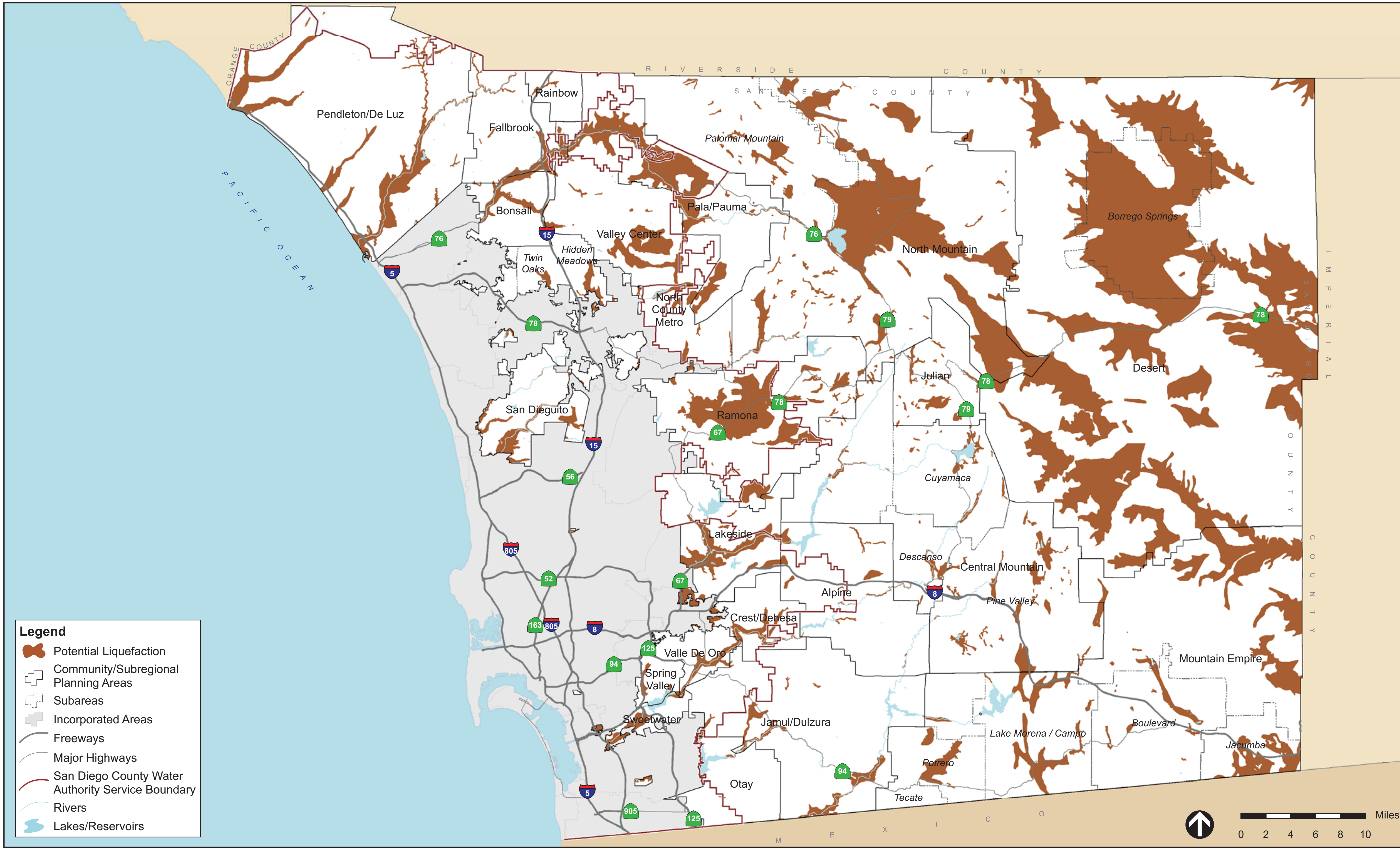
MAPPED FAULTS

FIGURE 2.6-1



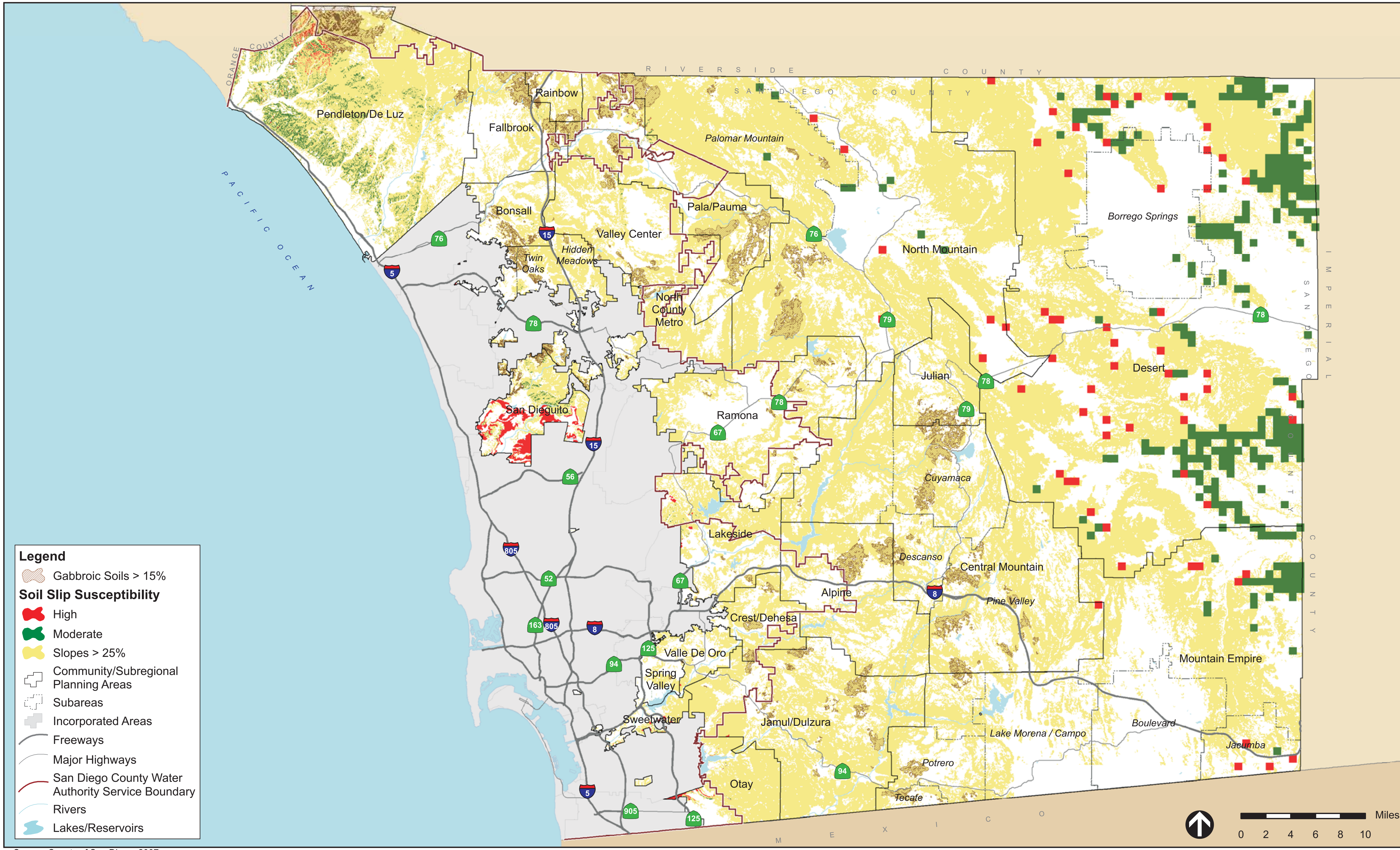
Source: County of San Diego, 2007

**ALQUIST-PRIOLO AND COUNTY SPECIAL STUDY FAULT ZONES** **FIGURE 2.6-2**



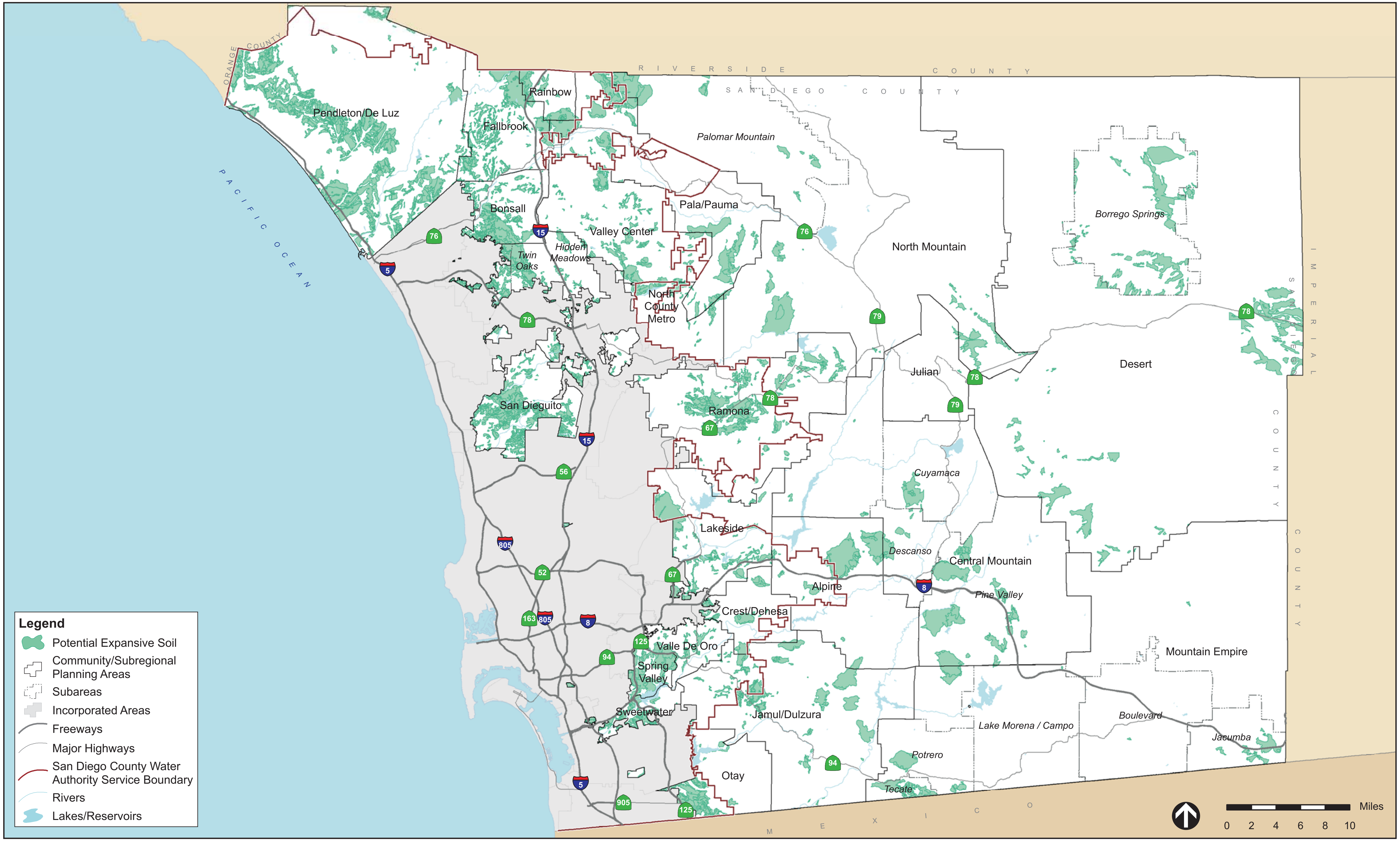
Source: County of San Diego, 2007

**POTENTIAL LIQUEFACTION AREAS** **FIGURE 2.6-3**




Source: County of San Diego, 2007

**LANDSLIDE SUSCEPTIBILITY AREAS** **FIGURE 2.6-4**




Source: County of San Diego, 2007

**POTENTIAL EXPANSIVE SOIL AREAS** **FIGURE 2.6-5**