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Suite 200
Santa Ana, CA 92707

Attn: Dr. James Reede and the CEC Dockets Unit

Date: September 13, 2007

Re: Carlsbad Energy Center Project

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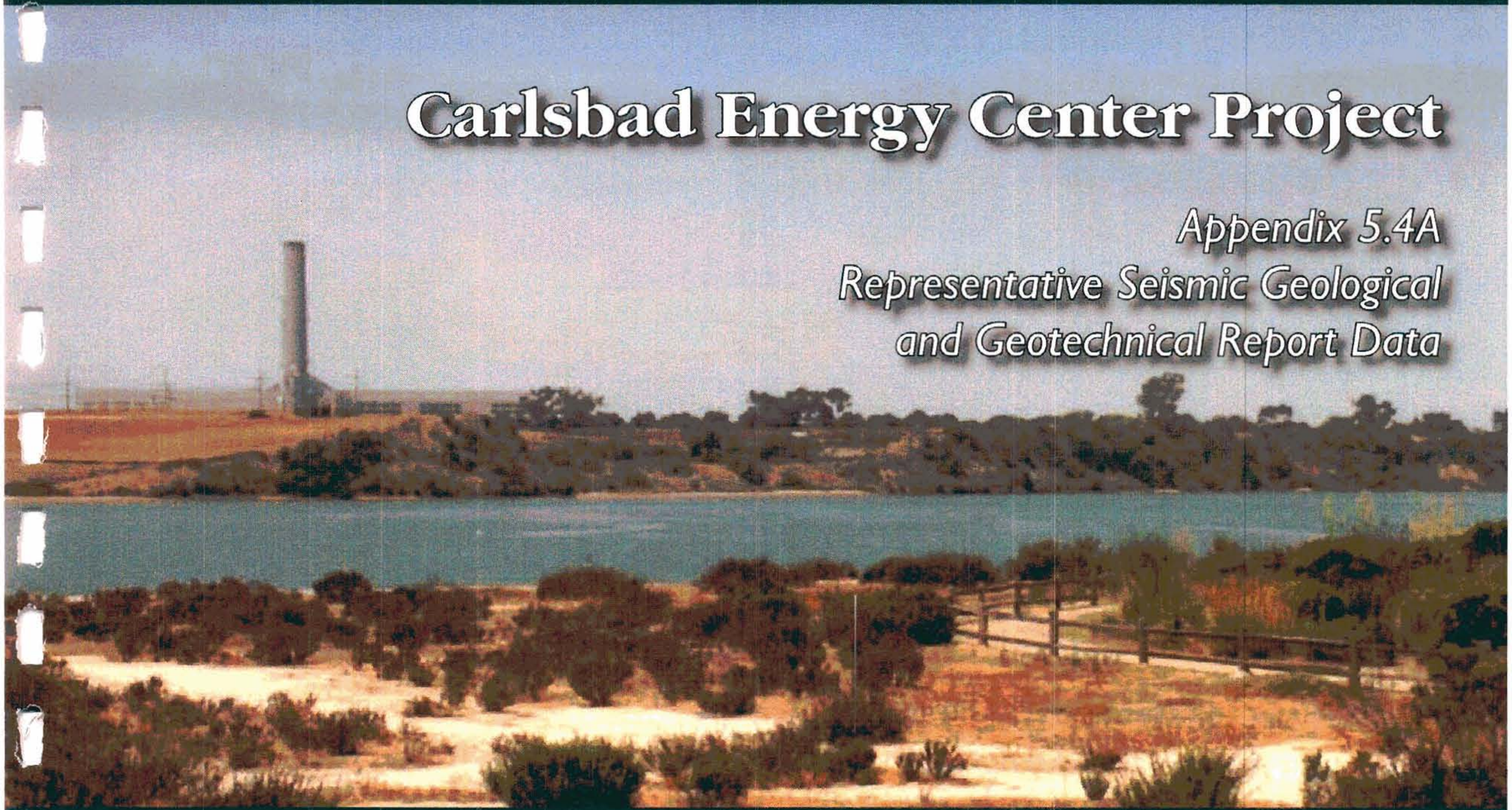
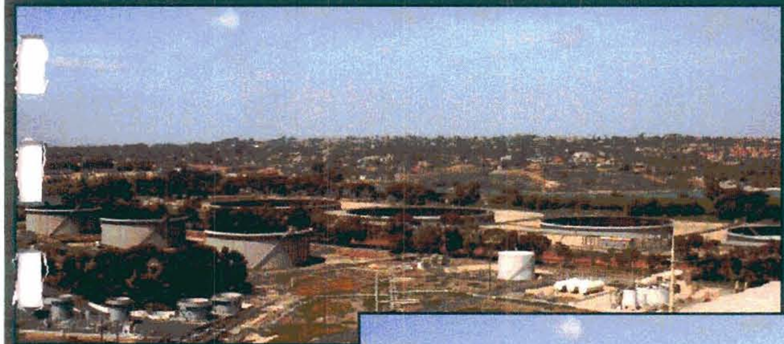
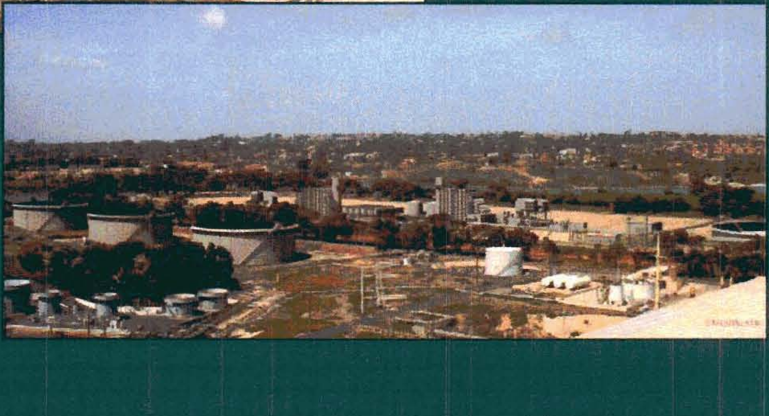


Carlsbad Energy Center Project

Appendix 5.4A
Representative Seismic Geological and Geotechnical Report Data

September 2007





Applicant

Carlsbad Energy Center LLC

Prepared by

CH2MHILL

Appendix 5.4A - Representative Seismic Geological and Geotechnical Report Data

The following geological/geotechnical information if derived from the proposed desalination plant at the same immediate location as the CECP site. This information is representative and applicable of the conditions at the CECP site.

D. SCOTT MAGORIEN, C.E.G.
ENGINEERING GEOLOGIST

A California State Certified Small Business

March 10, 2006

Mr. Kevin Thomas
RBF Consulting
3536 Concours, Suite 220
Ontario, CA 91764-5592

Subject: Geology, Soils, Seismicity, and Environmental Report in Support of San Diego County Water Authority's Regional Seawater Desalination Project at Encina EIR, Encina Power Generating Station, Carlsbad, California

Dear Mr. Thomas,

In accordance with your request and authorization, the following report presents an EIR-level evaluation of the geological, geotechnical and environmental aspects of the subject project. As part of this evaluation, a subsurface investigation and laboratory testing program were performed to assess the nature of the subsurface geological and geotechnical conditions, as well as an assessment of potential hazardous materials/ soil contamination associated with the four fuel oil storage tanks that currently occupy the two potential project sites, as well as an alignment for influent/ effluent pipelines, located within the Encina Power Station (EPS). Findings from these evaluations are included herein. In addition, a literature study was performed for three potential, 10-mile long, 48- to 66-inch diameter conveyance pipeline alignments extending from the desalination plant to SDCWA's Second Aqueduct within the City of San Marcos. No subsurface investigations or analyses relating to geotechnical constraints or hazardous materials were performed for the conveyance pipelines.

As currently planned, the proposed desalination plant will occupy either a 7.8 acre site in the area occupied by EPS's fuel storage tanks (Tanks) 2 and 3, or a 10.6 acre site occupied by Tanks 4 and 5. The project will include a pretreatment system, reverse osmosis system, product water

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pumping station and an associated belowground pumping station forebay, plant chemical storage facility and operations buildings, and influent/ effluent pipelines.

Based on the results of this study, there are no significant geologic/ geotechnical constraints to the development of the desalination plant, nor along the conveyance pipelines. In addition, there is no evidence to indicate any significant problems or constraints associated with onsite hazardous materials (i.e. soil contamination) surrounding the Tank sites. However, according to a previous environmental evaluation of Tank site No. 3 by GeoLogic Associates (2004), this particular tank was reportedly constructed on a bed of heavy oil to reduce the potential for leakage. It is very possible that the application of heavy oil was also used beneath one or more of the other fuel storage tanks.

There are no active or potentially active faults within or projecting towards the property.

If you have any questions or require additional information, please call.

Sincerely,

D. Scott Magorien, C.E.G. 1290

Principal Engineering Geologist

GEOLOGY, SOILS, SEISMICITY, AND ENVIRONMENTAL ASSESSMENT EIR ENCINA SEAWATER DESALINATION PROJECT

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Figure 2	Exploratory Boring Location Map for Proposed Influent and Effluent Pipeline Alignment
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APPENDIXES

Appendix A	Geomatrix Phase II Environmental Soil and Groundwater Assessment Report w/Boring Logs and Environmental Laboratory Test Data
Appendix B	Geotechnical Laboratory Test Data

INTRODUCTION

The scope of work performed as part of the geology, geotechnical and environmental portion for the Regional seawater Desalination Project at Encina EIR included the following:

- Compile and review relevant reports and maps that address geotechnical, geologic and hydrogeologic conditions for the project and surrounding area. A list of the reports, maps and other relevant data reviewed for this study are presented in the References section at the end of this report.
- Reconnaissance level geologic mapping.
- Coordination with EPS plant personnel to verify proposed exploratory boring locations.
- Preparation of a Health and Safety Plan for the exploratory drilling program.
- A subsurface investigation that included drilling, logging and sampling 26 hollow stem auger borings to depths ranging from 12 to 57 feet below ground surface (bgs); and 13 hand auger borings to depths of about four feet adjacent to the Tanks.
- Geotechnical laboratory testing and analyses of representative soil samples obtained from the exploratory drilling program, which included moisture content and dry density determinations, gradation/sieve analyses, sand equivalent, direst shear, consolidation, compaction curves, and Caltrans corrosivity.
- Environmental laboratory testing and analyses of selected soil and groundwater samples.
- Analysis of geotechnical and environmental data obtained from the exploratory drilling and lab testing program.
- Preparation of this report.

The results of the investigation for this study, including all exploratory boring logs, lab test data, environmental analysis (Appendix A and B), as well as pertinent impacts and mitigating measures are provided in the following report.

1.0 EXISTING CONDITIONS

1.1 GEOLOGIC STETTING

The proposed desalination facility and conveyance pipeline(s) and appurtenant structures are situated on the very western margin of the coastal plain of the Peninsular Ranges geomorphic province of Southern California. The Peninsular Ranges province is characterized in large part by northwesterly-trending mountains and intervening valleys that extend from the San Bernardino and San Gabriel mountains on the north, into Baja Mexico on the south. It is bounded on the west by what is referred to as the Continental Borderland, also known as the continental shelf. Structurally, the province appears to be an uplifted and westward tilted block, with its eastern flank forming the most rugged part, with altitudes gradually decreasing toward the ocean. Cutting across this large-scale pattern are a number of laterally extensive northwest-trending active faults, including the highly seismically active San Jacinto and Elsinore faults. The bulk of the Peninsular Ranges province is composed primarily of granitic type rocks, except along the southern California coast where late Cretaceous (65 to 90 million years old) and Cenozoic age (1.5 to 65 million year old) sedimentary and some older volcanic rocks are widely exposed.

During the last 54 million years, the region experienced several long-term episodes of both marine and non-marine deposition that produced thick accumulations of marine and non-marine sedimentary rocks, which were deposited above older granitic and volcanic rocks. During the last 1,500,000(+/-) years, gradual emergence of the region combined with episodes of marine inundation and regression produced a series of wave-abrasion platforms known as marine terraces along the coastal plain. Each marine terrace is mantled by a regressive sequence of marine and non-marine strata/soils that were deposited during these periods of sea level retreat (i.e. regression). In the vicinity of the proposed desalination plant, the four youngest terraces are widely exposed. The second youngest of these marine terraces (on the order of 125,000 years old) and associated sediments underlie the proposed desalination plant sites, whereas the 10-mile long conveyance pipeline alignments traverse a wide variety rock and soil types including marine terrace deposits, older marine and non-marine sedimentary, metavolcanic and granitic rocks.

Prior to construction of the fuel storage tanks (Tanks) for the EPS, the natural topography in the area of the proposed plant site consisted of a gently seaward sloping ground surface associated with an uplifted, late Pleistocene age terrace surface. Based on a review of USGS topographic maps, the natural ground surface elevations ranged from a high of about 60 feet above mean sea level (msl) along the eastern margin of the proposed plant site(s) to about 45 feet msl along the western margin.

1.1.2 Proposed Desalination Plant Sites

The proposed Alternative 1 (Tanks 2 and 3) desalination plant site is bordered by the North County Transit District (NCTD) Rail Line on the east; EPS Tank No.1 and the on the north, an SCE maintenance yard on the south, and a 30- to 44- foot-high (+/-), 1½:1 to 2:1 (horizontal to vertical), contiguous natural and man-made slope that descends down to the to the shoreline of Agua Hedionda Lagoon on the west. Construction of Tanks 2 and 3 was performed in 1952 within two rectangular-shaped excavations on the order of six-to eight-feet deep with 2:1 (horizontal to vertical) side slopes (berms), which are now covered with various forms of riprap, and two separate pads having relatively flat bottoms. The elevation along the top and bottom these excavations is approximately 43 feet msl and 35 feet msl, respectively. Surface water runoff occurs via sheet flow along the access roads on the top of the berms, and is allowed to flow into large depressions in the bottom of each excavation and allowed to evaporate. The perimeter road along the top of the berms are paved with asphalt, whereas as the majority of the bottom of the excavations are covered with man-made fill.

The Alternative 2 (Tanks 4 and 5) desalination plant site is bordered by the I-5 freeway on the east and the NCTD Rail Line on the west; and on the north and south by EPS Tank No.6 and private property, respectively. Construction for Tanks 4 and 5 in 1971 involved excavation of two separate 26-foot deep (+/-) box-shaped excavations that have steep [60 degrees (+/-)] gunite-coated side walls (i.e. berms), and a nearly level pad at the bottom of the excavation. The existing elevations along the top and bottom of the two excavations range from about 55 feet msl to 30 feet msl, respectively. Surface water runoff occurs via sheet flow along the access roads along the top of the berms, and is sumped-out from the bottom of the two excavations. The perimeter road along the top of the berms and the majority of the bottom of the excavation are paved with asphalt. Some time around 1979, a 100 foot by 120 foot wide (+/-), 35-foot-deep pit was excavated between Tank 5 and the right-of-way for the NCTD Rail Line for the purpose of constructing a pipe tunnel to convey fuel oil beneath the railroad tracks to the EPS (see Figure 1 for location).

The natural ground (terrace) surface along the proposed alignment for the plant's internal influent and effluent pipeline was similar to that at the proposed desalination plant sites, and has apparently been only slightly altered along the northern two-thirds of the alignment. Along the southern portion of the proposed alignment, grading for the EPS has removed most, if not all, of the terrace.

The two major geologic units that comprise the proposed plant sites include marine and non-marine terrace deposits of late Pleistocene age (80,000 to 125,000 years old), and underlying marine bedrock strata of Eocene age [50 million years old (+/-)]. Varying amounts of man-made fill soils blanket portions of the proposed plant sites and along the influent/ effluent pipeline alignment.

Based on a review of published relevant geologic, geotechnical data, as well as the findings from exploratory drilling and reconnaissance-level geologic mapping, there do not appear to be any significant geologic hazards associated with the current layout for the two alternative desalination plants, nor any evidence of hazardous materials associated with the historic storage of fuel oil. However, because no exploratory borings were drilled or soil samples obtained from beneath the tanks, the possibility of fuel oil-contaminated soils beneath the Tanks cannot be precluded.

Possible geologic/geotechnical constraints to the proposed plant(s) include potential surficial instability of the slope bordering Agua Hedionda Lagoon adjacent to the proposed western plant site, dewatering of excavations below the groundwater table, soil erosion, and moderate to strong seismically-induced ground motion from the Rose Canyon fault. Although the project area is located within the seismically active region of Southern California, there are no documented active or potentially active faults transecting or projecting towards the project area

1.1.3 Conveyance Pipeline Alignments

The three alternative 10-mile-long conveyance pipeline alignments, referred to as the Preferred, Central, and Southern alignments and the two short "Optional Connectors," would, for the most part, be constructed beneath existing access road right-of-ways and arterial roadways. Exceptions to this design would involve tunneling beneath the I-5 freeway for each alignment, a portion of the Southern alignment transecting through the City of Carlsbad municipal golf course currently under construction, and through undeveloped land for a portion of the Preferred and Northern alignments.

Site elevations along the proposed alignments range from a low of about 45 feet msl adjacent to the western plant site to about 600 feet msl along the eastern end of the alignments. Topographic conditions vary from nearly horizontal along the various roadways, to about 1:1 (horizontal to vertical) adjacent to areas of steep natural topography.

Easterly of the coastal terrace, the topography of the region through which the alignments pass transitions into low hills, mesas and ridges that are cut by stream-cut alluvial canyons. The majority of this area is underlain by Tertiary age sedimentary rocks. The exception to this lies along that portion of the Preferred/Northern alignment where it passes through volcanic and granitic rocks between El Camino Real on the west in the City of Carlsbad, and La Mirada Drive in the City of Vista. Alluvial, estuarine, and/or hydraulic fill deposits would also be encountered along several short segments of the Preferred and Northern alignments.

Based on a review of published relevant geologic, geotechnical data, there may be a number of significant geologic hazards/ geotechnical constraints associated with construction of the three conveyance pipeline alignments. These include pipe-trench wall stability, shallow groundwater, seismic shaking, liquefaction, lateral spread, landslides, rock fall, subsidence and flooding. Although the three alignments are located within the seismically active region of southern California, there are no documented active or potentially active faults transecting or projecting towards the three conveyance pipeline alignments.

No hazardous materials assessment for the conveyance pipeline alignments was performed for this study, nor has any information regarding soil contamination been reviewed.

1.2 GEOLOGIC MATERIALS

1.2.1 Desalination Plant Sites and Influent/ Effluent (I/E) Pipeline Alignment

The proposed desalination plant sites are underlain by Eocene age marine sediments, which are capped with either late Pleistocene age marine and non-marine terrace or artificial (man-made) fill, or a combination of the two. The distribution of these deposits is shown on Figure 1- Geologic Map of Proposed Desalination Plant Sites. Figure 2- Exploratory Boring Location Map for Proposed I/E Pipeline Alignment depicts only the depth of the particular geologic unit encountered in the shallow borings. The designations shown below, in parentheses, correspond to those shown on the Geologic Map.

Artificial Fill (af)

Artificial fill is man-made soils placed during grading/construction of the EPS plant, fuel storage tanks, and appurtenant facilities. There appear to be essentially two types of fill soils within the project area. The majority of these soils consist primarily of silty to slightly clayey, fine- to medium-grained sand that is yellowish brown to olive brown in color, moist, loose to medium dense, having trace amounts of gravel and organic matter. Based on a review of several sets of historic aerial photographs, geologic mapping, and the subsurface information obtained from exploratory borings, the greatest amounts of these types of fill soils occur along the southwestern perimeter of the proposed western plant site and as backfill for the excavation created in 1979 (+/-) for the below-grade fuel oil transmission piping facility located between Tank 5 and the NCTD Rail Line tracks (see Figure 1). Between six and seven feet of these types of fill soils were also encountered in exploratory borings along the eastern margin of the proposed western plant site, and between three to nine feet of fill was found in the bottom of the excavations for Alternative 1 (Tanks 2 and 3). Elsewhere, up to about three-foot-thick sections of similar types of fill soils were found mantling older terrace deposits throughout the upper elevations of the two plant sites. Expansivity testing by GeoLogic Associates (2004) indicates the fill soils beneath the pad for Tank 3 have a low expansion potential. However, given that no documentation was available concerning whether or not these soils were placed as engineered fill, they should be considered unsuitable for support of proposed above or below ground structures under their current conditions.

In contrast to the type of fill soils that occur throughout most of the project area, a sandy conglomeratic fill forms a 250-long portion of the westerly-facing, 30-foot-high (+/-) slope bordering Agua Hedionda Lagoon and the Alternative 1 plant site. This fill is made up of approximately 70 percent of subrounded gravel to cobble size volcanic and quartz-rich rock clasts in a matrix of fine- to coarse-grained sand and contains varying amounts of shell fragments. These coarse-grained soils appear to be loose, dry to slightly moist, and subject to surficial erosion. The shoreline of the adjacent portion of Agua Hedionda Lagoon is mantled with gravel and cobbles that have eroded from this soil unit. As these soils were not encountered in any of the exploratory borings, their lateral limits as it relates to the southwestern margin of the proposed Alternative 1 plant site is not well known. In addition, there is no documentation available concerning whether or not these soils were placed as engineered fill. Although it does not appear that these coarse-grained soils lie within the limits of the project site, the spatial position in relation to the proposed plant site could create a concern relative to subjacent support (i.e. slope stability).

Soil (not designated)

Prior to construction of the EPS, United States Department of Agriculture (USDA, 1973) maps indicate project the area was mantled with up to about 60 inches of Marina loamy coarse sand, which has formed within the uppermost portions of the marine and non-marine terrace deposits. Below the top soils layer, at depth of about 10 inches, the USDA (1973) indicates these soils are typically dark yellowish brown to dark reddish brown in color, moist, massive, slightly hard, friable, highly permeable, contain very fine roots and have a slight to moderate erosion hazard. Remnants of these soils are present along the western and eastern margins of both plant sites, as well as beneath portions of the berms that separate each of the Tanks.

Marine and Non-Marine Terrace Deposits (Qt)

Late Pleistocene age terrace deposits, which have been deposited atop an ancient wave-cut terrace surface, form a blanket-like deposit across much of the project area, except along the bottom of the excavations for the tanks. These deposits attain a maximum thickness of about 22 to 28 feet and are discontinuously exposed along the heavily vegetated natural slope bordering Agua Hedionda Lagoon. The uppermost portions are well exposed on the near vertical cut slopes on either side of the NCTD Railroad tracks. As encountered in the exploratory borings in the vicinity of Alternative 2 (Tanks 4 and 5), these soil-like materials are represented by an upper 9- to 11- foot-thick upper section consisting of silty sand, which is typically yellowish brown to brown in color, moist, and contains between 70 to 85 percent fine- to medium- grained sand with low plasticity fines representing the remaining portions. Between a depth of 11 feet and the top of the underlying bedrock (around 22 feet bgs), the terrace deposits in this area are composed largely of poorly graded, fine- to medium-grained sand with silt, which is typically mottled olive yellow to brown in color, moist, and loose to moderately dense. Portions of the soils from these two units are considered slightly compressible and may not be suitable for foundation support for certain components of the plant. However, these soils can be easily excavated and readily used as compacted fill for support of proposed structures.

Based on the results of the exploratory drilling and sampling in the vicinity of Alternative 1 (Tanks 2 and 3), the character of the terrace deposits in this area are represented by, in decreasing order of abundance, layers and lenses of silty/clayey sand, lean clay with sand, and poorly graded sand. Silty and clayey sand layers/ lenses comprise about 80 percent of the terrace deposits in this area. Overall, these soils consist of about 60 to 85 percent fine- to medium-grained sand with the remaining portions represented by low plasticity silt and clay, which are typically light olive brown to strong brown in color, moist, loose to moderately dense. The more clayey soils occur in layers/lenses between about one, to as much as 10-feet-thick locally, contain less than about 45 percent fine-grained sand, are pale brown in color, moist, firm to stiff, and of medium plasticity. Portions of the soils are considered slightly compressible and may not be suitable for foundation support for certain components of the plant. However, as with the terrace deposits in the vicinity of Alternative 2 (Tanks 4 and 5), these soils can be easily excavated and readily used as compacted fill for support of proposed structures

Corrosivity testing of the terrace materials along the proposed influent/ effluent pipeline alignment indicates portions of these deposits are moderately corrosive to steel (pipe). During design-level studies for the pipeline a corrosion engineer would be retained to further assess the corrosive nature of these soils and, if steel pipe is to be used, provide recommendations to eliminate the corrosive action on the pipe.

Based on the overall coarse-grained nature of the terrace deposits, expansive soils associated with these deposits are not likely to be encountered within either of the proposed plant sites.

In order to assess the liquefaction potential of the terrace soils, an empirically based approach as presented by Seed and Idriss (1982) was used in this study. For this approach, Standard Penetration Test (SPT) blowcounts (e.g. drive energy of a 140 pound weight falling a distance of 18 inches), as well as other seismic and overburden pressures at the point(s) of interest, are needed for this assessment. For this study, SPT blowcounts were obtained in each of the exploratory borings where the more significant amounts of terrace soils were believed present.

Based on the results of the SPTs, visual observations and grain size analyses of the soil samples, the majority of the terrace deposits are considered to have a moderate to high liquefaction potential. However, given the elevated topographic position of these soils in relation to the elevation groundwater table (i.e. about four to five feet msl) beneath the project area, the likelihood of seismically induced liquefaction of these sediments is considered remote.

Santiago Formation (Ts)

The entire project area is underlain by mid Eocene age (about 40 million-years old), near shore marine sedimentary strata assigned to the Santiago formation (Tan and Kennedy, 1996). As discussed above, a wave cut terrace was eroded into the Santiago formation in the late Pleistocene upon which younger marine and non-marine terrace soils were deposited. Based on the information obtained in the exploratory borings during this investigation, as well from an earlier study by GeoLogic Associates (2005), the top of this gently, seaward-sloping terrace surface lies between an elevation of about 34 feet msl in the vicinity of Alternative 2, and between about 23 and 29 feet msl along the western margin of Alternative 1. Based on observations along the shoreline of the lagoon at low tide, another younger (latest-most Pleistocene age) marine terrace surface, and associated non-marine soil deposits presumably lay between the high tide line in the lagoon and older and more elevated terrace surface that underlies the two plant sites. The modern equivalent of these older eroded terrace surfaces has formed along intertidal zone at the base of the bluff bordering the lagoon.

As encountered in all of the exploratory borings, as well as exposed along the base of the bluff in the lagoon, the Santiago formation consists mainly of well indurated sandstone strata with varying amounts of siltstone, claystone and shale. Subordinate interbedded layers and lenses of sandy claystone, claystone and shale occur throughout the section of the bedrock in the vicinity of the project area. The overall character of this bedrock formation is represented by greenish- to light-yellowish-brown, fine- to medium-grained silty sandstone and sandy lean claystone, which is very dense and displays varying amounts of secondary manganese and iron-staining on fracture (i.e. joint) surfaces. Minor groundwater seepage and associated yellowish-colored mineral staining was noted along the base of the bluff emanating from several four-inch thick (+/-) sandy claystone layers that are sandwiched between two, light greenish-gray sandstone beds. The Santiago formation bedrock serves as the principal groundwater reservoir beneath the site.

Based on the coarse-grained nature of these deposits, expansive soils are not present within either of the proposed plant sites.

Overall, there do not appear to be any major geotechnical-related constraints associated with these deposits, except where significant excavations are planned, such as the below grade pumping forebay structure. For this excavation, the project engineer would be responsible to design appropriate shoring.

1.2.2 Conveyance Pipelines

No subsurface investigation has been performed to assess the specific nature of the geologic/ soil conditions along what are referred to as the Preferred, Northern, and Southern pipeline conveyance alignments (see Figure 3). A preliminary geotechnical report prepared by Group Delta Consultants (GDC, 2003) for three similar conveyance pipeline alternatives (referred to as the Orange, Green and Blue alignments) involved a compilation and review of existing geologic literature/ maps, as well as existing geotechnical reports for adjacent properties, a field reconnaissance, and a preliminary geotechnical assessment for each alternative alignment.

With some minor exceptions, the Orange, and Green pipeline alternatives studied by GDC (2003) are, for the most part, the same or similar to the Preferred/Northern and Southern alignments, respectively. For the most part, each of the three alignments will lie beneath existing arterial roadways and access road right-of-ways.

Soil (not designated)

Maps prepared by the United States Department of Agriculture (USDA, 1973) have identified the following soil associations along the proposed conveyance pipeline alignments.

Salinas-Corralitos Association: this consists of moderately well-drained to somewhat excessively drained clays, clay loams, and loamy sands on alluvial fans, on 0 to 9 percent slopes.

Cieneba-Fallbrook Association (Very Rocky): these soils are excessively drained to well-drained coarse sandy loams and sandy loams that have a sandy clay loam subsoil over decomposed granodiorite. These soils occur between 200 and 3,000 feet msl and occur on 9 to 75 percent slopes.

Exchequer-San Miguel Association: rocky, well drained silt loams over metavolcanic rock, typically on 0 to 30 percent slopes.

Diablo-Altamont Association: well drained clays are the major characteristic of this association, normally found on 5 to 15 percent slopes.

Diablo-Las Flores Association: this association consists of well drained clays and moderately well drained loamy fine sands that have a subsoil of sandy clay. These soils occur between 100 and 600 feet msl and occur on 9 to 30 percent slopes (NCRS 1973).

Las Flores-Huerhuero Association: this association consists of moderately well-drained loamy fine sands to loams that have a subsoil of sandy clay or clay; 9 to 30 percent slopes.

Ramona-Placentia Association: this association consists of well drained and moderately well drained sandy loams to sandy clay over granitic alluvium. This soil type is largely in foothills between 200 and 1,800 feet msl and occurs on grades of 2 to 15 percent.

Fallbrook-Vista Association (Rocky): these soils consist of well-drained sandy loams and coarse sandy loams that have a subsoil of sandy clay loam and sandy loam over decomposed granodiorite. These soils occur between 200 and 2,500 feet msl and occur on 9 to 30 percent slopes.

Friant-Escondido Association (Eroded): these soils are excessively well drained fine sandy loams and very fine sandy loams over metasedimentary rock. These soils occur between 400 and 3,500 feet msl and occur on 30 to 70 percent slopes (NCRS 1973).

Surficial Deposits (Map Unit No. 1)

Surficial deposits include stream-laid alluvium, estuarine deposits, and hydraulic fill deposits next to bodies of water and canyon bottoms. Geotechnical constraints associated with these deposits could include erosion, settlement, liquefaction, lateral spread, shallow groundwater, corrosive soils and slope/ trench wall instability.

Terrace Deposits/ Older Alluvium (Map Unit No. 2)

Coastal marine and non-marine terrace deposits similar to those underlying the proposed desalination plant sites. These deposits display varying degrees of erosion potential depending upon age, settlement, perched groundwater and trench wall instability.

Late Cretaceous and Tertiary Age Sedimentary Formations (Map Unit No. 3)

These 65 to 40 million year old (+/-) marine and non-marine sedimentary rocks include, from oldest to youngest, conglomeratic rocks of the Lusardi formation, thinly bedded siltstone, claystone and fine-grained sandstone of the Point Loma formation, and well bedded sandstone and siltstone of the Santiago formation. Both the Point Loma and Santiago formations are prone to landsliding where weak claystone and siltstone bedding planes dip out of slope. Other geotechnical constraints associated with these deposits include the presence of large cobbles, perched groundwater, naturally cemented portions that may prove difficult to excavate, trench wall stability in deeper trenches.

Granitic and Metavolcanic Rocks (Map Unit No 4)

The crystalline rocks consist of variably weathered dacite, diorite, gabbro and metavolcanic rocks. These rocks display varying degrees of weathering, fracturing/ jointing, which generally decreases with increasing depth below the ground surface. Where relatively unweathered and only slightly fractured, these rocks will be very difficult to excavate with conventional heavy duty trenching/ grading equipment and will likely require blasting in order to excavate. Hence, excavations could produce varying quantities of oversized rock that would likely require off-site disposal. Other geotechnical constraints associated with these materials include groundwater seepage along fractures and trench wall instability from rock fall due to unfavorably oriented joints and fractures.

1.3 GEOLOGIC STRUCTURE

1.3.1 Desalination Plant Site

The geologic structure within both of the plant sites is defined by the orientation of bedding planes within the Santiago formation, as well as the orientation of the contact between the late Pleistocene age terrace surface(s) and the overlying marine and non-marine terrace deposits. Where observed along the shoreline of the lagoon, the bedding within the Santiago formation is gently undulatory in nature, with dip angles on the order of 5 to 8 degrees to the south and west. Given the low bedding angles, as well as the well indurated nature of the formation, problems associated with slope stability within the bedrock are not anticipated, except where near vertical excavations are planned, such as for the proposed pumping station forebay. Currently, no significant cut slopes are planned.

The general overall orientation of the late Pleistocene wave-cut terrace surface beneath Alternative 2 appears to have a westerly slope on the order of about 0.02 foot/ foot (or less than 2 degrees). Beneath Alternative 1 the orientation of this surface is not well constrained due to the lack of subsurface information along the eastern perimeter of the site. The presence of underground utilities along the eastern margin of Alternative 1 precluded exploratory drilling in this area. However, based on our reconnaissance-level geologic mapping along the shoreline of the lagoon, as well as limited subsurface data from exploratory borings, the terrace surface in this area appears to be more undulatory, and a more southerly sloping gradient on the order of about 0.01 foot/foot.

1.3.2 Conveyance Pipeline Alignments

Similar to the proposed desalination plant sites, the geologic structure along the three alignments is defined by the orientation of bedding planes within the Late Cretaceous and Tertiary age sedimentary strata, and orientation of joints and fractures in the older granitic and metavolcanic rocks. Based on regional geologic mapping by Tan and Kennedy (1996), bedding planes in the sedimentary rocks along the proposed alignments are generally inclined (i.e. dipping) to the west and southwest between 3 to 20 degrees, except at the eastern terminus of the alignments where bedding planes in the Santiago formation dip to the east 5 and 25 degrees. There is no data concerning the orientation of the major joints/ fractures in the crystalline rocks, however given the "structural grain" of the Peninsular Ranges geomorphic province, the strike of major fracturing/ jointing is northwest-southeast and northeast-southwest, with dip angles between 20 and 90 degrees in various directions.

1.4 GROUNDWATER

1.4.1 Desalination Plant Sites

Groundwater was encountered within the Santiago formation bedrock in several of the exploratory borings. As observed during the reconnaissance level geologic mapping along the shoreline of the lagoon, groundwater seepage was noted emanating from sandy claystone layers bounded above and below by well indurated sandstone beds. Based on groundwater level data from the exploratory borings, and observations along the base of the lagoonal bluff, the elevation of the groundwater table beneath the sites is on the order of about three to five feet msl. No evidence of groundwater was found in the overlying terrace deposits. There are no known individual private or irrigation wells in the project area.

1.4.2 Conveyance Pipeline Alternatives

In general, shallow groundwater should be anticipated in the low-lying coastal areas adjacent to Agua Hedionda Lagoon and alluviated canyon bottoms. In most other areas groundwater will likely be limited to perched water and seeps.

1.5 MINERAL RESOURCES

There are no economic metallic ore deposits within or directly adjacent to the project areas; and the potential for oil and/or gas deposits beneath the project areas is remote. However, sand, gravel and crushed rock, which are included among mineral commodities classified as "Construction Materials" (CDMG, 1983) are present in the vicinity of the conveyance pipeline alignments. These commodities, collectively referred to as "aggregate" provide the bulk and strength to Portland cement concrete (PCC), asphaltic concrete, and plaster and stucco (CDMG, 1983).

Under the authority granted by the Surface Mining and Reclamation Act (SMARA) in 1975, the State Mining and Geology Board (1979) classified Mineral Resource Zones (MRZ) for aggregate resources in western San Diego County. In 1983, the California Geological Survey

(CGS), formally known as the California Division of Mines and Geology (CDMG), classified land in the western San Diego County according to the presence or absence of significant sand and gravel deposits and crushed rock source areas. The emphasis in the western San Diego County classification is placed on PCC aggregate. Under this classification, areas classified as MRZ-1 are considered to have little likelihood of containing significant deposits suitable for production of high-quality aggregate. Areas classified as MRZ-2 have a high likelihood that significant deposits exist. Areas classified as MRZ-3 are considered to have mineral deposits, the significance of which cannot be evaluated from available information. Lastly, MRZ-4 denotes areas where available information is inadequate for assignment to any other MRZ zone.

The proposed desalination plant sites are located in an MRZ-3 zone, as is the majority of the area within the City of Carlsbad. There is one area adjacent to (but not affected by) the Preferred and Northern conveyance pipeline alternatives that are classified as MRZ-2, the South Coast Materials Company Carlsbad quarry, located just south of the SR78/College Boulevard intersection.

1.6 ENVIRONMENTAL ANALYSES

The following section of this report was prepared by Geomatrix Consultants, Inc. (Geomatrix) who, serving as a subconsultant, was tasked to perform a limited evaluation of the presence, or absence, of potentially contaminated soils and groundwater at each of the proposed desalination plant sites. A complete report detailing the scope of work, findings, and conclusions reached by Geomatrix is attached in Appendix A of this report.

1.6.1 Previous Environmental Investigations

Prior environmental studies for the desalination plant sites include Phase I and II assessments conducted by Fluor Daniel GTI in 1998, a Phase II due diligence assessment conducted by URS Greiner Woodward Clyde for NRG Energy in 1999, and a geotechnical investigation report conducted by GeoLogic Associates in 2003. These assessments provide information for the study area and also for other parts of the property. Pertinent information for the study area presented in the Fluor Daniel GTI Phase I assessment report included a summary of four historical releases at the Tank 2 and Tank 3 areas (Fluor Daniel GTI, 1998a). Available information for several historical reported spills and their containment and remediation, as reported by Fluor Daniel GTI (1998a), is as follows:

- **Fuel Oil Tank 3, April 21, 1970:** *While transferring low sulfur fuel oil (No. 6), approximately 200 to 300 barrels of No. 6 fuel oil escaped from a 1-inch relief valve located on the western side of the tank when a line was dead-ended. Oil and soil were scraped from the impoundment floor and mixed with a "pulvi-mixer" to produce a paveable material.*

- **Fuel Oil Tank 2, 1978 -1987:** *Several leaks occurred in the flow of Fuel Oil Tank 2 in this period. Encina Power Plant (EPP) sealed the tank floor with fiberglass in 1979; however, leaks resumed, and EPP installed a double bottom in 1994.*

- **Fuel Oil Pump Pit, October 1992:** *The fuel oil strainer on the pump at the bottom of the pit developed a leak. Approximately 2000 gallons were released onto the concrete floor of the pit. The fuel oil was mixed with sand and removed.*

- **Fuel Oil Tank 3, December 1993.** *The floor of the tank leaked approximately 80 barrels of No. 6 fuel oil. EPP retired the tank from service and has not used it since retirement. An area of approximately 30 by 50 feet was impacted. A total of approximately 210 yards^3 of soil was excavated and disposed of at a Class I landfill.*

In 1998, Fluor Daniel GTI conducted a Phase II assessment that included drilling and soil sampling in the Tank 2, 3, 4, and 5 areas. At the Tank 2 and 3 area, 13 soil borings were drilled and sampled in a general grid pattern to depths between 1 and 5 feet below ground surface (feet bgs); only one boring extended to a depth of greater than 15 feet bgs. Groundwater was not encountered or sampled in the vicinity of Tanks 2 and 3. At the Tank 4 and 5 area, 15 soil borings were drilled and sampled. Eight of these soil borings were drilled and sampled to depths between 1 and 5 feet bgs. The other seven soil borings were drilled and sampled to depths between 5 and 15 feet bgs at locations along the perimeter of the Tank 4 and 5 area. In addition, two borings were drilled to depths of approximately 36 feet bgs and 12 feet bgs near the base of Tanks 4 and 5, respectively, and a groundwater sample from each boring was collected and submitted for laboratory analysis. Total petroleum hydrocarbons (TPH) in the fuel oil range was detected at concentrations that ranged from 3.2 to 110 milligrams per kilogram (mg/kg) in 10 of 11 soil samples submitted for laboratory analysis from the Tank 2 area. TPH was also detected in 11 of the 12 soil samples submitted for laboratory analysis from the Tank 3 area, at concentrations that ranged from 3.1 to 960 mg/kg. TPH was detected in seven of eight soil samples collected from the Tank 4 area at concentrations that ranged from 0.8 to 22 mg/kg and from 1.8 to 140 mg/kg in the eight soil samples analyzed from the Tank 5 area. Metals, where detected in the soil samples from these tank areas, were not above background concentrations established by Fluor Daniel GTI for the Phase II assessment program (Fluor Daniel GTI, 1998b). TPH was not detected in the groundwater sample collected from near Tank 4 and was detected at 0.15 milligrams per liter (mg/l) in the sample from near Tank 5. Volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) were not detected in the groundwater samples.

In 1999, URS Greiner Woodward Clyde was retained by NRG Energy Inc. and Dynegy Power Corporation to conduct additional Phase II assessment activities at the EPP before purchase of the property from San Diego Gas and Electric. During this assessment, two soil borings were drilled and sampled to depths of 45 feet bgs and 43 feet bgs adjacent to Tanks 2 and 3, respectively. TPH was not detected in soil samples collected from depths of approximately 1, 5, 10, 15, and 20 feet bgs and submitted for laboratory analysis. Grab groundwater samples were collected and submitted for laboratory analysis from the Tank 2 and 3 areas. The results indicated 0.67 microgram per liter (μg/l) of methylene chloride (also detected in the method blank) and 0.22 μg/l of toluene in the groundwater sample collected from the Tank 2 area. VOCs were not detected in the groundwater sample collected from the Tank 3 area. TPH was not detected in the groundwater samples collected from the Tank 2 and 3 areas. No additional soil or groundwater sampling was conducted in the Tank 4 and 5 areas.

In December 2003, GeoLogic Associates conducted a geotechnical and environmental investigation at the Tank 3 area on behalf of Poseidon Resources Corporation (Poseidon) to provide data to allow Poseidon to assess its plans to construct a desalination plant at that location. The GeoLogic Associates investigation included drilling and sampling a total of eight soil borings. These included six soil borings in the vicinity of Tank 3, one soil boring at the location of proposed intake pump station, and one soil boring on the roadway extension for the proposed facility. GeoLogic Associates presented the investigation findings in a February 18, 2004 report titled *Geotechnical Report, Proposed Carlsbad Desalination Plant, Encina Generating Station, Carlsbad, California*. In this report, GeoLogic Associates indicated that Tank 3 was reportedly "constructed on a bed of heavy oil to reduce the potential for leaking." They concluded that they did not encounter evidence of heavy oil around the perimeter of Tank 3 during drilling, but acknowledged the soils immediately beneath the tank were not accessible at the time of the site investigation.

GeoLogic Associates analyzed selected soil samples for TPH, metals, VOCs, semi-volatile organic compounds (SVOCs), dioxin, polychlorinated biphenyls (PCBs), pesticides, and other selected compounds including total cyanide, phenols, and sulfide. Of these compounds, TPH was detected in one of eight soil samples submitted for laboratory analysis at a concentration of

18 mg/kg. Metals, where detected in soil samples, were detected at low concentrations that are within background concentrations reported for natural soils in the State of California (GeoLogic Associates, 2004). Pesticides (DDD and DDT) were detected in one of three soil samples submitted for laboratory analysis and were noted to be below State of California and U.S. EPA guideline values. VOCs, SVOCs, dioxin, PCBs, and inorganic compounds were not detected at concentrations above their respective laboratory reporting limits in three soil samples submitted for analysis of these compounds.

The results of the previous assessments suggested that fuel oil-range TPH compounds are the primary chemicals of concern detected in shallow site soils. Low concentrations of TPH and VOCs, specifically toluene and possibly methylene chloride, detected in grab groundwater samples collected beneath the study area suggest that these compounds may be of concern in relation to potential construction dewatering for construction of deeper subsurface facilities such as the forebay pumping station for the desalination plant.

1.6.2 Findings from Geomatrix Study

This section presents the findings of the soil and groundwater assessment conducted at the study area. The analytical results for soil samples collected and submitted for laboratory analysis are summarized in Tables 1 through 3, and the analytical results for grab groundwater samples collected during the assessment activities are summarized in Tables 4 and 5 of the attached Geomatrix report in Appendix A. Soil boring locations are shown on Figures 1 and 2.

1.6.3 Analytical Results for Soil Samples

TPH Results

A total of 88 soil samples were submitted for laboratory analysis of TPH using EPA Method 8015M (carbon chain analysis). As shown in Table 1, TPH was detected in 8 of the 88 samples at concentrations ranging from 10.9 mg/kg (in the soil sample collected from soil boring HA-5) to 1060 mg/kg (in the soil sample collected from soil boring GB-16). Seven of the eight samples with detected TPH were collected from near-surface soils (between ground surface and a depth of 1 foot bgs). TPH in several of these locations (e.g., GB-5, GB-14, GB-16 and GB-17) may be related to the asphaltic surface materials that were penetrated to expose the subsurface soils at these areas.

Soil borings GB-13 and HA-11 were drilled and sampled at locations that contained an approximate 1- to 2-inch thickness of surficial materials that appeared to be asphaltic in nature and possibly represent a remnant(s) of an old release of No. 6 fuel oil that dried and hardened in-place. TPH was not detected in a soil sample collected from a depth of approximately 0.25 to 0.50 feet bgs at GB-13, immediately underlying this material. TPH was detected in a soil sample collected from a depth of 0.50 to 0.75 feet bgs in HA-11 at concentrations of 35.6 mg/kg (C13 to C22 carbon chain range), 138 mg/kg (C23 to C32 carbon chain range), and 142 mg/kg (C33 to C44 carbon chain range). TPH was not detected in the soil sample collected from a depth of approximately 3.75 to 4 feet bgs at HA-11, suggesting a limited vertical extent of TPH in near surface soils at this location.

VOC, PCB, Pesticides, and PAH Results

As shown in Table 2, VOCs, PCBs, pesticides, and PAHs were not detected in soil samples, with the exception of 0.058 mg/kg of anthracene reported in the shallow soil sample collected from GB-5. As listed in Table 2 in Appendix A, this reported concentration of anthracene is well below the U.S. EPA Region 9 preliminary remediation goals (PRGs) for residential and industrial sites.

Metals Results

Metals results for soil samples are shown in Table 3 in Appendix A. With the exception of arsenic, the detected concentrations of Title 22 metals in soil samples were well below the State of California Total Threshold Limit Concentrations (TTLCs) and U.S. EPA PRGs for industrial and residential sites. Arsenic was detected at concentrations well below TTLCs and below the U.S. EPA industrial PRG (1.6 mg/kg), but above the California modified industrial PRG (0.25 mg/kg) and the residential PRG. The detected concentrations of arsenic are within the range of background concentrations (not detected to 1.8 mg/kg) calculated by Fluor Daniel GTI (1998b) for soil at the site and are consistent with arsenic concentrations detected in soils at other sites in southern California.

1.6.3 Analytical Results for Groundwater Samples

The analytical results for the grab groundwater samples collected during the assessment program are summarized in Tables 4 and 5 in Appendix A. As listed in Table 4, TPH, VOCs, PCBs, pesticides, and PAHs were not detected in the nine grab groundwater samples collected and submitted for laboratory analysis. As listed in Table 5 in Appendix A, metals, where detected, were at concentrations below Water Quality Control Plan water quality objectives for the San Diego Basin (9) established by the Regional Water Quality Control Board, San Diego Region.

1.6.4 Summary and Conclusions

The following findings and conclusions are based on Geomatrix's Phase II assessment program conducted at the study area.

- TPH was detected in 8 of 88 soil samples analyzed during this assessment at concentrations ranging from 10.9 to 1060 mg/kg. The majority (seven out of eight) of the soil samples with detected TPH were collected from shallow soils located between ground surface and a depth of 1 foot bgs. TPH concentrations detected at several of these locations may be related to the asphaltic surface materials that were penetrated to expose and sample the subsurface soils. The shallow and scattered occurrence and low concentrations of TPH in soil is generally consistent with the findings of previous Phase II assessment activities conducted by others at the site.

- Surficial materials that appeared to be asphaltic in nature and may represent a remnant(s) of an old release of No. 6 fuel oil that dried and hardened in-place were observed in the general vicinity of soil borings HA-11 and GB-13. Analytical results for shallow soil samples collected from these locations show non detected or very low concentrations of TPH and suggest that the vertical impact of heavy hydrocarbons in these areas has been very limited.

- The heavy oil reportedly placed beneath Tank 3, as described in the GeoLogic Associates (2004) report, was not encountered, nor could the area beneath Tank 3 be accessed during the current assessment.

- With the exception of 0.058 mg/kg concentration of anthracene reported in the shallow soil sample collected from GB-5, VOCs, PCBs, pesticides, and PAHs were not detected in the soil samples analyzed during this assessment. The general non-detection of these chemicals in soil samples is consistent with the results of previous Phase II assessment activities conducted within the study area.

- With the exception of arsenic, detected concentrations of metals were well below regulatory thresholds and guideline values. Arsenic was detected at concentrations that exceed California modified industrial and residential PRGs, but likely represent naturally-occurring conditions.

- TPH, VOCs, PCBs, pesticides, and PAHs were not detected in the nine grab groundwater samples analyzed during this assessment.

It is expected that the interpretation of soil and groundwater conditions at each of the boring locations would be subject to confirmation of the actual conditions encountered during construction and assume that sufficient observation and testing will be provided during construction.

2.0 GEOLOGIC HAZARDS

General

The primary geologic hazards within the proposed desalination plant project areas are those associated with possible slope instability, groundwater seepage, soil erosion, strong ground motion from earthquakes, and erosive affects resulting from potential seiche and tsunami run up along the shoreline area of Agua Hedionda Lagoon. Geologic hazards associated with the conveyance pipeline alternatives include pipe-trench wall stability, shallow groundwater, seismic shaking, liquefaction, lateral spread, landslides, rock fall, subsidence and flooding.

2.1 FAULTING AND SEISMICITY

Hazards associated with earthquakes include primary hazards, such as ground shaking and surface rupture; and secondary hazards, such as liquefaction, seismically-induced settlement, and landsliding, tsunamis, and seiches.

In accordance with the CGS, a fault is a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time. An inactive fault is a fault that has not experienced earthquake activity within the last three million years. In comparison, an active fault is one which has experienced earthquake activity in the past 11,000 years. A fault which has moved within the last two to three million years, but not proven by direct evidence to have moved within the last 11,000 years, is considered potentially active. No active or potentially active faults are located within or project towards the project area.

The project area, like most of Southern California, is part of a seismically active region. The Alquist-Priolo Act (Act) of 1972 (now the Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code 2621-2624, Division 2, Chapter 7.5) regulates development near active faults so as to mitigate the hazard of surface fault-rupture. Under the Act, the State Geologist is required to delineate "special study zones" along known active faults in California. The Act also requires that, prior to approval of a project, a geologic study be conducted to define and delineate any hazards from surface rupture. A geologist registered by the State of California, within or retained by the lead agency for the project must prepare this geologic report. The project area is not currently known to be located within an Alquist-Priolo Fault Rupture Hazard Zone, according to the CGS.

The Modified Mercalli intensity scale was developed in 1931 and measures the intensity of an earthquake's effects in a given locality, and is perhaps much more meaningful to the layman because it is based on actual observations of earthquake effects at specific places. On the Modified Mercalli intensity scale, values range from I to XII. The most commonly used adaptation covers the range of intensity from the conditions of "I –not felt except by very few, favorably situate," to "XII – damage total, lines of sight disturbed, objects thrown into the air". While an earthquake has only one magnitude, it can have many intensities, which decrease with distance from the epicenter.

Ground motions, on the other hand, are often measured in percentage of gravity (percent g), where g = 32 feet per second per second (980 cm/sec^2) on the earth. One hundred percent of gravity (1g) is the acceleration a skydiver would experience during free-fall. An acceleration of 0.4g is equivalent to accelerating from 0 to 60 miles (0–97 km) per hour in about 7 seconds. The force that you would feel during an earthquake with 0.4g acceleration would be similar to the force you would feel if you were standing in the back of a truck that was accelerating very rapidly onto a freeway. One difference between the earthquake and the ride in the truck, however, is that in the earthquake you would accelerate backward and forward for many cycles. That is why it is difficult to stand up during episodes of strong ground shaking.

Ground shaking accompanying earthquakes on nearby faults can be expected to be felt within the proposed plant site and in the vicinity of the conveyance pipeline alternatives. However, the intensity of ground shaking would depend upon the magnitude of the earthquake, the distance to the epicenter, and the geology of the area between the epicenter and the property.

A listing of active faults considered capable of producing strong ground motion at the proposed plant site and along the conveyance pipeline, their closest distances to the proposed plant site and the maximum magnitude expected earthquake along each fault is presented in Table 1. Also presented are generalized evaluations of maximum ground shaking on site for the maximum earthquakes, and generalized predictions of the likelihood of such events occurring.

TABLE 1

SUMMARY OF FAULT AND GENERALIZED EARTHQUAKE INFORMATION

PROPOSED REGIONAL SEAWATER DESALINATION PROJECT

ENCINA POWER STATION

Name	Miles(direction from site)	Maximum Magnitude	Expected Level of Ground Shaking	Likelihood
Rose Canyon (Offshore Segment)	4.3 (southwest)	6.9	High	Moderate
Newport-Inglewood (Offshore Segment	8.4 (northwest)	6.9	High	Moderate
Coronado Bank	20.5 (southwest)	7.4	High	Moderate
Elsinore	24 (northeast)	6.8	Moderate	High
San Jacinto (Anza Segment)	48 (northeast)	7.2	Moderate	High

The most severe ground shaking would be expected to accompany a large earthquake on the Rose Canyon fault. An earthquake magnitude of 6.9 on this fault could produce Modified Mercalli intensities in the range of VII to IX within the proposed plant site; and maximum peak horizontal ground acceleration of 0.32g, and for the UBC (1977) design Level Earthquake a peak horizontal ground acceleration of 0.28g. Damage from ground rupture within the project site, as well as along the proposed pipeline conveyance alignments is extremely unlikely because no known active faults cross these sites.

Secondary earthquake hazards include liquefaction, ground lurching, lateral spreading, seismically-induced settlement, tsunamis, seiche and earthquake-induced landsliding.

Liquefaction

Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. Liquefaction is caused by a sudden temporary increase in pore water pressure due to seismic densification or other displacement of submerged granular soils. Liquefaction more often occurs in earthquake prone areas underlain by young alluvium where the groundwater table is higher than 50 feet below the ground surface.

Based on the results of the SPT data obtained from the exploratory borings at the proposed plant sites, portions of the terrace deposits are considered susceptible to liquefaction. However, given the fact that the groundwater level beneath the site occurs below the base of the terrace deposits the potential for liquefaction within these soils is considered remote. Moreover, given the age of the underlying Santiago formation sediments (around 50 million years old) that lie below the water table, the liquefaction potential is considered remote.

The liquefaction potential along the proposed conveyance pipeline alternatives is generally low, except along the low-lying coastal lagoonal area, and in young alluvial-filled canyons.

Lateral Spreading

Lateral spreading involves the lateral displacement of surficial blocks of sediment as a result of liquefaction in a subsurface layer. As previously stated, the liquefaction potential within the proposed desalination plant areas is considered remote. However, along the proposed conveyance pipeline alternatives the low-lying coastal lagoonal area, and in young alluvial-filled canyons the possibility of lateral spread cannot be precluded without further site- specific geotechnical investigations.

Tsunamis

A tsunami is a seismic sea-wave caused by sea-bottom deformations that are associated with earthquakes, landslides or volcanic activity beneath the ocean floor. Damaging tsunamis are rare but potentially catastrophic events that present a danger to the people and economy of California, primarily through the impact on our ports [State of California Seismic Safety Commission (SSC), 2005]. Over 80 tsunamis have been observed or recorded along the coast of California in the past 150 years, nine of which have caused minor damage in ports and harbors, and two with major impacts (SSC, 2005). The worst recorded tsunami event occurred in 1964 when 12 people died in California from the tsunami generated from the Great Alaska earthquake. According to a recent SSC report (December, 2005) entitled "The Tsunamis Threat To California," the Cascadia subduction zone, which extends from offshore northern California to the Pacific northwest, will produce the State's largest tsunamis. The Cascadia subduction zone is similar to the Alaska-Aleutian trench that generated the 1964 magnitude 9.2

Alaska earthquake and the Sunda trench in Indonesia that produced the magnitude 9.3 December 2004 Sumatra earthquake.

Local tsunamis can be caused by significant vertical displacement offshore faults or coastal and submarine landslides and are always largest closest to the source region where they may strike the closest coastline only minutes after the triggering. Factors at the originating point such as earthquake magnitude, type of fault movement, depth of earthquake, focus, water depth and the ocean bottom profile all contribute to the size and momentum of a tsunami (Iida, 1969, *in* GeoLogic Associates, 2004). Because Southern California is oriented obliquely with major originating tsunami zones (i.e. Cascadia subduction zone), has a relatively wide and rugged intercontinental borderland, which acts as a diffuser and reflector of remotely generated tsunami wave energy, as well as the nature of offshore faults (i.e. strike-slip, as opposed to large thrust or normal faults), there is a low potential for catastrophic damage to the San Diego County coastline. However, the recent SSC (2005) tsunami threat report for California indicates that, given the nature of San Diego Bay, this particular area could experience tsunamis run-up heights between two to five meters (6.3 feet to almost 16 feet). Elsewhere along the Southern California coast, the SSC (2005) indicates that tsunami run-up heights are estimated between 0.1 to 1.0 meters (0.3 feet to slightly over 3 feet).

Based on the elevation of the proposed desalination plant sites (i.e. 44 to 50 feet msl), the factors discussed above, and estimates from the SSC (2005) report, there is a low potential for catastrophic damage from tsunami run-up at the proposed plant sites. The potential for tsunami-related impacts to the low-lying portions of the conveyance pipeline are also considered to be low.

Seiches

Seiching involves an enclosed body of water oscillating due to ground shaking, usually following an earthquake. According to the City of Carlsbad South Coastal Redevelopment Plan (2000), seiches are not expected to affect areas five to ten feet above the mean water level in the lagoon. Although the proposed Alternative 1 desalination plant would lie at an elevation of 44 feet msl, and therefore not directly impacted, its proximity to the highly erodible bluffs could pose a concern as it relates to subjacent slope instability resulting from wave action undercutting the slope.

Ground Lurching

Certain soils have been observed to move in a wave-like manner in response to intense seismic ground shaking, forming ridges or cracks on the ground surface. Areas underlain by thick accumulations of colluvium and alluvium appear to be more susceptible to ground lurching than bedrock. Under strong seismic ground motion conditions, lurching can be expected within loose, cohesionless solids, or in clay-rich soils with high moisture content. Generally, only lightly loaded structures such as pavement, fences, pipelines and walkways are damaged by ground lurching; more heavily loaded structures appear to resist such deformation. Ground lurching may occur where deposits of loose soils/alluvium exist along portions of conveyance pipeline alignments, such as along the low-lying lagoon areas and within alluviated canyon bottoms.

Seismically Induced Ground Settlement

Strong ground shaking can cause ground settlement by allowing sediment particles to become more tightly packed, thereby reducing pore space. Unconsolidated, loosely packed alluvial deposits are especially susceptible to this phenomenon. Poorly compacted artificial fills may also experience seismically induced ground settlement.

As all structures for the desalination plant will be founded on either compacted fill soils or bedrock, the potential for seismically induced ground settlement is nil. However, unconsolidated soils such as modern alluvium and/or hydraulic fills along portions of the conveyance pipeline alternatives may be subject to seismically induced ground settlement.

Landslides

No landslides are known to exist either within or adjacent to the two proposed plant sites or the conveyance pipeline alternatives. Landslide hazards associated with the construction of the conveyance pipeline(s) are considered minimal in light of the fact that the pipelines would be placed underground and the affected ground surface would be regraded to its pre-construction condition.

3.0 THRESHOLDS OF SIGNIFICANCE

Earth resource and/or topographic impact resulting from the proposed project could be considered significant if any of the following occur:

- exposure of people or property to substantial geological hazards, such as landslides, mudslides, ground failure or similar hazards, or soil and/or seismic conditions so unfavorable that they could not be overcome by design using reasonable construction and/or maintenance practices;

- location of a structure within a mapped hazard area or within a structural setback zone;

- location of a structure within an Alquist-Priolo Fault-Rupture Hazard Zone, or within a known active fault zone, or an area characterized by surface rupture that might be related to a fault;

- triggering or acceleration of geologic processes, such as landslides or erosion that could result in slope failure;

- substantial irreversible disturbance of the soil materials at the site or adjacent sites, such that their use is compromised;

- modification of the surface soils such that abnormal amounts of windborne or waterborne soils are removed from the site;

- earthquake induced ground shaking capable of causing ground rupture, liquefaction, settlement, or surface cracks resulting in the substantial damage to people and/or property;

- deformation of foundations by expansive soils (those characterized by shrink/swell potential); and

- modification of the on-site topography (i.e., grading) in a manner that results in decreased stability for adjacent residential enclaves.

4.0 IMPACTS

The level of geotechnical and landform information contained herein is adequate to analyze the potential project effects on earth resources and landforms, and to determine appropriate mitigation measures. For certain items, the project geotechnical engineer should perform further testing and review of on-site conditions as part of the final design work. This additional work will further refine details for site design, but is not anticipated to alter the conclusions of significance contained herein. In accordance with CEQA case law, this later additional refinement is not a deferral of mitigation. Rather, it is a design refinement, consistent with the commitment to mitigation included in this EIR.

Desalination Plant Site(s)

For the most part, the natural ground (terrace) surface that existed prior to construction of the EPS has been significantly modified by construction of the Tanks and appurtenant structures. The current plans for construction of the desalination plant calls for the demolition of two Tanks and the intervening containment berm and re-grading the area to a relatively flat pad via re-compacting the soils to a minimum relative compaction of 95 percent (based on ASTM D1557). The fill soils would be derived from the terrace deposits that are located within the project envelope, as well as some amount of import from off site. Based on proposed pad grade elevations of either 44 feet msl at Tanks 2 and 3, or 50 feet msl at Tanks 4 and 5, the remaining containment berm slopes bordering the proposed plant site(s) would, for the most part, be eliminated. Trench excavations for the onsite influent/effluent pipelines would be backfilled with compacted fill to pre-trenching grades.

Demolition of the Tanks may reveal the presence of fuel-oil contaminated soil. However, based on the character of the fuel oil, and our observations of several limited areas of spillage next to the Tanks, the potential soil contamination would likely be in the form and chemical nature of asphalt. However, if contaminated soils are encountered, sampling and laboratory testing would be necessary to assess their chemical nature, which would then allow quantification of the condition and allow for an assessment regarding their proper removal and transport to a state-certified disposal facility.

Based on the coarse-grained nature of the terrace deposits and underlying bedrock, as well as laboratory testing of fill soils by GeoLogic Associates (2004), expansive soils are not known to be present within either of the proposed plant sites.

The major geotechnical/ environmental-related factors/impacts that are considered relevant to the design and construction of the desalination plant, at either location, include the following:

- soil erosion;
- stability of the bluff area bordering Tanks 2 and 3;
- stability and dewatering of temporary deep excavations;
- use of excavated materials for compacted fill and pipe trench backfill;
- corrosivity of onsite soil materials; and

- potential heavy oil-contaminated soil beneath the Tanks.

There are also a number of other short-and long-term impacts related to the current physical/geological setting that can be generally expected from grading and development activities. These are described in the following impacts sections.

Offsite Conveyance Pipeline

The three alternative 10-mile-long conveyance pipeline alignments and the two "Optional Connectors" would, for the most part, be constructed beneath existing access road right-of-ways and roadways. Exceptions to this design would involve tunneling beneath the I-5 freeway for each alignment, a portion of the Southern alignment transecting through the City of Carlsbad municipal golf course currently under construction, and through undeveloped land for a portion of the Preferred/Northern alignment.

The following key geotechnical-related factors/impacts that are relevant to the design and construction of the conveyance pipeline should be considered in the final selection of the pipeline alignment:

- liquefaction potential
- lateral spreading potential
- rockfall potential
- settlement potential
- excavation difficulties
- use of excavated material for backfill
- temporary slopes and shoring
- dewatering

4.1 POTENTIALLY SIGNIFICANT IMPACTS

4.1.1 Desalination Plant Sites

The most significant potential impacts to project development at either of the proposed plant sites would be caused by changes in existing topography, erosion of surficial soil deposits, ground shaking from nearby seismic sources, and the erosive effects from a potential seiche along the shoreline of the lagoon next to the western plant site. Temporary stockpiling of soil could expose these soils to significant erosion. No significant impact to groundwater quality is anticipated.

Slope Stability

The only significant construction slope associated with the project is associated with the temporary excavation for the proposed forebay pumping facility. However, prior to the excavation the project engineer would prepare an appropriate shoring design, which would be implemented during construction and would reduce this temporary impact to a less-than-significant level.

Given the close proximity of the lagoonal bluff to the northwest corner of the Alternative 1 plant site, seiche-induced undermining of the bluff could create a slope failure that could encroach into the plant site. One method to mitigate the potential impact to the plant would be to install a row of soldier piles along the northwestern margin of the Alternative 1 site, which would reduce this impact to a less-than-significant level.

Soil Erosion

Because the terrace deposits are considered moderately erodible, adverse surface drainage in the vicinity of the Alternative 1 plant site could promote accelerated soil erosion which could lead to increased sedimentation within the lagoon. A similar condition could result during temporary stockpiling of soils during construction. This impact would be considered significant if not mitigated.

Mitigation measures, such as providing adequate surface drainage, creating temporary berms surrounding the stockpiled soils, or covering exposed soils on final slopes with gunite or other suitable protective cover would reduce this impact to a less-than-significant-level.

Use of excavated materials for compacted fill and pipe trench backfill

Based on laboratory testing, soils derived from the terrace deposits and man-made fill soils can readily be used for use as compacted fill for the proposed plant site, and as general backfill for the influent/ effluent pipeline. However, portions of the terrace deposits to be are moderately corrosive to steel. If these materials are to be used for backfill in association with steel piping, a corrosion engineer will need to be retained to address this problem, in which case this impact would be reduced to a less-than-significant-level.

Hazardous Materials

Construction of the proposed desalination plant will not involve extensive excavation or soil removal, and therefore, it is not anticipated that exposure of potentially contaminated soils or groundwater would result from construction activities. Project construction would remove the existing fuel oil storage tanks, and through that process will remediate any potential fuel contamination. Demolition activities will be required to adhere to appropriate regulatory requirements of the Occupational Safety and Health Administration to protect workers from exposure to potential hazards. Additionally, the ultimate disposition of demolition debris that may contain hazardous materials will be required to adhere to applicable local, state, and federal regulations regarding disposal. Therefore, project construction is not anticipated to result in exposure of people to potential hazards or result in release or upset associated with any hazardous substances, and impacts are considered to be less than significant.

It has been reported that heavy oil had been placed prior to construction beneath Tank 3 in order to reduce the potential for leakage. To date, there has been no environmental evaluation regarding this condition beneath any of the Tanks for either of the two proposed plant sites. Upon demolition of the tanks for either plant site, appropriate soil sampling, laboratory testing and analyses will be necessary. The significance related to this condition cannot be determined at this time.

Ground Shaking

Given the highly seismic character of the Southern California Region, moderate to severe ground shaking can be expected within the project area due to moderate to large earthquakes on the offshore segments of the Rose Canyon or Newport-Inglewood fault zones. This impact would be considered significant if not mitigated. In order to reduce this impact a less-than-significant-level, all structures should be constructed in accordance with seismic design standards set forth in the latest edition of the International Building Code.

Seiche

The amount of potential impact from seiche would be dependant on the slope of the near-shore environment (i.e. shoreline angle), the height of sea level at the time of the seismic event, and the severity of oscillation of seismically-induced waves. Seiche-induced erosion along the shoreline of the lagoon could conceivably occur due to significant ground motion from a major earthquake on nearby faults. Except as noted in the slope stability impact description above, the elevation of the two proposed plant sites is such that this impact is reduced to a less-than-significant-level.

4.1.2 Conveyance Pipeline Alternatives

Although no pipeline-specific geotechnical or environmental investigation has been performed for the three pipeline alternatives, the following presents what is considered to be the most likely significant impacts related to construction for either of the alignments.

Liquefaction potential

Based on the nature of the currently known geologic/soils conditions, the Southern alignment appears to have the lowest liquefaction potential. There is likely a moderate to high liquefaction potential where the Preferred/Northern alignments transect low-lying areas of saturated alluvium. Actual potential for liquefaction induced settlement or damage depends on a number of factors, including the depth of the pipeline, the depth, thickness, density, and grain size characteristics of the alluvium and the location of the groundwater table (Group Delta Consultants, 2003).

In other areas underlain by terrace deposits, older sedimentary formations and granitic and metavolcanic rocks, the liquefaction potential in these areas is nil

Lateral spreading potential

The potential impacts from lateral spreading is generally restricted that portion of the Northern pipeline alignment that lies within the low-lying lagoonal areas. Elsewhere, the potential for lateral spreading to affect the three alignments is considered to be low.

Rock fall/ Landslide potential

Based on existing geologic maps, the three alignments do not transect any known landslides. Given the general orientation of bedding planes in the older sedimentary formations, and the trend of the alignments, the likelihood of landsliding during trenching for the pipeline(s) is considered remote. However, the potential for rock fall may exist along the Preferred/Northern alignments where they would cut through steep bedrock terrain.

Settlement potential

Compressible soils materials that could promote post construction settlement are limited to low-lying alluvial-filled canyon bottoms. This condition is only likely to occur if the grades (i.e. elevation) of the ground surface are raised over the pipeline where it is underlain by compressible alluvial-type soils.

Excavation difficulties

Pipe trench excavations will be, for the most part, readily excavatable with moderate to heavy effort within the majority of the geologic units. However, excavation difficulties may be encountered where the Preferred/Northern pipeline alignments traverses through relatively unweathered and weakly fractured granitic and/or metavolcanic rocks, in which case heavy ripping, and possibly blasting, may required.

Use of excavated materials

The majority of the man-made fill and native materials that would be excavated for either of the three pipeline alignments are expected to be suitable for general trench backfill material. Possible exceptions would include oversize rocks generated from excavations in the granitic and metavolcanic rock terrains, and cobbley materials from the Lusardi formation. Where saturated alluvial or man-made fill soils are encountered, these soils would require drying or blending prior to compaction.

Based on limited corrosivity testing of the terrace deposits at the two proposed desalination plant sites, portions of these deposits were found to be moderately corrosive to steel.

Temporary slopes and shoring

As with most all forms of underground excavations, shoring of the trench walls will be necessary and should comply with OSHA requirements, and OSHA Soil Type should be determined during actual construction by a qualified person. Where temporary cut slopes are planned, site-specific slope stability evaluations would need to be prepared and reviewed by the County Department of Public Works prior to construction.

Dewatering

Dewatering would likely be necessary for excavations below the permanent groundwater table, such as within the bottom of major alluviated canyon bottoms. Elsewhere, groundwater that is encountered in the form of isolated seeps, dewatering could generally be accomplished by the use of sump pumps.

No significant impact to groundwater quality is anticipated.

4.2 CONSTRUCTION RELATED IMPACTS

Grading activities within the project area for the desalination plant would create changes to the current, man-made, landforms/topography. The greatest changes to existing topography would occur where the excavations for the tanks would essentially be filled in to create a relatively flat pad. However, in consideration of the developed, industrial nature of the project site and surrounding area, topography impacts would be less than significant.

5.0 REFERENCES

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AERIAL PHOTOGRAPHS REVIEWED

Source	Date of Photo	Flight No./ Frame.	Scale
Fairchild Collection	1932	C-1980/ 47, 48	1"=800'
Fairchild Collection	9/5/46	C-10680/ 1:445,146	1"=600'
Fairchild Collection	2/27/58	C-23023/ 10: 48, 49	1"=3,000'
Continental Aerial Photo	2/17/79	210 13B/ 21, 22 SDCO	1"=1,000'
Continental Aerial Photo	8/12/98	C123/ 3-12, 13	1"=1,000'

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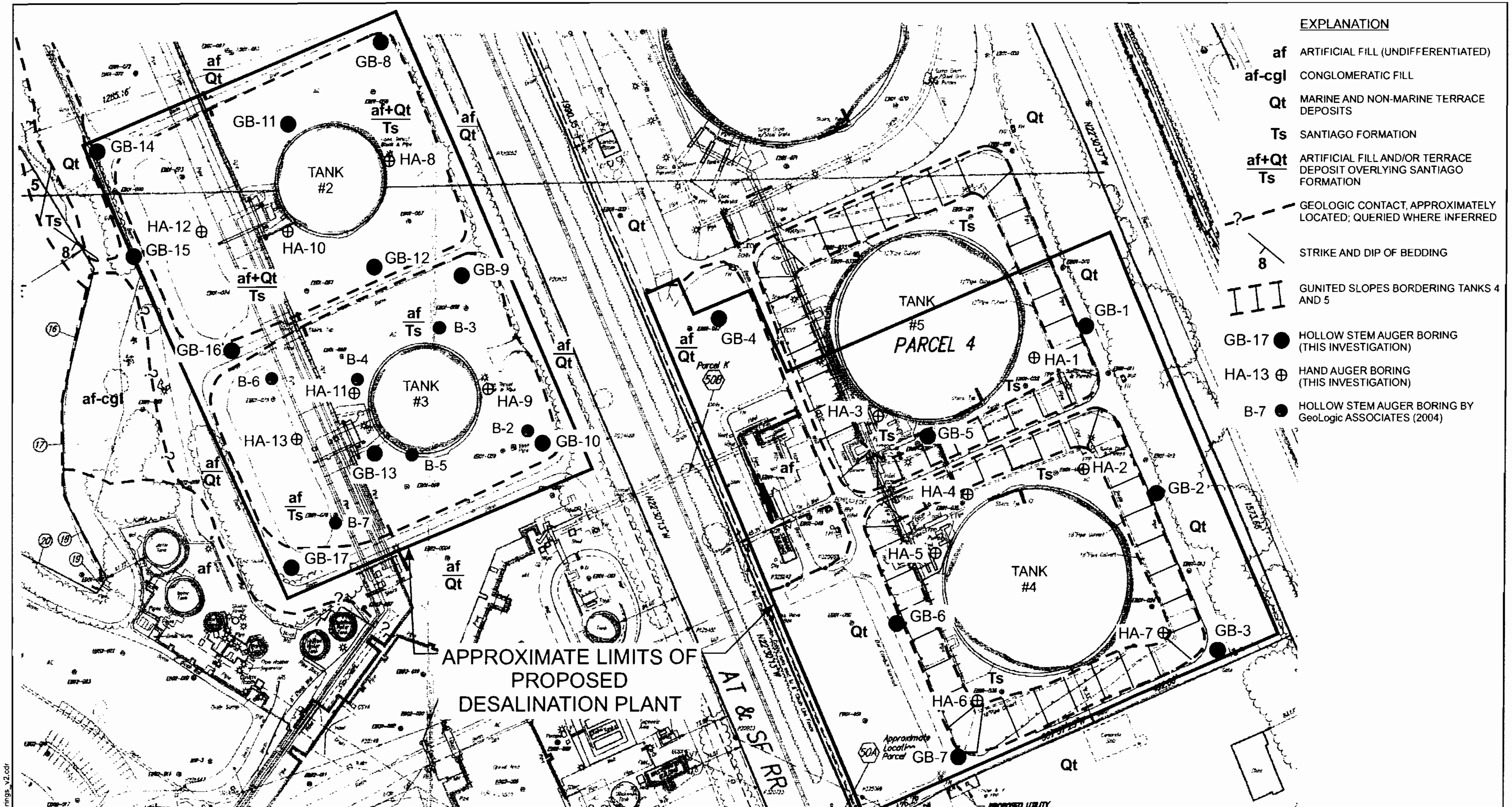
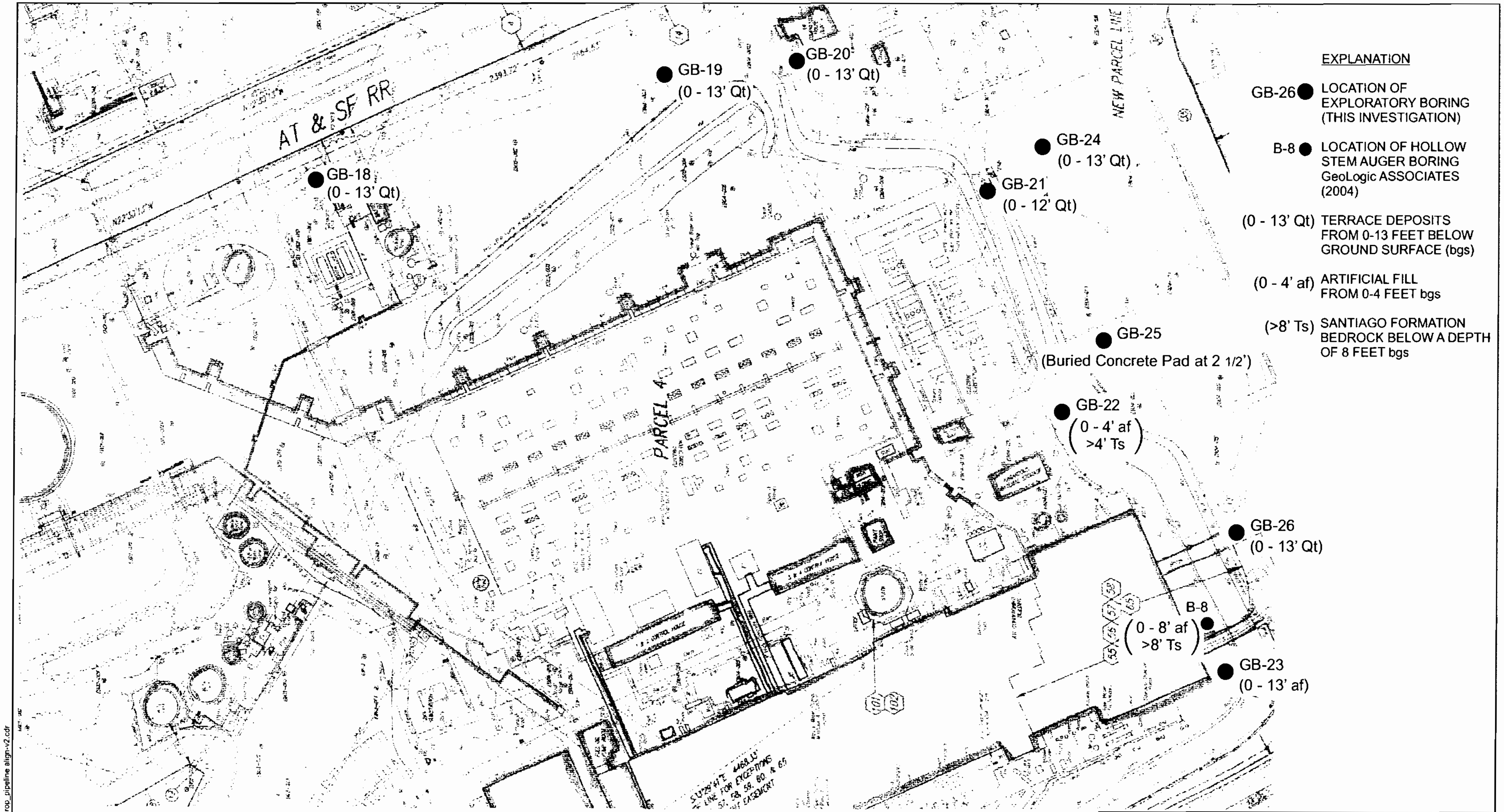


BASE MAP FROM SHEET 6 OF NOLTE'S JANUARY 2001 ALTA/ACSM SURVEY, ENCINA POWER PLANT

GEOLOGIC AND EXPLORATORY BORING LOCATION MAP PROPOSED REGIONAL SEAWATER DESALINATION PLANT EIR Carlsbad, California			
D. Scott Magorien, C.E.G. 1290 Consulting Engineering Geologist	Figure by jrw Date 3/10/06	Project No. 10065	Figure 1



BASE MAP FROM SHEET 6 OF NOLTE S JANUARY 2001 ALTA/ACSM SURVEY ENCINA POWER PLANT

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EXPLORATORY BORING LOCATION MAP FOR PROPOSED INFLUENT/EFFLUENT PIPELINE ALIGNMENT

PROPOSED REGIONAL SEAWATER DESALINATION PLANT EIR
Carlsbad, California

D. Scott Magorien, C.E.G. 1290 Consulting Engineering Geologist	Figure by: jrw	Project No.: 10065	Figure: 2
	Date: 3/10/06		

PHASE II ENVIRONMENTAL SOIL AND GROUNDWATER ASSESSMENT REPORT

Encina Seawater Desalination Project

Carlsbad, California

Prepared for:

D. Scott Magorien, Consulting Engineering Geologist
510 Superior Avenue, Suite 200
Newport Beach, California 92663

Prepared by:

Geomatrix Consultants, Inc.
510 Superior Avenue, Suite 200
Newport Beach, California 92663
(949) 642-0245

March 10, 2006

Project No. 10065

Geomatrix

Geomatrix

PHASE II ENVIRONMENTAL SOIL AND GROUNDWATER ASSESSMENT REPORT
Encina Seawater Desalination Project
Carlsbad, California

March 10, 2006
Project 10065.000.0

This report was prepared by the staff of Geomatrix Consultants, Inc., under the supervision of the Geologists whose signatures appear hereon.

The findings, recommendations, specifications, or professional opinions are presented within the limits described by the client, in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.

Duane G. Paul, CHG #414
Senior Hydrogeologist

Craig Stewart, CHG #106
Principal Hydrogeologist

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-1

BORING LOCATION: East of Tank #5, on berm	ELEVATION AND DATUM: ~56' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/24/05 — DATE FINISHED: 10/24/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 56.5 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER — FIRST: — COMPL.: — 24 HRS.:
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo, inter. Surface Elevation: ~56' MSL	PID READING (ppm)	REMARKS
0			asphalt		Hand augered to 5 ft bgs
1	1		SILTY SAND with GRAVEL (SM): dark yellowish brown (10YR 3/4), moist, ~55% fine to medium sand, ~30% fine igneous subangular to subrounded gravel, ~15% fines [FILL]		8-inch diameter boring
2	2		SILTY SAND (SM): dark reddish brown (5YR 3/3), ~70% fine to medium sand, ~30% low plasticity fines [TERRACE]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
4			brown (7.5YR 4/4)		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
5	3	4, 5, 4	strong brown (7.5YR 5/6), ~80% fine to medium sand, ~20% fines	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
7	4	5, 9, 7	yellowish brown (10YR 5/6)		PID readings are headspace (HS) in resealable plastic bags
9			light olive brown (2.5Y 5/6), ~85% fine to medium sand, ~15% low plasticity fines		Bulk samples collected from 0.5 to 4 ft bgs and 10 to 13 ft bgs
10	5	3, 12, 16	POORLY GRADED SAND (SP): mottled light olive brown (2.5Y 5/6) and black (2.5/N), ~95% fine to medium sand, ~5% fines	0.0 (HS)	
12	6	7, 11, 9			
14			pale yellow (2.5Y 8/4)		

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-1 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				POORLY GRADED SAND (SP): continued		
15			5		0.0 (HS)	
	7		8			
16			10			
			8	mottled pale yellow (2.5Y 7/4) and black (2.5/N)		
17	8		11			
			37	light olive brown (2.5Y 5/6)	0.0 (HS)	
18				CLAYEY SAND (SC): light gray (2.5Y 7/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines, predominantly fine sand [BEDROCK]		
19						
20			11			
	9		11			
21			24			
			15	SANDY LEAN CLAY (CL): light gray (2.5Y 7/1), moist, ~70% fines, ~30% fine sand, medium plasticity, some lenses of mottled strong brown (7.5YR 5/6)		
22			21			
	10		38		0.0 (HS)	
23						
24				CLAYEY SAND (SC): light olive gray (5Y 6/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines		
25			19			
	11		20		0.0 (HS)	
26	12		50			
27						
				light gray (2.5Y 7/2)		
28						
29						
30			18			
	13				0.0 (HS)	
31	14		50/5"			

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-1 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR		CLAYEY SAND (SC): continued		
32						
33						
34				light brownish gray (2.5Y 6/2)		
35			10			
36	15		15			
	16		50			
37						
38				SILTY SAND (SM): light gray (5Y 7/2), moist, ~80% fine to medium sand, ~20% low plasticity fines, predominantly fine sand		
39						
40	17		13		0.0 (HS)	
	18		50/5"			
41		NR				
42						
43						
44						
45			7		0.0 (HS)	
	19		38	LEAN CLAY (CL): olive gray (5Y 5/2), dry to moist, ~100% fines, trace medium sand, medium plasticity, slow dilatancy, thin platy structure		
46	20	NR	50	CLAYEY SAND (SC): grayish brown (2.5Y 5/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines		
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-1 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				CLAYEY SAND (SC): continued light olive gray (5Y 6/2)		
49						
50	21		9			
	22		50/5"			
51		NR				
52						
53				SILTY SAND (SM): pale olive (5Y 6/3), moist, ~70% fine to medium sand, ~30% low plasticity fines		
54						
55	23		15		0.0 (HS)	
	24		48			
56		NR	50/2"			
57				Bottom of boring at 56.5 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
58						
59						
60						
61						
62						
63						
64						
65						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-2

BORING LOCATION: East of Tank #2, on berm	ELEVATION AND DATUM: ~55' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/26/05 / DATE FINISHED: 10/26/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 60.0 / MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST / COMPL. / 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs / DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul / REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. — Surface Elevation: ~55' MSL	PID READING (ppm)	REMARKS
			asphalt		Hand augered to 5 ft bgs
	1		SILTY SAND with GRAVEL (SM): dark yellowish brown (10YR 3/4), moist, ~55% fine to medium sand, ~30% fine igneous subangular to subrounded gravel, ~15% fines [FILL]		8-inch diameter boring
1–2			SILTY SAND (SM): yellowish brown (10YR 5/4), moist, ~70% fine to medium sand, ~30% low plasticity fines [TERRACE]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
2	2		dark reddish brown (5YR 3/3)	0.0 (HS)	
3			brown (7.5YR 4/4)		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
5		5	yellowish brown (10YR 5/6), ~80% fine to medium sand, ~20% fines		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
	3	7			
6		9			PID readings are headspace (HS) in resealable plastic bags
7		7			
	4	12		0.0 (HS)	Bulk sample collected from 0.5 to 5 ft bgs
8	NR	13			
9			yellow (2.5Y 7/8), ~85% fine to medium sand, ~15% fines		
10		4		0.0 (HS)	
11	5	13			
		23			
		7	POORLY GRADED SAND (SP): mottled pale yellow (2.5Y 7/3) and black (2.5/N), ~95% fine to medium sand, ~5% fines		
12		11			
13	6	11	pale yellow (2.5Y 7/4)		
14					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-2 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				POORLY GRADED SAND (SP): continued		
15			6			
	7		11			
16			13			
17			18	CLAYEY SAND (SC): light gray (2.5Y 7/1), moist, ~70% fine to medium sand, ~30% medium plasticity fines, predominantly fine sand [BEDROCK]		
			21			
18	8		29			
19						
20			3	~60% fine sand, ~40% fines		
	9		18		0.0 (HS)	
21	10		50/4"	LEAN CLAY (CL): olive gray (5Y 5/2), dry to moist, ~100% fines, medium plasticity		
22						
23				light gray (5Y 7/2), ~70% fine to medium sand, ~30% fines		
24						
25	11		8		0.0 (HS)	
	12		50/4"			
26		NR				
27						
28				light olive gray (5Y 6/2), ~60% fine sand, ~40% medium plasticity fines		
29						
30	13		19			
	14		50/5"			
31					0.0	

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-2 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				POORLY GRADED SAND (SP): light gray (5Y 7/2), ~95% fine to coarse sand, ~5% fines, predominantly fine to medium sand	(HS)	
32						
33						
34						
35	15		12		0.0 (HS)	
	16		50/5"			
36		NR		CLAYEY SAND (SC): light gray (5Y 7/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines, predominantly fine sand		
37						
38						
39				SILTY SAND (SM): light gray (5Y 7/2), moist, ~80% fine to medium sand, ~20% low plasticity fines, predominantly fine sand		
40	17		12			
	18		50/5"			
41		NR				
42						
43				trace fine gravel (sandstone)		
44				CLAYEY SAND (SC): light olive gray (5Y 7/2), moist, ~85% fine to medium sand, ~15% medium plasticity fines, predominantly fine sand		
45	19		20		0.0 (HS)	
	20		50/5"	SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~85% fine to medium sand, ~15% low plasticity fines, predominantly fine sand		
46		NR				
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-2 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo inter.	PID READING (ppm)	REMARKS
				CLAYEY SAND (SC): light olive gray (5Y 6/2), moist, ~80% fine to medium sand, ~20% medium plasticity fines, predominantly fine sand		
49						
50	21					
	22		27	LEAN CLAY (CL): olive gray (5Y 5/2), dry to moist, ~100% fines, medium plasticity, thin platy structure	0.0 (HS)	
51		NR	50			
52						
53				SILTY SAND (SM): pale olive (5Y 6/3), moist, ~85% fine to medium sand, ~15% fines, predominantly fine sand		
54						
55	23		31		0.0 (HS)	Drilled to 60 ft bgs, pulled augers back to 55 ft bgs. Depth to water after 13 minutes = 57.8 ft bgs.
56	23	NR	50/5"	Weathered sandstone, light gray (2.5Y 7/2)		
57						Groundwater sample GB2-25 collected with disposable bailer: pH = 7.01 SEC = 23.6 mS/cm Turbidity = >999 NTU Temp. = 23.9°C
58						
59						
60				Bottom of boring at 60 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
61						
62						
63						
64						
65						

Log of Boring No. GB-3

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-3**
BORING LOCATION: Southeast of Tank #4, on berm	ELEVATION AND DATUM: ~55' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/26/05 — DATE FINISHED: 10/26/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 56.5 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST — COMPL. — 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~55' MSL	PID READING (ppm)
0			asphalt	
	1		SILTY SAND with GRAVEL (SM): dark yellowish brown (10YR 3/4), moist, ~55% fine to medium sand, ~30% fine igneous subangular to subrounded gravel, ~15% fines [FILL]	
2	2		SILTY SAND (SM): dark reddish brown (5YR 3/3), ~70% fine to medium sand, ~30% low plasticity fines [TERRACE]	0.0 (HS)
4			brown (7.5YR 4/4)	
			yellowish brown (10YR 5/6)	
5	3	4, 14, 20	yellowish brown (10YR 5/8), ~85% fine to medium sand, ~15% fines	
6			yellowish brown (10YR 5/6)	0.0 (HS)
7	4	6, 9, 9	pale yellow (2.5Y 7/4)	
9			POORLY GRADED SAND (SP): mottled light olive brown (2.5Y 5/6) and black (2.5/N), ~95% fine to medium sand, ~5% fines	
10	5	7, 11, 17		
12	6	75, 11, 11	pale yellow (2.5Y 8/4)	0.0 (HS)
14				

REMARKS

Hand augered to 5 ft bgs

8-inch diameter boring

Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler

Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves

PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard

PID readings are headspace (HS) in resealable plastic bags

Bulk samples collected from 0.5 to 5 ft bgs, 45 to 47 ft bgs, and 50 to 50.5 ft bgs

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-3 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				POORLY GRADED SAND (SP): continued		
				mottled pale yellow (2.5Y 8/3) and black (2.5/N)		
15			6			
	7		17			
16			33			
			11	CLAYEY SAND (SC): light gray (2.5Y 7/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines, predominantly fine sand [BEDROCK]		
17			29			
	8		34			
18						
19						
20	10		7	fine to medium sand		
	9		26			
21			50/5"			
22						
23						
24				light brownish gray (2.5Y 6/2), ~60% fine to medium sand, ~40% fines, predominantly fine sand		
25			13			
	11		19		0.0 (HS)	
26	12		15			
27						
28						
29				SILTY SAND (SM): light yellowish brown (2.5Y 6/3), moist, ~85% fine to medium sand, ~15% low plasticity fines, predominantly fine sand		
30	13		20		0.0 (HS)	
	14		50/4"			
31						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-3 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR		SILTY SAND (SM): continued		
32						
33				CLAYEY SAND (SC): light brownish gray (2.5Y 6/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines, predominantly fine sand		
34						
35	15		14		0.0 (HS)	
	16		50/5"			
36		NR				
37						
38						
39						
40	17		11			
	18		50/4"	POORLY GRADED SAND (SP): pale yellow (2.5Y 7/3), moist, ~95% fine to medium sand, ~5% fines		
41		NR				
42						
43				trace fine gravel (siltstone)		
44						
45	19		10	SILTY SAND (SM): pale yellow (2.5Y 7/4), moist, ~80% fine to medium sand, ~20% low plasticity fines, predominantly fine sand		
	20		50/5"			
46		NR				Difficult drilling
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-3 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued trace fine gravel (siltstone)		
49				CLAYEY SAND (SC): grayish brown (2.5Y 5/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines		
50	21		23	Weathered sandstone, light gray (2.5Y 5/2)	0.0 (HS)	
	22		50/5"	SILTY SAND (SM): light yellowish brown (2.5Y 6/3), moist, ~70% fine to medium sand, ~30% low plasticity fines		
51		NR				
52						
53						
54						
55	23		23			
	24		50/5"			
56		NR				
57				Bottom of boring at 56.5 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
58						
59						
60						
61						
62						
63						
64						
65						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-4**	
BORING LOCATION: Northwest of Tank #5, on berm	ELEVATION AND DATUM: ~30' MSL	
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/24/05	DATE FINISHED: 10/24/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 60.0	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER / FIRST / COMPL. / 24 HRS.	
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez	
HAMMER WEIGHT: 140 lbs / DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~30' MSL	PID READING (ppm)	REMARKS
0	1		SILTY SAND (SM): yellowish brown (10YR 5/6), moist, ~80% fine to medium sand, ~20% low plasticity fines, trace fine gravel [FILL]	0.0 (HS)	Hand augered to 5 ft bgs 8-inch diameter boring
2	2		yellow (10YR 7/6)		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
4			yellowish red (5YR 4/6), ~70% fine to medium sand, ~30% low plasticity fines [TERRACE]	0.0 (HS)	Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5	3	4 10 13	yellowish red (5YR 5/6), trace clayey nodules		PID readings are headspace (HS) in resealable plastic bags
6.5	4	3 7 6	strong brown (7.5YR 5/6)	0.0 (HS)	Bulk sample collected from 0.5 to 5 ft bgs
9			light olive brown (2.5Y 5/4), ~85% fine to medium sand, ~15% low plasticity fines		
10	5	9 8 14	olive brown (2.5Y 4/4)		
11			POORLY GRADED SAND (SP): olive yellow (2.5Y 6/6), ~95% fine to medium sand, ~5% fines [TERRACE]		
11.5	6	5 12 14	NR mottled very dark grayish brown (2.5Y 3/2) and very pale brown (10YR 8/3)	0.0 (HS)	

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				POORLY GRADED SAND (SP): continued mottled yellow (2.5Y 8/6) and black (2.5/N)		
15	7		8			
			14	pale yellow (2.5Y 8/4)		
16			17			
			8	yellow (2.5Y 8/6)		
17			12			
	8		15			
18						
19						
20			6	pale yellow (2.5Y 8/4)		
	9		18			
21			35			
			32	light gray (2.5Y 7/2) [BEDROCK]	0.0 (HS)	
22	10		50/3"			
		NR				
23						
24				SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~70% fine to medium sand, ~30% low to medium plasticity fines, predominantly fine sand		
25			23			
	11		26			
26	12		50/5"			
27						
28				CLAYEY SAND (SC): light gray (2.5Y 7/2), moist, ~65% fine sand, ~45% medium plasticity fines		
29						
30			19			
	13		24			
31					0.0	

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-4 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
	14		50	CLAYEY SAND (SC): continued	(HS)	
32						
33						
34				~70% fine to medium sand, ~30% medium plasticity fines, predominantly fine sand		
35			15			
36	15		39		0.0 (HS)	
	16		50/3"	light yellowish brown (2.5Y 6/3), ~60% fine sand, ~40% fines		
37						
38						
39						
40			11			
				LEAN CLAY (CL): olive gray (5Y 5/2), moist, ~100% fines, trace medium sand, medium plasticity, slow dilatancy, thin platy structure		
41	17		39			
	18		50			
42						
43				CLAYEY SAND (SC): grayish brown (2.5Y 5/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines		
44						
45			15			
	19		34		0.0 (HS)	
46	20	NR	50/3"			
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-4 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				CLAYEY SAND (SC): continued		
49				SILTY SAND (SM): pale yellow (2.5Y 7/3), ~60% fine to medium sand, ~40% low to medium plasticity fines, predominantly fine sand		
50	21		12			
51	22	NR	50/5"			
52						
53				light yellowish brown (2.5Y 6/3)		
54						
55	23		14			Drilled to 60 ft bgs, pulled augers back to 54 ft bgs. Depth to water after 5 minutes = 58.15 ft bgs.
56	24	NR	50/5"			
57						Groundwater sample GB4-25 collected with disposable bailer: pH = 6.69 SEC = 7.77 mS/cm Turbidity = >999 NTU Temp. = 23.7°C
58						
59						
60				Bottom of boring at 60 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
61						
62						
63						
64						
65						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California			Log of Boring No. GB-5		
BORING LOCATION: South of Tank #5, in basin			ELEVATION AND DATUM: ~31' MSL		
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.			DATE STARTED: 10/24/05	DATE FINISHED: 10/24/05	
DRILLING METHOD: Hollow-stem auger			TOTAL DEPTH (ft.): 40.0	MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer			DEPTH TO WATER	FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: See remarks			LOGGED BY: A. Gonzalez		
HAMMER WEIGHT: 140 lbs	DROP: 30 in.		RESPONSIBLE PROFESSIONAL: D. Paul		REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~31' MSL	PID READING (ppm)	REMARKS
	1			asphalt		Hand augered to 5 ft bgs
1				POORLY GRADED SAND with GRAVEL (SP): olive brown (2.5Y 4/3), moist, ~60% fine to coarse sand, ~40% fine igneous angular to subangular gravel [FILL]		8-inch diameter boring
				CLAYEY SAND (SC): light yellowish brown (2.5Y 6/3), ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
2	2				0.0 (HS)	
3						Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4						
5			17	gray (2.5Y 6/1)		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
	3		50/5"		0.0 (HS)	
6		NR				PID readings are headspace (HS) in resealable plastic bags
7			11	light gray (2.5Y 7/1)		
			29			Bulk sample collected from 0.5 to 4 ft bgs
8	4		47		0.0 (HS)	
9						
10			18			
	5		36			
11	6	NR	50/4"			
12						
13						
14						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-5 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				CLAYEY SAND (SC): continued		
15			17			
	7		26	SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~80% fine to medium sand, ~20% low plasticity fines	0.0 (HS)	
16	8		50			
17						
18						
19				pale yellow (2.5Y 7/3), ~70% fine to medium sand, ~30% low plasticity fines, predominantly fine sand		
20	9		14	trace fine gravel		
	10		50/5"		0.0 (HS)	
21		NR				
22						
23				light brownish gray (2.5Y 6/2), ~80% fine to medium sand, ~20% low plasticity fines, predominantly fine sand		
24						
25	11		15		0.0 (HS)	
	12		50/4"			
26						
27						
28				light reddish brown (5Y 6/4), trace gravel (sandstone)		
29						
30	13			pale yellow (2.5Y 7/3)	0.0 (HS)	
	14		50			
31		NR				

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-5 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR		SILTY SAND (SM): continued		
32						
33				CLAYEY SAND (SC): light gray (2.5Y 7/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines		
34						Drilled to 40 ft bgs, pulled augers back to 36 ft bgs. Depth to water after 27 minutes = 37.16 ft bgs.
35	15		33			
	16		50			Groundwater sample GB5-17 collected with disposable bailer: pH = 7.23 SEC = 10.7 mS/cm Turbidity = >999 NTU Temp. = 28.6°C
36		NR				
37						
38						
39						
40				Bottom of boring at 40 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
41						
42						
43						
44						
45						
46						
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-6**		
BORING LOCATION: West of Tank #4, on berm	ELEVATION AND DATUM: ~31' MSL		
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/25/05	DATE FINISHED: 10/26/05	
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 60.0	MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER	FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez		
HAMMER WEIGHT: 140 lbs / DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336	

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~31' MSL	PID READING (ppm)	REMARKS
	1			asphalt		Hand augered to 5 ft bgs
				SILTY SAND with GRAVEL (SM): dark yellowish brown (10YR 4/4), moist, ~55% fine to medium sand, ~30% igneous subrounded to subangular gravel, ~15% fines [FILL]		8-inch diameter boring
1				SILTY SAND (SM): strong brown (7.5YR 4/6), moist, ~70% fine to medium sand, ~30% low plasticity fines [TERRACE]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
2						
3	2			brown (7.5YR 4/4)		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4				SILTY SAND with GRAVEL (SM): brownish yellow (10YR 6/8), moist, ~70% fine to coarse sand, ~15% fine to coarse subrounded gravel, ~15% fines [TERRACE]		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5	3		2 4 10	SILTY SAND (SM): strong brown (7.5YR 4/6), moist, 70% fine to medium sand, ~30% low plasticity fines [TERRACE]	0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags
6	4		5 8 7	strong brown (7.5YR 5/6)		Bulk sample collected from 0.5 to 5 ft bgs
7						
8						
9				POORLY GRADED SAND (SP): yellowish brown (10YR 5/6), moist, ~95% fine to medium sand, ~5% fines		
10	5		6 5 9			
11			5 8 10	mottled olive yellow (2.5Y 6/6) and black (2.5/N)		
12	6				0.0 (HS)	
13						
14						

Log of Boring No. GB-6 (cont'd)

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
			POORLY GRADED SAND (SP): continued		
15		5	mottled light gray (2.5Y 7/2) and black (2.5/N)		
	7	10			
16		11			
		7	mottled pale yellow (2.5Y 7/4) and black (2.5/N)		
17		12			
	8	14			
18				0.0 (HS)	
19			yellow (2.5Y 7/6), trace fine gravel		
20		2			
	9	9			
21		22	pale yellow (2.5Y 8/4), trace coarse sand and fine gravel		
		9			
22		18	olive yellow (2.5Y 6/6)		
	10	15	SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~70% fine to medium sand, ~30% low to medium plasticity fines, predominantly fine sand [BEDROCK]		
23				0.0 (HS)	
24					
25		10			
	11	29		0.0 (HS)	
26	12	50/5"			
27					
28			CLAYEY SAND (SC): light brownish gray (2.5Y 6/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines, predominantly fine sand		
29					
30		17			
	13	26		0.0 (HS)	
31					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-6 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
	14		50	CLAYEY SAND (SC): continued		
32						
33				light gray (2.5Y 7/2)		
34						
35	15		19		0.0 (HS)	
	16		50/5"			
36		NR				
37						
38				SILTY SAND (SM): light gray (2.5Y 7/1), moist, ~80% fine to medium sand, ~20% fines, predominantly fine sand		
39						
40			10	mottled with red (2.5YR 4/8)		
	17		23			
41	18		50		0.0 (HS)	
42						
43				mottled white (2.5Y 8/1) and black (2.5/N)		
44						
45	19		14		0.0 (HS)	
	20		50/5"			
46		NR				
47				CLAYEY SAND (SC): light brownish gray (2.5Y 6/2), ~70% fine to medium sand, ~30% medium plasticity fines, predominantly fine sand		
48						

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				CLAYEY SAND (SC): continued		
49				SILT with SAND (ML): light gray (2.5Y 7/1), dry, ~85% fines, ~15% fine sand, low plasticity		
50	21		14			
	22	NR	50/5"	SILTY SAND (SM): light olive gray (5Y 6/2), moist, ~85% fine to medium sand, ~15% low plasticity fines, predominantly fine sand		
51						
52						
53				CLAYEY SAND (SC): pale olive (5Y 6/3), moist, ~70% fine to medium sand, ~30% low to medium plasticity fines, predominantly fine sand		
54						
55	23		12			Drilled to 60 ft bgs, pulled augers back to 50 ft bgs. Borehole is dry 10/25/05. Depth to water 10/26/05 at 0714 = 54.0 ft bgs.
	24	NR	50/5"			
56						
57						Groundwater sample GB6-25 collected with disposable bailer: pH = 6.92; SEC = 17.7 mS.cm; Turbidity = 99 NTU; Temp. = 22.5°C
58						
59						
60				Bottom of boring at 60 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
61						
62						
63						
64						
65						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	Log of Boring No. GB-7	
BORING LOCATION: Southwest of Tank #4, on berm	ELEVATION AND DATUM: ~55' MSL	
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/25/05	DATE FINISHED: 10/25/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 60.0	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez	
HAMMER WEIGHT: 140 lbs / DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~55' MSL	PID READING (ppm)	REMARKS
			asphalt		Hand augered to 5 ft bgs
1	1		SILTY SAND with GRAVEL (SM): dark yellowish brown (10YR 3/2), moist, ~55% fine to medium sand, ~30% fine igneous subrounded to subangular gravel, ~15% fines [FILL]		8-inch diameter boring
2	2		SILTY SAND (SM): strong brown (7.5YR 4/6), moist, ~70% fine to medium sand, ~30% low plasticity fines [TERRACE]	0.0 (HS)	Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3–4			brown (7.5YR 4/4)		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
5			strong brown (7.5YR 4/6)		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
6	3	12, 22, 27			PID readings are headspace (HS) in resealable plastic bags
7		8, 11	yellowish brown (10YR 5/6)		
8	4	11		0.0 (HS)	Bulk sample collected from 0.5 to 5 ft bgs
9			POORLY GRADED SAND (SP): mottled light olive brown (2.5Y 5/6) and black (2.5/N), ~95% fine to medium sand, ~5% fines		
10–11	5	6, 9, 12			
12		8, 11	yellowish brown (10YR 5/6)		
13	6	12			
14					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-7 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				POORLY GRADED SAND (SP): continued		
15			4			
	7		4	mottled very dark grayish brown (10YR 3/2) and very pale brown (10YR 8/3)		
16		NR	14			
			16	pale yellow (2.5Y 7/4)		
17			15			
	8		21	light olive brown (2.5Y 5/6)		
18					0.0 (HS)	
19				POORLY GRADED SAND with GRAVEL (SP): yellow (2.5Y 7/6), ~60% fine to coarse sand, ~30% fine to coarse subrounded gravel, ~10% fines		
20			10			
	9		27		0.0 (HS)	
21			37			
			23			
22	10		26			
			50	SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~70% fine to medium sand, ~30% low to medium plasticity fines [BEDROCK]		
23						
24						
25				gray (2.5Y 6/1), ~75% fine to medium sand, ~25% low to medium plasticity fines		
			12			
	11		32			
26	12	NR	50/5"			
27						
28				light brownish gray (2.5Y 6/2)		
29						
30						
	13		15			
	14		50/5"			
31						

Log of Boring No. GB-7 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued		
32						
33				CLAYEY SAND (SC): light brownish gray (2.5Y 6/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines		
34						
35	15		9		0.0 (HS)	
	16		50/4"			
36		NR				
37						
38				light gray (2.5Y 7/2), ~65% fine to medium sand, ~45% medium plasticity fines		
39						
40			15			
41	17		38		0.0 (HS)	
	18		50/5"			
42						
43				light brownish gray(2.5Y 6/2)		
44						
45	19		13		0.0 (HS)	
	20		50/5"			
46		NR		SILTY SAND (SM): light yellowish brown (2.5Y 6/3), moist, ~70% fine to medium sand, ~30% low to medium plasticity fines, predominantly fine sand		
47						
48						

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued pale yellow (2.5Y 7/3), ~80% fine to medium sand, ~20% low plasticity fines, predominantly fine sand		
49						
50	21		14			
	22		50/5"			
51		NR				
52						
53				light yellowish brown (2.5Y 6/3)		
54						
55	23					
	24		50/5"		0.0 (HS)	Drilled to 60 ft bgs, pulled augers back to 55 ft bgs. Depth to water after 5 minutes = 56.4 ft bgs.
56		NR				
57						Groundwater sample GB7-25 collected with disposable bailer: pH = 7.2 SEC = 8.25 mS/cm Turbidity = >999 NTU Temp. = 24.5°C
58						
59						
60				Bottom of boring at 60 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
61						
62						
63						
64						
65						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-8**		
BORING LOCATION: Northeast of Tank #2, in basin	ELEVATION AND DATUM: ~55' MSL		
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/20/05	DATE FINISHED: 10/21/05	
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 36.5	MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER	FIRST	COMPL. 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez		
HAMMER WEIGHT: 140 lbs DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336	

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~55' MSL	PID READING (ppm)	REMARKS
0	1		SILTY SAND (SM): yellowish brown (10YR 5/6), moist, ~60% fine to medium sand, ~40% low plasticity fines [FILL]	0.0 (HS)	Hand augered to 5 ft bgs
1					8-inch diameter boring
2					Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3			light yellowish brown (2.5Y 6/3), fine gravel sized silt nodules present		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
5		3	light olive brown (2.5Y 5/4), ~75% fine to medium sand, ~25% fines		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
6	2	15			
		17			PID readings are headspace (HS) in resealable plastic bags
7		10			
		15	SILTY SAND with GRAVEL (SM): light olive brown (2.5Y 5/4), moist, ~70% fine to medium sand, ~15% fine gravel, ~15% fines [TERRACE]		Bulk sample collected from 0 to 5 ft bgs
8	3	18			
9				0.0 (HS)	
10		4			
11	4	16	SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~60% fine to medium sand, ~40% low plasticity fines, predominantly fine sand [BEDROCK]		
		17			
12		15			
		37	~80% fine to medium sand, ~20% fines		
13	5	49		0.0 (HS)	
14					

RMRK3

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-8 (cont'd)

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
			SILTY SAND (SM): continued		
15		15			
	6	31		0.0 (HS)	
16	7	50/4"			
17					
18					
19			~75% fine to medium sand, ~25% fines		
20		20			
	8	33		0.0 (HS)	
21	9	50/4"	pale yellow (2.5Y 7/4)		
22					
23					
24			light gray (2.5Y 7/2), ~85% fine to medium sand, ~15% low plasticity fines		
25					
26	10			0.0 (HS)	
	11				
27					
28					
29			pale olive (5Y 6/3)		
30		11		0.0 (HS)	
	12				
	13	50/5"			
31					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-8 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR		SILTY SAND (SM): continued		
32						
33						
34						
35	14		13		0.0 (HS)	
36	15	NR	50/5"			
37				Bottom of boring at 36.5 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-9**	
BORING LOCATION: Northeast of Tank #3, in basin	ELEVATION AND DATUM: ~44' MSL	
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/20/05	DATE FINISHED: 10/20/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 40.0	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER / FIRST:	COMPL.: / 24 HRS.:
SAMPLING METHOD: See remarks	LOGGED BY: K. Howe/A. Gonzalez	
HAMMER WEIGHT: 140 lbs / DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~44' MSL	PID READING (ppm)	REMARKS
0	1			SILTY SAND (SM): brown (10YR 5/3), moist, ~60% fine to medium sand, ~40% low plasticity fines, trace organic matter [FILL]	0.0 (HS)	Hand augered to 5 ft bgs
1						8-inch diameter boring
2				light yellowish brown (2.5Y 6/3), fine gravel sized silt nodules present		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3–4				light yellowish brown (2.5Y 6/4), ~65% fine to medium sand, ~30% low plasticity fines, ~5% fine to coarse gravel sized silt nodules		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
5–6	2		22 / 22 / 23	light yellowish brown (2.5Y 6/3), ~75% fine to coarse sand, ~25% low plasticity fines	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
6.5–8	3		10 / 16 / 29	CLAYEY SAND (SC): pale yellow (2.5Y 8/3), ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		PID readings are headspace (HS) in resealable plastic bags Bulk samples collected from 0 to 5 ft bgs and 16.9 to 17.5 ft bgs
10–11.5	4	NR	9 / 16 / 22	black (2.5/N) mottling		
11.5–13	5		4 / 26 / 36	SILTY SAND (SM): yellow (2.5Y 7/6), ~80% fine to medium sand, ~20% low plasticity fines		
14						

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				CLAYEY SAND (SC): white (2.5Y 8/1), moist, ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		
15			9			
	6		22			
16			36			
			6	mottled with very dark brown (2.5Y 3/1)		
17			8			
				LEAN CLAY (CL): light brownish gray (2.5Y 6.4) mottled with very dark brown (2.5Y 3/1), ~100% fines, trace fine sand, no dilatancy, medium toughness		
	7		24			
18				pale yellow (2.5Y 8/3)		
19				SILTY SAND (SM): light brownish gray (2.5Y 6/2), moist, ~70% fine to medium sand, ~30% low plasticity fines, predominantly fine sand [BEDROCK]		
20			15			
	8		34			
21	9	NR	50/2"			
22						
23						
				light yellowish brown (2.5Y 6/3)		
24						
25			9		0.0 (HS)	
	10		25			
26	11	NR	50/4"			
27						
28						
				pale yellow (2.5Y 7/3)		
29						
30			10			
	12		37			
31	13					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-9 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR	50/3"	SILTY SAND (SM): continued	0.0 (HS)	
32						
33						
34				light yellowish brown (2.5Y 6/3), ~60% fine to medium sand, ~40% low plasticity fines		
35			25			
	14		50/4"			
36	15	NR				Drilled to 40 ft bgs. Depth to water = 38.45 ft bgs.
37				light olive brown (2.5Y 5/3)		Groundwater sample GB9-16 collected with disposable bailer
38						
39						
40				Bottom of boring at 40 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
41						
42						
43						
44						
45						
46						
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-10**
BORING LOCATION: Southeast of Tank #3, in basin	ELEVATION AND DATUM: ~45' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/20/05 — DATE FINISHED: 10/20/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 36.5 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER — FIRST: — COMPL.: — 24 HRS.:
SAMPLING METHOD: See remarks	LOGGED BY: K. Howe/A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~45' MSL	PID READING (ppm)	REMARKS
0	1			SILTY SAND (SM): brown (10YR 5/3), moist, ~60% fine to medium sand, ~40% low plasticity fines, trace organic matter [FILL]	0.0 (HS)	Hand augered to 5 ft bgs
1						8-inch diameter boring
2				light yellowish brown (2.5Y 6/3), trace fine gravel sized silt nodules		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3						
4				CLAYEY SAND (SC): light yellowish brown (2.5Y 6/3), ~60% fine to medium sand, ~40% medium plasticity fines		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
5			11			PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
6	2		19			
		NR	30			PID readings are headspace (HS) in resealable plastic bags
7			9	SILTY SAND (SM): grayish brown (2.5Y 5/2), moist, ~60% fine to medium sand, ~40% low plasticity fines [BEDROCK]		
			10			Bulk samples collected from 0 to 5 ft bgs and 5 to 15 ft bgs
8	3		11			
9				CLAYEY SAND (SC): light yellowish brown (2.5Y 6/3), moist, ~60% fine sand, ~40% medium plasticity fines		
10			3			
11	4		8			
			11			
12			5	SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~65% fine to medium sand, ~35% low plasticity fines	0.0 (HS)	
	5		16			
13		NR	30			
14						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-10 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued		
15	6		9 24 50/5"	mottled pale yellow (2.5Y 7/3) and olive yellow (2.5Y 6/6)		
16		NR			0.0 (HS)	
17	7	NR	16 50	white (2.5Y 8/1), ~70% fine to medium sand, ~30% low plasticity fines		
18				POORLY GRADED SAND (SP): white (2.5Y 8/1), moist, ~95% fine to medium sand, ~5% fines		
19						
20	8 9	NR	11 32 50/5"			
21				CLAYEY SAND (SC): pale yellow (2.5Y 8/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines		
22						
23						
24				SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~60% fine to medium sand, ~40% low plasticity fines		
25	10 11	NR	18 46 50			
26				SANDY LEAN CLAY (CL): light gray (2.5Y 7/2), moist, ~60% fines, ~40% fine sand, medium plasticity, no dilatancy, high dry strength	0.0 (HS)	
27						
28						
29				SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~65% fine to medium sand, ~35% low plasticity fines		
30	12 13		23 39			
31						

Log of Boring No. GB-10 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR	50/5"	SILTY SAND (SM): continued		
32						
33				light yellowish brown (2.5Y 6/3), ~75% fine sand, ~25% low plasticity fines		
34						
35	14		15		0.0 (HS)	
	15	NR	50/5"			
36						
37				Bottom of boring at 36.5 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California		Log of Boring No. GB-11		
BORING LOCATION: North of Tank #2, in basin		ELEVATION AND DATUM: ~45' MSL		
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.		DATE STARTED: 10/21/05	DATE FINISHED: 10/21/05	
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 40.0	MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer		DEPTH TO WATER / FIRST	COMPL.	24 HRS.
SAMPLING METHOD: See remarks		LOGGED BY: K. Howe/A. Gonzalez		
HAMMER WEIGHT: 140 lbs	DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336	

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~45' MSL	PID READING (ppm)	REMARKS
0–1	1		SILTY SAND (SM): dark yellowish brown (10YR 4/4), moist, ~70% fine to medium sand, ~30% low plasticity fines [FILL]	0.0 (HS)	Hand augered to 5 ft bgs 8-inch diameter boring
2	2		light yellowish brown (2.5Y 6/4), ~60% fine to medium sand, ~40% fines, trace fine gravel sized silt nodules	0.0 (HS)	Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3–4			light olive brown (2.5Y 5/4), ~75% fine to medium sand, ~25% fines		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5–6	4	10, 15, 20, 19	SILTY SAND with GRAVEL (SM): light olive brown (2.5Y 5/4), moist, ~60% fine to medium sand, ~20% fines, ~20% fine to coarse gravel [TERRACE] iron oxidation present		PID readings are headspace (HS) in resealable plastic bags
7–8	5	12, 29 (NR)			Bulk sample collected from 0 to 5 ft bgs
9–11	6	13, 18, 35	SILTY SAND (SM): mottled light gray (2.5Y 7/2) and very dark gray (2.5Y 3/1), moist, ~60% fine to medium sand, ~40% fines [BEDROCK]	0.0 (HS)	
12–13	7	14, 29, 50	pale yellow (2.5Y 3/3), ~80% fine to medium sand		
14					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-11 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued light gray (2.5Y 7/2), ~85% fine to medium sand, ~15% low plasticity fines		
15			11		0.0 (HS)	
	8		27			
16	9		36			
17						
18				CLAYEY SAND (SC): light gray (2.5Y 7/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines		
19						
20			16			
	10		33	mottled with reddish yellow (7.5YR 6/8)		
21	11		46			
22						
23				SILTY SAND (SM): pale yellow (2.5Y 7/3), ~80% fine to medium sand, ~20% low to medium plasticity fines		
24						
25			12			
	12		41			
26	13		50/4"		0.0 (HS)	
27				mottled light brownish gray (2.5Y 6/2) and dark yellowish brown (10YR 4/4)		
28						
29						
30			13			
31	14		36		0.0	

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-11 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist. % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
	15		50	SILTY SAND (SM): continued	(HS)	
32						
33				pale olive (5Y 6/4), predominantly fine sand		
34						
35			18			Drilled to 40 ft bgs, pulled augers back to 35 ft bgs. Depth to water after 15 minutes = 39.7 ft bgs.
36	16		31			
	17		50			Groundwater sample GB11-18 and duplicate sample GB11-19 collected with disposable bailer: pH = 7.42 SEC = 4.54 mS/cm Turbidity = >999 NTU Temp. = 23.5°C
37						
38						
39						
40				Bottom of boring at 40 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
41						
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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-12**
BORING LOCATION: Southeast of Tank #2, in basin	ELEVATION AND DATUM: ~45' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/21/05 ; DATE FINISHED: 10/21/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 36.5 ; MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST ; COMPL. ; 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: K. Howe/A. Gonzalez
HAMMER WEIGHT: 140 lbs ; DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul ; REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~45' MSL	PID READING (ppm)	REMARKS
0–2	1		POORLY GRADED SAND with GRAVEL (SP): dark yellowish brown (10YR 4/2), moist, ~65% fine to coarse sand, ~20% fine igneous angular to subangular gravel, ~15% fines [FILL]	0.0 (HS)	Hand augered to 5 ft bgs 8-inch diameter boring Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard PID readings are headspace (HS) in resealable plastic bags Bulk sample collected from 0 to 5 ft bgs
2–5	2		SILTY SAND (SM): pale brown (10YR 6/3), ~75% fine to medium sand, ~25% low plasticity fines light yellowish brown (2.5Y 6/3)		
5–6		8			
6	4	13, 19	CLAYEY SAND (SC): mottled grayish brown (2.5Y 5/2) and grayish brown (10YR 5/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines dark grayish brown (2.5Y 4/2)		
7		5, 12		0.0 (HS)	
8	5	18	SILTY SAND (SM): pale olive (5Y 6/3), moist, ~85% fine to medium sand, ~45% low plasticity fines [TERRACE]		
10–11	6	3, 9, 14	mottled light gray (2.5Y 7/1) and olive yellow (2.5Y 6/8) [BEDROCK] ~60% fine to medium sand, ~40% fines	0.0 (HS)	
12		5, 9	LEAN CLAY (CL): light olive gray (5Y 6/2), ~90% fines, ~10% fine sand, medium plasticity, medium toughness		
13	7	16	CLAYEY SAND (SC): olive (5Y 5/6), ~60% fine sand, ~40% medium plasticity fines ~70% fine to medium sand, ~30% low plasticity fines	0.0 (HS)	
14					

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued		
15			2			
	8		22	~60% fine to medium sand, ~40% fines	0.0 (HS)	
16	9	NR	48			
17						
18						
19						
20			9	mottled with yellowish brown (10YR 5/8)		
				LEAN CLAY (CL): light olive gray (5Y 6/2), moist, ~90% fines, ~10% fine sand, medium plasticity, medium to high toughness, very dark gray (5Y 3/1) fractures		
21	10		26		0.0 (HS)	
	11		29			
22						
23						
24				SILTY SAND (SM): light gray (5Y 7/1), moist, ~75% fine to medium sand, ~25% low plasticity fines		
25			18			
	12		32			
26	13				0.0 (HS)	
	14	NR	50/4"	LEAN CLAY with SAND (CL): light olive gray (5Y 6/2), moist, ~85% fines, ~15% fine sand, medium plasticity, medium toughness		
27						
28						
29				POORLY GRADED SAND (SP): pale yellow (5Y 8/2), moist, ~95% fine to medium sand, ~5% fines		
30			9			
31	15		29		0.0 (HS)	

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-12 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
	16	X	50/4"	CLAYEY SAND (SC): light olive gray (5Y 6/2), moist, ~60% fine sand, ~40% medium plasticity fines		
32						
33						
34				pale olive (5Y 6/3)		
35	17	■	7		0.0 (HS)	
	18	X	50/4"			
36		NR				
				Bottom of boring at 36.5 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-13**
BORING LOCATION: Southwest of Tank #3, in basin	ELEVATION AND DATUM: ~36' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/20/05 — DATE FINISHED: 10/20/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 36.5 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER — FIRST — COMPL. — 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: K. Howe/A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~36' MSL	PID READING (ppm)	REMARKS
0–3	1		spilled/hardened bunker oil POORLY GRADED SAND (SP): yellowish brown (10YR 5/6), moist, ~95% fine to medium sand, ~5% fines, trace asphalt pieces [FILL]	0.0 (HS)	Hand augered to 5 ft bgs 8-inch diameter boring Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3–5.5			CLAYEY SAND (SC): grayish brown (10YR 5/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines, trace cobbles [BEDROCK]		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5–6.5	2	29, 46, 38	POORLY GRADED SAND with SILT (SP-SM): brown (10YR 5/3), moist, ~90% fine to medium sand, ~10% low plasticity fines	0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags Bulk sample collected from 0 to 5 ft bgs
6.5–8	3	26, 19, 22			
9–11.5	4	10, 11, 17	SILTY SAND (SM): olive yellow (2.5Y 6/6), moist, ~70% fine to medium sand, ~30% low plasticity fines [BEDROCK]		
11.5–13	5	13, 34, 44	light brownish gray (2.5Y 6/2), ~60% fine to medium sand, ~40% low plasticity fines	0.0 (HS)	

Log of Boring No. GB-13 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				CLAYEY SAND (SC): light gray (2.5Y 7/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines		
15						
16	6, 7				0.0 (HS)	
17						
18				SILTY SAND (SM): pale yellow (2.5Y 7/3), moist, ~85% fine to medium sand, ~15% low plasticity fines		
19						
20			16			
21	8, 9		44, 50/5"			
22						
23						
24				~80% fine to medium sand, ~20% low to medium plasticity fines		
25	10, 11		18, 50/3"			
26		NR				
27						
28				light yellowish brown (2.5Y 6/3), ~70% fine to medium sand, ~30% low plasticity fines		
29						
30	12, 13		12, 50/5"		0.0 (HS)	
31						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-13 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR		SILTY SAND (SM): continued		
32						Drilled to 36 ft bgs, pulled augers back to 30 ft bgs. Depth to water = 34.5 ft bgs.
33						Groundwater sample GB13-16 collected with disposable bailer
34				CLAYEY SAND (SC): light yellowish brown (2.5Y 6/3), ~55% fine to medium sand, ~45% medium plasticity fines		
35	14		13			
	15		50/4"			
36		NR				
37				Bottom of boring at 36.5 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
38						
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46						
47						
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-14**
BORING LOCATION: West of Tank #2, on berm	ELEVATION AND DATUM: ~36' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/19/05 — DATE FINISHED: 10/19/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 46.5 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST — COMPL. — 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: K. Howe/A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~36' MSL	PID READING (ppm)	REMARKS
0	1		SANDY LEAN CLAY (CL): brown (10YR 4/3), moist, ~60% fines, ~40% fine to medium sand, medium plasticity [FILL]	0.0 (HS)	Hand augered to 5 ft bgs
1					8-inch diameter boring
2			CLAYEY SAND (SC): very pale brown (10YR 8/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3–4			SILTY SAND (SM): dark yellowish brown (10YR 4/4), moist, ~85% fine to medium sand, ~15% fines [TERRACE]		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
5	2	14			PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
6	3	20	yellowish brown (10YR 5/6)		
		17			PID readings are headspace (HS) in resealable plastic bags
7		5			
		8			
8	4	13	strong brown (7.5YR 5/6)	0.0 (HS)	Bulk sample collected from 0 to 5 ft bgs
9			brown (10YR 4/3), ~70% fine to medium sand, ~30% low plasticity fines		
10		3			
11	5	7	yellowish brown (10YR 5/6), ~85% fine to medium sand, ~15% fines		
		7	dark yellowish brown (10YR 5/6), ~70% fine to medium sand, ~30% fines		
12		3			
		6			
13	6	9			
14					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-14 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued		
15	7		4			
			41			
16		NR	50/2.5"			
			18	~80% fine to medium sand, ~20% fines		
17	8		38			
		NR	50/3"			
18						
19				SANDY LEAN CLAY (CL): pale brown (10YR 6/3), ~55% fines, ~45% fine to medium sand, medium plasticity		
20			8		0.0 (HS)	
21	9		8			
	10		23			
22						
23						
24						
25			3	light brownish gray (10YR 6/2)	0.0 (HS)	
	11		13			
26	12	NR	50/4"			
27						
28				SILTY SAND (SM): very pale brown (10YR 8/2), moist, ~80% fine to medium sand, ~20% fines [BEDROCK]		
29						
30			8		0.0 (HS)	
	13		50/5"			
31	14					

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-14 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
		NR		SILTY SAND (SM): continued		
				light gray (10YR 7/2)		
32						
33						
34						
35	15		5	very pale brown (10YR 8/2)		
	16		23	~85% fine to medium sand, ~15% low plasticity fines		
36		NR	50/4"			
37						
38						
39						
40	17					
41		NR		POORLY GRADED SAND with SILT (SP-SM): moist to wet, ~90% fine to medium sand, ~10% fines		
42				SILTY SAND (SM): very pale brown (10YR 7/3), ~70% fine to medium sand, ~30% fines		
43						
44						
45	18		14			
	19		50/4"			
46		NR			0.0 (HS)	Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
47				Bottom of boring at 46.5 ft bgs		
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California		Log of Boring No. GB-15	
BORING LOCATION: Southwest of Tank #2, on berm		ELEVATION AND DATUM: ~32' MSL	
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.		DATE STARTED: 10/19/05	DATE FINISHED: 10/19/05
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 46.5	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer		DEPTH TO WATER / FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: See remarks		LOGGED BY: K. Howe/A. Gonzalez	
HAMMER WEIGHT: 140 lbs	DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~32' MSL	PID READING (ppm)	REMARKS
			asphalt		Hand augered to 5 ft bgs
1	1		SILTY SAND (SM): light olive brown (2.5Y 5/4), moist, ~70% fine to medium sand, ~30% low plasticity fines [FILL]	0.0 (HS)	8-inch diameter boring
2			light yellowish brown (2.5Y 6/3), trace coarse gravel		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3–4			POORLY GRADED SAND with CLAY (SP-SC): pale yellow (2.5Y 7/3), moist, ~90% fine to medium sand, ~10% fines		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4–5			SILTY SAND (SM): light olive brown (2.5Y 5/4), moist, ~70% fine to medium sand, ~30% fines, some clay present		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5	2	9 7 11	dark yellowish brown (2.5Y 4/6)		PID readings are headspace (HS) in resealable plastic bags
7	3	8 12 17		0.0 (HS)	Bulk samples collected from 0 to 5 ft bgs and 5 to 10 ft bgs
8			dark yellowish brown (2.5Y 4/4) [TERRACE]		
9.5			dark brown (7.5YR 3/3), ~80% fine to medium sand, ~20% low plasticity fines		
10–11	4	12 16 14			
12	5	4 5 5		0.0 (HS)	
13			LEAN CLAY with SAND (CL): brown (10YR 4/3), ~80% fines, ~20% fine to medium sand, medium plasticity		
14					

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter	PID READING (ppm)	REMARKS
				LEAN CLAY with SAND (CL): continued		
15			4	dark grayish brown (10YR 4/2)		
	6		24	SILTY SAND (SM): light gray (2.5Y 7/2), ~70% fine to medium sand, ~30% low plasticity fines [BEDROCK]		
16			15			
			4	SANDY LEAN CLAY (CL): light brownish gray (2.5Y 5/1), ~55% fines, ~45% fine to medium sand, medium plasticity		
17			8			
	7		10			
18						
19						
20			5	light gray (2.5Y 7/2), thin platy structure		
	8		22			
21			49			
22						
23						
24						
25			9			
	9		17	dark gray (2.5Y 4/1)		
26			26			
27						
28				SILTY SAND (SM): light gray (2.5Y 7/2), ~70% fine to medium sand, ~30% low plasticity fines		
29						
30			15			
			19	SANDY LEAN CLAY (CL): see next page		
31						

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
	10		50/5"	SANDY LEAN CLAY (CL): light brownish gray (2.5Y 6/2), moist, ~55% fines, ~45% fine to medium sand, medium plasticity		
32						
33						
34				POORLY GRADED SAND with SILT (SP-SM): pale yellow (2.5Y 7/3), ~90% fine to medium sand, ~10% low plasticity fines		
35	11		17 50/5"		0.0 (HS)	
36		NR				
37						
38				SILTY SAND (SM): light gray (2.5Y 7/2), ~80% fine to medium sand, ~20% low plasticity fines		
39						
40	12		15 36 50/3"			
41						
42						
43				▼ light olive brown (2.5Y 5/3)		
44						
45	13		25 50/4"			
46		NR				Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
47				Bottom of boring at 46.5 ft bgs		
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	Log of Boring No. GB-16	
BORING LOCATION: Southwest of Tank #2, on berm	ELEVATION AND DATUM: ~44' MSL	
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 1/18/05	DATE FINISHED: 10/19/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 46.5	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Mart Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER / FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: K. Howe/A. Gonzalez	
HAMMER WEIGHT: 140 lbs / DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~44' MSL	PID READING (ppm)	REMARKS
				asphalt	0.3 (HS)	Hand augered to 5 ft bgs
1	1			SILTY SAND (SM): light olive brown (2.5Y 5/4), moist, ~80% fine to coarse sand, ~20% low plasticity fines [FILL]		8-inch diameter boring
2						Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3				SANDY LEAN CLAY (CL): light yellowish brown (2.5Y 6/4), moist, ~60% fines, ~40% fine to medium sand, medium plasticity gray (2.5Y 5/1)		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4						
5			3	yellowish brown (10YR 5/6)		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
6	2		7 12	POORLY GRADED SAND with SILT (SP-SM): yellowish brown (10YR 5/4), moist, ~90% fine to medium sand, ~10% low plasticity fines [TERRACE]	0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags
7			5 7			Bulk samples collected from 0 to 5, 5.5 to 10, 18 to 20, and 20 to 25 ft bgs
8	3		6			
9						
10			3		0.0 (HS)	
11	4		2 2	SILTY SAND (SM): strong brown (7.5YR 4/6), moist to wet, ~75% fine to medium sand, ~25% low plasticity fines		
12						
13						
14						

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued dark yellowish brown (10YR 4/4), ~70% fine to medium sand, ~30% low plasticity fines [BEDROCK]		
15	5		9 50/5"			
16		NR		olive brown (2.5Y 4/3), ~80% fine to medium sand, ~20% low plasticity fines		
17	6		10 20 28			
18				light olive brown (2.5Y 5/4), trace cobbles	0.0 (HS)	
19						
20	7		4 11 20	SANDY LEAN CLAY (CL): light gray (2.5Y 7/2), moist, ~60% fines, ~40% fine to medium sand, medium plasticity		
21						
22	8		14 24 37	SILTY SAND (SM): pale yellow (2.5Y 8/2), moist, ~75% fine to medium sand, ~25% low plasticity fines		
23						
24						
25	9		5 25			
26		NR	50/3"	SANDY LEAN CLAY (CL): light brownish gray (2.5Y 6/2), moist, ~60% fines, ~40% fine to medium sand, medium plasticity		
27						
28				SILTY SAND (SM): pale yellow (2.5Y 7/3), moist, ~80% fine to medium sand, ~20% low plasticity fines		
29						
30	10		6 21		0.0 (HS)	
31						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-16 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
			47	SILTY SAND (SM): continued		
32						
33				SANDY LEAN CLAY (CL): light yellowish brown (2.5Y 6/3), ~70% fines, ~30% fine to medium sand, medium plasticity		
34						
35	11		15 50/5"			
36		NR		POORLY GRADED SAND with SILT (SP-SM): light gray (2.5Y 6/3), moist, ~90% fine to medium sand, ~10% low plasticity fines		
37						
38				SILTY SAND (SM): light gray (2.5Y 7/2), moist, ~80% fine to medium sand, ~20% low plasticity fines		
39						
40	12	NR	12 37 50/3"			Drilled to 45 ft bgs, pulled augers back to 40 ft bgs. Depth to water after 5 minutes = 42.91 ft bgs. Groundwater sample GB16-14 collected with disposable bailer: pH = 6.98 Turbidity = >999 NTU Temp. = 29.9°C
41						
42						
43						
44						
45	13		50/6"			
46		NR				Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
47				Bottom of boring at 46.5 ft bgs		
48						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California		Log of Boring No. GB-17		
BORING LOCATION: Southwest of Tank #3, on berm		ELEVATION AND DATUM: ~43' MSL		
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.		DATE STARTED: 1/18/05	DATE FINISHED: 10/18/05	
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 46.5	MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer		DEPTH TO WATER	FIRST	COMPL. 24 HRS.
SAMPLING METHOD: See remarks		LOGGED BY: K. Howe/A. Gonzalez		
HAMMER WEIGHT: 140 lbs	DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul		REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~43' MSL	PID READING (ppm)	REMARKS
				asphalt		Hand augered to 5 ft bgs
1	1			SILTY SAND (SM): brown (10YR 5/3), moist, ~80% fine to coarse sand, ~20% low plasticity fines [FILL]	1.1 (HS)	8-inch diameter boring
2				light yellowish brown (2.5Y 6/3), ~85% fine to medium sand, ~15% low plasticity fines		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings and 1.5" x 18" SPT sampler
3						Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4				POORLY GRADED SAND with SILT (SP-SM): dark yellowish brown (10YR 4/4), moist, ~90% fine to medium sand, ~10% low plasticity fines		
5	2		7	SILTY SAND (SM): light gray (2.5Y 7/2), ~75% fine to medium sand, ~25% low plasticity fines [TERRACE]		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
6			12			
		NR	15			PID readings are headspace (HS) in resealable plastic bags
7						Bulk samples collected from 1 to 5, 5 to 10, 10 to 15, 16.5 to 18, and 25 to 30 ft bgs
8						
9						
10			4	light olive brown (2.5Y 5/4), moist, ~75% fine to medium sand, ~25% low to medium plasticity fines	0.0 (HS)	
11	3		7			
			9	~80% fine to medium sand, ~20% low plasticity fines		
12			4	strong brown (7.5YR 4/6)		
			8			
13	4		9			
14				yellowish brown (10YR 5/4)		

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
				SILTY SAND (SM): continued		
15			8	dark yellowish brown (10YR 4/6)		
	5		9	strong brown (7.5YR 5/6)		
16			8			
			5			
17			8	dark grayish brown (10YR 4/2)	0.0 (HS)	
	6		9			
18						
19						
20			6	SILTY SAND (SM): yellow (2.5Y 7/8), moist, ~80% fine to medium sand, ~20% low plasticity fines		
	7		24	pale yellow (2.5Y 8/2) [BEDROCK]		
21		NR	50/4"			
22						
23						
				SANDY LEAN CLAY (CL): light yellowish brown (2.5Y 6/4), moist, ~55% fines, ~45% fine to medium sand, medium plasticity		
24						
25			12			
	8		29			
26			50/4"			
27						
28				light yellowish brown (2.5Y 6/3)		
29						
30			22	SILTY SAND (SM): light gray (2.5Y 7/1), ~70% fine to medium sand, ~30% low plasticity fines		
			50/5"			
31						

PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. GB-17 (cont'd)

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast, density, structure, cementation, react. w/HCl, geo. inter.	PID READING (ppm)	REMARKS
	9	X		SILTY SAND (SM): continued	0.1 (HS)	
32						
33						
34						
35	10	X	16 50/4"		0.0 (HS)	
36		NR		POORLY GRADED SAND with SILT (SP-SM): light gray (2.5Y 7/2), moist, ~90% fine to medium sand, ~10% low plasticity fines		
37				SANDY LEAN CLAY (CL): light brownish gray (2.5Y 6/2), moist, ~60% fines, ~40% fine to medium sand, medium plasticity		
38						
39				light gray (2.5Y 7/2)		
40	11	X	12 40 50/3"		0.0 (HS)	
41						
42						
43						
44				POORLY GRADED SAND with SILT (SP-SM): light brownish gray (2.5Y 6/2), moist, ~90% fine to medium sand, ~10% low plasticity fines		
45	12	X	28 50/5"		0.0 (HS)	
46		NR		SANDY LEAN CLAY (CL): light gray (2.5Y 7/2), moist, ~60% fines, ~40% fine to medium sand, medium plasticity		
47				Bottom of boring at 46.5 ft bgs		Boring destroyed by placing high solids bentonite grout through the center of the hollow-stem augers to fill the boring from bottom to top.
48						

PROJECT: ENCINA DESALINATION PLANT EIR, Carlsbad, California	**Log of Boring No. GB-18**
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~43' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05 — DATE FINISHED: 10/27/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER — FIRST: — COMPL.: — 24 HRS.:
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	SAMPLES: Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. — Surface Elevation: ~43' MSL	PID READING (ppm)	REMARKS
0			asphalt		Hand augered to 5 ft bgs
0–0.5	1		SILTY SAND with GRAVEL (SM): yellowish brown (10YR 5/4), moist, ~55% fine to medium sand, ~30% fine gravel, ~15% fines		8-inch diameter boring
1			SILTY SAND (SM): yellowish brown (10YR 5/4), moist, ~75% fine to medium sand, ~25% low plasticity fines, predominantly fine sand [TERRACE]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
2	2				
3					Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4			dark yellowish brown (10YR 4/6), trace coarse gravel		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5	3	4			
6		18			PID readings are headspace (HS) in resealable plastic bags
		19			
6.5		6	POORLY GRADED SAND with GRAVEL (SP): brownish yellow (10YR 6/6), moist, ~75% fine to coarse sand, ~20% fine to coarse subrounded gravel, ~5% fines	0.0 (HS)	Bulk sample collected from 0.5 to 2.5 ft bgs
7		11	POORLY GRADED SAND (SP): brownish yellow (10YR 6/6), moist, ~95% fine to medium sand, ~5% fines, trace fine gravel		
8	4	10			
9			yellowish brown (10YR 5/8)		
10	5	11			
11		29	POORLY GRADED SAND with GRAVEL (SP): yellow (10YR 7/6), ~80% fine to coarse sand, ~15% fine subrounded gravel, ~5% fines		
	NR	50			
11.5		13			
12		22			
12.5	6	32			Destroyed boring by backfilline with medium bentonite chips hydrated in place with potable water
13			Bottom of boring at 13 ft bgs		
14					

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-19**
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~39' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05 / DATE FINISHED: 10/27/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0 / MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER / FIRST / COMPL. / 24 HRS
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs / DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul / REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~39' MSL	PID READING (ppm)	REMARKS
				asphalt		Hand augered to 5 ft bgs
1	1			SILTY SAND with GRAVEL (SM): light yellowish brown (2.5Y 6/3), dry to moist, ~55% fine to medium sand, ~30% fine gravel, ~15% fines	0.0 (HS)	8-inch diameter boring
2	2			SILTY SAND (SM): dark yellowish brown (10YR 4/4), dry to moist, ~75% fine to medium sand, ~25% low plasticity fines, predominantly fine sand [TERRACE]	0.0 (HS)	Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
3						Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4						PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5	3		3 11 33			
6		NR				PID readings are headspace (HS) in resealable plastic bags
7			9 13	moist, dark yellowish brown (10YR 4/4)		Bulk sample collected from 0.5 to 2.5 ft bgs
8	4		11	brownish yellow (10YR 6/6), ~85% fine to medium sand, ~15% fines	0.0 (HS)	
9						
10	5		9 20 22	POORLY GRADED SAND with GRAVEL (SP): olive yellow (2.5Y 6/6), moist, ~75% fine to medium sand, ~20% fine to coarse subangular to subrounded gravel, ~5% fines		
11			17	pale yellow (2.5Y 7/3)		
12	6		17 12	POORLY GRADED SAND (SP): olive yellow (2.5Y 6/6), moist, ~95% fine to medium sand, ~5% fines		
13		NR		Bottom of boring at 13 ft bgs		Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
14						

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-20**
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~37' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05 — DATE FINISHED: 10/27/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER — FIRST: — COMPL.: — 24 HRS.:
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~37' MSL	PID READING (ppm)	REMARKS
0			asphalt		Hand augered to 5 ft bgs
0.5–1	1		SILTY SAND with GRAVEL (SM): light olive brown (2.5Y 5/3), ~55% fine to medium sand, ~30% igneous subangular to subrounded gravel, ~15% fines [FILL]		8-inch diameter boring
1.5–2	2		SILTY SAND (SM): pale yellow (2.5Y 7/3), ~80% fine to medium sand, ~20% low plasticity fines, trace coarse sand [TERRACE]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
3					Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4			CLAYEY SAND (SC): light gray (2.5Y 7/2), moist, ~80% fine to medium sand, ~20% medium plasticity fines, predominantly fine sand		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5–6.5	3	8, 8, 11		0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags
6.5–8	4	7, 11, 11	SILTY SAND (SM): light olive brown (2.5Y 5/4), moist, ~85% fine to medium sand, ~15% fines		Bulk sample collected from 0.5 to 2.5 ft bgs
10–11.5	5	2, 5, 16 (NR)			
10.7			POORLY GRADED SAND (SP): dark yellowish brown (10YR 4/6), ~95% fine to medium sand, ~5% fines		
11.5–13	6	9, 14, 16		0.0 (HS)	
12.5			mottled light yellowish brown (2.5Y 6/4) and black (2.5/N)		Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
13			Bottom of boring at 13 ft bgs		

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	Log of Boring No. GB-21		
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~35' MSL		
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05	DATE FINISHED: 10/27/05	
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0	MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER / FIRST:	COMPL.:	24 HRS.:
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez		
HAMMER WEIGHT: 140 lbs DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336	

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~35' MSL	PID READING (ppm)	REMARKS
0				asphalt		Hand augered to 5 ft bgs
				SILTY SAND with GRAVEL (SM): olive (5Y 4/3), moist, ~55% fine to medium sand, ~30% fine igneous subangular to subrounded gravel, ~15% fines [FILL]		8-inch diameter boring
1	1					
				light yellowish brown (2.5Y 6/4), ~65% fine to medium sand, ~20% fines, ~15% fine gravel		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
2	2			SILTY SAND (SM): strong brown (7.5YR 4/6), moist, ~80% fine to medium sand, ~20% low plasticity fines [TERRACE]		
3						Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4					0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5			5			
6	3		10		0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags
			21	strong brown (7.5YR 5/6)		
7			2	yellowish brown (10YR 5/6)		Bulk sample collected from 0.5 to 2.5 ft bgs
			11			
8	4		12			
9						
10			3		0.0 (HS)	
	5		19	POORLY GRADED SAND with GRAVEL (SP): yellowish brown (10YR 5/6), moist, ~80% fine to medium sand, ~15% fine to coarse subangular to subrounded gravel, ~5% fines		
11		NR	50/4"			
	6		21	SILTY SAND (SM): pale yellow (5Y 7/2), moist, ~80% fine to medium sand, ~20% low plasticity fines		
12			50/5"			
		NR				Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
13				Bottom of boring at 13 ft bgs		
14						

Log of Boring No. GB-22

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~8' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05 · DATE FINISHED: 10/27/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0 · MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST · COMPL. · 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs · DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul · REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~8' MSL	PID READING (ppm)	REMARKS
0–1	1			asphalt SILTY SAND with GRAVEL (SM): olive (5Y 4/3), moist, ~55% fine to medium sand, ~30% fine igneous subangular to subrounded gravel, ~15% fines [FILL]		Hand augered to 5 ft bgs 8-inch diameter boring
1–3	2			yellowish brown (10YR 5/6), ~65% fine to medium sand, ~20% fines, ~15% fine gravel, highly-oxidized metallic debris, some iron oxide staining	0.0 (HS)	Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
3–4				olive (5Y 5/4)		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4–5				SILTY SAND (SM): pale yellow (5Y 7/4), moist, ~80% fine to medium sand, ~20% low plasticity fines, trace gravel, trace fine asphalt	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5–6.5	3	NR	16 50/5"	mottled white (5Y 8/1) and yellowish brown (10YR 5/8), predominantly fine sand olive (5Y 5/4)	0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags
6.5–8	4	NR	17 50/5"	pale yellow (5Y 7/3), ~85% fine to medium sand, ~15% low plasticity fines, predominantly fine sand [BEDROCK]		Bulk sample collected from 0.5 to 4 ft bgs
10–11.5	5	NR	6 28 50/5"		0.0 (HS)	
11.5–13	6	NR	14 50/5"	pale yellow (5Y 7/4)		
13				Bottom of boring at 13 ft bgs		Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water

RMRK3

Log of Boring No. GB-23

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~3' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05 · DATE FINISHED: 10/27/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0 · MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST · COMPL. · 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs · DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul · REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~3' MSL	PID READING (ppm)	REMARKS
0			asphalt		Hand augered to 5 ft bgs
0.5	1		SILTY SAND with GRAVEL (SM): olive (5Y 4/3), moist, ~55% fine to medium sand, ~30% fine to coarse igneous subangular to subrounded gravel, ~15% fines, trace asphalt pieces		8-inch diameter boring
1			pale olive (5Y 6/4), ~65% fine to medium sand, ~20% fines, ~15% fine gravel [FILL]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
2	2				
3				0.0 (HS)	Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4			olive (5Y 5/4), trace coarse subrounded gravel		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5		6	SILTY SAND (SM): dark gray (5Y 4/1), moist, ~70% fine to medium sand, ~30% low plasticity fines, trace fine gravel, trace asphalt pieces	0.0 (HS)	
6	3	11	~80% fine to medium sand, ~20% fines, trace clayey coarse sand to fine gravel nodules, hydrocarbon odor		PID readings are headspace (HS) in resealable plastic bags
		14			
7		13			Bulk sample collected from 0.5 to 5 ft bgs
		14			
8	4	15	pale olive (5Y 6/4), no hydrocarbon odor		
9					
10		3	mottled pale olive (5Y 6/4) and light olive brown (2.5Y 5/6), trace fine gravel		
11	5	5			
		9			
		7	olive (5Y 5/3)		
12		17			
13	6	16		0.0 (HS)	Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
13			Bottom of boring at 13 ft bgs		
14					

RMRK3

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-24**
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~36' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05 — DATE FINISHED: 10/27/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER — FIRST — COMPL. — 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. — Surface Elevation: ~36' MSL	PID READING (ppm)	REMARKS
0–1	1		POORLY GRADED GRAVEL (GP): mottled light gray (5Y 7/1) and gray (5Y 5/1), ~95% fine to coarse gravel, ~5% sand, subangular to subrounded		Hand augered to 5 ft bgs 8-inch diameter boring
1–2			SILTY SAND with GRAVEL (SM): light olive brown (2.5Y 5/4), moist, ~55% fine to medium sand, ~30% fine to coarse subangular to subrounded gravel, ~15% fines [FILL]		Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
2	2		SILTY SAND (SM): yellowish brown (10YR 5/6), moist, ~80% fine to medium sand, ~20% low plasticity fines [TERRACE]		Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5–6.5	3	7, 7, 13	POORLY GRADED SAND (SP): mottled yellow (2.5Y 7/6) and black (2.5/N), moist, ~95% fine to medium sand, ~5% fines	0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags
6.5–8	4 (NR)	7, 13, 14	pale yellow (2.5Y 7/4)		Bulk sample collected from 0.5 to 2.5 ft bgs
9			strong brown (7.5YR 5/8), fine to coarse sand		
10–11.5	5	17, 13, 22		0.0 (HS)	
11.5–12.5	6 (NR)	12, 50/5"	SILTY SAND (SM): light gray (2.5Y 7/1), moist, ~85% fine to medium sand, ~15% fines		Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
13			Bottom of boring at 13 ft bgs		

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-25**
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~36' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05 — DATE FINISHED: 10/27/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 2.5 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER — FIRST: — COMPL.: — 24 HRS.:
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs — DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~36' MSL	PID READING (ppm)	REMARKS
0–1	1	■		POORLY GRADED GRAVEL (GP): mottled light gray (5Y 7/1) and gray (5Y 5/1), ~95% fine to coarse gravel, ~5% medium sand, subangular to subrounded [FILL]		Hand augered to 2.5 ft bgs 3-inch diameter boring
1–1.8				SILTY SAND with GRAVEL (SM): light olive brown (2.5Y 5/4), moist, ~55% fine to medium sand, ~30% fine to coarse subangular to subrounded gravel, ~15% fines		Geotech samples collected in resealable plastic bags; environmental samples collected in 4-oz glass jars
1.8–2.5	2	■		SILTY SAND (SM): dark yellowish brown (10YR 4/6), moist, ~80% fine to medium sand, ~20% low plasticity fines	0.0 (HS)	
2.5				Bottom of boring at 2.5 ft bgs		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard PID readings are headspace (HS) in resealable plastic bags Bulk sample collected from 0.5 to 2.5 ft bgs Concrete slab encountered at 2.5 ft bgs Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. GB-26**
BORING LOCATION: Along proposed pipeline	ELEVATION AND DATUM: ~36' MSL
DRILLING CONTRACTOR: Gregg Drilling and Testing, Inc.	DATE STARTED: 10/27/05; DATE FINISHED: 10/27/05
DRILLING METHOD: Hollow-stem auger	TOTAL DEPTH (ft.): 13.0; MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Marl Technologies, Inc. M12 w/auto hammer	DEPTH TO WATER: FIRST / COMPL. / 24 HRS.
SAMPLING METHOD: See remarks	LOGGED BY: A. Gonzalez
HAMMER WEIGHT: 140 lbs; DROP: 30 in.	RESPONSIBLE PROFESSIONAL: D. Paul; REG. NO. PG 6336

DEPTH (feet)	Sample No.	Blows/6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~36' MSL	PID READING (ppm)	REMARKS
0	1		POORLY GRADED GRAVEL (GP): mottled light gray (5Y 7/1) and gray (5Y 5/1), ~95% fine to coarse gravel, ~5% sand, subangular to subrounded [FILL]		Hand augered to 5 ft bgs
1			SILTY SAND with GRAVEL (SM): light olive brown (2.5Y 5/4), moist, ~55% fine to medium sand, ~30% fine to coarse subangular to subrounded gravel, ~15% fines		8-inch diameter boring
2	2		SILTY SAND (SM): strong brown (7.5YR 4/6), moist, ~80% fine to medium sand, ~20% low plasticity fines [TERRACE]	0.0 (HS)	Geotechnical samples collected in CA Modified drive sampler lined with 1" x 2.5" rings
3					Environmental samples collected with 4-oz glass jars and SPT sampler lined with 1.5" x 6" sleeves
4					PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
5	3	7, 13, 24	yellowish brown (10YR 5/6)		
6			POORLY GRADED SAND (SP): mottled pale yellow (2.5Y 7/4) and black (2.5/N), moist, ~95% fine to medium sand, ~5% fines		PID readings are headspace (HS) in resealable plastic bags
7	4	4, 9, 11	mottled pale yellow (2.5Y 8/4) and black (2.5/N)	0.0 (HS)	Bulk sample collected from 0.5 to 2.5 ft bgs
8			mottled pale yellow (2.5Y 8/3) and black (2.5/N)		
9			mottled pale yellow (2.5Y 7/4) and black (2.5/N)		
10	5	10, 23, 30			
12	6	9, 14, 11			
13			Bottom of boring at 13 ft bgs		Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
14					

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. HA-1**	
BORING LOCATION: Southeast of Tank #5, in basin	ELEVATION AND DATUM: ~31' MSL	
DRILLING CONTRACTOR: NA	DATE STARTED: 10/20/05	DATE FINISHED: 10/20/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 1.0	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER / FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: Grab	LOGGED BY: J. Klein	
HAMMER WEIGHT: NA DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~31' MSL	PID READING (ppm)	REMARKS
				asphalt		3-inch diameter boring
1	1	■		POORLY GRADED SAND with GRAVEL (SP): olive brown (2.5Y 4/3), moist, ~60% fine to coarse sand, ~40% fine angular to subangular gravel [FILL]	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
				CLAYEY SAND (SC): light brownish gray (10YR 6/2), ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		PID readings are headspace (HS) in resealable plastic bags
2				Bottom of boring at 1 ft bgs		Refusal at 1 ft bgs
3						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California		**Log of Boring No. HA-2**	
BORING LOCATION: Northeast of Tank #4, in basin		ELEVATION AND DATUM: ~30' MSL	
DRILLING CONTRACTOR: NA		DATE STARTED: 10/20/05	DATE FINISHED: 10/20/05
DRILLING METHOD: Hand auger		TOTAL DEPTH (ft.): 1.3	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger		DEPTH TO WATER / FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: Grab		LOGGED BY: J. Klein	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~30' MSL	PID READING (ppm)	REMARKS
				asphalt		3-inch diameter boring
1	1	■		POORLY GRADED SAND with GRAVEL (SP): olive brown (2.5Y 4/3), moist, ~60% fine to coarse sand, ~40% fine gravel [FILL]	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
				CLAYEY SAND (SC): light brownish gray (10YR 6/2), moist, ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		
2				Bottom of boring at 1.25 ft bgs		PID readings are headspace (HS) in resealable plastic bags
3						Refusal at 1.25 ft bgs
4						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California		**Log of Boring No. HA-3**	
BORING LOCATION: Southwest of Tank #5, in basin		ELEVATION AND DATUM: ~31' MSL	
DRILLING CONTRACTOR: NA		DATE STARTED: 10/20/05	DATE FINISHED: 10/20/05
DRILLING METHOD: Hand auger		TOTAL DEPTH (ft.) 2.3	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger		DEPTH TO WATER / FIRST	COMPL. / 24 HRS.
SAMPLING METHOD: Grab		LOGGED BY: J. Klein	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~31' MSL	PID READING (ppm)	REMARKS
0–0.3				POORLY GRADED GRAVEL (GP): dark gray (2.5Y 4/1), ~100% fine gravel, angular to subangular [FILL]		3-inch diameter boring
0.3–2.0	1	■		POORLY GRADED SAND with GRAVEL (SP): olive brown (2.5Y 4/3), moist, ~60% fine to coarse sand, ~40% fine gravel, trace asphalt pieces	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
2.0–2.25				CLAYEY SAND (SC): light brownish gray (10YR 6/2), moist, ~60% fine sand, ~40% medium plasticity fines [BEDROCK] Bottom of boring at 2.25 ft bgs		PID readings are headspace (HS) in resealable plastic bags Refusal at 2.25 ft bgs Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

Log of Boring No. HA-4

PROJECT: ENCINA DESALINATION PLANT EIR, Carlsbad, California	
BORING LOCATION: North of Tank #4, in basin	ELEVATION AND DATUM: ~30' MSL
DRILLING CONTRACTOR: NA	DATE STARTED: 10/20/05 — DATE FINISHED: 10/20/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 1.8 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER: FIRST — COMPL. — 24 HRS.
SAMPLING METHOD: Grab	LOGGED BY: J. Klein
HAMMER WEIGHT: NA — DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~30' MSL	PID READING (ppm)	REMARKS
				asphalt		3-inch diameter boring
1	1	■		POORLY GRADED SAND with GRAVEL (SP): olive brown (2.5Y 4/3), moist, ~60% fine to coarse sand, ~40% fine gravel [FILL]		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
	2	■		CLAYEY SAND (SC): mottled light brownish gray (10YR 6/2) and olive brown (2.5Y 4/3), moist, ~70% fine to medium sand, ~30% medium plasticity fines [FILL]	0.0 (HS)	
2				light brownish gray (10YR 6/2), ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		PID readings are headspace (HS) in resealable plastic bags
				Bottom of boring at 1.75 ft bgs		Refusal at 1.75 ft bgs
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4						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
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Log of Boring No. HA-5

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. HA-5**
BORING LOCATION: West of Tank #4, in basin	ELEVATION AND DATUM: ~30' MSL
DRILLING CONTRACTOR: NA	DATE STARTED: 10/20/05 — DATE FINISHED: 10/20/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 2.8 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER — FIRST: — COMPL.: — 24 HRS.:
SAMPLING METHOD: Grab	LOGGED BY: J. Klein
HAMMER WEIGHT: NA — DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. — Surface Elevation: ~30' MSL	PID READING (ppm)	REMARKS
0–1	1	■		POORLY GRADED SAND (SP): light olive brown (2.5Y 5/3), moist, ~100% fine to medium sand [FILL]		3-inch diameter boring
1–2.5				CLAYEY SAND (SC): mottled light olive brown (2.5Y 5/3) and light brownish gray (10YR 6/2), moist, ~70% fine to medium sand, ~30% medium plasticity fines	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
2.5–2.75	2	■		light brownish gray (10YR 6/2), ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		PID readings are headspace (HS) in resealable plastic bags
2.75				Bottom of boring at 2.75 ft bgs		Bulk sample collected from 0.5 to 1 ft bgs
						Refusal at 2.75 ft bgs
						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	Log of Boring No. HA-6			
BORING LOCATION: Southwest of Tank #4, in basin	ELEVATION AND DATUM: ~30' MSL			
DRILLING CONTRACTOR: NA	DATE STARTED: 10/20/05		DATE FINISHED: 10/20/05	
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 2.0		MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER	FIRST	COMPL.	24 HRS.
SAMPLING METHOD: Grab	LOGGED BY: J. Klein			
HAMMER WEIGHT: NA DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul		REG. NO. PG 6336	

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~30' MSL	PID READING (ppm)	REMARKS
	1			POORLY GRADED GRAVEL (GP): dark gray (2.5Y 4/1), ~100% fine gravel, angular to subangular [FILL]	0.0 (HS)	3-inch diameter boring
1				POORLY GRADED SAND with GRAVEL (SP): olive brown (2.5Y 4/3), moist, ~60% fine to coarse sand, ~40% fine gravel		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
	2			CLAYEY SAND (SC): light brownish gray (10YR 6/2), moist, ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		
2				Bottom of boring at 2 ft bgs		PID readings are headspace (HS) in resealable plastic bags
3						Refusal at 2 ft bgs
4						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. HA-7**		
BORING LOCATION: Southeast of Tank #4, in basin	ELEVATION AND DATUM: ~30' MSL		
DRILLING CONTRACTOR: NA	DATE STARTED: 10/20/05	DATE FINISHED: 10/20/05	
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 1.0	MEASURING POINT: Ground surface	
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER / FIRST	COMPL.	24 HRS.
SAMPLING METHOD: Grab	LOGGED BY: J. Klein		
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336	

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~30' MSL	PID READING (ppm)	REMARKS
				asphalt		3-inch diameter boring
	1	■		POORLY GRADED SAND with GRAVEL (SP): olive brown (2.5Y 4/3), moist, ~60% fine to coarse sand, ~40% fine angular to subangular gravel [FILL]	0.1 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
1				CLAYEY SAND (SC): light brownish gray (10YR 6/2), moist, ~60% fine sand, ~40% medium plasticity fines [BEDROCK]		PID readings are headspace (HS) in resealable plastic bags
2				Bottom of boring at 1 ft bgs		Bulk sample collected from 0.25 to 0.5 ft bgs
3						Refusal at 1 ft bgs
4						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
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Log of Boring No. HA-8

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	
BORING LOCATION: East of Tank #2, in basin	ELEVATION AND DATUM: ~45' MSL
DRILLING CONTRACTOR: NA	DATE STARTED: 10/19/05 / DATE FINISHED: 10/19/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 2.0 / MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER / FIRST / COMPL. / 24 HRS.
SAMPLING METHOD: Grab	LOGGED BY: J. Klein
HAMMER WEIGHT: NA DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul / REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~45' MSL	PID READING (ppm)	REMARKS
0–1				POORLY GRADED SAND with GRAVEL (SP): dark grayish brown (10YR 4/2), moist, ~80% fine to coarse sand, ~20% fine angular to subangular gravel [FILL]		3-inch diameter boring
1	1	■		CLAYEY SAND (SC): grayish brown (10YR 5/2), ~80% fine sand, ~20% medium plasticity fines	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
2	2	■		Bottom of boring at 2 ft bgs		PID readings are headspace (HS) in resealable plastic bags Refusal at 2 ft bgs Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California		Log of Boring No. HA-9	
BORING LOCATION: Northeast of Tank #3, in basin		ELEVATION AND DATUM: ~45' MSL	
DRILLING CONTRACTOR: NA		DATE STARTED: 10/19/05	DATE FINISHED: 10/19/05
DRILLING METHOD: Hand auger		TOTAL DEPTH (ft.): 4.5	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger		DEPTH TO WATER FIRST	COMPL. 24 HRS.
SAMPLING METHOD: Grab		LOGGED BY: J. Klein	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul	REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~45' MSL	PID READING (ppm)	REMARKS
0–1	1	■		POORLY GRADED SAND (SP): dark yellowish brown (10YR 4/4), moist, ~95% fine to medium sand, ~5% fines, trace asphalt pieces and clay nodules [FILL]		3-inch diameter boring Bulk sample collected from 2 to 3 ft bgs Refusal at 4.5 ft bgs Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
2	2	■		▼ wet		
4.5	3	■		Bottom of boring at 4.5 ft bgs		
5–14						

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PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	**Log of Boring No. HA-10**
BORING LOCATION: Southwest of Tank #2, in basin	ELEVATION AND DATUM: ~45' MSL
DRILLING CONTRACTOR: NA	DATE STARTED: 10/19/05 — DATE FINISHED: 10/19/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 3.0 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER — FIRST: — COMPL.: — 24 HRS.:
SAMPLING METHOD: Grab	LOGGED BY: J. Klein
HAMMER WEIGHT: NA — DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~45' MSL	PID READING (ppm)	REMARKS
	1	■		POORLY GRADED SAND with GRAVEL (SP): dark grayish brown (10YR 4/2), moist, ~65% fine to coarse sand, ~30% fine angular to subangular igneous (diorite) gravel, ~5% fines [FILL]	0.0 (HS)	3-inch diameter boring PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
1				CLAYEY SAND (SC): strong brown (7.5YR 4/6), moist, ~70% fine to medium sand, ~30% medium plasticity fines		
2	2	■		POORLY GRADED SAND (SP): strong brown (7.5YR 4/6), moist, ~95% fine to medium sand, ~5% fines		PID readings are headspace (HS) in resealable plastic bags
3	3	■		CLAYEY SAND (SC): mottled strong brown (7.5YR 4/6) and grayish brown (10YR 5/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines grayish brown (10YR 5/2) Bottom of boring at 3 ft bgs		Bulk sample collected from 0 to 1 ft bgs Refusal at 3 ft bgs Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
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Log of Boring No. HA-11

PROJECT: ENCINA DESALINATION PLANT EIR Carlsbad, California	Log of Boring No. HA-11
BORING LOCATION: West of Tank #3, in basin	ELEVATION AND DATUM: ~36' MSL
DRILLING CONTRACTOR: NA	DATE STARTED: 10/19/05 — DATE FINISHED: 10/19/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 4.0 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER — FIRST — COMPL. — 24 HRS.
SAMPLING METHOD: Grab	LOGGED BY: J. Klein
HAMMER WEIGHT: NA — DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ 6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~36' MSL	PID READING (ppm)	REMARKS
0				spilled/hardened bunker oil		3-inch diameter boring
0.5–1	1	■		POORLY GRADED SAND (SP): dark yellowish brown (10YR 4/4), moist, ~95% fine to medium sand, ~5% fines, trace asphalt pieces [FILL]	0.0 (HS)	PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
2.5	2	■		mottled with yellowish brown (10YR 5/4) ▼		PID readings are headspace (HS) in resealable plastic bags
3				CLAYEY SAND (SC): grayish brown (10YR 5/2), moist, ~60% fine to medium sand, ~40% medium plasticity fines [BEDROCK]		Bulk sample collected from 0.5 to 1.5 ft bgs
4	3	■		Bottom of boring at 4 ft bgs		Refusal at 4 ft bgs
5–14						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water

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PROJECT: ENCINA DESALINATION PLANT EIR
Carlsbad, California

Log of Boring No. HA-12

BORING LOCATION: West of Tank #2, in basin	ELEVATION AND DATUM: ~45' MSL
DRILLING CONTRACTOR: NA	DATE STARTED: 10/18/05 — DATE FINISHED: 10/18/05
DRILLING METHOD: Hand auger	TOTAL DEPTH (ft.): 4.3 — MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER: FIRST — COMPL. — 24 HRS.
SAMPLING METHOD: Grab	LOGGED BY: J. Klein
HAMMER WEIGHT: NA — DROP: NA	RESPONSIBLE PROFESSIONAL: D. Paul — REG. NO. PG 6336

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/6 inches	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: ~45' MSL	PID READING (ppm)	REMARKS
0–1	1	■		SILTY SAND (SM): dark brown (7.5YR 3/2), moist, ~80% fine to medium sand, ~20% low to medium plasticity fines [FILL]	0.0 (HS)	3-inch diameter boring
1–2				CLAYEY SAND (SC): strong brown (7.5Y 4/6), moist, ~70% fine to medium sand, ~30% medium plasticity fines		PID = MiniRAE 2000 photoionization detector calibrated to 100 ppm isobutylene standard
2	2	■			0.0 (HS)	PID readings are headspace (HS) in resealable plastic bags
3				mottled grayish brown (10YR 5/2)		
				caliche		Bulk sample collected from 1.5 to 2 ft bgs
4	3	■		grayish brown (10YR 5/2) [BEDROCK]	0.0 (HS)	
4.25				Bottom of boring at 4.25 ft bgs		Refusal at 4.25 ft bgs
5–6						Destroyed boring by backfilling with medium bentonite chips hydrated in place with potable water
7–14						

RMRK3

1.0 INTRODUCTION

1.1 Purpose and Scope

This report presents the results of our geotechnical and environmental investigation at the proposed Carlsbad Seawater Desalination Project site located at the Encina Generating Station in Carlsbad, California (Figure 1, Vicinity Map). The project will include construction of an intake pump station (at the southwest corner of the power plant), a desalination facility (at the location of existing Tank No. 3), associated piping, extension of the existing roadway east of the desalination facility, and new at-grade parking.

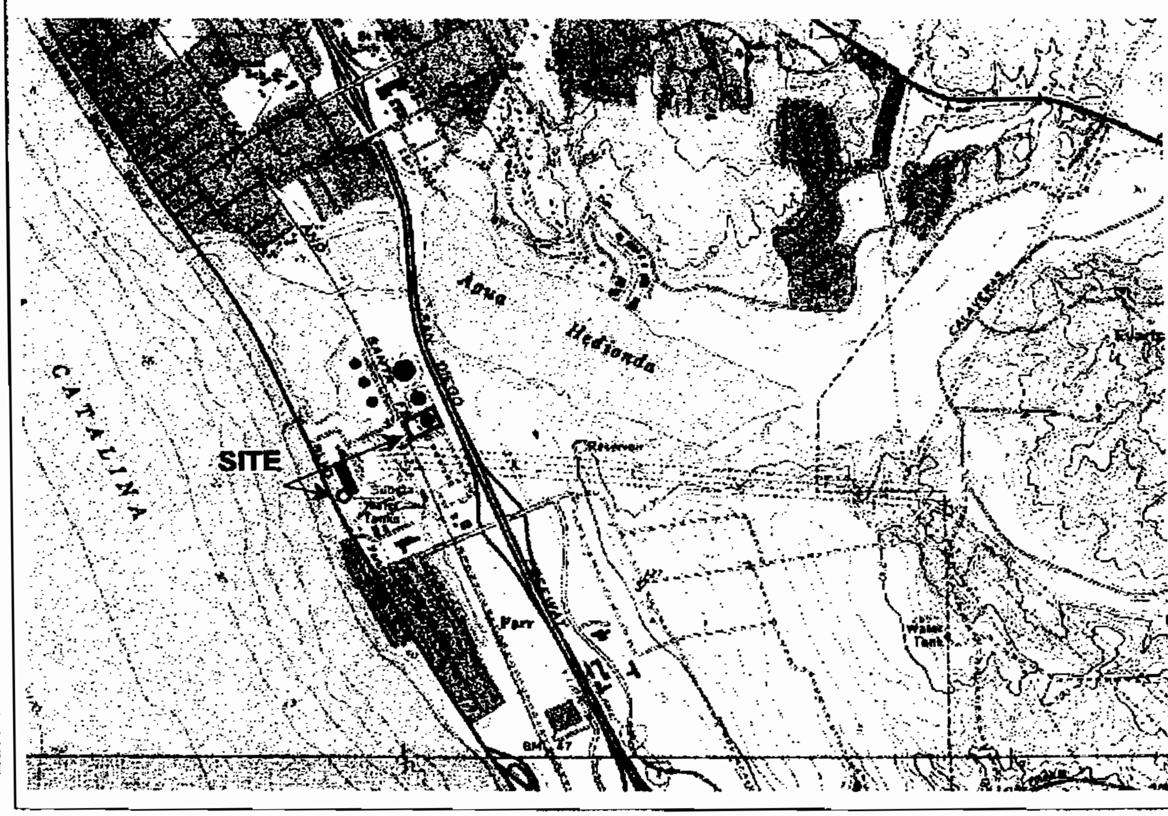
We anticipate the new wet well and intake pump station will be constructed near the southwestern corner of the Generating Station (Figure 2). The top of the wet well is proposed at an elevation of +10 feet and the base of the wet well is planned at approximately 25 feet below existing grade (or at an elevation of approximately –15 feet mean sea level (MSL) (PBS&J, 2003)).

The desalination structure is proposed to have two different lowest finish floor elevations. The Reverse Osmosis (RO) Building is proposed at a finish floor elevation of 36.5 feet MSL. The Pre-treatment Filters Building is proposed at a lowest finish floor elevation of 27.5 feet MSL. Minor filling and excavation on the order of 5 to 10 feet is anticipated for the RO Building and the Pre-Treatment Filters Building, respectively. The existing tank will be removed and the existing site piping will be re-routed as part of the construction. Investigation for the purpose of designing the pipelines associated with the proposed improvements was not part of this scope of work.

It was reported that the existing tank was constructed on a bed of heavy oil to reduce the potential for leaking. Accordingly, a limited environmental investigation was conducted to assess the extent of petroleum hydrocarbons-contaminated soil in the vicinity of Tank No. 3, and to screen for possible contaminants at the proposed wet well location adjacent to the Generating Station.

The purpose of this investigation was to evaluate the existing significant geotechnical and environmental conditions present at the site and develop conclusions and recommendations relative to the proposed development for use in the preparation of the project plans and specifications by Poseidon Resources. Our scope of services included:

- Review of available pertinent, published and unpublished geotechnical literature and maps.
- Field reconnaissance of the existing onsite geologic/geotechnical conditions.
- Coordination with Plant personnel to verify that the proposed boring locations would not



REFERENCE: U.S.G.S.,1967, 7.5 Minute Topographic Series, San Luis Rey Quadrangle

N

0 4,000 8,000 12,000 feet

Approximate Graphic Scale

1:48,000

FIGURE 1

CARLSBAD DESALINATION PROJECT
ENCINA GENERATING STATION
CARLSBAD, CALIFORNIA

Vicinity Map

GeoLogic Associates

Geologists, Hydrogeologists, and Engineers

Draft	Date	Project No.
AIF	12/03	2003-091

interfere with existing site usage or utilities.

- Preparation of a Health and Safety Plan for the field investigation.

- Subsurface exploration consisting of drilling, logging and sampling of eight exploratory borings at the site. One deep (50.5 feet) boring was drilled at the proposed intake pump station location. Six borings were completed within the proposed desalination facility footprint to depths that ranged from approximately 30.7 to 50.7 feet below the existing grade. One shallow (4 feet) boring was completed in the northeast corner of the site in the area where the existing roadway will be extended.

- Geotechnical laboratory testing of representative soil samples obtained from the subsurface exploration. Geotechnical testing included moisture content and dry density determination, gradation/sieve analysis, Atterberg limits, direct shear, R-Value, expansion index testing, soluble sulfate, consolidation, and corrosivity assessments, including pH and minimum resistivity determinations.

- Environmental analyses of shallow (upper 15 feet) soil samples from two borings adjacent to the existing tank, and one boring for the wet well/pump station. Environmental testing included analyses for the U. S. Environmental Protection Agency (USEPA) Priority Pollutants, Total Petroleum Hydrocarbons, Total Sulfide, and Ignitability.

- Analysis of the geotechnical and environmental data obtained from the field sampling and laboratory testing.

- Preparation of this report presenting our findings, conclusions, and recommendations with respect to the proposed site improvements.

2.0 DATA ACQUISITION

2.1 Document Review

Available geologic and geotechnical literature pertaining to the project site and surrounding areas was reviewed. The materials included published topographic maps, geologic maps, and reports. Specific documents reviewed are referenced in Section 8.0.

2.2 Site Reconnaissance

A GLA geologist visited the site to observe and map geologic conditions. Surface conditions were noted, including the general geologic and topographic setting, surface soils, and related conditions. The exploratory boring locations were also selected.

2.3 Subsurface Exploration

2.3.1 Site Safety

A health and safety plan for the site was prepared by GLA and is on file at GLA's San Diego office. The plan was kept on-site during the phases of field work supervised by GLA. GLA field personnel and subcontractors were required to read, sign, and comply with the plan. The plan is designed to identify hazards associated with the scope of work, including drilling, sample collection, chemicals of concern, and action levels. The plan also includes emergency information, hospital route, and contact numbers. Use of the plan is intended to protect on-site workers and the public.

2.3.2 Permitting

Before conducting the field investigation, GLA submitted a boring permit to Mr. Ernesto Profeta of the San Diego County Department of Environmental Health (DEH) for work on the site. The permit was approved on November 24, 2003. A copy of the permit is included in Appendix A.

2.3.3 Drilling and Soil Sampling

Subsurface exploration consisted of drilling and soil sampling of eight exploratory borings at the project site. The field exploration program was conducted at the site on December 1 and 2, 2003. Exploratory boring locations were selected within the proposed building areas to provide representative samples of the subsurface materials. One shallow boring (B-1, to a depth of 4 feet) was completed in the northeast corner of the site in the area of the proposed roadway extension. Six borings (B-2 through B-7) were located in the area of the proposed desalination plant at the existing Tank No. 3 site. These borings were advanced to approximate depths of 30.7 to 50.7 feet below the existing grade. One boring (B-8, 50.5 feet) was located at the proposed intake pump station location at the southwestern corner of the Generating Station. The location of the boring was placed approximately 100 feet southeast of the proposed pump station location due to subsurface utility conflicts. The approximate exploratory boring locations are shown on Figure 2, Site Plan. A cross section of the site through the borings is presented on Figure 3. The shallow borehole (B-1) was backfilled with onsite soils. The rest of the boreholes were grouted with bentonite and cold patched with asphalt, where applicable, prior to the GLA representative leaving the site.

Seven borings (B-2 to B-8) were drilled using hollow stem auger drilling equipment. Boring B-1 was completed with a portable hand auger. The drilling of exploratory boreholes was performed under the supervision of a GLA geologist who also logged the borings and obtained the samples for subsequent examination and laboratory testing. Both disturbed and relatively undisturbed samples were obtained from the borings for visual observation and testing in the laboratory.

Disturbed samples were collected from the drill cuttings (bulk samples) and during Standard Penetration Testing (SPT). Relatively undisturbed samples were obtained with a California sampler driven with a 140-pound automatic hammer falling from a 30-inch height. Samples were logged and field screened for volatile organic compounds (VOCs) with a portable photoionization detector (PID) by a GLA geologist. Subsurface materials were visually classified in the field in accordance with standard geologic practices, and the Unified Soil Classification System (USCS) explained in Appendix A. Details of the subsurface investigation and boring logs are presented in Appendix A. PID readings are included on the boring logs in Appendix A.

Prior to drilling and environmental sampling, the drill rig rods and sampling equipment were decontaminated with brushes and a non-toxic, non-phosphate detergent and water solution and rinsed using a potable water rinse. This process was repeated between each sampling interval to reduce the likelihood of cross-contamination.

2.3.4 Soil Disposal

Soil generated from drilling activities in the paved area for the proposed intake pump station (boring B-8) was placed in two 55-gallon Department of Transportation (DOT) drums and stored at the Hazmat waste storage shed at the plant pending waste characterization based on analytical results. Soil cuttings generated from drilling activities in the unpaved areas at the proposed Desalination Plant were placed on visqueen sheets and covered with visqueen. The soils were left at the project site awaiting direction from the environmental plant personnel.

2.4 Laboratory Testing

2.4.1 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples from all borings to provide geotechnical parameters for engineering analyses. The testing program was designed to fit the specific needs of this project. Tests of selected samples retrieved from the borings included moisture content and dry density determination, gradation/sieve analysis, Atterberg limits, direct shear, R-Value, expansion index testing, consolidation, and corrosivity assessments (including soluble sulfate, pH, and minimum resistivity). Descriptions of the tests performed, and the results of the tests, are summarized in Appendix B. Moisture and density values are presented on the exploratory boring logs in Appendix A.

2.4.2 Environmental Analyses

Soil samples from borings B-3, B-5, and B-8 were selected for laboratory analysis based on field readings using the PID, groundwater occurrence, and obvious hydrocarbon staining. Undisturbed soil samples from boring B-8 were collected at the groundwater table and within the "smear" zone. Undisturbed soil samples from borings B-3 and B-5 were collected at shallow depths (2 to 5 feet). In addition, disturbed composite samples were collected in the upper 10 to 15 feet in the other three borings. Undisturbed soil samples were collected in a brass sleeve covered with teflon, capped and sealed, and retained for possible chemical analysis. Disturbed (bulk) soil samples were collected into laboratory-provided glass sample containers. All samples were stored and transferred in a chilled cooler with ice, and submitted to the analytical laboratory following standard chain-of-custody procedures.

Six soil samples collected from borings B-3, B-5, and B-8 were analyzed for Extractable Fuel Hydrocarbons using EPA Modified 8015-California Department of Health Services (DOHS) method. One soil sample from each boring was analyzed for EPA Priority Pollutants, Total Sulfide, and Ignitability. Soil sample analyses included volatile organic compounds (VOCs) (including benzene, toluene, ethylbenzene, and xylenes [BTEX], methyl tertiary butyl ether [MTBE], and the oxygenates) by EPA Method 8260B, semi-VOCs (by EPA Method 8270C), chlorinated pesticides (by EPA Method 8081A), polychlorinated biphenyls (PCBs) (by EPA Method 8082), thirteen Priority Pollutant metals (by EPA Method 6010B/7471A), total cyanide (by EPA Method 9014), phenols (by EPA Modified Method 420.1), sulfide (by EPA Method 9034), 2,3,7,8-TCDD (dioxin) (by EPA Method 8280), and ignitability. Soil sample analyses were performed in DOHS-certified laboratories. Analytical data reports are presented in Appendix C.

3.0 SITE CONDITIONS

3.1 Site Location and Surface Conditions

The project site is located east of Carlsbad Boulevard and north of Cannon Road in the City of Carlsbad, San Diego, California (Figure 1). The proposed project is located adjacent to the Encina Generating Station facilities within the fenced power plant property (4600 Carlsbad Boulevard). The intake pump station will be constructed in the southwest corner of the existing power plant. The proposed desalination facility will be located at the existing Tank No. 3 site located northeast of the generating station. The proposed desalination facility will include a Reverse Osmosis (RO) building and Pre-Treatment/Media Filtration area. The RO building will consist of an RO Treatment area and will also house laboratory, offices, and administration space. Additional improvements at the desalination facility will include an extension of the existing roadway and construction of new at-grade parking adjacent to the RO building.

The proposed desalination facility site is presently occupied by a 140-foot diameter fuel tank (Tank No. 3) and associated piping. The site is surrounded by an approximately 10-foot high berm with a paved access road on top. The site is a part of the power plant tank farm. Surface elevations at Tank No. 3 range from approximately 31 to 35 feet MSL at the tank pad to about 41 feet MSL at the surrounding berm (based on the site plan prepared by PBS&J, May 2003).

Recent grading was accomplished (by others) in the western half of the Tank No. 3 site during GLA's scoping visit in November 2003. Excavation of up to 6 to 8 feet of contaminated soil was accomplished and clean soil was imported and placed in the excavation. Compaction of the fill was accomplished and reportedly documented by others. Accordingly, the current soil grade of the western portion of the site is only approximately as depicted on the site plan on Figure 2. Surface runoff generated onsite during rainy periods is likely to pond adjacent to the existing tank in the eastern portion of the site as well as in the center of the berm at the western portion of the site.

The existing ground surface elevation at the proposed wet well/intake pump station location is approximately +10 feet MSL (PBS&J, 2003). The area is currently surfaced with concrete and asphalt concrete.

3.2 Subsurface Conditions and Groundwater

The subject site is situated on the coastal plain of the Peninsular Ranges Geomorphic Province of California. The coastal plain area has undergone several episodes of marine inundation and subsequent marine regression throughout the last 54 million years, resulting in the deposition of a thick sequence of marine and non-marine sedimentary rocks on the uplifted and eroded high-relief basement terrain. Gradual emergence of the region from the sea occurred in Pleistocene time, and numerous wave-cut platforms, most of which were covered by relatively thin marine and non-marine terrace deposits, formed as the sea receded from the land. Accelerated fluvial erosion during periods of heavy rainfall, coupled with the lowering of the base sea level during Quaternary times, resulted in the rolling hills, mesas, and deeply incised canyons which characterize the landforms we see in the general site area today.

The general vicinity is underlain by Tertiary marine sediments capped by Quaternary marine and non-marine sediments deposited on wave-cut terraces. Each marine terrace was formed during a Pleistocene sea level high stand, and tectonically uplifted. Each subsequent sea-level rise would produce a new terrace, eventually forming a series of terraces along the modern shoreline, with the oldest terrace occupying the highest elevation. Based on our subsurface exploration, the majority of the project site is underlain by artificial fill and very light brown to green-brown silty sandstone interbedded with siltstone, mapped as the mid-Eocene Santiago Formation (Tan and Kennedy, 1996).

Artificial fill was encountered in all exploratory borings. It was observed at the ground surface in borings B-1 through B-7. At the intake structure in boring B-8, fill soil was encountered below the pavement section that consisted of 3 inches of asphalt concrete placed over 10 inches of aggregate base. Fill soils were encountered to approximately two to seven feet below ground surface (bgs). They consisted of damp to moist, fine to medium silty sand to fine sandy silt and silt. Expansion index testing of the fill soils generally indicates that the fill soils have a low expansion potential (expansion index from 21 to 50 per UBC, 1997 based on ASTM D4829).

In the area of the roadway extension, fill soils were encountered to the total explored depth of four feet in boring B-1. In the area of the desalination facility, fill soils were underlain by silty sandstone of the Santiago Formation in borings B-2 to B-7, by residual soil resulted from weathering and erosion of the Santiago Formation in boring B-7, and by lagoonal deposits in boring B-8.

Residual soils were encountered in boring B-7 at 2 to 8 feet bgs, and consisted of greenish gray, loose to medium dense, fine to medium clayey sand with scattered fine gravel. These soils were underlain by the Santiago Formation.

Lagoonal deposits were encountered in boring B-8 below the fill soils at 4 to 8 feet bgs. They were comprised of gray, dense, fine to medium micaceous silty sand. These deposits were underlain by the Santiago Formation.

The Eocene-age sedimentary strata of the Santiago Formation were encountered in all deeper borings (B-2 to B-8) to the maximum depth of exploration (50.7 feet). They were represented by light brown and greenish brown, fine- to coarse-grained silty sandstone with sandy siltstone and siltstone layers and clayey siltstone lenses. The silty sandstone locally varied from soft to hard and contained scattered fine gravel, and calcite/caliche joint filling. Difficult drilling conditions were encountered in boring B-4 at 10 to 13 feet bgs, likely due to gravel, and the borehole was re-located and re-drilled.

Groundwater was encountered in exploratory borings B-2, B-4, and B-6 through B-8. Groundwater was observed in the formational deposits at depths ranging from 20.8 to 28.9 feet (elevation of 1.1 to 14.2 feet MSL) at the Desalination Facility site, and at 12.4 feet bgs (elevation –11.4 feet MSL) at the intake pump location. Although groundwater was encountered at an elevation of –11.4 feet MSL, the actual static groundwater level is likely to be near or above mean sea level. It should be noted that the depths to groundwater observed in the borings represent temporary groundwater levels prior to backfilling, and should not be considered as the static groundwater table. The groundwater levels in borings are anticipated to vary seasonally. The groundwater levels observed during the field investigation are also presented in the boring logs in Appendix A and on Figure 3, Cross Section A-A' (for borings B-2 through B-7).

A geologic cross section (section A-A') of the site conditions along with the finish floor elevations of the proposed construction is presented on Figure 3.

4.0 FAULTING AND SEISMICITY

4.1 Faulting

Our discussion of faults on the site is prefaced with a discussion of California legislation and policies concerning the classification and land-use criteria associated with faults. By definition of the California Geological Survey, an active fault is a fault that has had surface displacement within Holocene time (about the last 11,000 years). The state geologist has defined a potentially active fault as any fault considered to have been active during Quaternary time (last 1,600,000 years). This definition is used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Geologic Hazards Zones Act of 1972 and as subsequently revised in 1975, 1985, 1990, 1992, and 1994. The intent of this act is to assure that unwise urban development and certain habitable structures do not occur across the traces of active faults. The subject site is not included within any Earthquake Fault Zones as created by the Alquist-Priolo Act. Our review of available geologic literature (Section 8.0) indicates that there are no known major or active faults on or in the immediate vicinity of the site. The nearest active regional faults are the Rose Canyon Fault Zone and the Newport-Inglewood Fault (offshore) located approximately 4.3 and 5.6 miles from the site, respectively.

4.2 Regional Seismicity

The site can be considered to lie within a seismically active region, as can all of Southern California. From a deterministic standpoint, Table 1 identifies potential seismic events that could be produced by the maximum (formerly referred to as maximum credible) earthquake event.

Table 1
Seismic Parameters for Active Faults

Fault Zone (Seismic Source)	Distance to Site (miles)	Maximum Earthquake Event		Design Earthquake*
		Moment Magnitude	Peak Horizontal Ground Acceleration (g)	Peak Horizontal Ground Acceleration (g)
Rose Canyon	4.3	6.9	0.31	0.28
Newport-Inglewood (Offshore)	5.6	6.9	0.27	
Coronado Bank	20.4	7.4	0.14	

Notes: * UBC (1997)

The maximum earthquake is defined by the State of California as the maximum earthquake that appears capable of occurring under the presently understood tectonic framework. Site-specific seismic parameters included in Table 1 are the distances to the causative faults, earthquake magnitudes (Mw), and expected ground accelerations, which were determined with EQFAULT and FRISKSP software (Blake, 2000a and Blake, 2000c).

As indicated in Table 1, the Rose Canyon Fault is the active fault considered to have the most significant effect at the site from a design standpoint. The maximum earthquake from the fault has a 6.9 moment magnitude, generating a peak horizontal ground acceleration of 0.31g at the project site. Secondary effects associated with severe ground shaking following a relatively large earthquake on a regional fault that may affect the site include ground lurching and shallow ground rupture, soil liquefaction and dynamic settlement, seiches and tsunamis. These secondary effects of seismic shaking are discussed in the following sections.

From a probabilistic standpoint, the design ground motion (per UBC, 1997) is defined as the ground motion having a 10 percent probability of being exceeded in 50 years (475-year return period). This ground motion is referred to as the design earthquake. The design earthquake ground motion at the site is predicted to be 0.28g.

The effect of seismic shaking may be mitigated by adhering to the Uniform Building Code and state-of-the-art seismic design parameters of the Structural Engineers Association of California. The site is located within Seismic Zone 4 (ICBO, 1997, Figure 16-2).

4.3 Historic Seismicity

The historic record of earthquakes in southern California for the past 200 years has been reasonably well established. More accurate instrumental measurements have been available since 1933. Based on recorded earthquake magnitudes and locations, the area may be vulnerable to moderate seismic ground shaking during the design life of the project. Review of historic earthquakes (Blake, 2000b) indicates that the most significant seismic event that impacted the site over the last 200 years was a Magnitude 6.5 earthquake event (south of the site on the Rose Canyon Fault) that occurred in 1800 approximately 9.8 miles from the site which was estimated to have caused a site acceleration of 0.19g at the site (Appendix D).

4.4 Seismic Lurching

Soil lurching refers to the rolling motion on the ground surface by the passage of seismic surface waves. Effects of this nature are likely to be significant where the thickness of soft sediments vary appreciably under structures. Damage to the proposed development should not be significant since a relatively large differential fill thickness does not exist below the site.

4.5 UBC Criteria

The soil parameters in accordance with UBC 1997, determined with UBCSEIS software (Blake, 2003), are as follows:

Seismic Zone = 4 (Figure 16-2, 1997 UBC)
Soil Profile Type = S_C (Table 16-J, 1997 UBC)
Slip Rate (Rose Canyon Fault), SR, (Table 16-U) = 1.5mm per year (CDMG, 1996)
Seismic Source Type (Table 16-U) = B
N_a = 1.0 (Table 16-S)
N_v = 1.1 (Table 16-T)
C_a = 0.40 (Table 16-Q)
C_v = 0.45 (Table 16-R)

4.6 Liquefaction and Dynamic Settlement

Liquefaction is a phenomenon in which soils lose shear strength for short periods of time during an earthquake, which may result in very large total and/or differential settlements for structures founded on liquefiable soils. In order for the potential effects of liquefaction to be manifested at the ground surface, the soils generally have to be granular, loose to medium dense, saturated relatively near the ground surface, and must be subjected to a sufficient magnitude and duration of shaking.

GLA has performed a liquefaction evaluation based on the SPT and California modified sampler blow counts (modified in accordance with the criteria of the NCEER workshop, 1997) observed during our drilling. Our calculations (Appendix D) indicate that the dynamic factor of safety under the design earthquake loading is above 1.3 (per CDMG, 1997) for the UBC, 1997 Design Earthquake event (475-year return period). The overall subsurface profile and the overlying thickness of non-saturated soils (non-liquefiable soils) indicates that the potential for large-scale liquefaction at the site during the life of the structure is very low. In addition, based on the age of the formational deposits (Tertiary materials of the Santiago Formation are on the order of 50 million years old), large-scale liquefaction effects at the ground surface are not considered likely. It is therefore our opinion that adverse liquefaction affects on the proposed structures due to the design earthquake event are unlikely.

It should be recognized, however, that many of the parameters used in liquefaction evaluation are subjective and open to interpretation. It should also be understood that much of Southern California is an area of moderate to high seismic risk and is not generally considered economically feasible to build structures totally resistant to earthquake related hazards. However, current standards in the Uniform Building Code for design and construction are intended to reduce the potential for major structural damage.

Calculated dynamic settlement of the ground at the site due to the design earthquake event is expected to produce a maximum differential settlement of approximately less than 1/3 inches in a horizontal distance of 100 feet, which is less than the estimated static settlement.

4.7 Ground Surface Rupture

Since no active faults are known to transect the site, ground surface rupture as a result of movement along known faults is considered unlikely.

4.8 Landslides

The site is located in a gently sloping area with slight topographic relief. Accordingly, the potential for landslides or other slope instability problems is considered to be low.

4.9 Tsunamis and Seiches

A tsunami is a sea wave generated by submarine earthquakes, landslides or volcanic activity, which displaces a relatively large volume of water in a very short period of time.

Several factors at the originating point such as earthquake magnitude, type of fault, depth of earthquake, focus, water depth, and the ocean bottom profile, all contribute to the size and momentum of a tsunami (Iida, 1969). In addition, factors such as the distance away from the originating point, coastline profile (including width of the continental shelf), and angle at which the tsunami approaches the coastline also affect the size and severity of a tsunami.

There have been over 500 tsunamis reported with recorded history, most of them generated at subduction-convergent plate boundaries along the margin of the Pacific Ocean. Large tsunamis have been occurring somewhere in the Pacific Basin at an average rate of roughly 1 every 12 years (Joy, 1968). Most complete reports along the California coast are available from San Diego and San Francisco where tide gauges were installed in 1854 (McCulloch, 1985).

Table 2 shows a number of great tsunamis that generated wave heights in excess of 0.2 m in San Diego representing each of the major generating zones within the Pacific Basin (based on information compiled in McCulloch, 1985).

Table 2
Major Tsunamis Recorded in San Diego County to 1975
(after McCulloch, 1985)

		San Diego		La Jolla	
Event Location, Magnitude[3]	**Date**	**Arrival Time[1](hrs)**	**Wave Height[2] (m)**	**Arrival Time[1] (hrs)**	**Wave Height[2] (m)**
Hawaii, Ms 7.1	11/29/75	?	0.12, (0.37 in Imperial Beach)	?	0.3
Prince William Sound, AK, M 9.2	3/27/64	+6.2	1.1	+5.8	0.7
Coast of central Chile, M 9.5	5/22/60	+14	1.5	+14	1.0
Rat Islands, M 9.1	3/9/57	+6.9	0.45	+6.6	0.6
Off east coast Kamchatka, M 9.0	11/5/52	+9.6	0.7	+9.6	0.24
Southern Alaska, M 7.4	4/1/46	?	0.37	+6.2	0.43
Off point Arguello, CA*, M 7.3	11/24/27	?	0.05[1]	+0.98	0.05[1]
Chile, Magnitude unknown Chile, Ms 8.5	8/13/1868 8/14/1868	?	0.8 0.3	?	?
San Diego Bay, San Diego, California	5/27/1862	The only locally generated tsunami that has affected San Diego; associated with an earthquake that caused the most intense shaking locally known; eyewitness account only.			

[1] Joy, 1968, [2] Agnew, 1979, Magoon, 1965
* This is the only well documented locally generated tsunami in California history.

Tsunami wave heights and runup elevations experienced along the San Diego coastline during the last 170 years (including the values presented in Table 2) have fallen within the normal range of tidal fluctuations (approximately 9 feet).

McCulloch (1985) predicts the average tsunami height in the San Diego region for an event with a 10% probability of being exceeded in 50 years is approximately 11.5 feet mean sea level, indicating a low potential for significant tsunami effects at the Desalination Plant site (site elevation is above 30 feet MSL). Southern California is oriented obliquely (i.e. not directly in line) with the major originating tsunami zones, it has a relatively wide (about 240 km) and rugged continental shelf (or borderland), which acts as a diffuser and reflector of remotely generated tsunami wave energy (Joy, 1968). These conditions, in addition to the geologic and seismic conditions (such as the strike-slip fault regime, and the scarcity of large submarine earthquakes) along the coastline also tend to minimize the likelihood of a large tsunami at the site. Based on these factors, there is low potential for catastrophic damage along the San Diego County coastline. However, minor problems such as flooding of low-lying coastal areas and damage to some waterfront structures might occasionally occur.

Seiches are defined as oscillations in a semi-confined body of water due to earthquake shaking. The site is located approximately 1,000 feet from the Agua Hedionda lagoon, however, the site elevation at 30 feet mean sea level significantly lessens the potential for seiches to affect the site.

4.2.7 Engineering Properties of the Onsite Soils

Samples of the near-surface fill soils were collected in borings B-2, B-4, and B-6. The test results indicate that the expansion potential of the fill soils is in the low range (expansion index from 21 to 50 per UBC, 1997 based on ASTM D4829). Samples of the formational materials were tested for their load-settlement characteristics by performing a consolidation test at representative intervals. The results of the consolidation tests indicate that the materials of the Santiago Formation perform well under the anticipated load of the proposed footings. Corrosion testing of the near-surface soils indicate that the soils have a negligible potential for sulfate attack on concrete and a severe potential for corrosion to buried, uncoated metal conduits. The test results are presented in Appendix B.

5.0 ENVIRONMENTAL TEST RESULTS

5.1 Results of Soil Sample Analyses

Field screening of soil samples obtained during drilling for VOCs was performed with a MiniRAE 2000 PID instrument. Results of field measurements indicated no VOC concentrations (in parts per million) measured above background values. The results of the laboratory analyses of soil samples from the environmental investigation are summarized in Table 3. Laboratory analytical reports are included in Appendix C.

TABLE 3 SUMMARY OF ENVIRONMENTAL TESTING

Sample ID/ Boring	Depth (feet bgs)	Date Sampled	EFH	ORGANOCHLORINE PESTICIDES		METALS						
				4,4-DDD	4,4-DDT	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
			mg/kg	µg/kg		mg/kg						
			8015M	8081A		6010B			7471B	6010B		
B-3	2-2.5	12/02/03	<5.0	--	--	--	--	--	--	--	--	--
	6-6.4	12/02/03	<5.0	140	410	8.4	5.6	<2.0	<0.020	2.5	<1.0	9.7
B-5	3-3.5	12/02/03	<5.0	--	--	--	--	--	--	--	--	--
	2-5.5	12/02/03	<5.0	<7.5	<7.5	8.1	9.4	<2.0	0.028	4.5	1.2	13
	5.6-6.1	12/02/03	<5.0	--	--	--	--	--	--	--	--	--
B-6	5-16.5	12/01/03	<5.0	<5.0	<5.0	8.8	4.6	2.0	<5.0	3.2	<1.0	18.0
	5.5-6.0	12/01/03	18	--	--	--	--	--	--	--	--	--
	15.5-16.0	12/01/03	<5.0	--	--	--	--	--	--	--	--	--

NOTES:

bgs = below ground surface

EFH = extractable fuel hydrocarbons (C6-C40) analyzed by EPA Modified 8015-DOHS method

mg/kg = milligrams per kilogram

µg/kg = micrograms per kilogram

-- = Denotes compounds not analyzed

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0 4,000 8,000 12,000 feet
Approximate Graphic Scale
1:48,000

N

FIGURE 1

CARLSBAD DESALINATION PROJECT
ENCINA GENERATING STATION
CARLSBAD, CALIFORNIA

Vicinity Map

GeoLogic Associates
Geologists, Hydrogeologists, and Engineers

Draft	Date	Project No.
AIF	12/03	2003-091

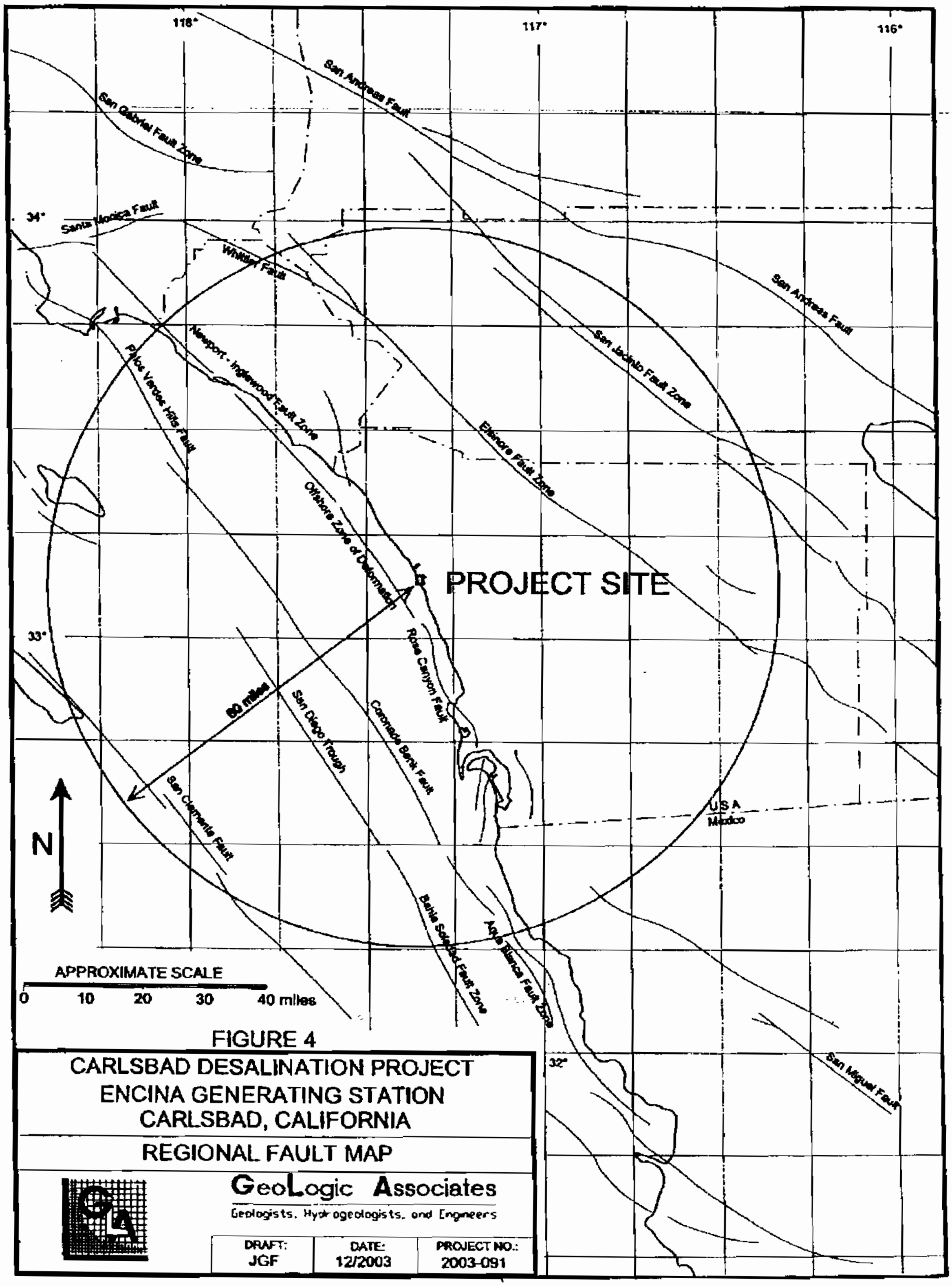


FIGURE 4

CARLSBAD DESALINATION PROJECT
ENCINA GENERATING STATION
CARLSBAD, CALIFORNIA

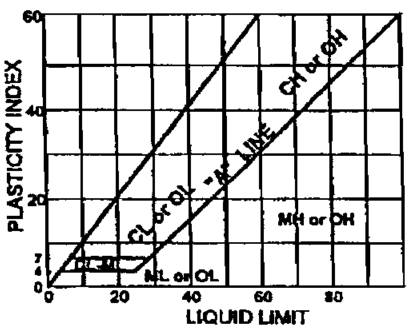
REGIONAL FAULT MAP

GeoLogic Associates
Geologists, Hydrogeologists, and Engineers

DRAFT:	DATE:	PROJECT NO.:
JGF	12/2003	2003-091

UNIFIED SOIL CLASSIFICATION

Pt	OH	CH	MH	OL	CL	ML	SC	SM	SP	SW	GC	GM	GP	GW
Highly Organic Soils	Silts and Clays Liquid Limit >50%			Silts and Clays Liquid Limit <50%			Sands with Fines >12% Fines		Clean Sands <5% Fines		Gravels with Fines >12% Fines		Clean Gravels <5% Fines	
							Sands - more than 50% of coarse fraction is smaller than No. 4 sieve				Gravels - more than 50% of coarse fraction is larger than No. 4 sieve			
Fine Grained Soils (more than 50% is smaller than No. 200 sieve)							Coarse Grained Soils (more than 50% is larger than No. 200 sieve)							



LABORATORY CLASSIFICATION CRITERIA

GW and SW: $Cu = D_{60}/D_{10}$ greater than 4 for GW, greater than 6 for SW
$Cc = D_{30}^2/D_{60} \times D_{10}$ between 1 and 3

GP and SP: Clean gravel or sand not meeting requirements for GW and SW

GM and SM: Atterberg Limits below "A" LINE and PI less than 4

GC and SC: Atterberg Limits above "A" LINE and PI greater than 7

Silt or Clay	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Coarse Gravel	Cobble	Boulder
Sieve Size 200	40	10	4	3/4"	3"	12"	

Classification of earth materials is based on field inspection and should not be construed to imply laboratory analysis unless so stated

MATERIAL SYMBOLS

- Asphalt
- Concrete
- Conglomerate
- Sandstone
- Silty Sandstone
- Clayey Sandstone
- Siltstone
- Sandy Siltstone
- Clayey Siltstone /Silty Claystone
- Claystone/Shale
- Calcaerous Sandstone
- Marl
- Limestone
- Dolostone
- Breccia
- Volcanic Ash/Tuff
- Metamorphic Rock
- Quartzite
- Extrusive Igneous Rock
- Intrusive Igneous Rock

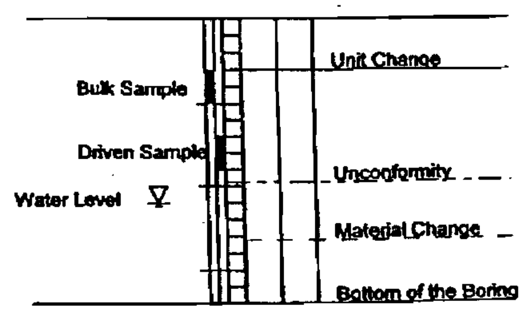
CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Blows / Foot*	Granular	Blows / Foot*	Cohesive
0 - 5	Very Loose	0 - 2	Very Soft
6 - 10	Loose	2 - 4	Soft
11 - 30	Medium Dense	4 - 8	Medium Stiff
31 - 50	Dense	8 - 15	Stiff
50	Very Dense	15 - 30	Very Stiff
		>30	Hard

* using 140-lb. hammer with 30" drop = 350 ft-lb/blow

LEGEND OF BORING



"NSR" indicates NO SAMPLE RECOVERY

GeoLogic Associates
Boring Log

BORING NO.: B-1

PAGE: 1 OF 1

JOB NO.: 2003-090
SITE LOCATION: ENCINA DESALINATION PROJECT
DRILLING METHOD: 2.5" ø HAND AUGER
CONTRACTOR: GEOLOGIC ASSOCIATES
LOGGED BY: A. FYODOROVA

DATE STARTED: 12/02/03
DATE FINISHED: 12/02/03
ELEVATION: 34 FEET (PBS&J, 2003)

GW DEPTH: NOT ENCOUNTERED
CAVING DEPTH: NONE OBSERVED
TOTAL DEPTH: 4.0 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	DEPTH IN METERS	MATERIAL SYMBOL	USCS/GEOLOGIC FORMATION	DESCRIPTION
	RV				BULK	1	0	0		SM	FILL: ORANGE-BROWN, MOIST, FINE TO MEDIUM SILTY SAND, TRACE OF FINE GRAVEL.

Depth scale (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

Depth scale (meters): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

NOTES:

1. TOTAL DEPTH = 4.0 FEET.
2. BORING BACKFILLED WITH CUTTINGS ON 12/02/2003.

LABORATORY TESTING KEY:

A = ATTERBERG LIMITS
C = CONSOLIDATION
CH = CHLORIDE
E = EXPANSION INDEX
G = GRADATION/SIEVE ANALYSIS
R = MINIMUM RESISTIVITY AND pH
RV = R-VALUE
S = SOLUBLE SULFATE
SE = SAND EQUIVALENT
SH = DIRECT SHEAR

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

GeoLogic Associates
Boring Log

BORING NO.: B-2

PAGE: 1 OF 1

JOB NO.: 2003-090
SITE LOCATION: ENCINA DESALINATION PROJECT, TANK #3
DRILLING METHOD: 8" ϕ HOLLOW STEM AUGER
CONTRACTOR: J.E.T. DRILLING
LOGGED BY: A. FYODOROVA

DATE STARTED: 12/02/03
DATE FINISHED: 12/02/03
ELEVATION: 35 FEET (PBS&J, 2003)

GW DEPTH: 23 FEET
CAVING DEPTH: 23 FEET
TOTAL DEPTH: 31.4 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	DEPTH IN METERS	USCS/GEOLOGIC FORMATION	DESCRIPTION
	A, E, S, RV, R				BULK	1	0	0	ML	FILL: LIGHT GREENISH BROWN, DAMP SILT WITH SAND.
								1	SM	LIGHT GREENISH BROWN, MOIST, FINE TO MEDIUM SILTY SAND.
0.4	C			21	1.4	2	5	2		SANTIAGO FORMATION (Tso): GREEN-BROWN, MOIST, FINE- TO MEDIUM-GRAINED SILTY SANDSTONE, WITH CALCITE IN FRACTURES. GRADING INTO
0.5	A	88.4	30.0	38	2.5	3	10	3		GREEN-BROWN, DAMP SILTSTONE TO SANDY SILTSTONE (WITH FINE TO MEDIUM SAND), WITH IRON OXIDE STAINING.
								4		LIGHT GREENISH BROWN, MOIST, FINE- TO MEDIUM-GRAINED SILTY SANDSTONE.
0.5				30	1.4	4	15	5		...FINE-GRAINED, WITH SCATTERED SMALL BROWN CLAYEY SILTSTONE LENSES, WITH MANGANESE OXIDE SPOTTING ON FRACTURE PLANES.
0.5		109.8	14.8	76/11"	2.5	5	20	6		...VERY LIGHT BROWN, FINE- TO MEDIUM-GRAINED.
							25	7, 8		
0.5			15.7	86/11"	1.4	6	30	9		...LIGHT GREENISH BROWN, FINE-GRAINED, SLIGHTLY MICACEOUS.
							35, 40, 45, 50	10–16		

NOTES:

1. TOTAL DEPTH = 31.4 FEET.
2. SAMPLER DRIVEN BY A 140-POUND AUTOMATIC HAMMER WITH A 30-INCH DROP.
3. BORING GROUTED WITH BENTONITE (VOLCLAY) GROUT ON 12/02/2003.
4. BACKGROUND PID READING = 0.4 PPM.

LABORATORY TESTING KEY:

A = ATTERBERG LIMITS
C = CONSOLIDATION
CH = CHLORIDE
E = EXPANSION INDEX
G = GRADATION/SIEVE ANALYSIS
R = MINIMUM RESISTIVITY AND pH
RV = R-VALUE
S = SOLUBLE SULFATE
SE = SAND EQUIVALENT
SH = DIRECT SHEAR

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

GeoLogic Associates
Boring Log

BORING NO.: B-3

JOB NO.: 2003-090
SITE LOCATION: ENCINA DESALINATION PROJECT, TANK #3
DRILLING METHOD: 8" ⌀ HOLLOW STEM AUGER
CONTRACTOR: J.E.T. DRILLING
LOGGED BY: A. FYODOROVA

DATE STARTED: 12/02/03
DATE FINISHED: 12/02/03
ELEVATION: 35 FEET (PBS&J, 2003)

GW DEPTH: NOT ENCOUNTERED
CAVING DEPTH: NONE OBSERVED
TOTAL DEPTH: 30.7 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	DEPTH IN METERS	USCS/GEOLOGIC FORMATION	DESCRIPTION
							0	0	SM	FILL: BROWN, MOIST, FINE TO MEDIUM SILTY SAND.
0.4	ENV			57	2.5	1			ML	LIGHT BROWN, MOIST, FINE SANDY SILT.
								1	SM	DARK GREEN-BROWN, MOIST, FINE TO MEDIUM SILTY SAND.
0.5	C	100.3	16.7	92/11"	2.5	2	5			SANTIAGO FORMATION (Tsa): GREEN-BROWN, MOIST, FINE- TO COARSE-GRAINED SILTY SANDSTONE, WITH IRON OXIDE STAIN AND CALCITE NODULES.
								2		
0.5		112.9	15.9	83	2.5	3	10	3		... LIGHT GREENISH BROWN, FINE- TO MEDIUM-GRAINED, WITH YELLOW IRON OXIDE STAINED ZONES.
								4		GRADING INTO
0.5				50/6"	1.4	4	15	5		VERY LIGHT BROWN, MOIST SANDY SILTSTONE TO SANDY SILTSTONE (FINE SAND).
0.5		105.9	21.5	72/10"	2.5	5	20	6		DARK GRAY AND BROWN, MOIST, FINE- TO COARSE-GRAINED SILTY SANDSTONE. ...VERY LIGHT BROWN, FINE- TO COARSE-GRAINED.
								7		
							25	8		
0.5				50/2.5"	1.4	6	30	9		
								10		
							35	11		
								12		
							40	13		
							45	14		
								15		
							50	16		

NOTES:

1. TOTAL DEPTH = 30.7 FEET.
2. SAMPLER DRIVEN BY A 140-POUND AUTOMATIC HAMMER WITH A 30-INCH DROP.
3. BORING GROUTED WITH BENTONITE (VOLCLAY) GROUT ON 12/02/2003.
4. BACKGROUND PID READING = 0.5 PPM.

LABORATORY TESTING KEY:

A = ATTERBERG LIMITS
C = CONSOLIDATION
CH = CHLORIDE
E = EXPANSION INDEX
G = GRADATION/SIEVE ANALYSIS
R = MINIMUM RESISTIVITY AND pH
RV = R-VALUE
S = SOLUBLE SULFATE
SE = SAND EQUIVALENT
SH = DIRECT SHEAR
ENV = ENVIRONMENTAL TESTING

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

GeoLogic Associates
Boring Log

BORING NO.: B-4

JOB NO.: 2003-090
SITE LOCATION: ENCINA DESALINATION PROJECT, TANK #3
DRILLING METHOD: 8" ø HOLLOW STEM AUGER
CONTRACTOR: J.E.T. DRILLING
LOGGED BY: A. FYODOROVA

DATE STARTED: 12/01/03
DATE FINISHED: 12/01/03
ELEVATION: 35 FEET (PBS&J, 2003)

GW DEPTH: 20.8 FEET
CAVING DEPTH: 20.8 FEET
TOTAL DEPTH: 50.7 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	DEPTH IN METERS	MATERIAL SYMBOL	USCS/GEOLOGIC FORMATION	DESCRIPTION
							0	0		SM	FILL: ORANGE-BROWN, DAMP, FINE TO MEDIUM SILTY SAND.
	G, E, S, R				BULK	1					
								1		ML	LIGHT BROWN, DRY SILT.
0.6	C	101.4	23.6	90	2.5	2	5	2			SANTIAGO FORMATION (Tsa): GREENISH BROWN, DAMP, FINE-GRAINED SILTY TO CLAYEY SANDSTONE, WITH CALCITE IN FRACTURES AND CLAYSTONE SEAMS. ...LIGHT BROWN, FINE- TO COARSE-GRAINED SILTY SANDSTONE.
0.6			10.0	50/4"	1.4	3	10	3			...WITH SCATTERED ROUNDED GRAVEL.
								4			
0.5		113.1	16.3	92/10"	2.5	4	15	5			...INTERBEDDED WITH FINE SANDY SILTSTONE, WITH CALCITE AND IRON OXIDE STAIN IN THIN (1/20") FRACTURES.
0.5			14.5	21	1.4	5	20	6			...FINE-GRAINED, SOFT, WITH IRON OXIDE IN FRACTURES.
								7			
0.4		108.1	13.3	50/5"	2.5	6	25	8			...HARD, MOIST TO VERY MOIST, WITH SCATTERED CALCITE NODULES UP TO 1/4" IN DIAMETER.
0.4			14.5	75	1.4	7	30	9			...WET, FINE- TO MEDIUM-GRAINED.
								10			
							35	11			
								12			
0.4			22.4	35	1.4	8	40	13			...FINE-GRAINED.
							45	14			
								15			
0.4			22.4	50/2"	1.4	9	50	16			

SEE SHEET 2 OF 2.

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

GeoLogic Associates

Boring Log

BORING NO.: B-4

JOB NO.:	2003-090	DATE STARTED:	12/01/03
SITE LOCATION:	ENCINA DESALINATION PROJECT, TANK #3	DATE FINISHED:	12/01/03
DRILLING METHOD:	8" ø HOLLOW STEM AUGER	ELEVATION:	35 FEET (PBS&J, 2003)
CONTRACTOR:	J.E.T. DRILLING		
LOGGED BY:	A. FYODOROVA		

GW DEPTH: 20.8 FEET
CAVING DEPTH: 20.8 FEET
TOTAL DEPTH: 50.7 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	DEPTH IN METERS	MATERIAL SYMBOL	USCS/GEOLOGIC FORMATION	DESCRIPTION
							50–100	16–31			NOTES: 1. TOTAL DEPTH = 50.7 FEET. 2. SAMPLER DRIVEN BY A 140-POUND AUTOMATIC HAMMER WITH A 30-INCH DROP. 3. DIFFICULT DRILLING FROM 10 TO 13 FEET BGS. MOVED THE HOLE APPROXIMATELY 2 FEET EAST. 4. BORING GROUTED WITH BENTONITE (VOLCLAY) GROUT ON 12/01/2003. 5. BACKGROUND PID READING = 0.2 PPM.

NOTES:

1. TOTAL DEPTH = 50.7 FEET.
2. SAMPLER DRIVEN BY A 140-POUND AUTOMATIC HAMMER WITH A 30-INCH DROP.
3. DIFFICULT DRILLING FROM 10 TO 13 FEET BGS. MOVED THE HOLE APPROXIMATELY 2 FEET EAST.
4. BORING GROUTED WITH BENTONITE (VOLCLAY) GROUT ON 12/01/2003.
5. BACKGROUND PID READING = 0.2 PPM.

LABORATORY TESTING KEY:

A = ATTERBERG LIMITS
C = CONSOLIDATION
CH = CHLORIDE
E = EXPANSION INDEX
G = GRADATION/SIEVE ANALYSIS
R = MINIMUM RESISTIVITY AND pH
RV = R-VALUE
S = SOLUBLE SULFATE
SE = SAND EQUIVALENT
SH = DIRECT SHEAR

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

GeoLogic Associates
Boring Log

BORING NO.: B-5

JOB NO.: 2003-090
SITE LOCATION: ENCINA DESALINATION PROJECT, TANK #3
DRILLING METHOD: 8" ∅ HOLLOW STEM AUGER
CONTRACTOR: J.E.T. DRILLING
LOGGED BY: A. FYODOROVA

DATE STARTED: 12/02/03
DATE FINISHED: 12/02/03
ELEVATION: 35 FEET (PBS&J, 2003)

GW DEPTH: NOT ENCOUNTERED
CAVING DEPTH: NONE OBSERVED
TOTAL DEPTH: 30.9 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET
0.5	ENV			12	2.5	1	
0.5		106.0	11.9	82/8"	2.5	2	5
	ENV				GLASS JAR	3	
0.5	SH, C	87.9	29.2	57	2.5	4	10
0.5				75	1.4	5	15
0.5		115.0	10.6	50/6"	2.5	6	20
0.5				50/4.5"	1.4	7	30

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 feet; 0–16 meters. Columns also include MATERIAL SYMBOL and USCS/GEOLOGIC FORMATION.

DESCRIPTION

SM — FILL:
ORANGE-BROWN, MOIST, FINE TO MEDIUM SILTY SAND.
...TO BROWN, VERY MOIST.
...TO MEDIUM, WITH MANGANESE OXIDE SPOTTING.

SANTIAGO FORMATION (Tsa):
GREENISH BROWN, MOIST, FINE- TO MEDIUM-GRAINED SILTY SANDSTONE, WITH CALCITE IN FRACTURES AND IRON OXIDE STAIN.
...VERY LIGHT GREENISH BROWN BELOW 6 FEET DEPTH.

...BROWN, FINE- TO COARSE-GRAINED, WITH CLAYEY SILT AND WITH IRON AND MANGANESE OXIDE IN UP TO 1/12"-THICK FRACTURES.
...LIGHT GREENISH BROWN, INTERBEDDED WITH GREENISH BROWN CLAYEY SILTSTONE, WITH MANGANESE AND IRON OXIDE STAINING.
...LIGHT BROWN, FINE-GRAINED.

...FINE- TO MEDIUM-GRAINED.

...FINE-GRAINED.

NOTES:

1. TOTAL DEPTH = 30.9 FEET.
2. SAMPLER DRIVEN BY A 140-POUND AUTOMATIC HAMMER WITH A 30-INCH DROP.
3. BORING GROUTED WITH BENTONITE (VOLCLAY) GROUT ON 12/02/2003.
4. BACKGROUND PID READING = 0.5 PPM.

LABORATORY TESTING KEY:
- A = ATTERBERG LIMITS
- C = CONSOLIDATION
- CH = CHLORIDE
- E = EXPANSION INDEX
- G = GRADATION/SIEVE ANALYSIS
- R = MINIMUM RESISTIVITY AND pH
- RV = R-VALUE
- S = SOLUBLE SULFATE
- SE = SAND EQUIVALENT
- SH = DIRECT SHEAR
- ENV = ENVIRONMENTAL TESTING

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

GeoLogic Associates
Boring Log

BORING NO.: B-6

JOB NO.: 2003-090
SITE LOCATION: ENCINA DESALINATION PROJECT, TANK #3
DRILLING METHOD: 8" ● HOLLOW STEM AUGER
CONTRACTOR: J.E.T. DRILLING
LOGGED BY: A. FYODOROVA

DATE STARTED: 12/02/03
DATE FINISHED: 12/02/03
ELEVATION: 30 FEET (PBS&J, 2003)

GW DEPTH: 28.0 FEET
CAVING DEPTH: NONE OBSERVED
TOTAL DEPTH: 35.5 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	DEPTH IN METERS	USCS/GEOLOGIC FORMATION	DESCRIPTION
	C, E, S, R				BULK	1	0	0	SM	FILL: GREENISH BROWN, MOIST, FINE TO MEDIUM SILTY SAND. ...LIGHT BROWN, DECREASED SILT. ...GREENISH BROWN TO BROWN, INCREASED SILT, SCATTERED FINE GRAVEL UP TO 3/4" IN DIAMETER.
0.4				71	1.4	2	5			
0.4	SH, C	99.0	23.2	51	2.5	3	10			SANTIAGO FORMATION (Tsa): LIGHT GRAYISH BROWN, MOIST, FINE-GRAINED SILTY SANDSTONE, WITH LIGHT GREENISH GRAY FINE SANDY SILTSTONE/SILTY SANDSTONE LENSES, WITH IRON OXIDE STAINING ON FRACTURE SURFACES.
0.5				40	1.4	4	15			...FINE- TO MEDIUM-GRAINED, WITH THIN SILTSTONE LAMINATIONS.
0.5		97.8	18.3	70	2.5	5	20			...FINE-GRAINED, SLIGHTLY MICACEOUS.
										...SEEPAGE AT 23 FEET DEPTH.
0.6				50/6"	1.4	6	25			...FINE- TO COARSE-GRAINED.
0.5				50/6"	1.4	7	35			

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 feet; 0–16 meters.

NOTES:

1. TOTAL DEPTH = 35.5 FEET.
2. SAMPLER DRIVEN BY A 140-POUND AUTOMATIC HAMMER WITH A 30-INCH DROP.
3. BORING GROUTED WITH BENTONITE (VOLCLAY) GROUT ON 12/02/2003.
4. BACKGROUND PID READING = 0.4 PPM.

LABORATORY TESTING KEY:
- C = CONSOLIDATION
- CH = CHLORIDE
- E = EXPANSION INDEX
- G = GRADATION/SIEVE ANALYSIS
- R = MINIMUM RESISTIVITY AND pH
- RV = R-VALUE
- S = SOLUBLE SULFATE
- SH = DIRECT SHEAR

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

GeoLogic Associates
Boring Log

BORING NO.: B-7

PAGE: 1 OF 1

JOB NO.: 2003-090
SITE LOCATION: ENCINA DESALINATION PROJECT, TANK #3
DRILLING METHOD: 8" Ø HOLLOW STEM AUGER
CONTRACTOR: J.E.T. DRILLING
LOGGED BY: A. FYODOROVA

DATE STARTED: 12/01/03
DATE FINISHED: 12/01/03
ELEVATION: 30 FEET (PBS&J, 2003)

GW DEPTH: 28.9 FEET
CAVING DEPTH: NONE OBSERVED
TOTAL DEPTH: 35.3 FEET

PID READING (PPM)	LABORATORY TESTING (SEE KEY)	DRY DENSITY (LBS/CU. FT.)	MOISTURE (%)	BLOWS (COUNT/FT.)	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	USCS/GEOLOGIC FORMATION	DESCRIPTION
							0	SM	FILL: BROWN, MOIST, FINE TO MEDIUM SILTY SAND.
								SC	RESIDUAL SOIL: GREENISH GRAY, MOIST, LOOSE TO MEDIUM DENSE, FINE TO MEDIUM CLAYEY SAND, SCATTERED FINE (UP TO 3/4"-DIAMETER) GRAVEL, ROUNDED, WITH ABUNDANT FINE (1/12"-DIAMETER) ROOTS, WITH VERY LIGHT BROWN SILT IN FRACTURES, WITH IRON OXIDE STAIN AND MANGANESE OXIDE AROUND ROOTS.
0.2	S, R	109.4	17.6	12	2.5	1	5		
									SANTIAGO FORMATION (Tsa): VERY LIGHT BROWN, MOIST, FINE- TO MEDIUM-GRAINED SILTY SANDSTONE, TRACE OF COARSE SAND, MASSIVE.
0.2	C			60	1.4	2	10		
									...GRAY, FINE-GRAINED, WITH VERY LIGHT BROWN SILTSTONE LENSES AND FRACTURE FILLINGS, CALCITE CEMENTED ZONES, AND IRON OXIDE STAINED ZONES. GRADING INTO
0.2		111.5	17.9	88/10.5"	2.5	3	15		
									GRAY, DAMP SANDY SILTSTONE (FINE MICACEOUS SAND), FISSILE, WITH CALCITE IN FRACTURES AND IRON OXIDE STAINING.
									VERY LIGHT GRAY, FINE- TO MEDIUM-GRAINED SILTY SAND.
0.2				50/6"	1.4	4	20		
0.2		99.5	13.5	90/8"	2.5	5	25		...LIGHT GRAYISH BROWN.
							30		
0.2				50/3"	1.4	6	35		

NOTES:

1. TOTAL DEPTH = 35.3 FEET.
2. SAMPLER DRIVEN BY A 140-POUND AUTOMATIC HAMMER WITH A 30-INCH DROP.
3. BORING GROUTED WITH BENTONITE (VOLCLAY) GROUT ON 12/01/2003.
4. BACKGROUND PID READING = 0.2 PPM.

LABORATORY TESTING KEY:

C = CONSOLIDATION
CH = CHLORIDE
E = EXPANSION INDEX
G = GRADATION/SIEVE ANALYSIS
R = MINIMUM RESISTIVITY AND pH
RV = R-VALUE
S = SOLUBLE SULFATE
SH = DIRECT SHEAR

The data presented on this log is a simplification of actual conditions encountered and applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change with the passage of time.

APPENDIX B

GEOTECHNICAL LABORATORY TESTING PROCEDURES AND TEST RESULTS

Expansion Index Tests: The expansion potential of selected materials was evaluated by the Expansion Index Test, U.B.C. Standard No. 18-2 and ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

Sample Location	Sample Description	Expansion Index	Expansion Potential*
B-2, 0-4'	Olive brown, sandy silt with clay	43	Low
B-4, 1'-7'	Brown, fine to medium clayey sand	21	Low
B-6, 1.5'-5'	Light brown, fine to coarse clayey sand	35	Low

*Based on the 1997 edition of the Uniform Building Code, prepared by the International Conference of Building Officials, (ICBO, 1997).

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with California Test Method 643. The results are presented in the table below:

Sample Location	pH	Minimum Resistivity (ohm-cm)	Corrosion Potential**
B-2, 0-5'	9.0	830	Severe
B-4, 1'-7'	9.0	1225	Severe
B-6, 1.5'-5'	9.8	1300	Severe
B-7, 5'-6.5'	9.6	740	Severe
B-8, 1'-5'	10.0	1350	Severe

** per U. S. Navy, 1969.

Soluble Sulfates: The soluble sulfate contents of selected samples were determined by California Test Method 417. The test results are presented in the table below:

Sample Location	Soluble Sulfate Content (ppm)	***Sulfate Exposure***
B-2, 0-5'	100	Negligible
B-4, 1'-7'	132	Negligible
B-6, 1.5'-5'	370	Negligible
B-7, 5'-6.5'	148	Negligible
B-8, 1'-5'	337	Negligible

*** Based on the 1997 edition of the Uniform Building Code, Table No. 19-A-4, prepared by the International Conference of Building Officials, (ICBO, 1997).

Consolidation Testing: Consolidation testing was performed in accordance with ASTM D 2435. The test results are presented on the following pages.

Atterberg Limit Testing: Atterberg Limit Testing (plasticity index) was performed in accordance with ASTM D4318. The results are presented in the following pages.

Grain Size Analysis: Grain-size distributions were performed on selected samples in accordance with ASTM D422. The results are presented in the following pages.

R-Value: Resistance "R" value was obtained for three samples. Testing was performed in accordance with California Test 301. The test results are presented below.

Sample Location	R-Value Test Result
B-1, 0-4'	68
B-2, 0-5'	38

Direct Shear Testing: Direct shear testing was performed in accordance with ASTM D3080. The results are presented on the following pages.

EXPANSION INDEX - UBC 18-2 & ASTM D 4829-88

PROJECT CDI A02-147 JOB NO. 2001-003

Sample B-2/1 By LD
Sta. No.
Soil Type Olive Brown Mottled, F. Sandy Silt w. Clay

Date	Time	Dial Reading	Wet+Tare	624
12/15/2003	10:15	0.3942	Tare	220
		H2O	Net Weight	404
12/16/2003	17:00	0.3514	% Water	12
			Dry Dens.	109.3
			% Max	
			Wet+Tare	643
			Tare	220
			Net Weight	423
INDEX	43	4.3%	% Water	17.3

Sample B-4/1 By LD
Sta. No.
Soil Type Brown Mottled, F.M. Clayey Sand

Date	Time	Dial Reading	Wet+Tare	650.7
12/15/2003	10:15	0.4121	Tare	220.8
		H2O	Net Weight	429.9
12/16/2003	17:00	0.3915	% Water	6.9
			Dry Dens.	121.9
			% Max	
			Wet+Tare	680
			Tare	220.8
			Net Weight	459.2
INDEX	21	2.1%	% Water	14.2

Sample B-6/1 By LD
Sta. No.
Soil Type L. Brown, F.C. Clayey Sand

Date	Time	Dial Reading	Wet+Tare	630.1
12/15/2003	10:15	0.3039	Tare	220.6
		H2O	Net Weight	409.5
12/16/2003	17:00	0.2687	% Water	8.9
			Dry Dens.	113.9
			% Max	
			Wet+Tare	677.7
			Tare	220.6
			Net Weight	457.1
INDEX	35	3.5%	% Water	21.6

Sample By LD
Sta. No.
Soil Type

Date	Time	Dial Reading	Wet+Tare	
			Tare	
			Net Weight	
			% Water	
			Dry Dens.	
			% Max	
			Wet+Tare	
			Tare	
			Net Weight	
INDEX			% Water	

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SOIL TEST RESULTS

Job No. 2003-091

SAMPLE NO.:	B-2/1	B-4/1	B-6/1	B-7/1	B-8/1
DESCRIPTION	Sandy Silt	Clayey Sand	Clayey Sand	Sandy Clay	Clayey Sand
[redacted]					
Initial Moisture Content %					
Dry Density (pcf)					
Normal Stress (psf)					
Peak Shear Stress (psf)					
Ultimate Shear Stress (psf)					
Cohesion (psf)					
Internal Friction Angle (degrees)					
[redacted]					
Initial Dry Density (pcf)					
Initial Moisture Content %					
Final Moisture Content %					
Pressure (psf)					
Expansion Index / Swell %					
[redacted]					
Resistivity (CTM643) (ohm-cm)	830	1225	1300	740	1350
pH (CTM643)	9.0	9.0	9.8	9.6	10.0
[redacted]					
Soluble Sulfate (CTM 417) (ppm)	100	132	370	148	337
Chloride Content (CTM 422) (ppm)					
[redacted]					
[redacted]					

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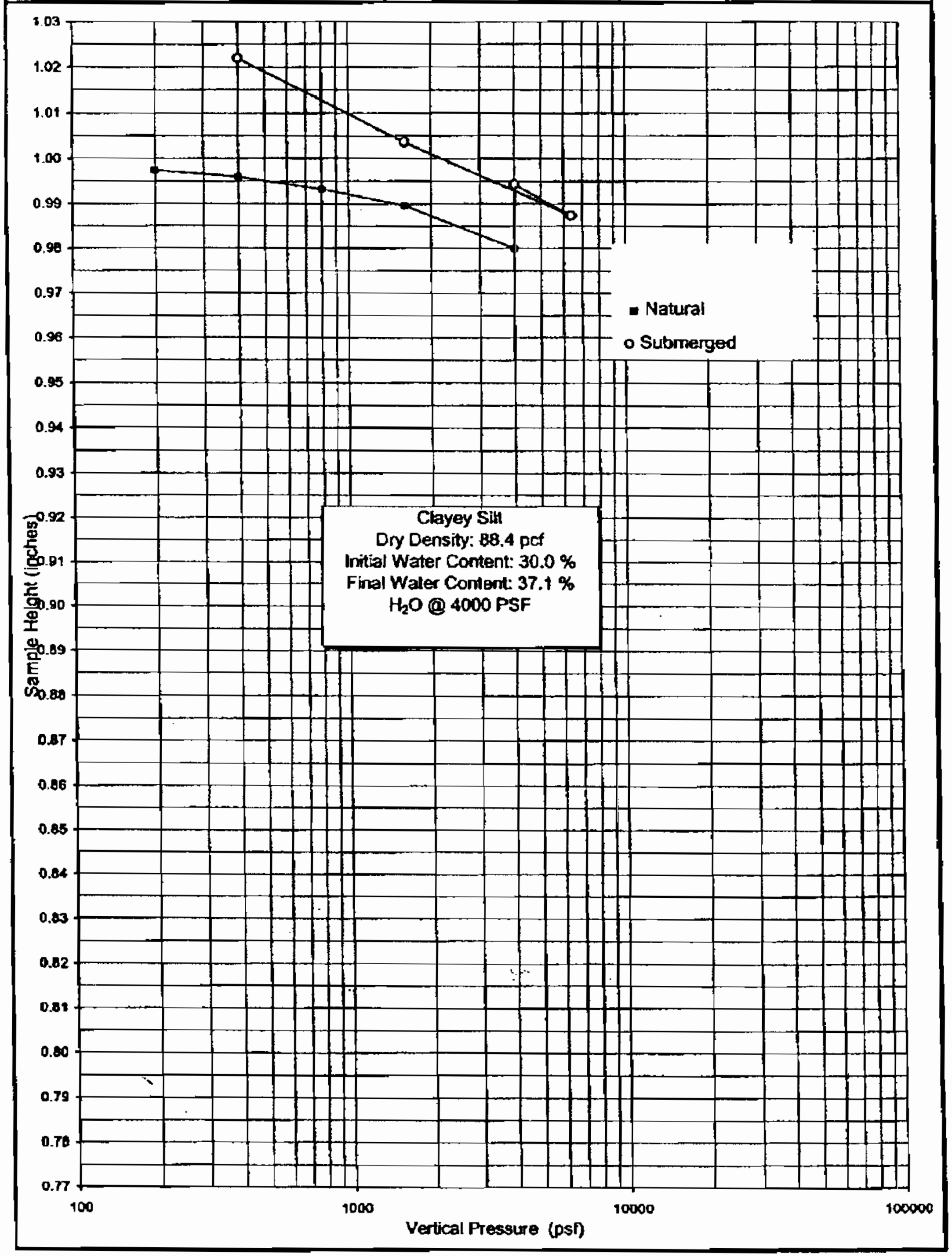
CONSOLIDATION TEST - ASTM D2435

Job No. 2003-091 _ Poseidon / Desal

Boring / Sample No.	B-2/3	Depth:	10' - 11.5'	Date	12-15-03



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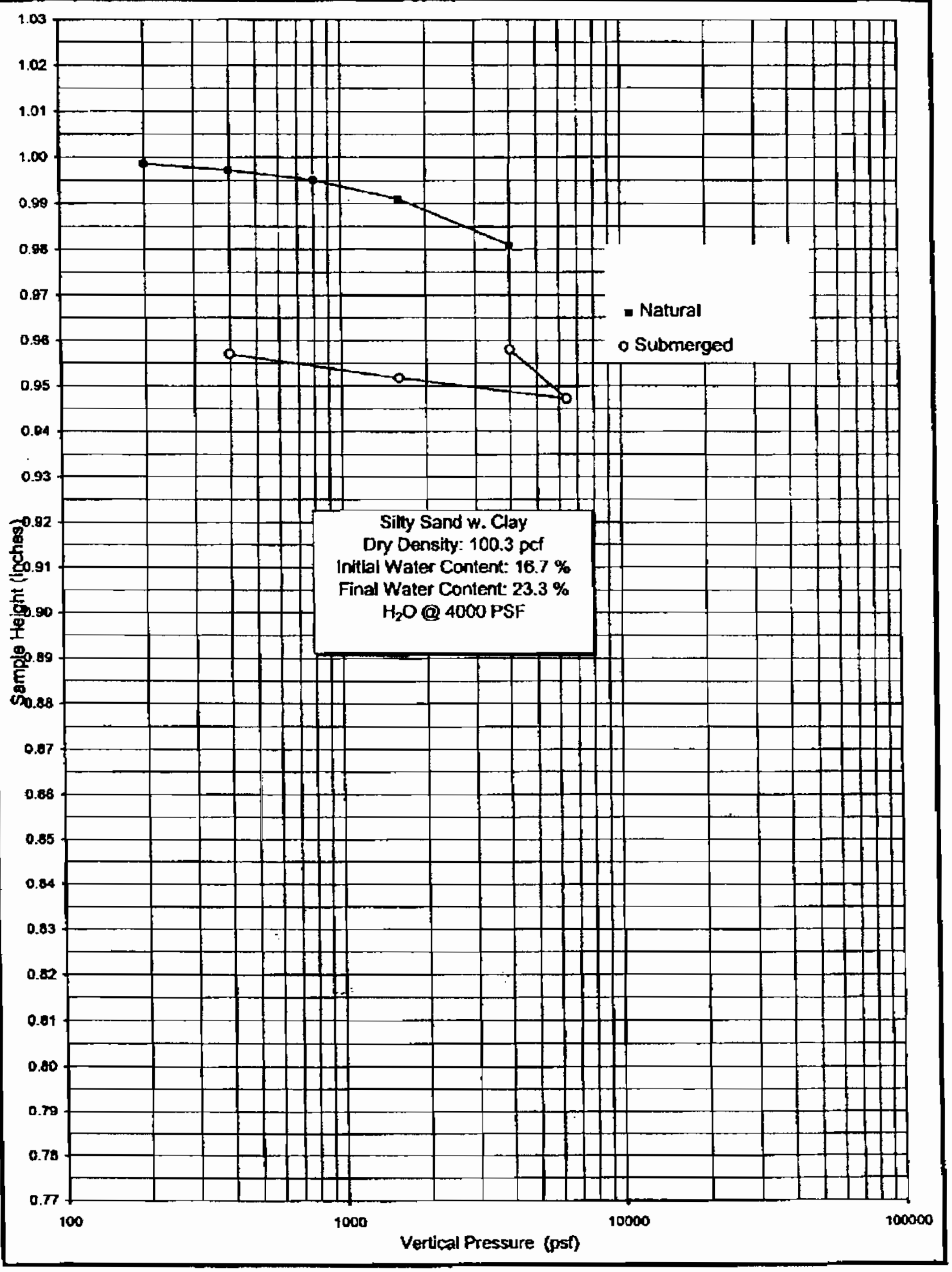
CONSOLIDATION TEST - ASTM D2435

Job No. 2003-091 _ Poseidon / Desal

Boring / Sample No.	B-3/2	Depth:	5' - 6.5'	Date	12-15-03



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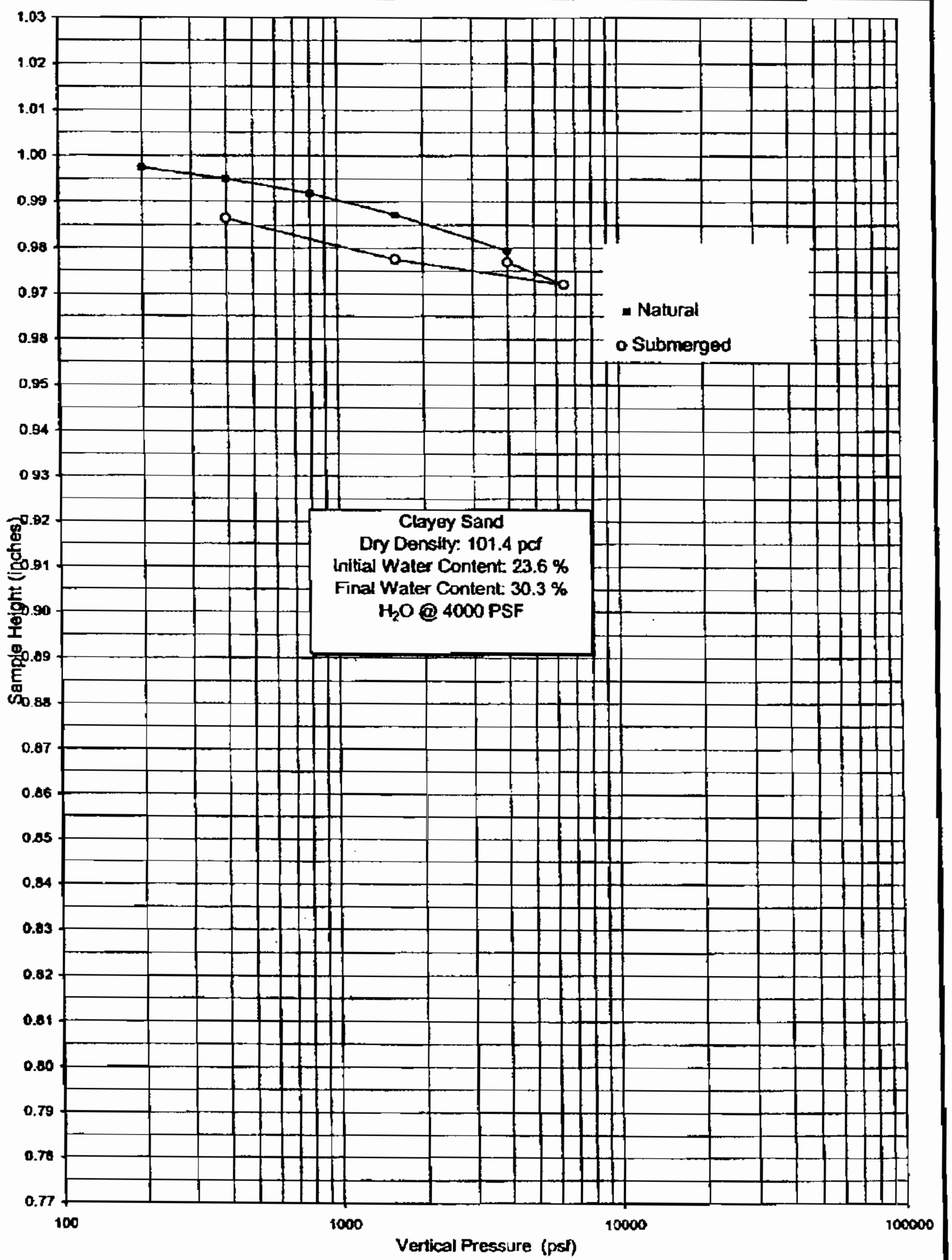
CONSOLIDATION TEST - ASTM D2435 *Job No. 2003-091 _ Poseidon / Desal*

Boring / Sample No. B-4/2	Depth: 5' - 6.5'	Date 12-15-03



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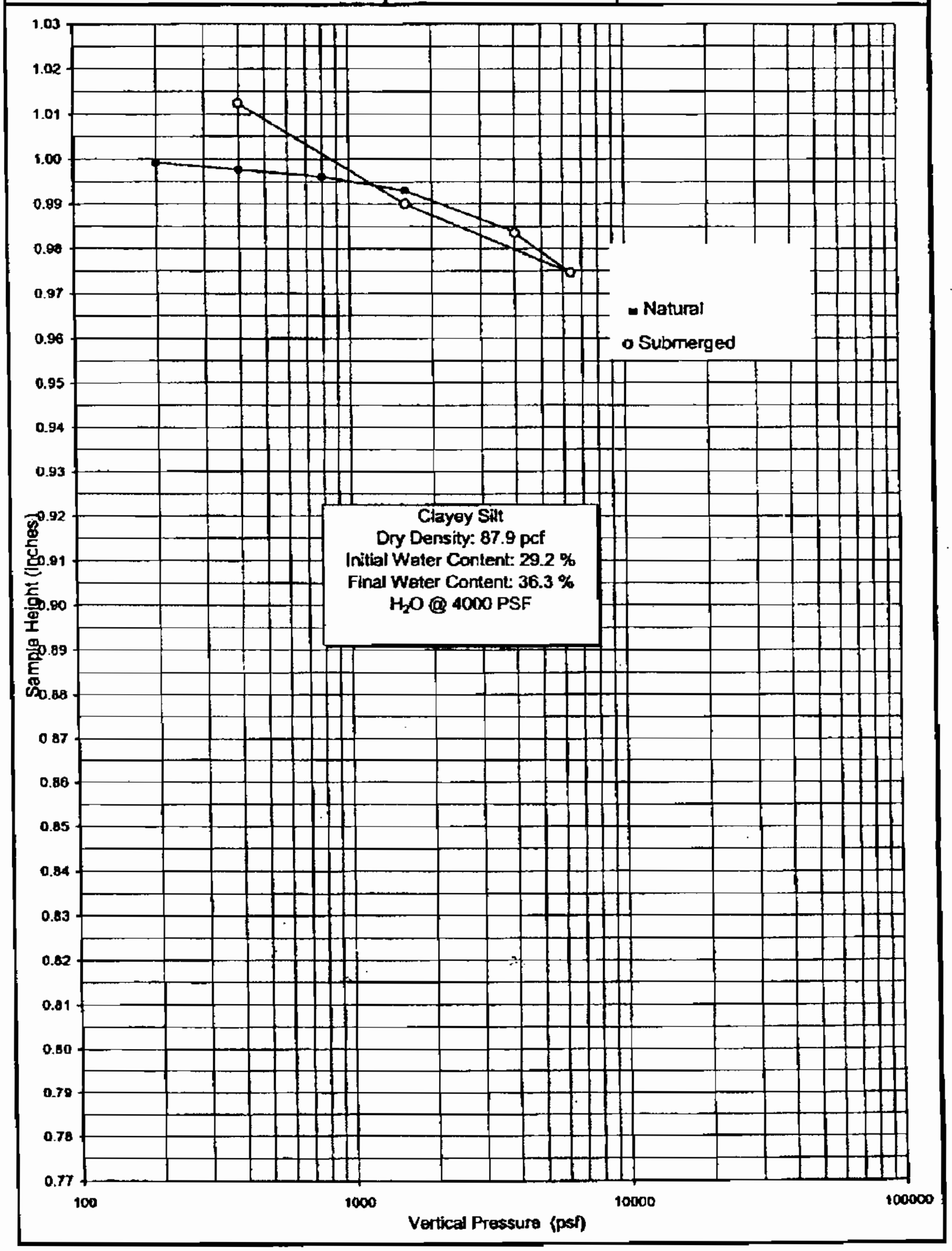
CONSOLIDATION TEST - ASTM D2435

Job No. 2003-091 _ Poseidon / Desal

Boring / Sample No. B-5-4	Depth: 10' - 11.5'	Date 12-15-03



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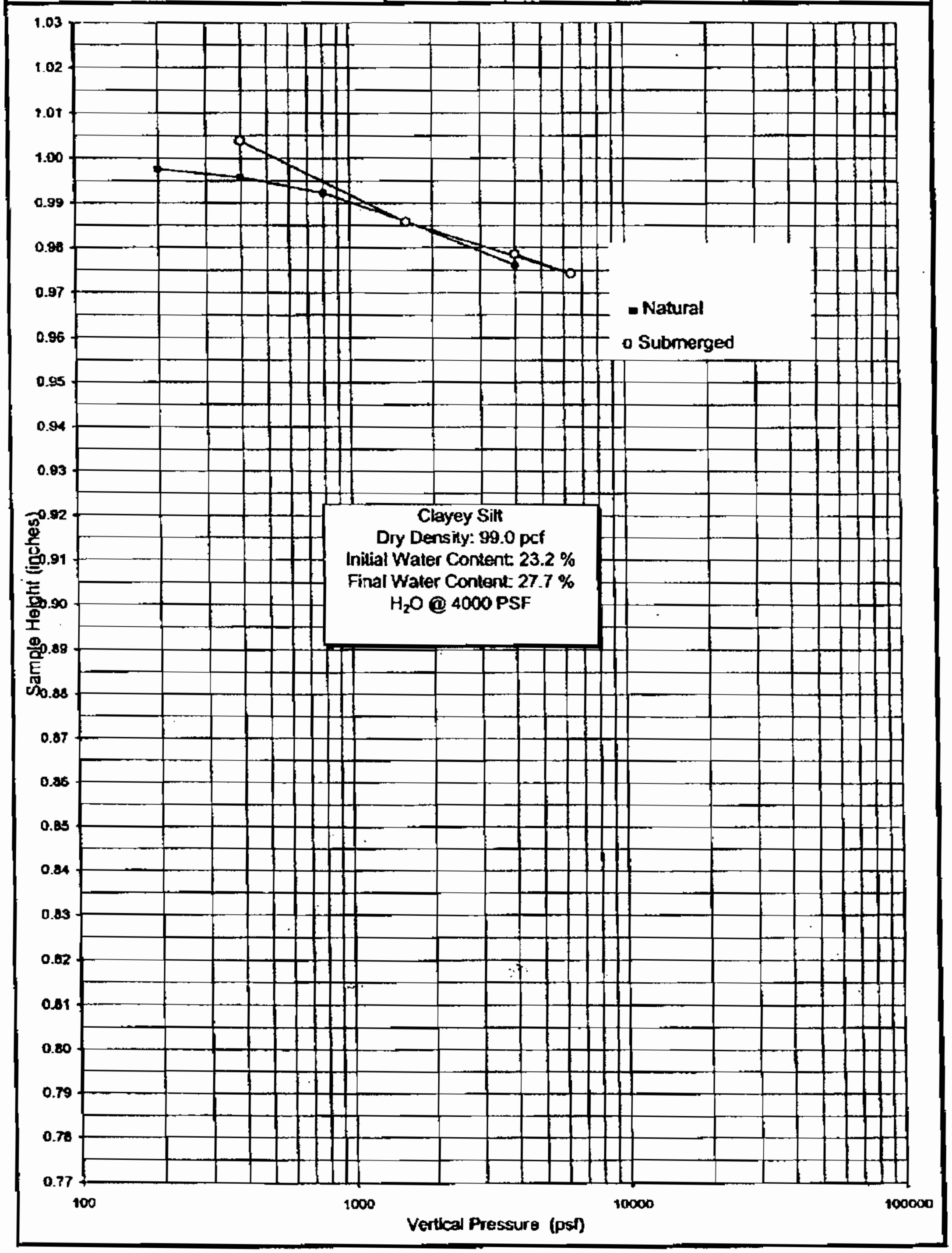
CONSOLIDATION TEST - ASTM D2435

Job No. 2003-091 _ Poseidon / Desal

Boring / Sample No. B-6/3	Depth: 10' - 11.5'	Date 12-15-03



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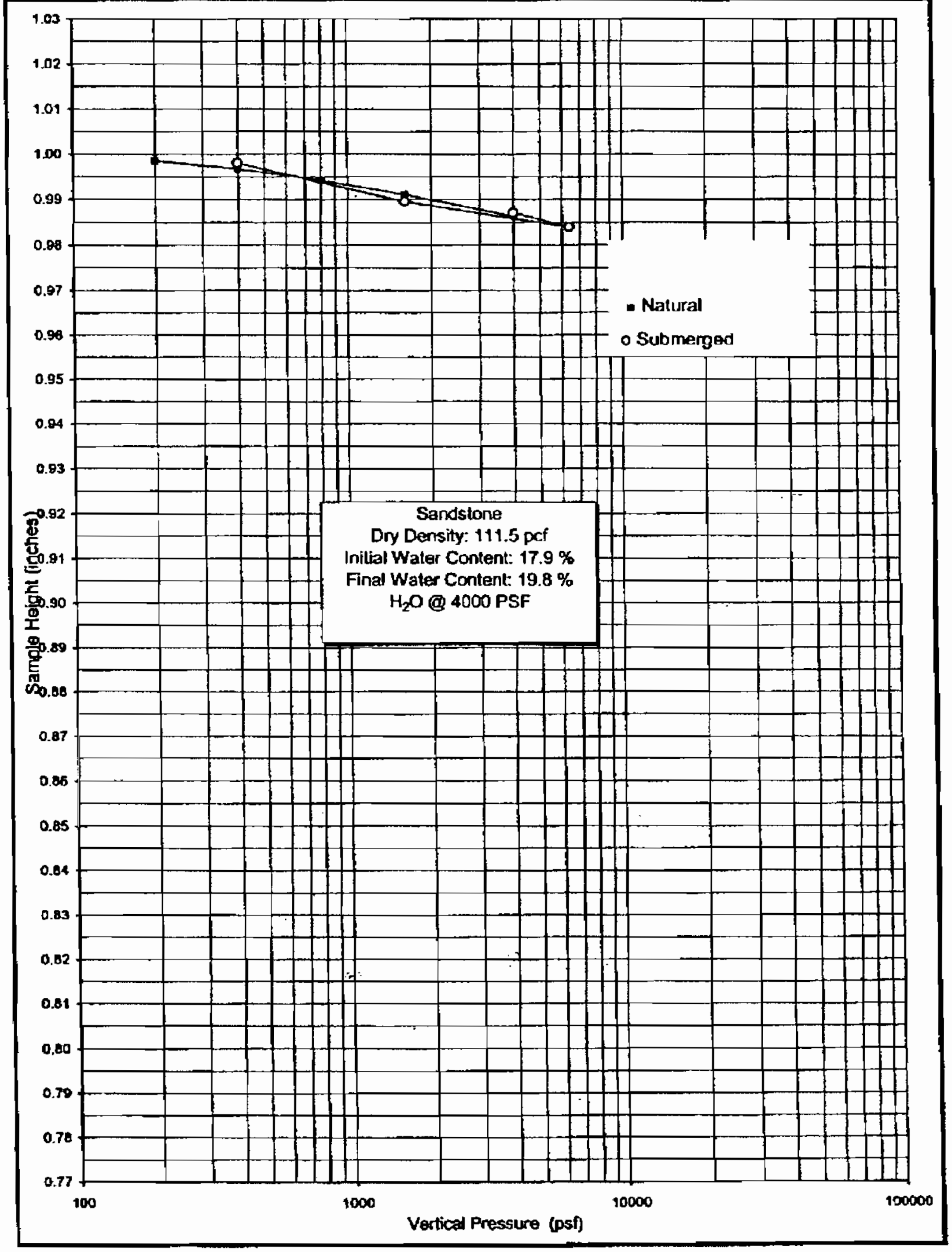
CONSOLIDATION TEST - ASTM D2435

Job No. 2003-091 _ Poseidon / Desal

Boring / Sample No. B-7/3	Depth: 15' - 16.5'	Date 12-15-03



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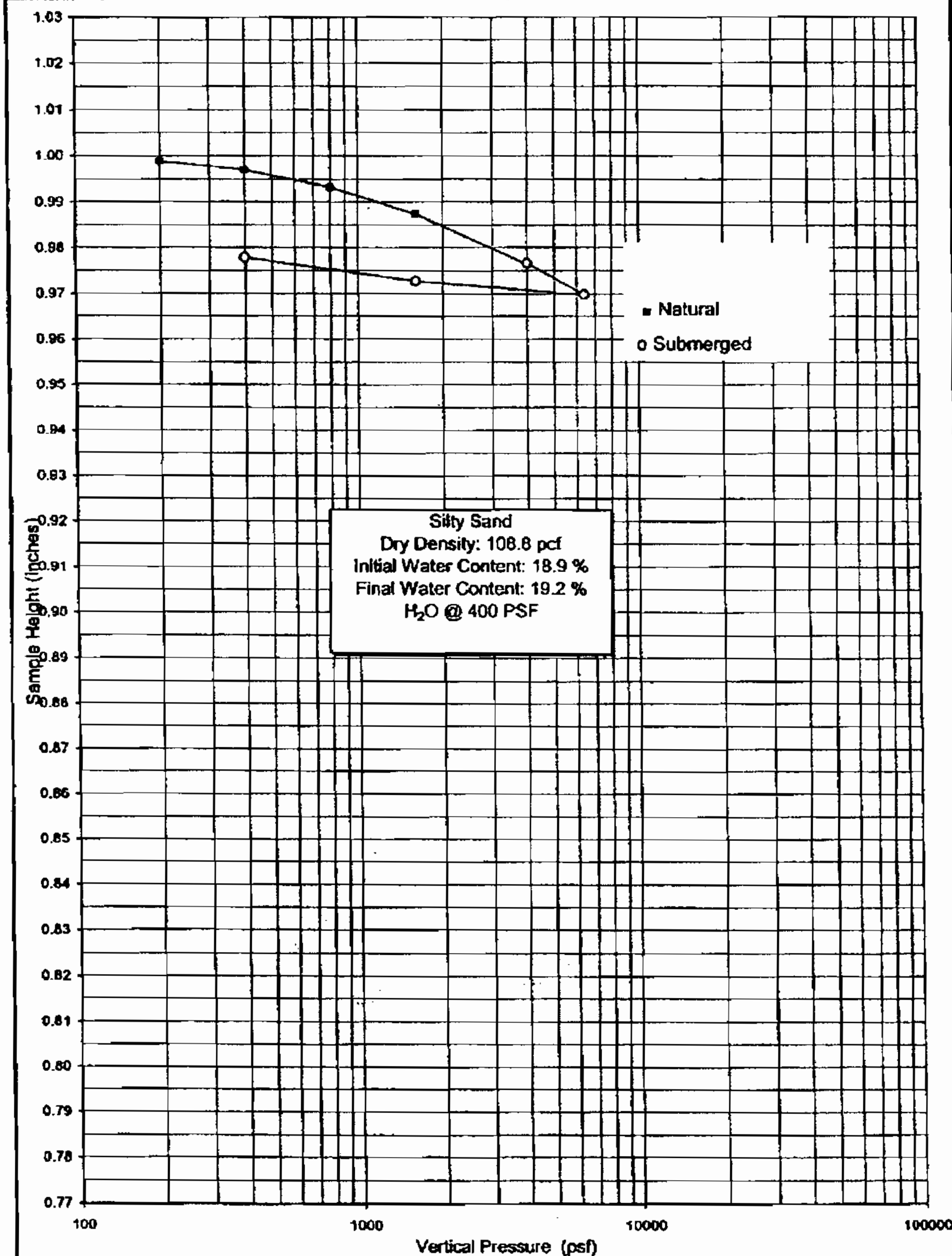
CONSOLIDATION TEST - ASTM D2435

Job No. 2003-091 _ Poseidon / Desal

Boring / Sample No.	B-8/4	Depth:	15' - 16.5'	Date	12-15-03



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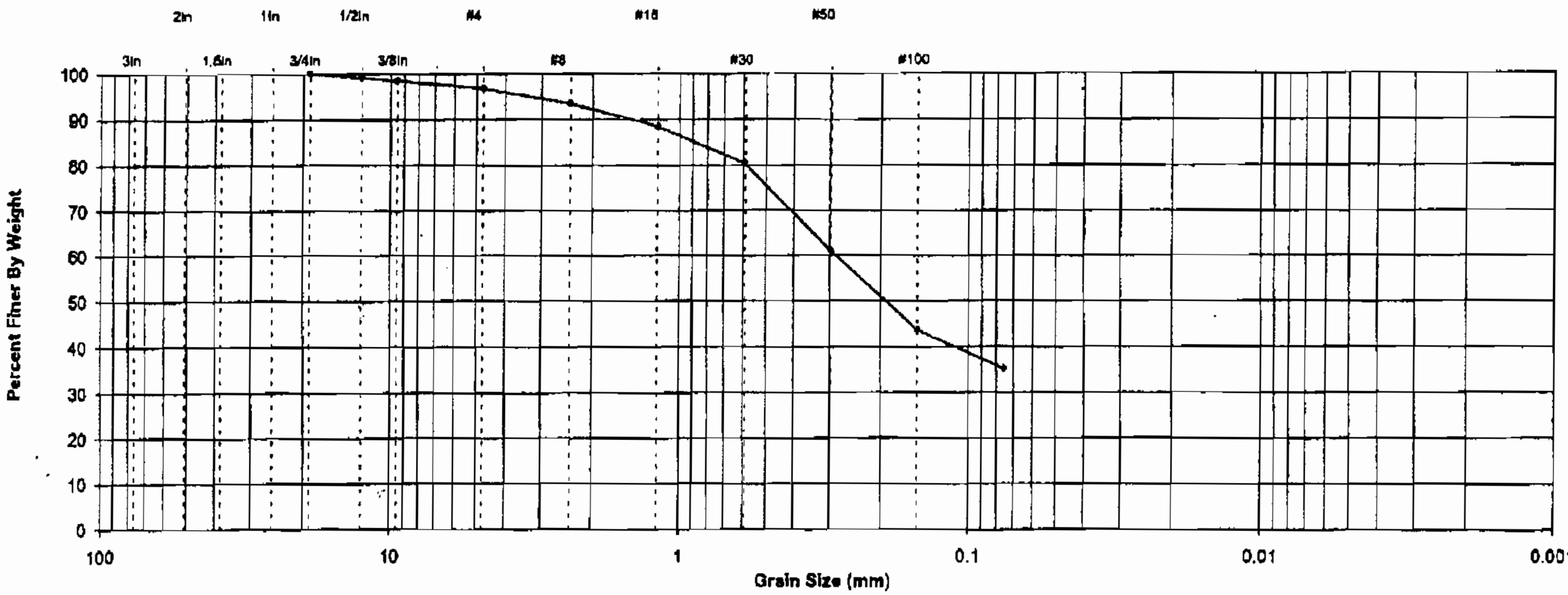
GRAIN SIZE ANALYSIS - ASTM D 422



Sample	Max. Dry Density (pcf)	Opt. Water Content (%)	Expansion Index	Test W.C.. (%)	Final W. C. (%)	Resistivity (ohm-cm)	pH	SO_4 (ppm)	Chloride Content (ppm)	Unified Soil Class.	Description
B-6/1.5'-5'										SC	CLAYEY SAND

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'R' VALUE CA 301

Project Poseidon / Desal **Job No.** 2003-091

Sample B-1/1 **By:** LD

Soil Type Brown, F.M. Silty Sand w. trace Clay **Date** 12/11/2003

TEST SPECIMEN		A	B	C	Grain Size Distribution		
Compactor Air Pressure	psi	350	100	200	Sieve	As Rec'vd. (%Pass.)	As Tested (%Pass.)
Initial Moisture Content	%	4.3	4.3	4.3	3"		
Water Added	ml	70	85	77	2 1/2"		
Moisture at Compaction	%	10.4	11.7	11.0	2"		
Sample & Mold Weight	gms	3150	3184	3176	1 1/2"		
Mold Weight	gms	2106	2106	2106	1"		
Net Sample Weight	gms	1044	1078	1070	3/4"		
Sample Height	in.	2.431	2.539	2.51	1/2"		
Dry Density	pcf	117.9	115.2	116.4	3/8"		
Pressure	lbs	9440	3190	4990	#4		
Exudation Pressure	psi	752	254	397	#8		
Expansion Dial	x 0.0001	0	0	0	#16		
Expansion Pressure	psf	0	0	0	#30		
Ph at 1000lbs	psi	12	21	16	#50		
Ph at 2000lbs	psi	21	39	28	#100		
Displacement	turns	3.94	4.38	4.11	#200		
R' Value		81	64	74	Sand Equivalent		
Corrected 'R' Value		80	64	74	(CTM 217)		

FINAL 'R' VALUE	
By Exudation Pressure (@ 300 psi):	68
By Epansion Pressure :	
TI =	

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'R' VALUE CA 301

Project Poseidon / Desal **Job No.** 2003-091

Sample B-2/1 **By:** LD

Soil Type Olive Brown, Clayey Silt **Date** 12/11/2003

TEST SPECIMEN		A	B	C	Grain Size Distribution		
Compactor Air Pressure	psi	70	50	120	Sieve	As Rec'vd. (%Pass.)	As Tested (%Pass.)
Initial Moisture Content	%	9.1	9.1	9.1	3"		
Water Added	ml	60	70	50	21/2"		
Moisture at Compaction	%	14.6	15.5	13.6	2"		
Sample & Mold Weight	gms	3172	3119	3156	11/2"		
Mold Weight	gms	2108	2091	2106	1"		
Net Sample Weight	gms	1064	1028	1050	3/4"		
Sample Height	in.	2.55	2.48	2.48	1/2"		
Dry Density	pcf	110.4	108.8	112.9	3/8"		
Pressure	lbs	4225	3200	6580	#4		
Exudation Pressure	psi	336	255	524	#8		
Expansion Dial	x 0.0001	12	8	20	#16		
Expansion Pressure	psf	52	35	87	#30		
Ph at 1000lbs	psi	28	32	25	#50		
Ph at 2000lbs	psi	76	80	66	#100		
Displacement	turns	4.1	4.46	3.81	#200		
R' Value		40	36	48	Sand Equivalent		
Corrected 'R' Value		40	36	48	(CTM 217)		

FINAL 'R' VALUE	
By Exudation Pressure (@ 300 psi):	38
By Epansion Pressure :	
TI =	

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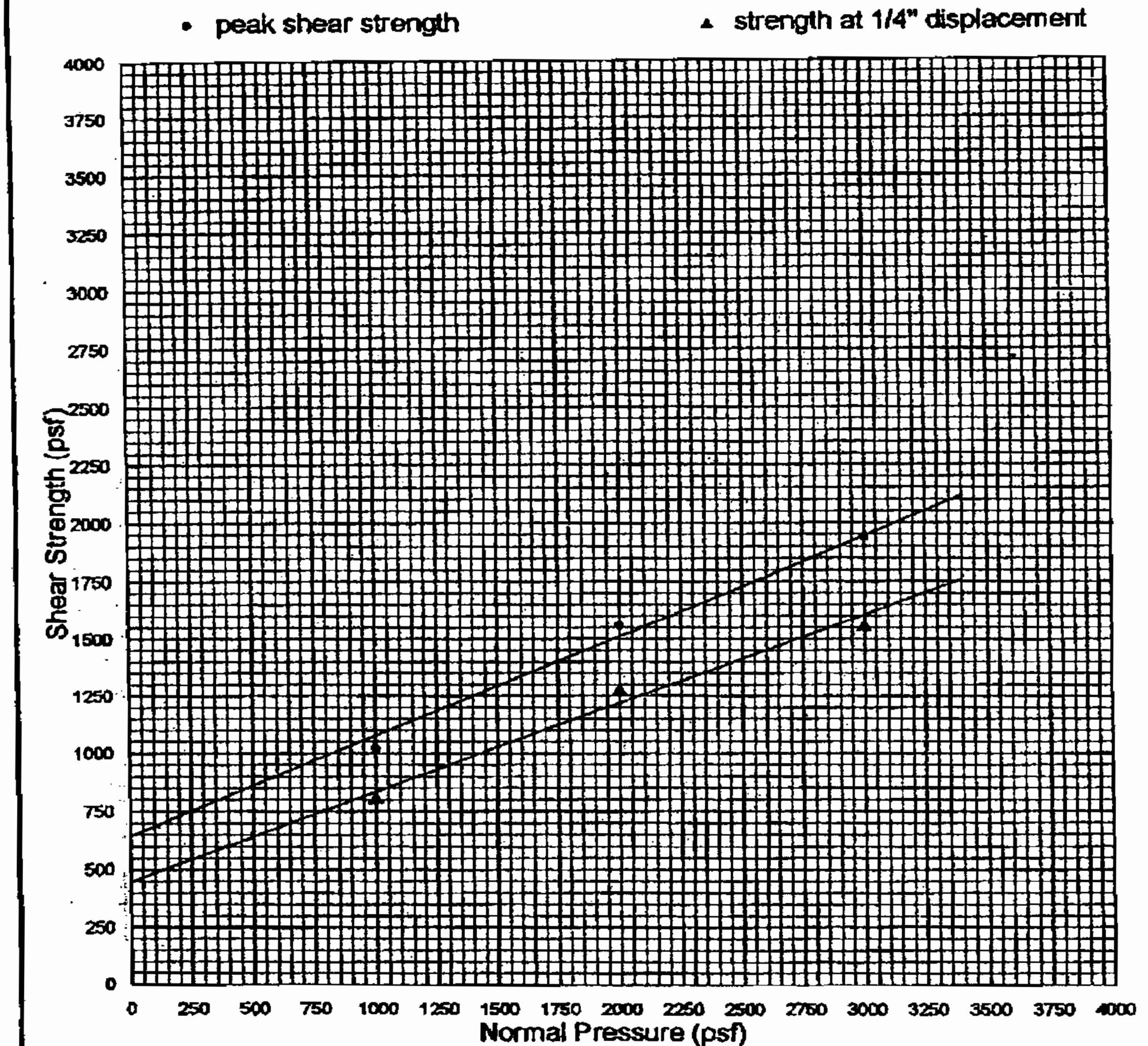
DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0042 in. / min.

Sample	Type	Description	Dry Density (pcf)	Water Content (%)
B-5-4	Undisturbed & Saturated	Clayey Silt	87.9	29.2

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	1020 @ 0.0495"	800
2000	1560 @ 0.0735"	1270
3000	1940 @ 0.0870"	1550
	C = 650 psf	C = 450 psf
	ϕ = 23 deg.	ϕ = 21 deg.

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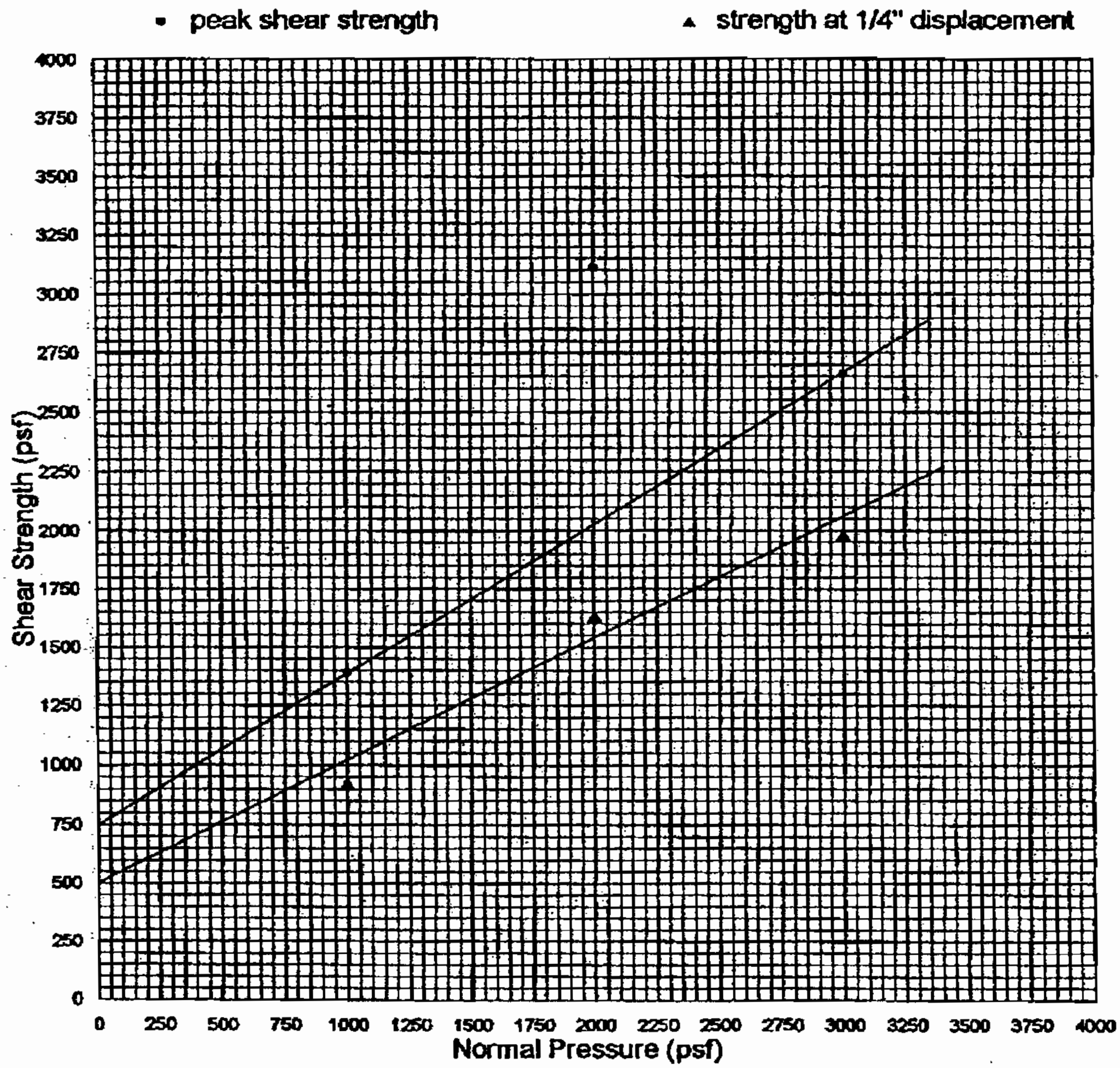
DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0042 in. / min.

Sample	Type	Description	Dry Density (pcf)	Water Content (%)
B-6/3	Undisturbed & Saturated	Clayey Silt	99.0	23.2

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	1390 @ 0.0480"	910
2000	3110 @ 0.0730"	1620
3000	2660 @ 0.0530"	1970
	C = 750 psf	C = 500 psf
	ϕ = 32 deg.	ϕ = 27 deg.

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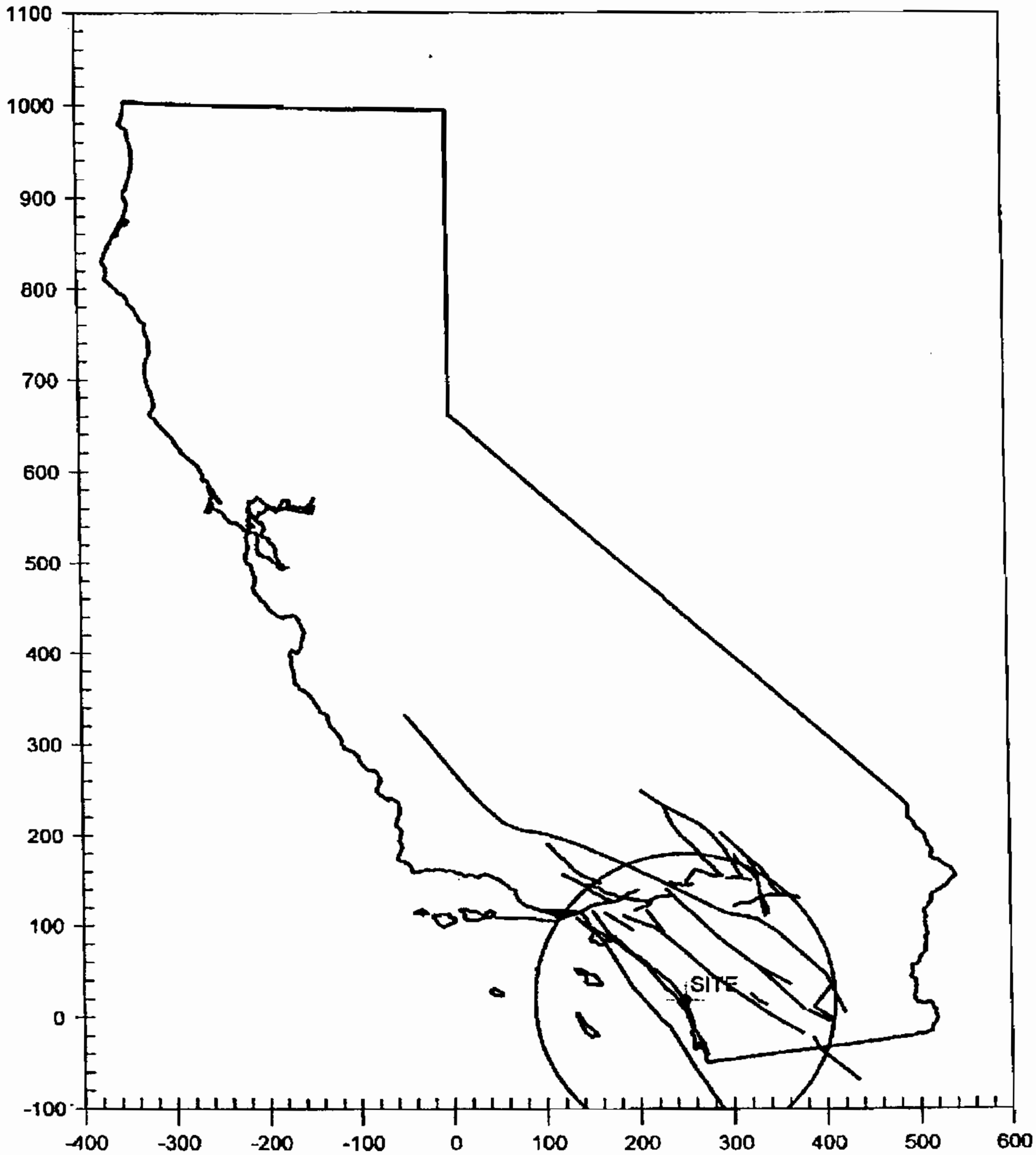
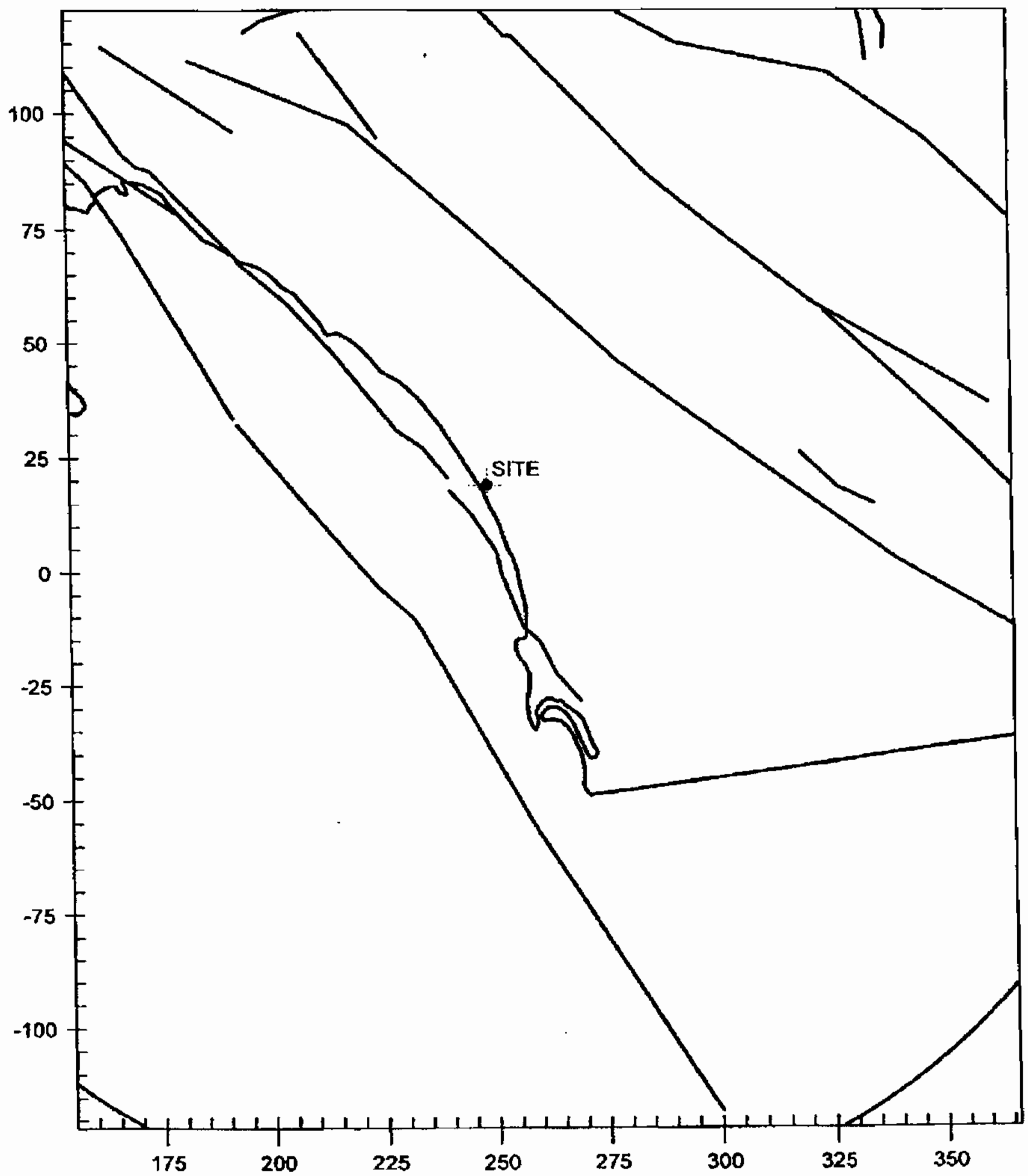
CALIFORNIA FAULT MAP

Poseidon Desalination Facility



CALIFORNIA FAULT MAP

Poseidon Desalination Facility



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*                    *
*   E Q F A U L T    *
*                    *
*   Version 3.00     *
*                    *
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 2003-085

DATE: 12-16-2003

JOB NAME: Poseidon Desalination Facility

CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: CDMGFLTE.DAT

SITE COORDINATES:
SITE LATITUDE: 33.1393
SITE LONGITUDE: 117.3346

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 2) Boore et al. (1997) Horiz. - NEHRP C (520)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: cd_2drp
SCOND: 0
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CDMGFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG. (Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD. MERC.
ROSE CANYON	4.3(6.9)	6.9	0.310	IX
NEWPORT-INGLEWOOD (Offshore)	5.6(9.0)	6.9	0.270	IX
CORONADO BANK	20.4(32.9)	7.4	0.144	VIII
ELSINORE-TEMECULA	24.7(39.8)	6.8	0.091	VII
ELSINORE-JULIAN	24.8(39.9)	7.1	0.106	VII
ELSINORE-GLEN IVY	34.8(56.0)	6.8	0.070	VI
PALOS VERDES	36.4(58.5)	7.1	0.079	VII
EARTHQUAKE VALLEY	43.7(70.3)	6.5	0.050	VI
NEWPORT-INGLEWOOD (L.A.Basin)	47.0(75.6)	6.9	0.058	VI
SAN JACINTO-ANZA	47.4(76.3)	7.2	0.068	VI
SAN JACINTO-SAN JACINTO VALLEY	48.0(77.3)	6.9	0.057	VI
CHINO-CENTRAL AVE. (Elsinore)	48.1(77.4)	6.7	0.063	VI
WHITTIER	52.4(84.3)	6.8	0.051	VI
SAN JACINTO-COYOTE CREEK	52.6(84.7)	6.8	0.051	VI
COMPTON THRUST	56.6(91.1)	6.8	0.058	VI
ELSINORE-COYOTE MOUNTAIN	57.5(92.6)	6.8	0.047	VI
ELYSIAN PARK THRUST	59.4(95.6)	6.7	0.053	VI
SAN JACINTO-SAN BERNARDINO	60.8(97.9)	6.7	0.043	VI
SAN ANDREAS - San Bernardino	65.7(105.8)	7.3	0.056	VI
SAN ANDREAS - Southern	65.7(105.8)	7.4	0.059	VI
SAN JACINTO - BORREGO	66.1(106.4)	6.6	0.038	V
SAN JOSE	69.2(111.4)	6.5	0.043	VI
CUCAMONGA	71.8(115.6)	7.0	0.054	VI
SIERRA MADRE	71.9(115.7)	7.0	0.054	VI
PINTO MOUNTAIN	72.7(117.0)	7.0	0.044	VI
SAN ANDREAS - Coachella	73.7(118.6)	7.1	0.046	VI
NORTH FRONTAL FAULT ZONE (West)	76.4(123.0)	7.0	0.051	VI
BURNT MTN.	78.5(126.4)	6.4	0.030	V
CLEGHORN	78.5(126.4)	6.5	0.032	V
NORTH FRONTAL FAULT ZONE (East)	80.8(130.0)	6.7	0.042	VI
RAYMOND	80.9(130.2)	6.5	0.038	V
CLAMSHELL-SAWPIT	81.3(130.8)	6.5	0.038	V
EUREKA PEAK	81.3(130.9)	6.4	0.029	V
SAN ANDREAS - 1857 Rupture	81.7(131.5)	7.8	0.061	VI
SAN ANDREAS - Mojave	81.7(131.5)	7.1	0.042	VI
SUPERSTITION MTN. (San Jacinto)	82.3(132.5)	6.6	0.032	V
VERDUGO	83.3(134.1)	6.7	0.041	V
HOLLYWOOD	85.3(137.2)	6.4	0.034	V
ELMORE RANCH	86.0(138.4)	6.6	0.031	V
SUPERSTITION HILLS (San Jacinto)	87.1(140.1)	6.6	0.031	V

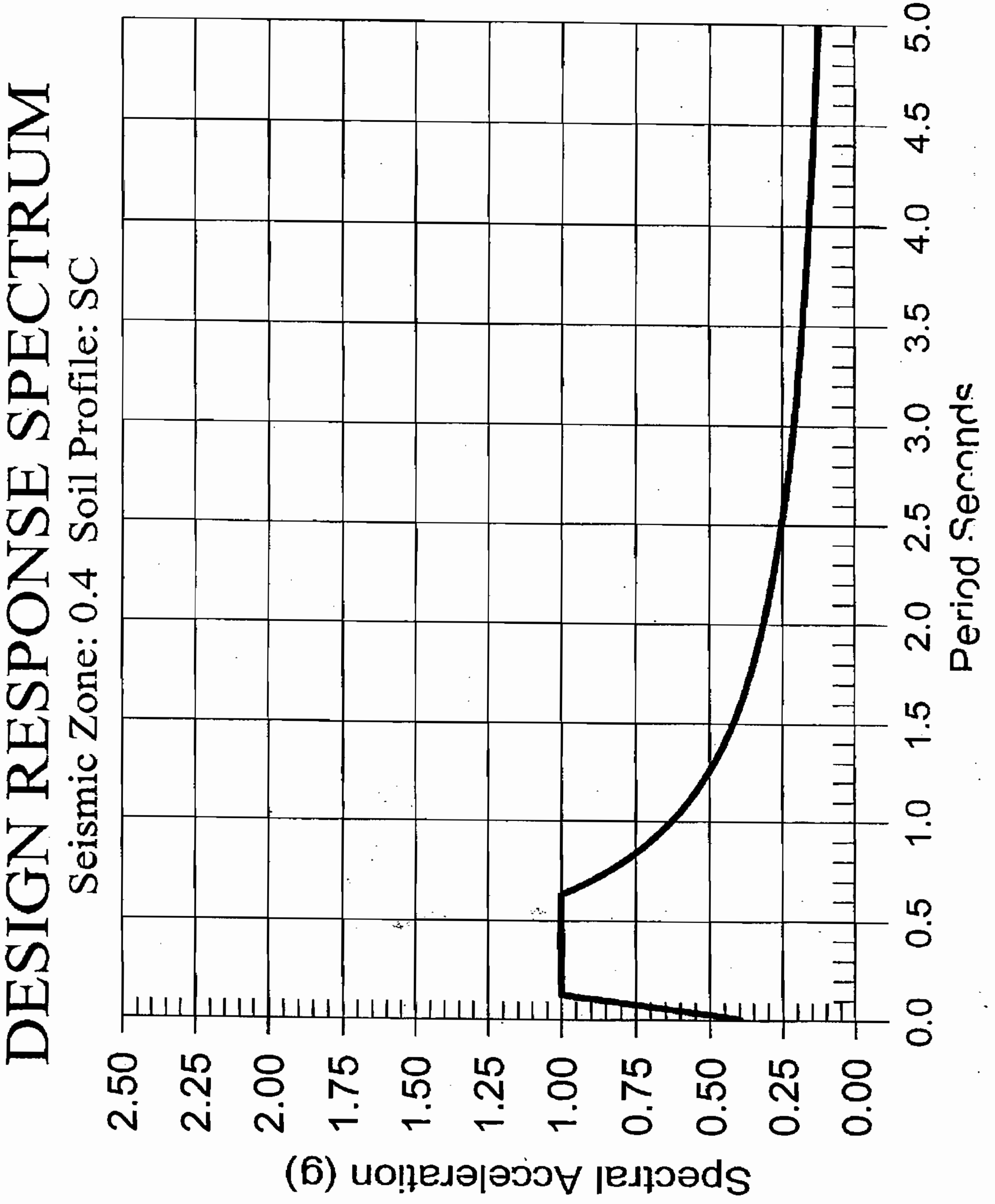
DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
LANDERS	88.5(142.4)	7.3	0.044	VI
LAGUNA SALADA	88.8(142.9)	7.0	0.038	V
HELENDALE - S. LOCKHARDT	89.2(143.6)	7.1	0.039	V
SANTA MONICA	90.0(144.8)	6.6	0.037	V
MALIBU COAST	92.7(149.2)	6.7	0.038	V
LENWOOD-LOCKHART-OLD WOMAN SPRGS	93.1(149.9)	7.3	0.042	VI
BRAWLEY SEISMIC ZONE	95.3(153.3)	6.4	0.026	V
JOHNSON VALLEY (Northern)	96.3(154.9)	6.7	0.030	V
SIERRA MADRE (San Fernando)	96.3(155.0)	6.7	0.037	V
NORTHRIDGE (E. Oak Ridge)	96.5(155.3)	6.9	0.041	V
EMERSON So. - COPPER MTN.	96.6(155.5)	6.9	0.033	V
ANACAPA-DUME	98.0(157.7)	7.3	0.050	VI
SAN GABRIEL	98.1(157.9)	7.0	0.035	V

-END OF SEARCH- 53 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

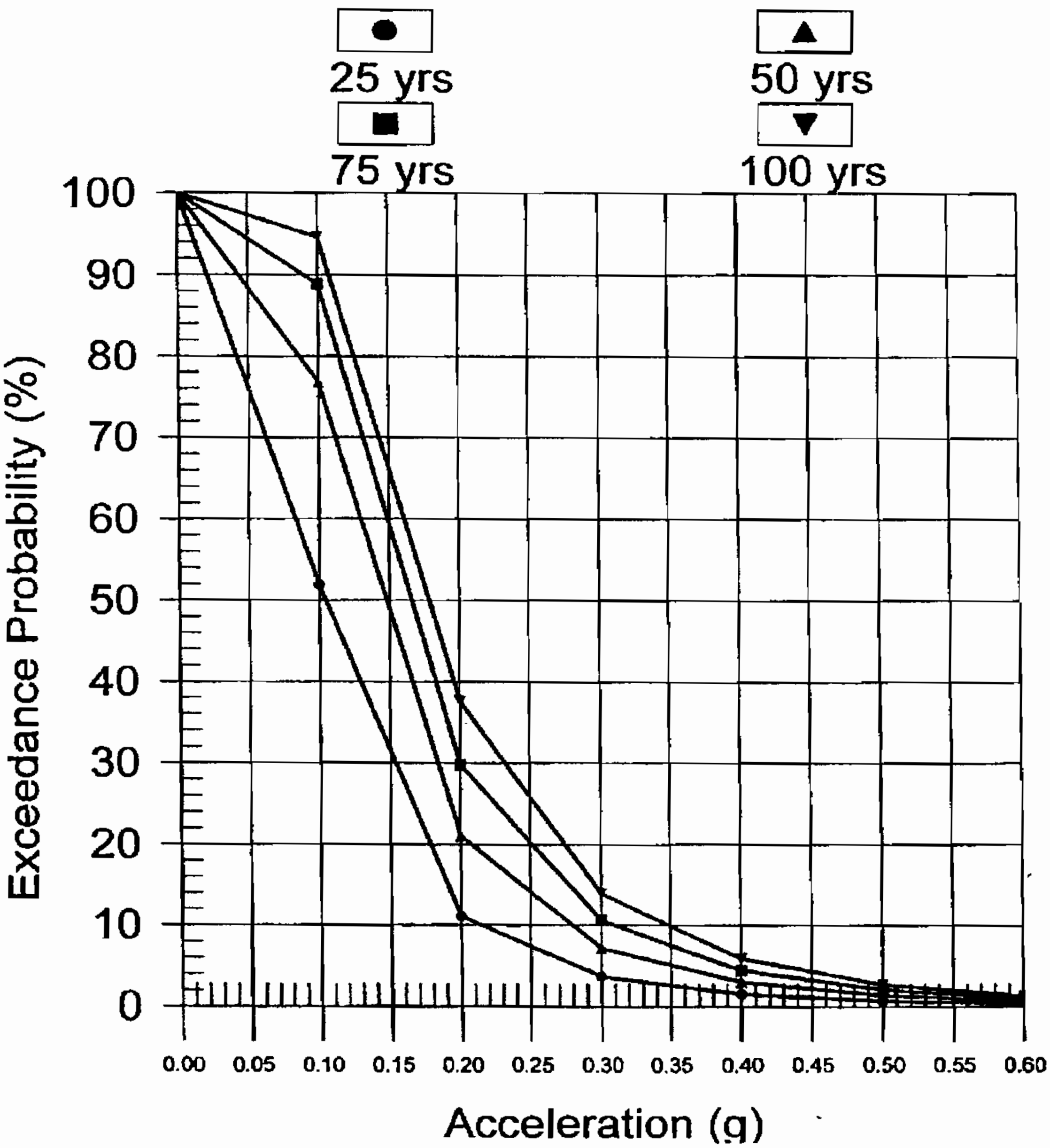
THE ROSE CANYON FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 4.3 MILES (6.9 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.3103 g


DESIGN RESPONSE SPECTRUM
Seismic Zone: 0.4 Soil Profile: SC
Spectral Acceleration (g)
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Period Seconds

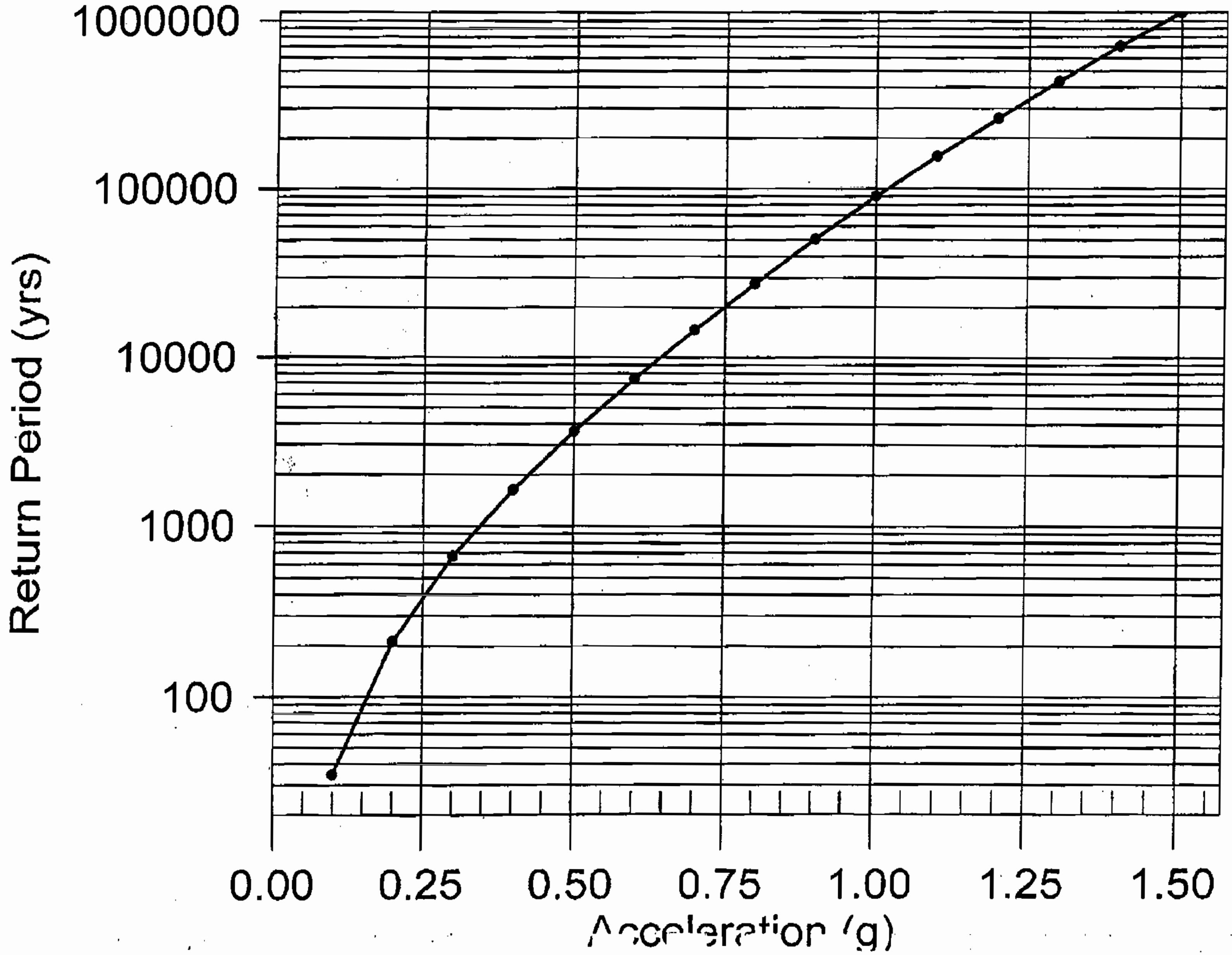
PROBABILITY OF EXCEEDANCE

BOORE ET AL(1997) NEHRP C (520)1



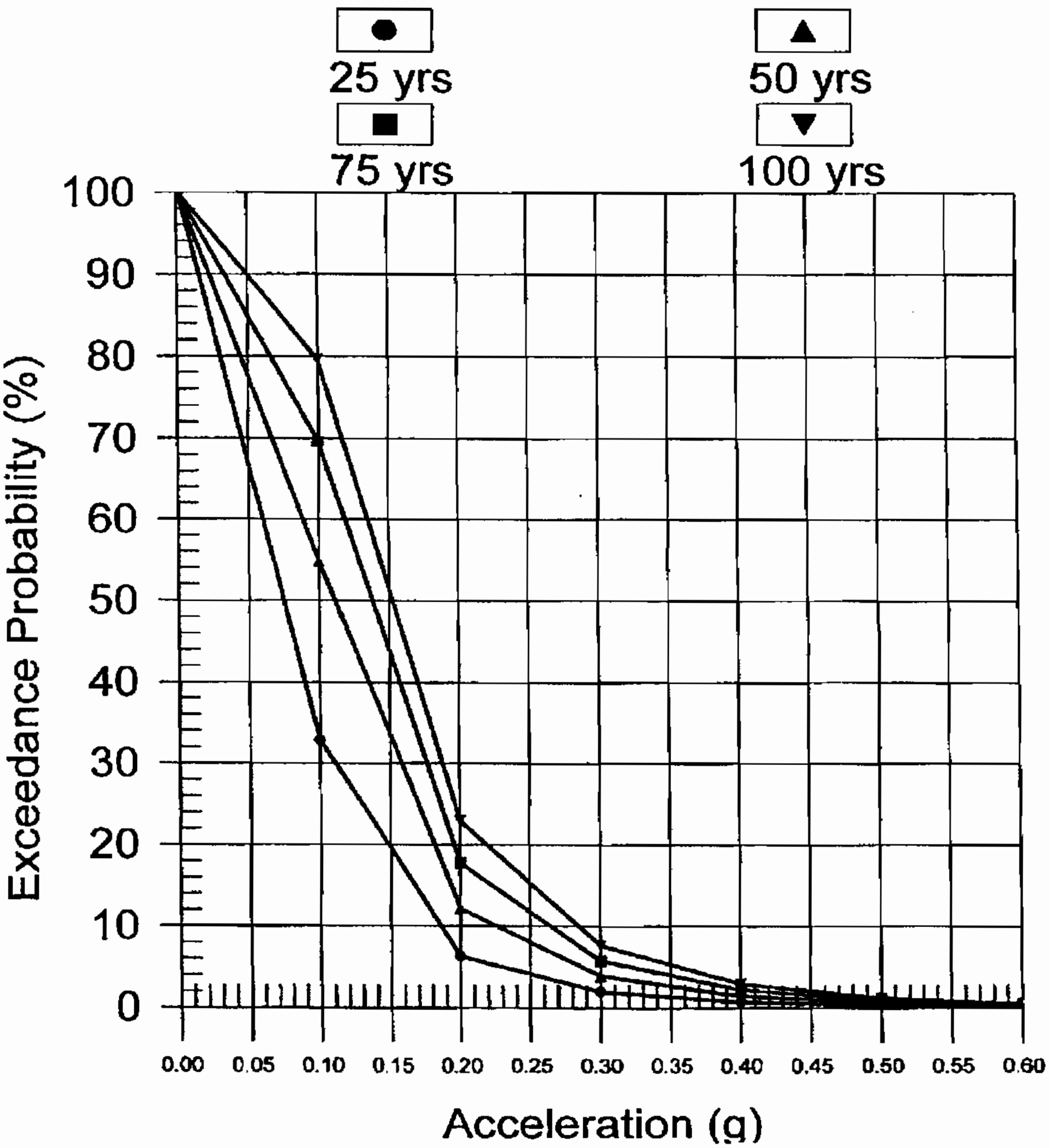
RETURN PERIOD vs. ACCELERATION

BOORE ET AL(1997) NEHRP C (520)1



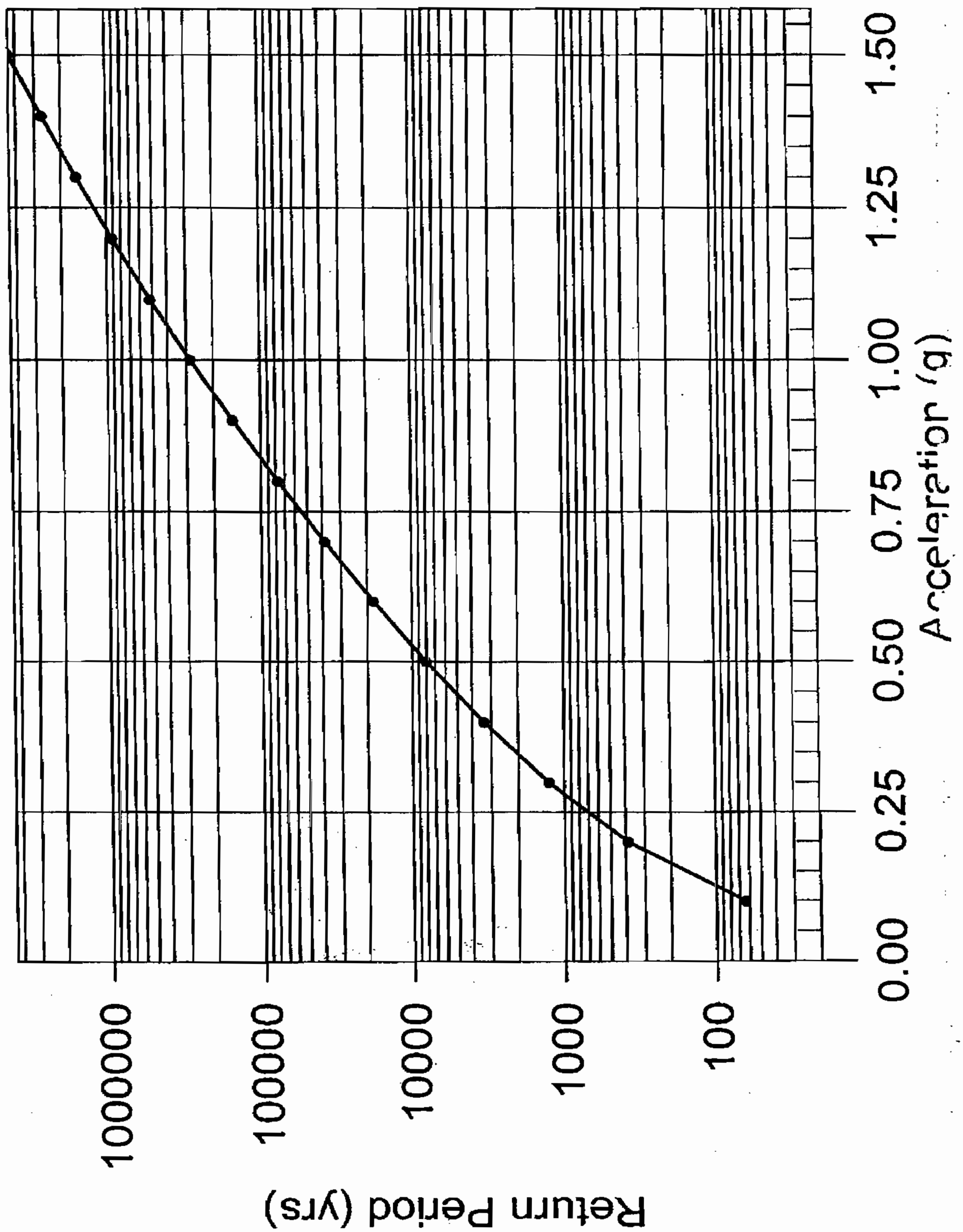
PROBABILITY OF EXCEEDANCE

BOORE ET AL(1997) NEHRP C (520)2



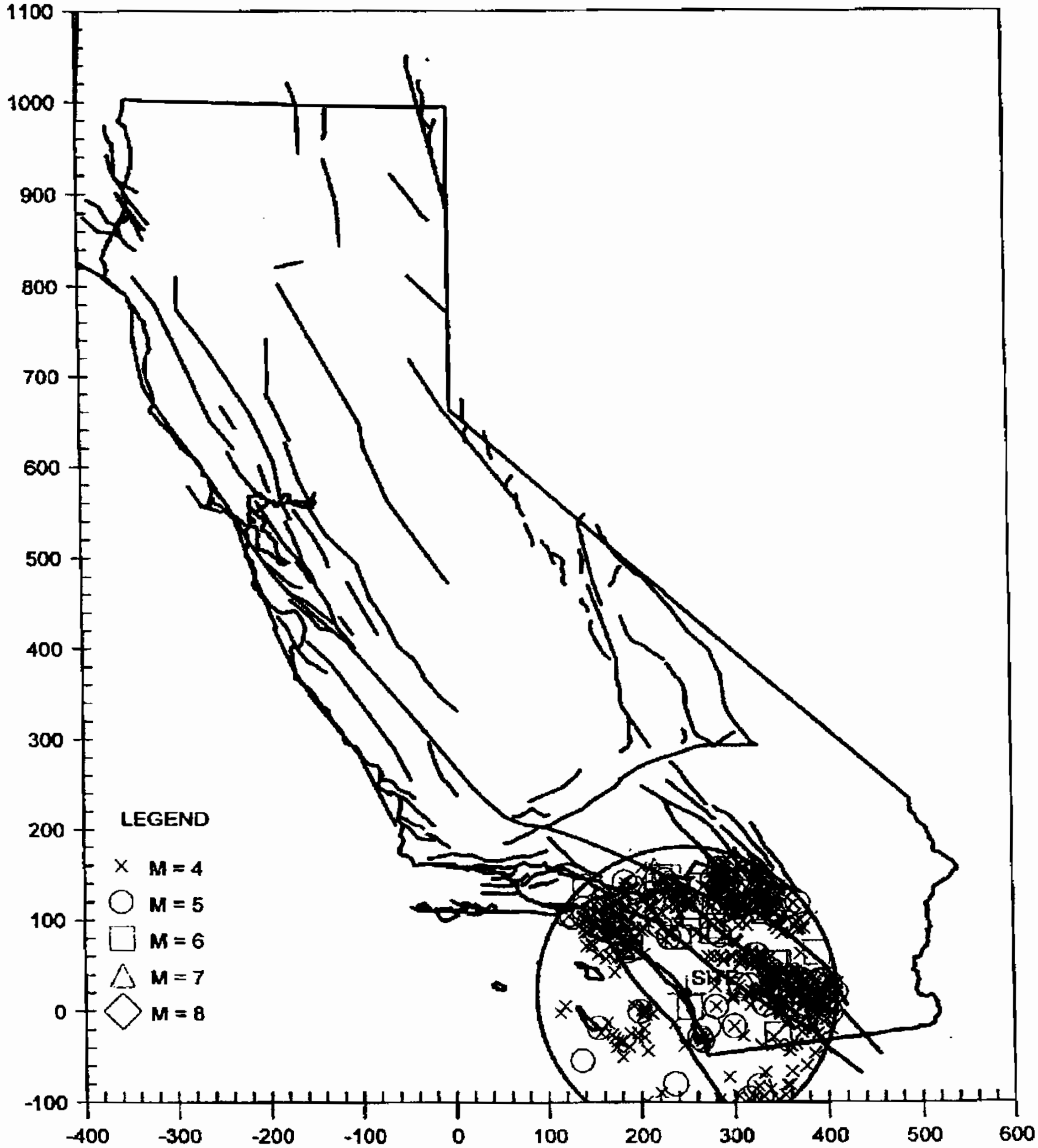
RETURN PERIOD vs. ACCELERATION

BOORE ET AL(1997) NEHRP C (520)2



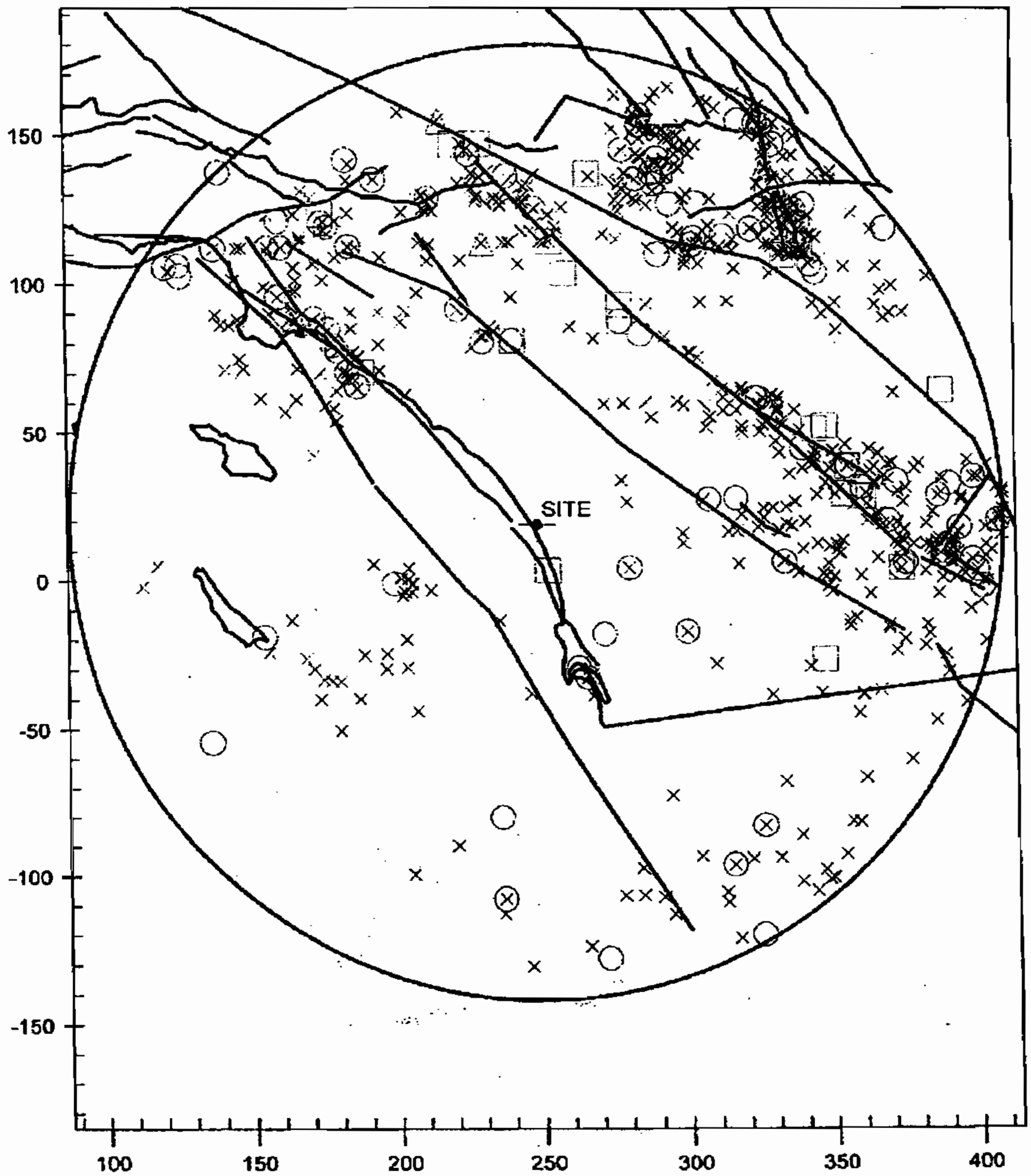
EARTHQUAKE EPICENTER MAP

Poseidon Desalination Facility



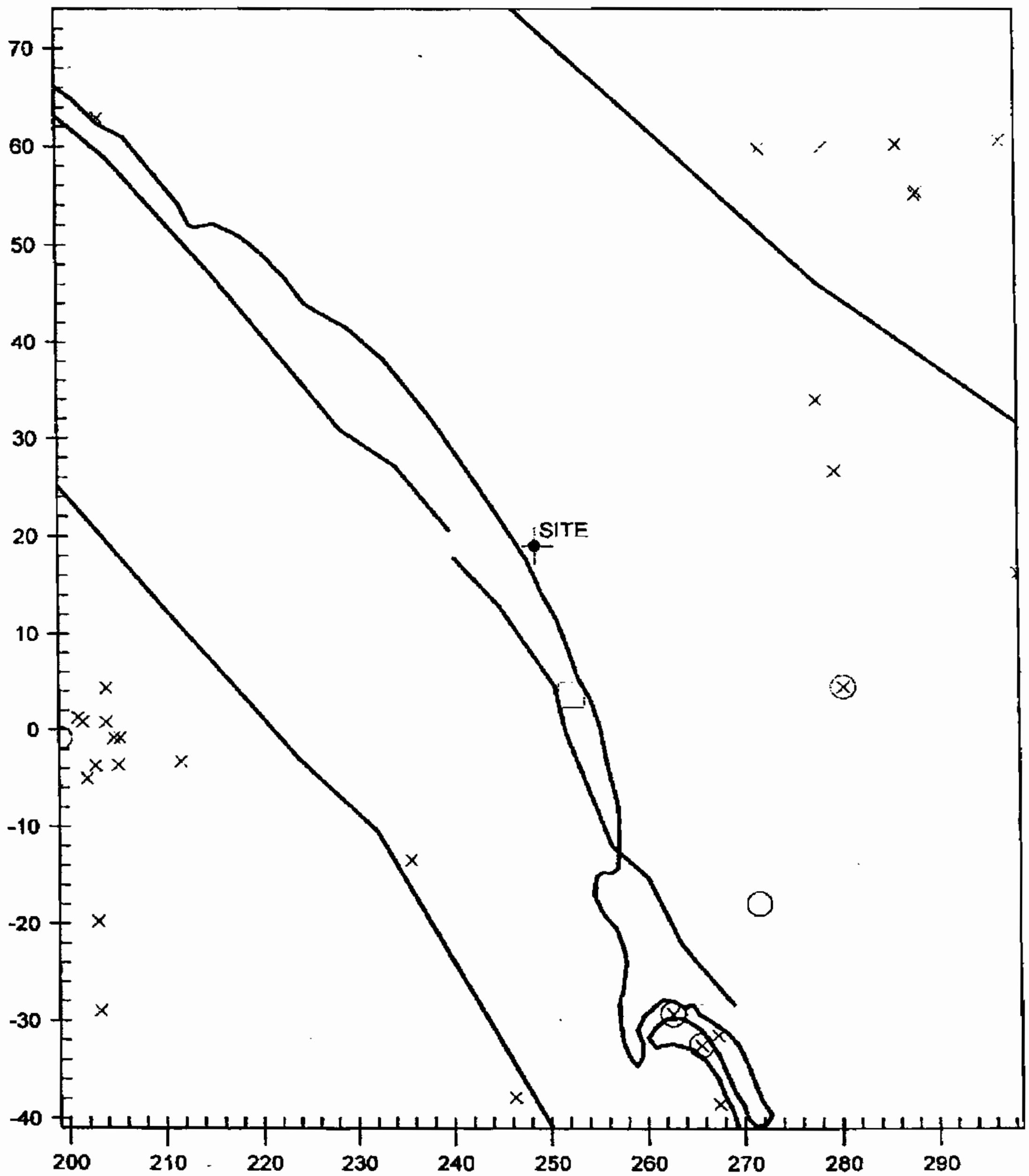
EARTHQUAKE EPICENTER MAP

Poseidon Desalination Facility



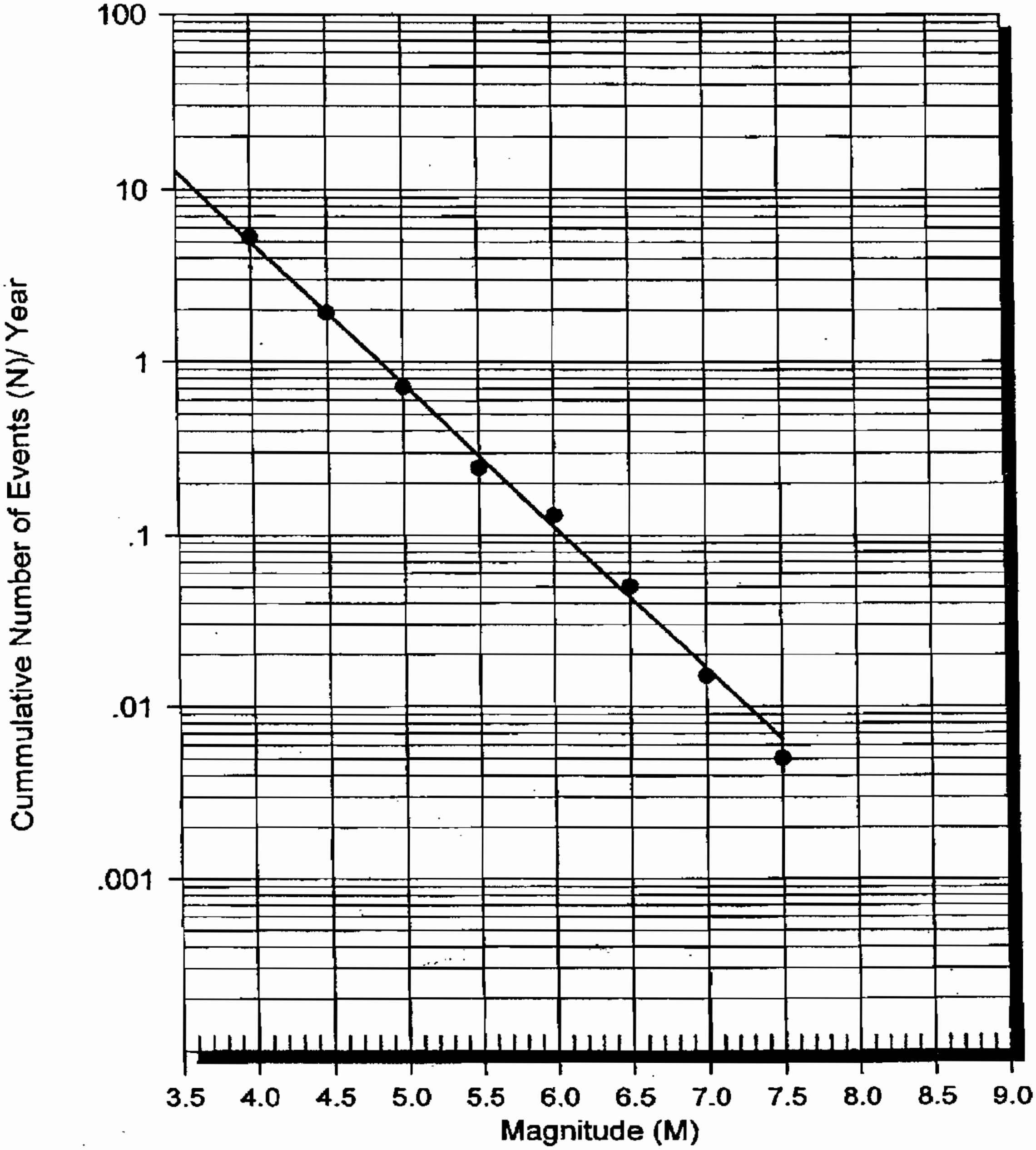
EARTHQUAKE EPICENTER MAP

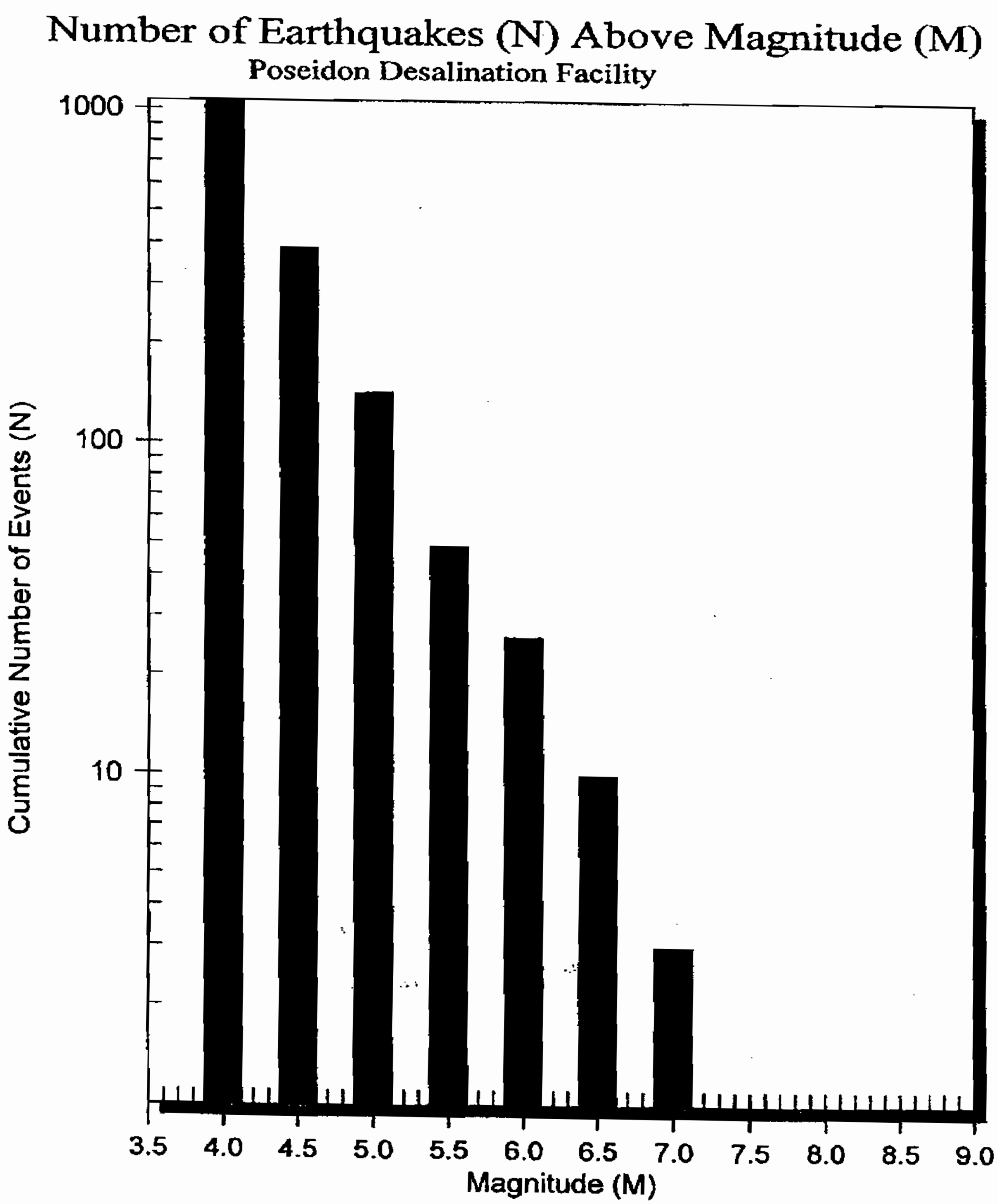
Poseidon Desalination Facility



EARTHQUAKE RECURRENCE CURVE

Poseidon Desalination Facility




Number of Earthquakes (N) Above Magnitude (M)
Poseidon Desalination Facility
1000
100
10
Cumulative Number of Events (N)
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
Magnitude (M)

LIQUEFACTION EVALUATION SPREADSHEET

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997
and *Evaluation of Settlements in Sand due to Earthquake Shaking*, Tokimatsu and Seed, 1987

Project: Poseidon Desalination Facility
Job No.: 2003-081

Maximum Credible Earthquake: 6.9 — Rose Canyon Fault at 6.3 miles from the site
Design Ground Motion: 0.28 g — UBC Design Earthquake Ground Motion using NEHRP (S2)
Total Unit Weight, γ_{total}: 120 ft^3
Bouyant Unit Weight, γ_{eff}: 57.6 ft^3
Depth to Groundwater: 20 ft

Data from Boring B-2, 3, 4, 5, 6,& 7

using average minimim SPT values

Resistance Evaluation

Boring Data: Depth (ft)	Blow Counts: SPT	Blow Counts: Mod. Cal	Effective Stress (tsf)	Sampling Corrections: Sampler Diameter	SPT N_m	Energy C_E	Borehole C_B	Rod C_R	Liner C_L	Overburden C_N	Corrected SPT $(N_1)_{60}$	Resistance to Liquefaction: Fines Content %	Confining Correction K_σ	SPT Clean Sands $(N_1)_{60cs}$	Cyclical Resistance $CRR_{M7.5}$	Magnitude Scaling Factor	Cyclical Resistance CRR_M	Induced Stress: Elastic Reduction r_d	Cyclical Stress CSR	Factor of Safety
5	20		0.30	1	20	1	1.15	0.75	1.1	1.83	35		1	35	NL	1.24	NL	0.990	0.045	NL
10	20		0.60	1	20	1	1.15	0.75	1.1	1.29	24		1	24	0.275	1.24	0.340	0.979	0.069	NL
15	20		0.90	1	20	1	1.15	0.85	1.1	1.05	23	25	1	30	0.405	1.24	0.501	0.969	0.132	NL
20	30		1.20	1	30	1	1.15	0.95	1.1	0.91	33	25	0.86	41	NL	1.24	NL	0.957	0.174	NL
25	30		1.34	1	30	1	1.15	0.95	1.1	0.86	31	25	0.82	39	NL	1.24	NL	0.942	0.191	NL
30	32		1.49	1	32	1	1.15	0.95	1.1	0.82	32	25	0.85	39	NL	1.24	NL	0.921	0.203	NL
35	33		1.63	1	33	1	1.15	1	1.1	0.78	33	25	0.85	41	NL	1.24	NL	0.891	0.209	NL
40	35		1.78	1	35	1	1.15	1	1.1	0.75	33	25	0.83	41	NL	1.24	NL	0.851	0.209	NL
45	37		1.92	1	37	1	1.15	1	1.1	0.72	34	25	0.82	42	NL	1.24	NL	0.804	0.208	NL
50	40		2.06	1	40	1	1.15	1	1.1	0.70	35	25	0.82	44	NL	1.24	NL	0.753	0.199	NL
55	42		2.21	1	42	1	1.15	1	1.1	0.67	36	25	0.82	44	NL	1.24	NL	0.703	0.191	NL
60	44		2.35	1	44	1	1.15	1	1.1	0.65	36	25	0.82	45	NL	1.24	NL	0.659	0.184	NL

NL=Non-liquefiable

Settlement Evaluation

Depth to Top of Layer (ft)	Depth to Bottom of Layer (ft)	Layer Thickness (ft)	Midpoint Depth (ft)	Total Stress (psf)	Effective Stress (psf)	Elastic Reduction r_d	Induced Cyclical Stress Ratio CSR_M	Magnitude Weighting Factor	Equivalent Cyclical Stress Ratio $CSR_{M7.5}$	$(N_1)_{60}$	Fines Correction	SPT Clean Sands $(N_1)_{60cs}$	Cyclical Resistance $CRR_{M7.5}$	Normalized Cyclical Stress Ratio (CSR/CRR)	Volumetric Strain (%)	Layer Settlement (in)
20	25	5	22.5	2700	2400	0.950	0.195	0.91	0.177	30	2	32	0.413	0.43	0.2%	0.12
25	30	5	27.5	3300	2688	0.932	0.208	0.91	0.189	30	2	32	0.413	0.46	0.2%	0.12
30	35	5	32.5	3900	2976	0.907	0.216	0.91	0.197	32	2	34	0.509	0.39	0.1%	0.06
35	50	15	42.5	5100	3264	0.828	0.235	0.91	0.214	34	2	36	1.000	0.21	0.0%	0

Total Post-Liquefaction Settlement of Saturated Sands = 0.30

Note:
For $(N_1)_{60cs}$ > 30, CRR is reported as NL (non-liquefiable)
Above ground water table, factor of safety is reported as NL

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C_N	$(P_a/\sigma'_{vo})^{0.5}$ $0.4<C_N<=2$
Energy Ratio	Donut Hammer Safety Hammer Automatic-Trip Donut-Type Hammer	C_E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.5 inch to 4.5 inch 6 inch 8 inch	C_B	1.0 1.05 1.15
Rod length	10 feet to 13 feet 13 feet to 19.6 feet 19.6 feet to 33 feet 33 feet to 98 feet > 98 feet	C_R	0.75 0.85 0.95 1.00 <1.0
Sampling Method	Standard Sampler Sampler without liners	C_L	1.00 1.1 to 1.3

Induced Cyclical Stress Ratio Compared to Cyclical Resistance Ratio Base Curve

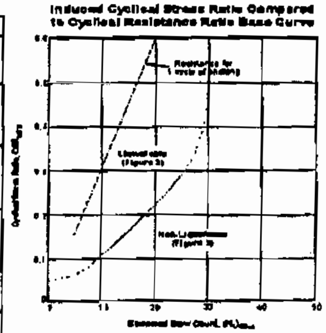


Figure 1

Post-Liquefaction Strain
Magnitude Weighting and Fines Correction according to Seed and Harder, 1990

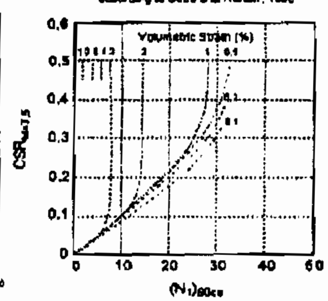


Figure 2

Pore Pressure Dissipation Strain
Pre-Mapping Induced Stresses and Resistant according to Youd and Idriss, 1997

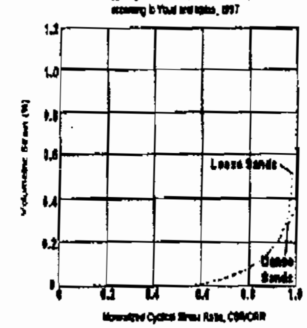


Figure 3