5.2 GEOLOGY, SOILS, & SEISMICITY

The following section is based on information supplied by the City of Huntington Beach General Plan (May 1996), United States Department of Agriculture Soil Conservation Service and Forest Service Soil Survey (September 1978), the United States Geologic Survey Newport Beach Quadrangle (1981), the Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act (Revised 1997), the Geologic Map of Orange County California, Showing Mines and Mineral Deposits, California Geological Survey (formerly the California Division of Mines and Geology) (1981), the Preliminary Review of Geotechnical Constraints and Geologic Hazards, Poseidon Resources Orange County Desalination Project, Huntington Beach, California (July 11, 2002), the Preliminary Review of Geotechnical Constraints and Geologic Hazards, Poseidon Resources Orange County Desalination Project, Huntington Beach, California, North and West Tank Options (July 12, 2002), the Preliminary Seismic Assessment, Orange County Desalination Project (November 2002), and the Federal Emergency Management Agency Flood Insurance Rate Map (revised February 18, 2004). In addition, Robert H. Sydnor of the California Geological Survey provided a comprehensive bibliography and several relevant maps that have been reviewed and incorporated into this section (see Section 10, BIBLIOGRAPHY).

It should be noted that no site-specific geotechnical investigation has been performed for the proposed project. However, there have been several subsurface geotechnical/environmental studies performed in the site vicinity to provide a basis for the Geotechnical Reports prepared for this EIR (refer to Appendix H, GEOLOGICAL REPORT - DESALINATION SITE, and Appendix I, GEOLOGICAL REPORT - ABOVEGROUND PRODUCT WATER STORAGE TANK SITE). These studies include:

- *Geotechnical Investigation for Future Huntington Beach Maintenance Facility, East End of Edison Road, East of Newland Street, Huntington Beach, California. Prepared by G.A. Nicoll, Inc., 2000.*
- *Geotechnical Investigation, Huntington Beach Channel (Flood Control Facility No. D01, City of Huntington Beach, County of Orange, California. Prepared for the Orange County Environmental Management Agency, February 21, 1991.*
- *Huntington Beach Generating Station Phase II Environmental Site Assessment. Prepared by CH2M Hill, November 27, 1996.*
- *Preliminary Geotechnical Assessment, Southeast Reservoir Site Acquisition, Huntington Beach, California. Prepared by GeoLogic Associates, May 24, 2002.*

EXISTING CONDITIONS

PROPOSED DESALINATION FACILITY SITE

Site Topography

The proposed project site is unpaved and is currently developed with three large fuel oil storage tanks (South, East, and West tanks), containment berms, pipelines, pumps, and associated structures. The subject site lies at an elevation of approximately five feet above mean sea level. The three storage tanks on-site are surrounded on all sides by a 10-to 15-foot high soil containment berm (the berm to the north of the South fuel oil tank is situated outside of the project site boundaries, however). Each tank is elevated by approximately two to three feet above the floor of the site, which slopes gently to the southeast.

Surrounding Topography

Areas within the project vicinity are similar in topography to the subject site. Surrounding areas to the west, north, and east are generally flat and have an approximate elevation of five feet above mean sea level. Elevations to the south gradually slope in a southwest orientation along Huntington State Beach and Huntington City Beach towards the Pacific Ocean. The Santa Ana River, located to the east of the project vicinity, lies in a depression with an approximate elevation of sea level at the mouth to six inches above mean sea level a quarter mile upstream. In addition, the Ascon/Nesi Landfill (located approximately 300 feet northeast of the project site) is elevated several feet above grade as a result of the accumulation of oil drilling byproducts and solid waste during its operation from approximately 1938 to 1984.

The most noticeable topographic feature in the area is the Huntington Beach Channel, which is operated and maintained by the Orange County Flood Control District (OCFCD). This channel borders the eastern margin of the project site. This 60-foot wide channel is bounded on each side by a five- to seven- foot high levee, while the bottom of the channel lies at one foot below mean sea level. The interior sides of the portion of the levee nearby the subject site have recently been improved with driven sheet-piles in order to increase the capacity of the channel. Each of the 33- to 36-foot long interconnecting sheet-piles have been driven to the point where only 10 to 12 feet of each pile are exposed above the bottom of the channel. The southern limit of the new sheet-pile wall terminates near the southeast corner of the project site.[1, 2]

SITE GEOLOGY

Surficial Geology

The native soils beneath the project site consist of an upper 60-foot thick layer of interbedded coastal estuarine/littoral sediments consisting of fine sand, silt, clay, and mixtures thereof. According to GeoLogic Associates (2002), these sediments range in age from approximately 8,600 years old to the present. Between depths of about 60 to 90 feet, the native sediments are represented by middle to late Holocene (8,600 to 11,000 years old) fluvial deposits. These sediments are composed largely of sand and clayey sand with layers and lenses of silt and highly plastic clay that contains varying amounts of organic detritus. Below a depth of 90 feet below ground surface are Pleistocene (11,000 to 1.8 million years old) marine and non-marine strata. These native soils are overlain by varying thicknesses of artificial fill soil that was placed during construction of the Huntington Beach Generating Station and associated fuel storage tanks. According to building foundation studies by G. A. Nicoll, Inc. (2000) for the newly constructed Huntington Beach Maintenance Facility (situated approximately 500 feet north of the site), without mitigation these alluvial deposits are considered unsuitable for foundation support due to their compressible nature when placed under structural (i.e. building) loads.

Below this upper layer of highly compressible soils are deposits of sandy coastal alluvial soils that make up the Talbert aquifer. Limited standard penetration test (SPT) data indicate that the uppermost 10 to 16 feet of these sediments are highly susceptible to liquefaction during strong ground motion from nearby seismic sources. Below a depth of approximately 17 to 25 feet below existing ground surface, these alluvial sediments have "N-values" (as derived from SPT data) that are suggestive of soils that are not prone to liquefaction, nor are they considered compressible or subject to collapse under normal structural loads.

---

[1] Telephone conversation with Albric Ghokasian, Orange County Flood Control District, November 23, 2004.

[2] Geotechnical Investigation, Huntington Beach Channel, City of Huntington Beach, County of Orange, California: Consultants Report for Orange County Environmental Management Agency. Prepared by Geosoils, Inc., 1991.

There is no current evidence that would suggest the occurrence of soils containing collapsible, organic peat deposits in the vicinity of the project site.

Seismicity/Faulting

The primary seismic hazard to the subject site vicinity is the possibility of ground shaking due to the proximity of major active faults in the Southern California region. A number of concealed faults exist approximately 1.25 miles north of the proposed project site, while the South Branch Fault (a concealed fault which branches from the Newport Inglewood Fault) traverses the northern portion of the subject site (refer to Exhibit 5.2-1, *REGIONAL GEOLOGY & SEISMICITY*).

Although the project area is not located within an Alquist-Priolo Earthquake Fault Zone (formerly referred to as Special Study Zones) as designated by the California Geological Survey[3], the site is within approximately 1.25 miles of the Newport-Inglewood Fault Zone, an Alquist-Priolo Earthquake Fault Zone. Additional active or potentially active faults in the vicinity include:

- Elsinore Fault - Located 28 miles from the City center and is capable of a magnitude 7.5 earthquake.
- Palos Verdes-Coronado Bank Fault - Located 10 miles from the City center and is capable of a magnitude 7.5 earthquake.
- Raymond Fault - Located 30 miles from the City center and is capable of a magnitude 7.5 earthquake.
- San Andreas Fault - Located 51 miles from the City center and is capable of a magnitude 8.3 earthquake.
- Sierra Madre-San Fernando Fault - Located 32 miles from the City center and is capable of a 7.5 magnitude earthquake.
- Whittier-North Elsinore Fault - Located 19 miles from the City center and is capable of a magnitude 7.5 earthquake.
- Elysian Park Fault - Located 25 miles from City center and is capable of a 7.0 magnitude earthquake.
- Compton Blind Thrust Fault - Located approximately 10 miles from the City center and is capable of a 7.0 magnitude earthquake.
- Torrance-Wilmington Fault - Located approximately 10 miles from the City Center and is capable of a magnitude 7.0 earthquake.

Newport-Inglewood Fault Zone. The subject site is shown as being approximately 1.25 miles south of the Newport-Inglewood Fault Zone, which is an Alquist-Priolo Earthquake Fault Zone.[4] Alquist-Priolo Earthquake Fault Zones are intended to prohibit the location of developments for human occupancy across the trace of active faults in order to minimize the loss of life and property in the event of an earthquake. The Newport-Inglewood Fault Zone is an active right-lateral fault system consisting of a series of *en echelon*[5] fault segments and anticlinal folds that are believed to be the expression of a deep-seated fault within the basement rock.[6, 7, 8] The fault zone is visible on the

[3] Alquist-Priolo Earthquake Fault Zone Map, issued by the State Geologist, 1986; California Division of Mines and Geology Special Publication 42 (1997).

[4] Active Fault Near-Source Zones, California Division of Mines and Geology, map atlas page N-34, February 1998.

[5] Faults that are in an overlapping or staggered arrangement.

[6] Convex upward folds with cores containing the stratigraphically older rocks.

[7] Bryant, 1988; Barrows, 1974.

[8] City of Huntington Beach General Plan EIR, 1995.

surface as a series of northwest-trending elongated hills, including Signal Hill and the Dominguez Hills, extending from Newport Beach to Beverly Hills. The total fault length is approximately 44 miles. The estimated maximum earthquake magnitude assigned to the fault zone is 6.9Mw (momentum magnitude), based on its estimated rupture length versus magnitude relationship by Slemmons (1982) and its slip rate at 1 2 millimeter/year (a Type B seismic source).

The South Branch Fault, a component of the Newport Inglewood Fault, traverses the northern portion of the project site under the existing South fuel oil storage tank. A seismic study performed for the Bolsa Chica Project (located approximately five miles northwest of the proposed desalination facility) indicates that the South Branch Fault is classified as neither active nor potentially active under the Bolsa Chica site.[9] The City of Huntington Beach utilizes their 1996 General Plan and the CDMG's Alquist-Priolo Earthquake Fault Zones to develop four categories for faults within the City. The City's General Plan indicates that this fault is a Category C fault, requiring special studies and subsurface investigation for critical and important land uses.

In addition, GeoLogic Associates' *Preliminary Seismic Assessment, Orange County Desalination Project* (2002) analyzes the potential for fault rupture beneath the proposed project site, currently occupied by the existing fuel oil tanks. A subsurface stratigraphic correlation/ fault investigation was performed to assess the potential for surface fault rupture within Holocene-age deposits below the potential water tank sites. According to the criteria established by the California Division of Mines and Geology, a fault is considered "active" if it can be demonstrated that the fault has produced surface displacement within Holocene time (about the last 11,000 years). Due to the presence of a relatively thick layer of fill soils and shallow groundwater, conventional fault trenching and soil-stratigraphic techniques could not be employed by GeoLogic Associates to assess the presence of surface fault rupture potential. Instead, their investigation involved the use of cone penetrometer test (CPT) and exploratory borings for stratigraphic correlation purposes, as well as the use of radiocarbon dating of organic sediments and shells obtained from the exploratory borings. According to data collected, no evidence of faulting within Holocene sediments was found beneath the site. The report concludes that the risk of surface fault rupture is minimal over the lifetime of the proposed project.

Liquefaction/Subsidence Potential

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similar to liquid when subject to intense ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density silty or fine sandy soils; and 3) high-intensity ground motion. Liquefaction occurs when the dynamic loading of a saturated sand or silt causes pore water pressures to increase to the point where grain-to-grain contact is lost and the material temporarily behaves as a viscous fluid. Liquefaction can cause settlement of the ground surface, settlement and tilting of engineered structures, flotation of buoyant buried structures and fissuring of the ground surface. A common trait of liquefaction is formation of sand boils - short lived fountains of soil and water that emerge from fissures or vents and leave freshly deposited conical mounds of sand or silt on the ground surface. The City of Huntington Beach General Plan designates the project area as having a Very High potential for liquefaction. In addition, the Seismic Hazards Zones Map prepared by the State Geologist (April 7,1997) shows the site as an Official Liquefaction Zone.[10] In addition, due to the relatively loose, unconsolidated nature of near surface soils on-site, there is a moderate to high potential for earthquake-induced ground settlement and subsidence.

[9] City of Huntington Beach General Plan EIR, 1995.

[10] Seismic Hazard Zones Map, April 7, 1997, prepared by the State Geologist.

Exhibit 5.2-1
REGIONAL GEOLOGY & SEISMICITY

According to building foundation studies by G. A. Nicoll, Inc. (2000) for the newly constructed Huntington Beach Maintenance Facility (situated approximately 500 feet north of the desalination facility site), the uppermost 13 feet of the native Holocene deposits are considered unsuitable for foundation support due to their compressible nature when placed under structural (i.e. building) loads. Limited standard penetration test (SPT) and cone penetrometer test (CPT) data (by G. A. Nicoll, Inc., 2000; and GeoLogic Associates, 2002 for the Beach Maintenance Facility and the proposed project site, respectively) indicate that the uppermost 10 to 16 feet of the native sediments are highly susceptible to liquefaction during strong ground motion from nearby seismic sources. According to the study performed by GeoLogic Associates (2002), the soil layers susceptible to liquefaction were not continuous beneath the proposed project site. Below a depth of about 17 to 25 feet, the native sediments have "N-values" (as derived from SPT and CPT data) that are suggestive of soils that are not prone to liquefaction. Soils below 17 to 25 feet are not considered compressible or subject to collapse under normal structural loads although some deeper sand lenses may be subject to liquefaction.

Lateral Spread

Lateral spreading involves the dislocation of the near surface soils generally along a near-surface liquefiable layer. In many cases, this phenomenon of shallow landsliding occurs on relatively flat or gently sloping ground adjacent to a "free face", such as an unsupported channel wall along a stream or flood control channel. Given the "weak" nature of near surface soils, fine-grained sediments, shallow groundwater, liquefaction-prone soils, and the nearby flood control channel, there is a high potential for lateral spread beneath the site during a major earthquake in the area. In addition, the sheet-piles that have recently been installed along the sides of the Huntington Beach Channel by the OCFCD are not designed to resist liquefaction or lateral loads that could occur as the result of a lateral spread.[11]

Landslides

Potential landslide areas within the City of Huntington Beach are limited primarily to the mesa bluffs region. However, the potential for seismically induced landsliding along the levee of the neighboring Huntington Beach Channel is considered moderate to high. As stated above, the new sheet-pile walls that are to be constructed along the interior walls of the levee are not designed to withstand potentially large lateral forces associated with strong ground motion from a nearby earthquake.

Tsunamis and/or Seiche Waves

Tsunamis are long period sea waves that are seismically generated by seafloor displacements. Previous evaluations put the tsunami potential for the City of Huntington Beach at very low. Of more concern are seiche waves caused by tsunamis captured and reflected within the enclosed area of an inner harbor, such as Huntington Harbor. Seiche area damage is most severe in the same area as tsunami hazards. However, the project site is not in the immediate vicinity of a harbor. There is a potential for seiches to impact the subject site, as it is situated adjacent to the Huntington Beach Channel. The magnitude of seiche waves impacting the project site are anticipated to be lower than that of a tsunami, given the frictional energy dissipation of water running along the bottom and walls of the Channel. In addition, given that the existing 10 to 15-foot high containment berm along the eastern boundary of the project site would remain (running along the Huntington Beach Channel), the likelihood of seiches or tsunamis impacting the site is considered low. Impacts in this regard are anticipated to be less than significant.

[11] Mr. Phil Jones, Orange County Flood Control District, May 21, 2001.

Groundwater/Percolation and Drainage

The subject site rests over the Talbert Aquifer, and is in a designated tidal flats region, characterized by poor drainage. Groundwater beneath the site fluctuates with the tidal cycles and the water level within the neighboring Huntington Beach Channel. Due to this interconnection, groundwater quality beneath the site is considered brackish. The site is underlain by shallow near surface water with depths ranging from five to seven feet under the surface within the project site vicinity.[12] This condition contributes to the vicinity's very high liquefaction potential.

OFF-SITE PIPELINE ALIGNMENT AND UNDERGROUND PUMP STATIONS

Proposed Pipeline Alignment

The proposed off-site product water delivery pipelines would be located primarily within existing roads or easements, generally flat. The pipeline alignment would traverse a wide range of surficial soils with varying characteristics and qualities, as the pipeline's length would be between approximately 30,000 and 40,000 linear feet. As with the desalination facility site, the off-site facilities are subject to typical seismic hazards of southern California. Shallow groundwater may be encountered along the pipeline alignment nearby the proposed desalination facility, depending on the depth of trenching for pipeline implementation.

OC-44 Booster Pump Station

The proposed underground booster pump station site would occur within an unincorporated portion of the County of Orange, within a Resource Preservation Easement. The pump station site rests at an approximate elevation of 200 feet above mean sea level. The surrounding terrain can be characterized as hilly, although much of the surrounding vicinity has been graded for residential development. Bedrock beneath the subject site belongs to the diabase intrusive volcanic formation, overlain by Calleguas clay loam soil.[13] This soil is characterized as being well drained and moderately permeable. It should be noted that the site is within a designated Zone of Required Investigation for liquefaction hazards, and has demonstrated either a historic occurrence of liquefaction or local geological, geotechnical, and groundwater conditions indicate a potential for liquefaction.[14] The subject site is not situated within an Alquist-Priolo Earthquake Fault Zone or earthquake-induced landslide Zone of Required Investigation as designated by the California Geological Survey.[15] As the pump station site is situated approximately 3.5 miles from the Pacific Ocean, inundation by tsunamis and/or seiche waves is not expected to occur.

Coastal Junction Booster Pump Station

The Coastal Junction pump station location is situated at an approximate elevation of 80 feet above mean sea level. The site is located in the parking lot of a church within a developed area. The topography of the site is flat. The subject site is not located within an Alquist-Priolo Earthquake Fault Zone or earthquake induced Zone of Required Investigation as designated by the California Geological Survey.[16] It is underlain by soils from the Sorrento-Mocho association, which is

[12] Huntington Beach Generating Station Phase II Environmental Site Assessment, CH2M Hill, November 27, 1996.

[13] United States Department of Agriculture Soil Conservation Service and Forest Service Soil Survey, September 1978.

[14] Seismic Hazard Zones, Tustin Quadrangle, Official Revised Map. California Geological Survey, January 17, 2001.

[15] Alquist-Priolo Earthquake Fault Zone Map, issued by the State Geologist, 1986; California Geological Survey Special Publication 42 (1997).

[16] Alquist-Priolo Earthquake Fault Zone Map, issued by the State Geologist, 1986; California Geological Survey Special Publication 42 (1997).

described as nearly level to moderate sloping, well drained sand loams, loams, or clay loams on alluvial fans and flood plains.[17] It should be noted that the site is within a designated Zone of Required Investigation for liquefaction hazards, and has demonstrated either a historic occurrence of liquefaction or local geological, geotechnical, and groundwater conditions indicate a potential for liquefaction.[18] As the site is located over three miles from the ocean, inundation by tsunamis and/or seiche waves is not expected to occur.

IMPACTS

Significance Criteria

Based on the criteria set forth by CEQA, a project may create a significant geological environmental impact if one or more of the following occurs:

- ❖ Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
  - Strong seismic ground shaking;
  - Seismic-related ground failure, including liquefaction;
  - Landslides;
- ❖ Result in substantial soil erosion or the loss of topsoil;
- ❖ 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;
- ❖ Be located on expansive soils, as defined in Table 18-1 B of the Uniform Building Code (1994), creating substantial risks to life or property; and/or
- ❖ Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

PROPOSED DESALINATION FACILITY SITE

Wind/Water Erosion

It is anticipated that the entire subject would be either landscaped or paved, thereby reducing the likelihood for long-term operational wind/water erosion impacts to less than significant levels. However, the project would involve construction processes possibly causing wind and water erosion to occur during grading activities. The project would be subject to standard erosion control practices as typically required by the City of Huntington Beach. Any potential temporary increase in wind/water erosion would be reduced to less than significant levels with implementation of standard grading practices such as use of sandbags along the site perimeter (also refer to Section 5.3,

[17] United States Department of Agriculture Soil Conservation Service and Forest Service Soil Survey, September 1978.

[18] Seismic Hazard Zones, Tustin Quadrangle, Official Revised Map. California Geological Survey, January 17, 2001.

HYDROLOGY AND WATER QUALITY, and Exhibit 3-16, *CONCEPTUAL LANDSCAPE MASTERPLAN*).

Topography

The proposed desalination facility site consists of three fuel storage tanks on a flat surface, surrounded by soil containment berms of 10 to 15 feet in height. The western and southern interior berms would be removed prior to construction of the desalination facility, while the eastern berm (the northern berm exists outside of the project boundaries) would not be removed. The site does not contain any other unique physical or topographical features. No significant landform impacts are anticipated.

Geology/Soils

As shallow groundwater exists on-site (at a depth of approximately five to seven feet below ground surface), saturated soils and caving conditions would be encountered during removal and excavation for grading/excavation below the groundwater table level. This would necessitate dewatering operations as well as lateral support for the sides of any excavation pits, if necessary. All dewatering activities would comply with National Pollution Discharge Elimination System (NPDES) regulations, and pumped groundwater would be sampled, tested, and treated, if necessary (refer to Section 5.9, *CONSTRUCTION RELATED IMPACTS* for more information regarding dewatering).

As the uppermost 17 feet of native soils within project site boundaries are considered compressible upon placement of structural loads (aboveground storage tank, buildings, etc.), project implementation would require either the complete removal and recompaction of compressible soils or the use of piles and grade beams to support the structure. In addition, Type V cement would be used for concrete and special coatings or other measures for metal pipes to protect against the effects of corrosion.

It is anticipated that the proposed product water storage tank could be supported by a conventional concrete mat type foundation, with provision to accommodate anticipated settlements due to existing saturated, soft soils and liquefaction. Soil conditions would not preclude the use of other foundation systems, however, which would be evaluated when design concepts are available. Dewatering may be necessary during construction, as shallow groundwater exists beneath the West tank site.

A detailed geotechnical survey would be performed during the design phase of the proposed project. This survey would further characterize on-site soil and groundwater conditions and would determine the site's soil bearing capacity. This information would be used to develop a detailed foundation design for on-site structures. With implementation of recommended mitigation measures, and adherence to the Uniform Building Code (UBC), impacts in this regard are anticipated to be less than significant (also refer to Section 5.9, *CONSTRUCTION RELATED IMPACTS*).

Seismicity/Faulting

GeoLogic Associates completed a Preliminary Seismic Assessment for this project (refer to Appendix V, *PRELIMINARY SEISMIC ASSESSMENT*). The results of this preliminary study indicate an absence of evidence that faulting has ever occurred at the facility site and that the risk of future surface faulting at the desalination facility site is minimal.

The Preliminary Seismic Assessment has determined that the maximum ground acceleration for the Maximum Credible Earthquake (MCE) for this site is 0.535 g. An earthquake of magnitude 6.9 on

the Newport Inglewood fault was considered to be the MCE for the site. The Preliminary Seismic Assessment also indicates that the return period of an earthquake with the design MCE acceleration of 0.535 g is more than 200 years and its probability of occurrence during the next 50 years is below 10 percent.

As a part of desalination operations, the operations staff would develop an earthquake mitigation and preparedness plan, which would be coordinated with the local jurisdiction's preparedness activities. This plan would define coordination measures to assure continuous facility operations and water delivery under earthquake emergency conditions.

The desalination facility would be designed with one standby reverse osmosis train to provide additional reliability of water production and supply. Typically, desalination facilities, including the existing desalination facilities in California, are designed to operate with all available reverse osmosis trains in operation at all times. During the times of potential outages caused by scheduled or unscheduled maintenance or emergency events, such as an earthquake, these facilities operate at reduced capacity or are down for a certain period of time. The proposed desalination facility would be designed to produce 50 mgd of product water with 12 RO trains, and would be constructed with an additional 13th RO standby train, which can produce up to 4.2 mgd of water at any time. This additional train would provide increased reliability and redundancy that exceeds current reliability standards and common practices for desalination facility design. The proposed desalination facility would be the first facility in California with such additional production standby capacity and reliability provisions.

Although the northern portion of the project site overlays the South Branch Fault, the site is not situated within an Alquist-Priolo Earthquake Fault Zone. The proposed project would be constructed in compliance with the seismic safety requirements of the Uniform Building Code (UBC) and applicable CDMG publications. Given the site's close proximity to the Newport-Inglewood and Compton Blind Thrust Faults, more stringent design measures may be warranted or required, as determined by the site-specific geotechnical survey for the project. All structures would be designed in accordance with the seismic design requirements of the most recent edition of the Uniform Building Code. The specific design provisions (wall and slab thickness, lateral bracing, structural configuration, etc.) for seismic enforcement would be developed during the design phase of this project. In addition, a detailed construction-level geotechnical study would be prepared during the design phase of the project. This report would include mitigation measures regarding grading, foundations, retaining walls, streets, utilities, remedial work, overexcavation/recompaction, dewatering, water quality, and chemical/fill properties of underground items including buried pipe and concrete and protection thereof. Impacts in this regard are expected to be less than significant with implementation of recommended mitigation measures.

Liquefaction Potential

The Preliminary Seismic Assessment prepared for the proposed project concluded that seismic activity from numerous faults within the vicinity, including the Newport Inglewood Fault Zone (the closest active fault), may result in liquefaction in soils at depths of seven to 16 feet below ground surface (bgs). Soils below that depth were not found to be susceptible to liquefaction. Soil layers susceptible to liquefaction were not determined to be continuous throughout the proposed desalination facility site and the "North" and "West" tank sites. Liquefied soils may experience post-liquefaction settlements of four to five inches. Proposed on-site aboveground structures have the potential to experience post-liquefaction distress. In addition, the presence of liquefaction-prone soils and the location of the subject site relative to the Huntington Beach Channel pose a risk of seismically induced lateral spread. Substantial distress to both above and underground structures would occur in the form of seismically-induced landsliding. However, as stated above, a construction-level geotechnical study would be prepared for the proposed project site during the

design phase of the project, which would recommend design measures to mitigate liquefaction and lateral spread impacts such as: 1) over excavation and recompaction of liquefaction/lateral spread-prone soils; 2) in-situ soil densification; 3) injection grouting; or 4) deep soil mixing. The desalination facility project would be subject to the Uniform Building Code (UBC) and applicable CDMG publications in regards to liquefaction. Upon adherence to applicable regulations and the incorporation of mitigation measures, impacts in this regard are expected to be less than significant.

OFF-SITE PIPELINES AND UNDERGROUND PUMP STATION

Proposed Pipeline Alignment

The proposed product water delivery pipeline is not anticipated to result in significant impacts in regards to geology and soils, as the majority of the alignment would occur within existing street right-of-way and various utility lines that currently exist along the alignment. Pipeline construction would be subject to standard erosion control measures similar to those implemented for the desalination facility site to contain any potential wind and water erosion on-site. As the pipeline alignment is relatively flat and has been graded, impacts to natural topography are not anticipated. A design-level geotechnical investigation would be performed for the selected pipeline alignment to examine the potential for earthquake shaking hazards, surface rupture, shallow groundwater, and unstable soils (liquefaction, subsidence, lateral spread). Should the potential for such geological hazards exist, adequate mitigation for both pipeline construction and pipeline design would be incorporated to mitigate impacts in this regard to less than significant levels. Also refer to Section 5.9, *CONSTRUCTION RELATED IMPACTS* for a more detailed evaluation of pipeline construction.

OC-44 Booster Pump Station

Construction of the proposed off-site underground booster pump station would also be subject to standard erosion control measures as required by local, state, and federal regulations to contain any potential wind and water erosion on-site. As the site is relatively flat and is only approximately 0.5 acres in size, impacts to the natural topography of the site and surrounding vicinity are not anticipated. A design-level, site specific geotechnical study would be prepared for the underground pump station and would incorporate adequate mitigation measures (if deemed necessary) for geological hazards such as seismic shaking, surface rupture, shallow groundwater, liquefaction, subsidence, lateral spread, and landslides. As the underground pump station would require excavation to a depth of approximately 40 feet, lateral bracing for the sides of the chamber may be necessary as the site is in a designated liquefaction hazard zone.[19] Upon the implementation of both standard and recommended mitigation measures, impacts in regards to geology and soils are not anticipated to be significant.

Coastal Junction Booster Pump Station

As both the geologic/seismic conditions of the site and design characteristics of the pump station are similar to that of the OC-44 pump station, refer to the impact analysis above.

MITIGATION MEASURES

WIND/WATER EROSION

[19] Seismic Hazard Zones, Tustin Quadrangle, Official Revised Map. California Department of Conservation, Division of Mines and Geology, January 17, 2001.

Refer to Section 5.3, *HYDROLOGY DRAINAGE, AND STORM WATER RUNOFF*, mitigation measure HWQ-1.

TOPOGRAPHY

None required.

GEOLOGY/SOILS

GEO-1 A detailed geotechnical report shall be prepared and submitted with the building permit application for the proposed desalination facility. This analysis shall include on-site soil sampling and laboratory testing of materials to provide detailed recommendations regarding grading, foundations, retaining walls, streets, utilities, remedial work, over excavation/recompaction, dewatering, water quality, and chemical/fill properties of underground items including buried pipe and concrete and protection thereof. The reports shall specifically address lateral spreading, flood control channel bank stability, liquefaction potential and groundwater constraints. Appropriate recommendations shall be provided to mitigate potentially adverse conditions. The geotechnical report shall also be submitted to the Department of Public Works for review and approval in conjunction with the grading plan.

GEO-2 In conjunction with the submittal of application for a precise grading permit, the Applicant shall demonstrate to the satisfaction of the City Engineer that the preliminary geotechnical report recommendations have been incorporated into the grading plan unless otherwise specified in the final geotechnical report and/or by the City Engineer.

GEO-3 Excavation for the proposed project shall implement dewatering activities in compliance with NPDES regulations. Pumped groundwater shall be sampled, tested, and (if deemed necessary) treated prior to discharge.

GEO-4 As native on-site soils are compressible upon placement of structural loads, project implementation shall implement complete removal and recompaction of compressible soils or use of piles and grade beams to support on-site structures.

GEO-5 Type V cement shall be used for concrete and buried metal pipes shall utilize special measures (coatings, etc.) to protect against the effects of corrosive soils.

SEISMICITY/FAULTING

GEO-6 Due to the potential for ground shaking in a seismic event, the project shall comply with the standards set forth in the UBC (most recent edition) to assure seismic safety to the satisfaction of the Department of Building and Safety prior to issuance of a building permit, including compliance with California Division of Mines and Geology Special Publication 117 (Guidelines for Evaluating and Mitigating Seismic Hazards in California, adopted March 13, 1997). However, given the proximity of the site to the Newport-Inglewood and Compton Blind Thrust Faults, more stringent measures may be warranted.

GEO-7 As the South Branch Fault (situated beneath the subject site) is classified as Category C by the City of Huntington Beach General Plan, special studies and subsurface investigation (including a site specific seismic analysis) shall be performed prior to issuance of a grading permit, to the approval of the City Engineer.

The subsurface investigation shall include CPT and exploratory borings to determine the fault rupture potential of the South Branch Fault, which underlies the subject site.

LIQUEFACTION POTENTIAL

GEO-8 Due to the potential for liquefaction within the project vicinity, the Applicant shall comply with the standards set forth in the UBC (most recent edition) for structures on-site to assure safety of the occupants to the satisfaction of the Department of Building and Safety prior to issuance of a building permit. These standards include compliance with the California Geological Survey Special Publication 117 (Guidelines for Evaluating and Mitigating Seismic Hazards in California, adopted March 13, 1997) and Recommended Procedures for implementation of California Geological Survey Special Publication 117 - Guidelines for Analyzing and Mitigating Liquefaction in California (Dr. Geoffrey R. Martin et al, May 1999).

GEO-9 The proposed project shall incorporate adequate measures to stabilize structures from on-site soils known to be prone to liquefaction. Typical methods include, but are not limited to:

- Over excavation and recompaction of soils;
- in-situ soil densification (such as vibro-flotation or vibro-replacement);
- injection grouting; and
- deep soil mixing.

GEO-10 The site specific geotechnical investigation for the proposed project shall analyze the potential for lateral spread on-site. If deemed a possibility, adequate subsurface stabilization practices (similar to those utilized for liquefaction) shall be incorporated prior to the construction of on-site structures.

OFF-SITE PIPELINES AND UNDERGROUND PUMP STATIONS

Refer to Section 5.9, *CONSTRUCTION RELATED IMPACTS.*

UNAVOIDABLE SIGNIFICANT IMPACTS

None have been identified.