8.15 Geologic Hazards and Resources

8.15.1 Introduction

This section evaluates the effect of geologic hazards and resources that might be encountered during the construction and operation of the South Bay Replacement Project (SBRP), during the construction and operation of the relocated SDG&E substation and during the demolition of the existing South Bay Power Plant (SBPP). The objective of this evaluation is to identify site conditions and the potential impacts from the construction, demolition and operation of the Project. This section presents a summary of the relevant laws, ordinances, regulations, and standards (LORS); the existing site conditions; and the expected direct, indirect, and cumulative impacts due to construction, demolition, and operation, and maintenance of the Project. Proposed mitigation measures and the effectiveness and monitoring plans are also described. Permits that are required and permitting agencies are identified.

The SBRP project consists of three phases:

- **The Construction Phase**—The first phase is the demolition of existing structures and foundations associated with the former Liquefied Natural Gas (LNG) Facility, preparation of construction lay down areas, and the construction of the SBRP. Initial operations of SBRP will include an interim interconnection to the San Diego Gas & Electric Company (SDG&E) transmission system through a new 230-kilovolt ampere (kVA) substation on approximately 0.6 acre (interconnecting to SDG&E's planned new 230-kilovolt (kV) transmission line) and an underground interconnection to the existing SDG&E South Bay 138/69 kV substation.[1]

- **The Demolition Phase**—The second phase of Project construction activities will occur after the SBRP achieves commercial operation. The construction activity during this phase will be the demolition of the existing SBPP facilities, excluding SDG&E's existing South Bay Substation which will remain in service until the new substation is constructed.

- **The New Substation Phase**—The final phase of the Project will involve the construction of the SDG&E substation on approximately 6.5 acres south of and adjacent to the SBRP site. This construction will be performed after the start up of the SBRP and demolition of SBPP. After the new SDG&E substation construction is completed and operational, and the SBRP generator leads are attached to the new facilities, SDG&E could then initiate demolition activities on the South Bay Substation, located north of the SBRP site. These demolition activities, however, are not part of the scope of this Application for Certification (AFC). They are part of a separate project of unknown timing and scope.

The reason there are two interconnect steps is to ensure that interconnection can be secured by the proposed on-line date of SBRP (2010). Also, SDG&E holds certain obligations

[1] SDG&E was granted a Certificate of Public Convenience and Necessity (CPCN) for the Otay Mesa Power Purchase Agreement (OMPPA) Transmission Project. The CPCN is for the construction of two new 230 kilovolt (kV) electric transmission circuits to connect SDG&E's Miguel Substation with both the Sycamore Canyon Substation and the Old Town Substation in San Diego County. The circuit to the Old Town Substation is planned to pass within approximately 100 feet of the proposed SBRP. This project is under construction. The SBRP interconnection plan is based in part on interconnecting to this circuit.

associated with a new substation as part of its MOU with the City of Chula Vista, but these obligations occur after the demolition of SBPP.

8.15.2 Laws, Ordinances, Regulations, and Standards

The LORS that may apply to geologic resources and hazards are summarized in Table 8.15-1. Among the local LORS discussed in this section are certain ordinances, plans or policies of the City of Chula Vista. For informational purposes, this section reviews compliance of the Project with such requirements even though the Applicant understands that they are not applicable to the Project as a matter of law. (*See* Section 8.4 — Land Use for a discussion of this issue.) The analysis of City LORS in this section is informational and does not address the jurisdictional issues which is discussed in Section 8.4 — Land Use.

TABLE 8.15-1
Laws, Ordinances, Regulations, and Standards

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

8.15.3 Affected Environment

The proposed SBRP is a 19.4-acre site (12.9 acres for SBRP and 6.5 acres for relocation of a SDG&E substation) located on the 33-acre former LNG site on San Diego Unified Port District (Port) property within the City of Chula Vista, California. The existing SBPP is on a 115-acre site leased by the Applicant from the Port. The Project site and linears are located along the southeastern shore of the San Diego Bay within the Peninsular Ranges physiographic province of California. The proposed facility site is relatively flat (approximate elevation 12 feet above mean sea level) and is underlain by artificial fill, alluvium, and terrace deposits. Southern California has experienced moderate to large earthquakes during the past 50 years or so, but in the Coastal San Diego area, small magnitude earthquakes are more common. The area is designated as a California UBC Seismic Zone 4.

8.15.3.1 Regional Geology

SBRP and the existing SBPP is located on the southeastern shore of San Diego Bay within the Peninsular Ranges physiographic province of southern California. The Peninsular Ranges are characterized as being one of the largest geologic units in western North America. They extend from the Transverse Ranges in the Los Angeles area to the tip of Baja California. The province contains minor Jurassic and extensive Cretaceous igneous rocks primarily as result of Nevadan plutonism and contains roof rocks that establish continuity of the pre-Nevadan history of the Sierra Nevada (Norris and Webb, 1990).

8.15.3.2 Local Geology

The Project site and linears are located in an area of fairly flat topography (elevation approximately 10 to 25 feet above mean sea level) on the southeastern part of San Diego Bay. The Project site is on a coastal plain on the edge of the Peninsular Ranges physiographic province of Southern California. The coastal plain is underlain by artificial fill, Holocene alluvium, and Pleistocene terrace and marine deposits (Black & Veatch, 2005, Woodward-Clyde Consultants, 1992).

Artificial fill has occurred in the vicinity of the site since prior to the 1950s to raise the grade. Recent sediments are characteristic of deltaic and shallow bay depositional environments. Older Holocene alluvial sediments originated from Telegraph Creek and other drainages that emptied into the bay. This alluvial material accumulated in the bay margin over an essentially flat surface underlain by the older Pleistocene Bay Point Formation (Woodward-Clyde Consultants, 1992).

The geologic structure of southern California is dominated by right-lateral strike-slip faulting with the movement of two tectonic plates. The San Andreas fault system marks the principal boundary between the Pacific plate and the North American plate. Much of the San Diego coastal area is a graben lying within the Rose Canyon fault zone, a series of right-lateral faults encompassing the Project site.

Figure 8.15-1 (figures are located at the end of the section) shows the stratigraphic units and geographic features within a 2-mile radius of the SBRP site.

8.15.3.3 Stratigraphy

Younger and recent geologic units dominate the San Diego Bay area. These units include artificial fill and alluvial deposits. Geologic units that are present within Project site area (2-mile radius) are described below with details provided by ***Geology of the National City, Imperial Beach, and Otay Mesa Quadrangles, Southern San Diego County Metropolitan area California*** (California Geological Survey, formerly Division of Mines and Geology, 1977).

Quaternary Artificially Compacted Fill. Consists of artificially compacted earth materials derived usually from local sources.

Quaternary Alluvium and Slopewash. Consists primarily of poorly consolidated stream deposits of silt, sand, and cobble-sized particles derived from nearby bedrock sources. The slopewash deposits are poorly consolidated surficial materials chiefly derived from nearby sources of soil and decomposed bedrock. Thickness ranges from 50 to 100 feet.

Quaternary Stream Terrace Deposits. Occur locally as thin veneer along the larger drainage courses. Consists of unconsolidated sand and gravel derived locally from sedimentary, igneous and metamorphic rocks of the area.

Quaternary Bay Point Marine Formation. Widespread and well exposed in the San Diego Bay area. Composed of marine, lagoonal, and non-marine, poorly consolidated, fine- and medium-grained fossiliferous sandstone.

Tertiary San Diego Formation (conglomerate part). Consists of pebble, cobble, and boulder conglomerate in a coarse-grained sandstone matrix. Typically poorly sorted, well indurated, and cemented with ferruginous cement that are resistant to weathering.

8.15.3.4 Seismicity

The seismicity of the San Diego area has been characterized as a broad scattering of small magnitude earthquakes. Surrounding areas (Imperial Valley, northern Baja, and offshore regions) are typically characterized as having a high rate of moderate to large magnitude earthquakes (Woodward-Clyde Consultants, 1992).

Two major zones of seismic activity are located within 20 miles of the site and include the Rose Canyon and Coronado Bank fault zones. The Rose Canyon fault zone represents a significant seismic hazard to the coastal metropolitan region of San Diego. The Rose Canyon fault zone is complex and is comprised of many structurally-related fault segments that have been the location of repeated small magnitude earthquakes. In 1985, a series of earthquakes, up to magnitude (M) 4.7, were measured and traced to this zone. Some sections within this fault zone (primarily to the north of the site) exhibit evidence of Holocene displacement (Jennings, 1994). The major fault associated with this zone is the Rose Canyon Fault, which has an estimated maximum credible earthquake (MCE) magnitude of 7.2 (Blake, 2002). This fault is located approximately 3.3 miles west of the energy facility site (Blake, 2002). According to California Department of Transportation (Caltrans) seismic hazard map, a splay of the Rose Canyon Fault is located approximately 0.6 miles west of the site. This fault zone is considered to represent a significant seismic hazard to the study area and to the metropolitan San Diego area.

Located approximately 12.8 miles west of the site lies the Coronado Bank Fault Zone The major fault associated with this zone is the Coronado Bank Fault, which, like the Rose Canyon fault noted above, has exhibited Holocene displacement (Jennings, 1994). This fault has an estimated MCE magnitude of 7.6 (Blake, 2002).

The location of these faults relative to the Project site is shown on Figure 8.15-2.

8.15.3.6 Geologic Hazards

A geotechnical investigations has been conducted for the Project site by Black & Veatch (2005, 2006). The scope of the investigations was to assess soil conditions, depth to groundwater, and anticipated foundation loads for the proposed Project site.

The following are potential geologic hazards that might occur in the Project area, based on the geotechnical investigation performed by Black & Veatch (2005, 2006).

Ground Rupture. Ground rupture is caused when an earthquake event along a fault creates rupture at the surface. Since no known faults exist at the Project site, the likelihood of ground rupture to occur at the Project site is low. (Black & Veatch, 2005; 2006).

Seismic Shaking. The most significant geologic hazard at the SBRP site is strong ground-shaking due to an earthquake. Ground-shaking of a magnitude 6 earthquake or greater could occur from earthquakes within a 100-mile radius of the site (Blake, 2002).

The earthquake hazard for a particular site is traditionally quantified using two levels of seismic ground motion:

> Design Basis Earthquake (DBE): ground motions associated with a 500 year mean return period or 10 percent probability of exceedance in 50 years
>
> Maximum Credible Earthquake (MCE): ground motions associated with a 2500 year mean return period or 2 percent probability of exceedance in 50 years

Because it is less frequent, the MCE represents a larger magnitude of ground shaking than the DBE. The California Building Code is inherently based on a DBE level event, with special provisions to provide for collapse prevention under the MCE.

The controlling fault impacting the site is the Rose Canyon fault. This fault is capable of generating a peak bedrock acceleration (PBA) 0.53g (rounded up, Blake, 2002) based on the MCE event. According the Caltrans Seismic Hazard Map, a PBA of 0.6g based on the MCE event is reported. The PBA associated with the DBE event is estimated at 0.26g (Blake, 2002).

Liquefaction. During strong ground-shaking, loose, saturated, cohesionless soils can experience a temporary loss of shear strength. This phenomenon is known as liquefaction. Liquefaction is dependent on grain size distribution, relative density of the soils, degree of saturation, and intensity and duration of the earthquake. The potential hazard associated with liquefaction is seismically induced settlement. In addition, liquefaction can cause sand boils, ground rupture, and lateral spreading. The depth to groundwater at the Project site is very shallow, approximately 0.5 to 4 feet below existing grade, and the soil types generally consist of silty sands and silt. Data obtained from cone penetrometer soundings and shear wave velocities were analyzed and determined the site to beliquefiable. The likelihood that liquefaction could occur is considered moderate to high. (Black & Veatch, 2005; 2006, Woodward-Clyde Consultants, 1992). The City of Chula Vista General Plan Update identifies the site area as a liquefaction hazard area (City of Chula Vista, 2005).

Mass Wasting. Mass wasting is the downslope movement of rock, regolith, and soil, under the influence of gravity and depends on steepness of the slope, underlying geology, surface soil strength, and moisture in the soil. Because the SBRP site is flat and no significant excavation is planned during site construction, the potential for direct impact from mass wasting at the site is considered low. The City of Chula Vista General Plan Update identifies the site area as not within a slope instability area (City of Chula Vista, 2005). After demolition of former LNG tank foundations, the SBRP will be brought to an elevation of 22 ft msl with the additional of approximately 168,000 cubic yards of imported structural fill materials that will be compacted to support the SBRP facilities. Engineered fill slopes up to

3:1 will be created. It is anticipated that this grading will not have a significant effect on the mass wasting potential of the site.

As part of demolition of the existing SBPP, approximately 73,000 cubic yards of imported structural fill materials will be used to backfill the former Northern Tank Farm of the SBPP (the tanks were previously removed, but the spill containment areas of the tank farm remain). The backfill will not create slopes, therefore the backfill will not have a significant effect on the mass wasting of the existing SBPP site.

Subsidence. Subsidence can be a natural or man-made phenomenon resulting from tectonic movement, consolidation, hydrocompaction, or rapid sedimentation. Subsidence has not been identified as a geologic hazard at the site (City of Chula Vista, 2005, Woodward-Clyde Consultants, 1992). The potential for subsidence as a hazard that could affect the Project site is low.

Expansive Soils. Expansive soils shrink and swell with wetting and drying. The shrink-swell capacity of expansive soils can result in differential movement beneath foundations. The geotechnical investigation conducted at the site in 2005 and 2006 by Black & Veatch did not specifically assess expansive soils. The 1992 geotechnical investigation identified that some highly expansive soils were present at the site. (Woodward-Clyde Consultants, 1992).

Tsunami/Seiche. Tsunamis are seismically-induced ocean waves with very long periods. Tsunamis may be manifested in the form of wave bores or a gradual upwelling of sea level and can be caused by landslides or earthquakes. The offshore area of San Diego contains many faults and fault scarps capable of producing tsunamis, however, seismically induced sea waves are uncommon or rare. Due to the lack of study of offshore fault zones, the potential for tsunamis is not fully known (Black & Veatch, 2006). The full impact of tsunamis is difficult to quantify, given the lack of study data.

Tsunami impact to coastal San Diego could be possible from an offshore seismic event, however, given the location of the Project site in the south part of San Diego Bay, the likelihood of a tsunami to impact the Project site would be low.

Geologic Resources of Recreational, Commercial, or Scientific Value. Geologic resources of recreational, commercial, or scientific value in the Project vicinity that could be affected include aggregate and gas reserves.

Aggregate Resources. Mineral resources of significance near the proposed power plant site are limited to sand and gravel deposits north of Otay River. Most of the area is within Mineral Resource Zone (MRZ) 3, which is classified as having unknown aggregate deposits. The sand and gravel deposits in the Otay River are classified as MRZ-1 and MRZ-2. Due to population density, it is unlikely that these deposits will be developed.

Natural Gas. No oil or gas fields are present in the immediate Project vicinity, according to on-line maps from the State of California Division of Oil, Gas and Geothermal Resources (CDOGGR 2005). Approximately 1-mile to the south and southeast are known oil and gas fields. The SBRP will not impact these fields.

There are no known geologic resources that provide a significant scientific or recreational value in the vicinity of the site.

8.15.4 Environmental Impacts

8.15.4.1 Project Site

Geologic Hazards. Ground-shaking presents the most significant geologic hazard to the proposed SBRP, the relocated SDG&E substation, and linear facilities. Ground shaking also presents a geologic hazard to the existing SBPP site. Based on the analysis in Section 8.15.3, Table 8.15-2 summarizes the geologic hazards associated with the SBRP site, the relocated SDG&E substation site and linear facilities that have a moderate to high potential to occur.

TABLE 8.15-2
Summary of Potential Geologic Hazards

Project Component	Area of Potential Concern	Geologic Hazards of Potential Concern
Project Site (12.9 acres for SBRP; 6.5 acres SDG&E substation)	Entire site	Seismic ground-shaking, liquefaction, expansive soils
Proposed Linear Facilities	Entire site	Seismic ground-shaking, liquefaction, expansive soils
SBPP Site (115 acres)	Entire site	Seismic ground-shaking, liquefaction, expansive soils

Geologic Conditions and Topography. Construction and demolition will require minor grading and excavation, thereby altering the terrain of the SBRP site and the SBPP site. Impacts on the geologic conditions involve changes in drainage, cuts, and fills. Since the site is generally level, site grading is not expected to adversely impact the geologic environment.

8.15.4.2 Linear Facilities

Linear facilities associated with the SBRP site include a natural gas line, potable water line, transmission lines, and recycled water line discussed below. The geologic hazards associated with the linear facility are summarized in Table 8.15-2.

Seismically induced ground-shaking presents a possible hazard to the proposed linear facilities. This hazard could cause pipeline rupture. With implementation of the mitigation measures proposed in subsection 8.15.5, the hazards will be reduced to less than significant.

8.15.4.3 Geologic Resources of Recreational, Commercial, and Scientific Value

Sand and gravel deposits have been identified north of the Project site near Otay River. Construction and operation of the SBRP site would not significantly affect this resource. Also, there are no known geologic resources that provide a significant scientific or recreational value in the vicinity of the site. Therefore, the SBRP would not affect these resources.

8.15.5 Mitigation Measures

The following describes project design features that will be used to reduce impacts from geologic hazards.

8.15.5.1 Ground Rupture

No active faults cross the SBRP site or the existing SBPP site, nor are active faults located in the vicinity of the site, with the close fault located approximately 3.3 miles west of the site (Jennings 1994). Therefore, no design measures are required to reduce the hazard from surface faulting rupture.

8.15.5.2 Ground-Shaking

The SBRP generating facility will be designed and constructed to withstand strong earthquake-shaking as specified in the 2001 California Building Code (CBC) for Seismic Zone 4.

8.15.5.3 Liquefaction

The soil types present at the SBRP site are conducive to liquefaction. As a result, the design of SBRP will include appropriate structural foundations.

8.15.5.4 Subsidence

Subsidence has not been identified to have occurred in the Project vicinity, and as a result, no design measures would be required.

8.15.5.5 Expansive Soils

Expansive soils will be managed through project design by either removing the soil and backfilling with non-expansive soil, instituting a chemical stabilization of the soil, or by constructing a foundation treatment that resists uplift of the expansive soil. The site-specific geotechnical investigation identified soils that would be prone to expansion. As a result, appropriate structural and foundation design methods will be included in the project.

8.15.6 Involved Agencies and Agency Contacts

No permits are required for compliance with geological LORS. Compliance with building standards and building structures are within the exclusive jurisdiction of the CEC.

8.15.7 Permits Required and Permit Schedule

Compliance of building construction to UBC standards is covered under engineering and construction permits for the Project that are within the exclusive jurisdiction of the CEC. There are no other permit requirement that specifically address geologic resources and hazards.

8.15.8 References

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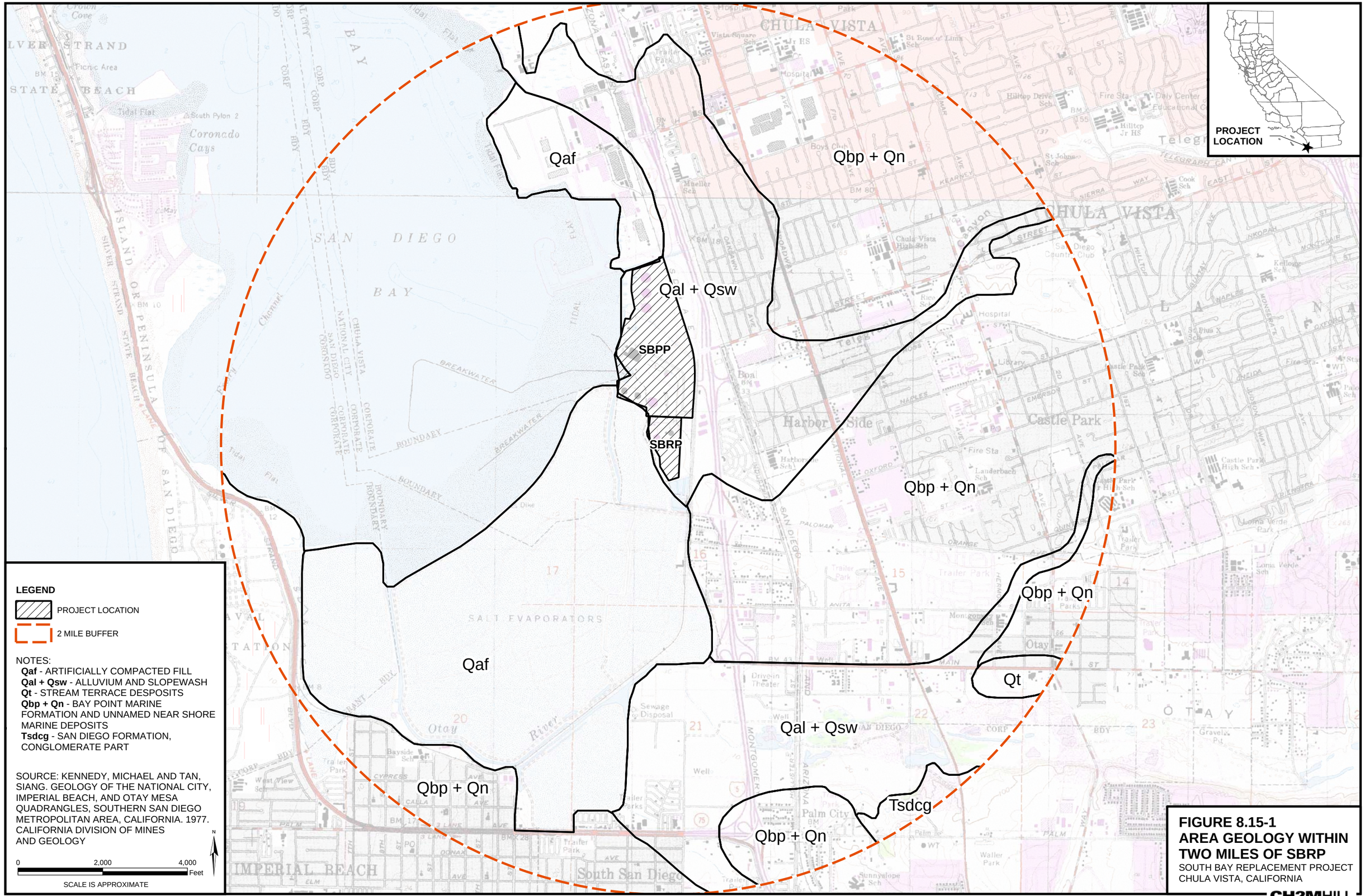

FIGURE 8.15-1
AREA GEOLOGY WITHIN TWO MILES OF SBRP
SOUTH BAY REPLACEMENT PROJECT
CHULA VISTA, CALIFORNIA

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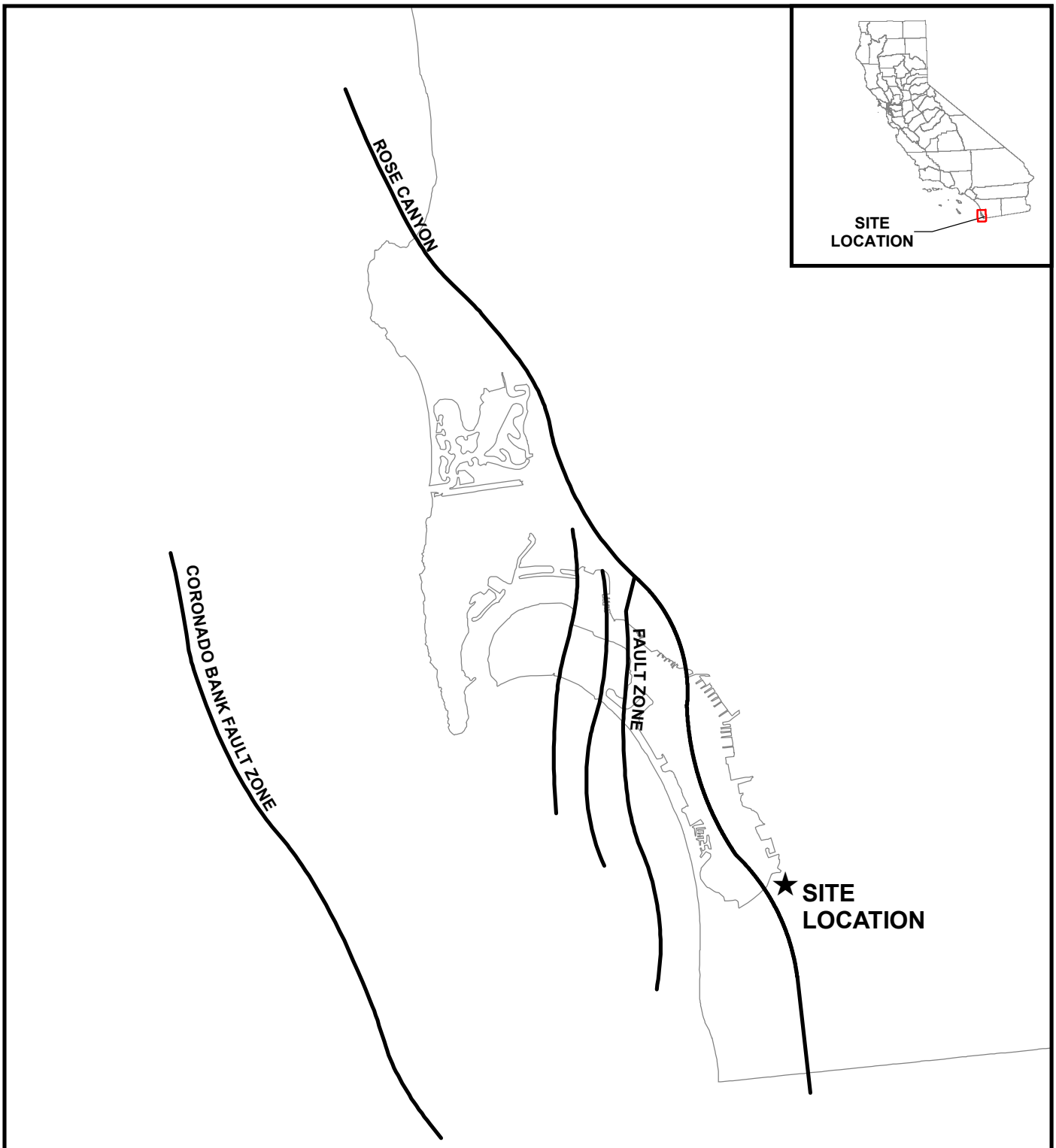

LEGEND

★ SITE LOCATION

FAULTS

COUNTY BOUNDARIES

SOURCE: BIAKE, 2002 AND CALTRANS SEISMIC HAZARD MAP 1996, ERRATA 03/15/06, 11/15/04

N

0 3.75 Miles

SCALE IS APPROXIMATE

FIGURE 8.15-2
PROJECT SITE IN RELATION TO PRINCIPAL FAULTS
SOUTH BAY REPLACEMENT PROJECT
CHULA VISTA, CALIFORNIA

CH2MHILL

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