APPENDIX E

ENGINEERING GEOLOGICAL AND GEOHAZARDS ASSESSMENT REPORT, MISSION GEOSCIENCE, INC.

REPORT OF GEOTECHNICAL INVESTIGATION, PROPOSED HOME DEPOT, OIL TANK FARM, GPI GEOTECHNICAL PROFESSIONALS, INC.

LOS ANGELES
SAN FRANCISCO

MISSION GEOSCIENCE, INC.

ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

ENGINEERING GEOLOGIC & GEOHAZARDS ASSESSMENT REPORT

LONG BEACH HOME DEPOT SITE
400 STUDEBAKER ROAD
LONG BEACH, CALIFORNIA

Prepared for:
CITY OF LONG BEACH
DEPARTMENT OF PLANNING & BUILDING
333 West Ocean Boulevard, 7th Floor
Long Beach, California 90802
Attn: Ms. Angela Reynolds, AICP
Environmental & Advance Planning Officer

MISSION File Number 03-475

December 20, 2004

Prepared by:
MISSION GEOSCIENCE, INC.
2082 Michelson Drive, 4th Floor
Irvine, CA 92612

LOS ANGELES
SAN FRANCISCO

MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

December 20, 2004

Ms. Angela Reynolds, AICP
Environmental & Advance Planning Officer
CITY OF LONG BEACH
DEPARTMENT OF PLANNING & BUILDING
333 West Ocean Boulevard, 7th Floor
Long Beach, California 90802

RE: ENGINEERING GEOLOGIC & GEOHAZARDS ASSESSMENT REPORT
LONG BEACH HOME DEPOT SITE
400 Studebaker Road, Long Beach, CA
MISSION File Number 03-475

Dear Ms. Reynolds:

In accordance with your request and authorization, Mission Geoscience, Inc. (MISSION) has prepared this *Engineering Geologic & GeoHazards Assessment Report* for the City of Long Beach and LSA Associates, Inc. (LSA), for the proposed Long Beach Home Depot commercial center to be located at 400 Studebaker Avenue, Long Beach, California (the SITE). The SITE is a former Tank Farm with a total area of approximately 17.8 acres, and adjoins the Alamitos Generating Station (AGS) to the north and east. The SITE is located to the east of the intersection of Loynes Drive and Studebaker Road. This Report presents MISSION's findings, conclusions and recommendations.

2082 Michelson Drive, Suite 400, Irvine, CA 92612 • (949) 955-9086 • FAX (949) 955-9088
www.MissionGeoscience.com • NATIONWIDE (800) 556-4774

MISSION appreciates this opportunity to be of professional service to you, the City of Long Beach, and LSA on this proposed commercial development project. Should you have any questions or desire additional information, please contact us at your earliest convenience.

Respectfully Submitted,
MISSION GEOSCIENCE, INC.

Ronaldo A. Almero, RG, CEG, REA
Senior Engineering Geologist

John Jay Roberts, RG, CEG, REA
Associate Geologist

CERTIFIED ENGINEERING GEOLOGIST
RONALDO A. ALMERO
RG No. 6654
CEG No. 2157
Exp 9/30/05
STATE OF CALIFORNIA

REGISTERED GEOLOGIST No. 3459
JOHN JAY ROBERTS
CERTIFIED ENGINEERING GEOLOGIST No 1010
EXPIRATION DATE
STATE OF CALIFORNIA

DISTRIBUTION: 3 copies - Addressee
1 copy - Ms. Lisa D. Williams, REHS, REA/LSA Associates, Inc.

RAA/JJR/03-475GeohzRpt.wpd

EXECUTIVE SUMMARY

This report presents the findings of MISSION's Engineering Geologic & GeoHazards Assessment for the approximate 17.8-acre former Tank Farm located at 400 Studebaker Road, Long Beach, California (the SITE, Figure 1) which is located east of the intersection of Loynes Drive and Studebaker Road and within the Alamitos Generating Station (AGS) facility complex. It is MISSION's understanding that this property is presently owned by Studebaker LB, LLC, and is proposed to be developed for the Long Beach Home Depot commercial center.

This study was conducted by Mission Geoscience, Inc. (MISSION) on behalf of the City of Long Beach Department of Planning and Building (LBDPB) and LSA Associates, Inc. (LSA). Considering that this SITE is located within a generally seismically-active region, and also within a partly reclaimed (backfilled) former tidal marsh area (wetlands), MISSION performed this assessment in order to identify potential engineering geologic and geologic hazards which may subsequently be addressed during project planning, design and construction.

Based upon the information reviewed during the completion of this investigation, MISSION presents the following conclusions and recommendations:

- The SITE is <u>not</u> located within a currently-designated Alquist-Priolo (AP) Earthquake Fault Zone, nor is it currently identified by the regulatory community as being located within zones of either primary or secondary co-seismic surface deformation (i.e., pressure ridges, escarpments, fissures, etc.). Thus, the SITE is not expected to experience primary surface fault rupture or related ground deformation during the life of the proposed development. However, since the SITE is only 0.9 km northeast of the recognized surface traces of ground deformation within the Newport-Inglewood Structural Zone (NISZ) which is the nearest AP fault to the SITE significant ground shaking or secondary seismic ground deformation effects may be anticipated at the SITE should a major seismic event occur along the NISZ or any of the active faults discussed in Section 3.1 of this report.

- For preliminary design purposes, the strong ground shaking due to an earthquake expected on-SITE associated with a "design basis ground motion or design basis earthquake" (DBE, with a 10 percent probability of exceedance in 50 years), is estimated to be 0.45g. However, the ultimate SITE seismic design acceleration should be determined by the Project Structural Engineer. Earthquake-resistant design should be incorporated into final SITE drawings in accordance with the most current California Building Code and the recommended seismic design parameters of the Structural Engineers Association of California, at a minimum.

- Historic shallow groundwater beneath the SITE and vicinity is reported at approximate depths of 4 to 18 feet below ground surface (bgs). The SITE is located in an area where liquefiable materials occur and/or where liquefaction has occurred in the past, and the SITE liquefaction hazard potential has been identified in the literature to be very high. Therefore, MISSION recommends that the liquefaction potential be evaluated during a detailed geotechnical investigation of the SITE during project design and construction phases.

- Based upon MISSION's review of the latest Grading Plan C-2.0 prepared by Madison Civil Engineering/Land Surveying and dated October 5, 2004, the ground surface is relatively flat with no manufactured slopes greater than 4:1 (horizontal:vertical). Furthermore, the potential for lateral spreading on SITE which may be caused by liquefaction was evaluated by GPI (2003). Based upon their study, GPI concluded that it was unlikely that lateral spreading would occur on the SITE. Thus, MISSION concludes that the potential hazard due to lateral spreading on the SITE is low.

- Due to relatively flat SITE area topography, MISSION considers the potential hazards from either static or dynamic slope instability to be negligible.

- Considering that the SITE lies within Flood Zone X which is outside the 100-Year Flood Plain, MISSION concludes that the potential of SITE flooding is low.

- The on-SITE clayey soils have an expansion potential of medium to high, and are considered to be severely corrosive to steel (GPI, 2003); thus MISSION recommends that specific recommendations be provided in a comprehensive geotechnical report to mitigate these geotechnical constraints during the design and construction of SITE structures.

- High concentrations of methane exceeding regulatory limits in were detected shallow on-SITE soils during a preliminary methane soil gas investigation in the area where the proposed Home Depot building pad is planned to be constructed. Thus, MISSION recommends that additional methane soil gas investigation be conducted following rough grading and prior to building construction and utility installation. The additional methane soil gas investigation should be performed in accordance with the local industry standards and be approved by the City of Long Beach. Based upon the results of this additional investigation, mitigation measures may be necessary including providing conventional vapor barriers and venting systems beneath buildings and confined spaces. Methane mitigation measures should be approved by the City of Long Beach.

- Undocumented fills and petroleum hydrocarbon-impacted soils were reported to occur on-SITE. MISSION recommends that an on-SITE Soil and Air Monitoring Program to be approved by the City of Long Beach be prepared and implemented during SITE grading and excavation. Air monitoring should be in conformance with applicable rules and regulations of the South Coast Air Quality Management District. Petroleum hydrocarbon-impacted soils found to contain petroleum hydrocarbon constituents in excess of prevailing regulatory thresholds should be removed and recycled at an appropriate State-approved facility.

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Purpose and Scope 1
1.2 SITE Description and Vicinity 2
1.3 Proposed SITE Development 3

2.0 GEOLOGIC SETTING 4
2.1 SITE Geology and Soils 4
2.2 Hydrogeology 5

3.0 ACTIVE FAULTING AND CO-SEISMIC DEFORMATION 6
3.1 Regional Faults 6
3.1.1 Newport-Inglewood Structural Zone 9
3.1.2 Compton-Los Alamitos Blind Thrust Fault System 9
3.1.3 Palos Verdes Fault 10
3.1.4 Combined Elysian Park-Puente Hills Blind Thrust System 10
3.1.5 Whittier-Elsinore Fault Zone 11
3.1.6 Raymond Fault 11
3.1.7 Chino-Central Avenue Fault 11
3.1.8 Sierra Madre-Cucamonga Fault Zone 12
3.1.9 San Jacinto Fault Zone 12
3.1.10 San Andreas Fault Zone 13
3.2 Surface Faulting Potential 13
3.3 Significant Historic Earthquakes 13
3.4 Geologic Subgrade Classification and Soil Profile 15
3.5 Seismic Zone 15
3.6 Near-Source Effects 15
3.7 Probabilistic Ground Response Estimate 16
3.8 Liquefaction 16

4.0 GEOTECHNICAL CONSTRAINTS 17
4.1 Slope Stability 17
4.2 Flood and Wave Run-Up Hazards 18
4.3 Subsidence 18
4.4 Methane Gas 19
4.5 Expansive Soils 19
4.6 Undocumented Fills and Petroleum Hydrocarbon-Impacted Soils 19

TABLE OF CONTENTS *(Cont'd.)*

5.0 SUMMARY OF FINDINGS, CONCLUSIONS, & RECOMMENDATIONS 20

6.0 LIMITATIONS 22

7.0 REFERENCES 23

FIGURES

Figure 1	SITE Location Map
Figure 2	SITE Plan
Figure 3	Potential Seismic Sources
Figure 4	Earthquake Fault Zones Zone Map
Figure 5	Seismic Hazards Zones Map
Figure 6	Flood Hazards Zones Map
Figures 7.1, 7.2 & 7.3	Probabilistic Ground Response Curves

APPENDICES

Appendix	Description
A	Ground Response Estimation Technique

1.0 INTRODUCTION

This report presents the findings of the engineering geologic and geologic hazards assessment for an approximate 17.8-acre former Tank Farm located at 400 Studebaker Road, Long Beach, California (the SITE, Figure 1) which is located east of the intersection of Loynes Drive and Studebaker Road and within the Alamitos Generating Station (AGS) facility complex. It is MISSION's understanding that this property is presently owned by Studebaker LB, LLC, and is proposed to be developed for the Long Beach Home Depot commercial center.

This study was conducted by Mission Geoscience, Inc. (MISSION) on behalf of the City of Long Beach Department of Planning and Building (LBDPB) and LSA Associates, Inc. (LSA). Considering that this SITE is located within a generally seismically-active region, and also within a partly reclaimed (backfilled) former tidal marsh area (wetlands), MISSION performed this assessment in order to identify potential engineering geologic and geologic hazards which may impact project development and which may subsequently be addressed during project planning, design and construction.

1.1 Purpose and Scope

The purpose of this assessment is to provide the necessary preliminary engineering geologic and geotechnical hazards information, including but not limited to the identification and evaluation of active faults and on-SITE geotechnical conditions which may potentially impact the SITE development.

To accomplish this objective, the following scope of work was performed:

- Reviewed readily available published and unpublished soils, geologic, geotechnical, seismic, hydrologic and hydrogeologic documentation pertaining to the subject SITE and vicinity.

- Conducted a limited reconnaissance involving observations of surficial engineering geologic conditions on January 27, 2004, to preliminarily identify potential geotechnical hazards.

- Conducted literature review of nearby known "Active" and "Potentially Active" faults for assessment of primary seismic hazards, including estimates of "design basis ground motion" (DBE) at the SITE resulting from earthquake events along these faults.

- Conducted literature review for secondary seismic hazards which may potentially impact the SITE, as defined within the State of California's Seismic Hazards Mapping Act, including seismic slope instability and liquefaction.

- Performed a preliminary and qualitative evaluation of general slope stability, soils liquefaction potential and other potential geotechnical concerns at the SITE, based upon our SITE reconnaissance and review of available documents.

- Presented our professional opinions in this *Engineering Geologic & GeoHazards Assessment Report* which includes our conclusions and recommendations for further investigation, if appropriate.

1.2 SITE Description and Vicinity

The Long Beach Home Depot commercial center is proposed to be developed as a 16.7-parcel Site on a generally rectangular shaped, approximate 17.8-acre property located at 400 Studebaker Road, City of Long Beach, California, which is located east of the intersection of Loynes Drive and Studebaker Road. According to the USGS 7.5 minute series topographic map, Alamitos Quadrangle (USGS, 1964), the SITE is situated on generally flat topography at elevations between 5 and 10 feet above mean sea level (msl). An available grading plan (Madison, 2002, Figure 2) indicates ground surface elevations at the SITE range from 7.5 to 10.5 feet above msl. The overall ground surface in the SITE vicinity consists of very gentle slopes, basically from the location of the above ground petroleum storage tanks (ASTs) toward the perimeter of the containment berms. In general, the on-SITE ground surface slopes toward the southwest.

The SITE is a former Tank Farm developed with four large and two small ASTs (with storage capacities ranging between 840,000 and 9.4 million gallons), and associated pumping, piping, and heating facilities (Figure 2). Each of the tanks is enclosed by an approximate 10-foot-high earthen containment berm. The ground surface around the tanks is paved with asphalt. Along the inner side of the berms are drainage systems and containment area gate valves. At present the tank system is inactive, partly damaged, and exposing the inner insulation materials. The asphalt paved surfaces around the tanks have already deteriorated in areas exposing the gravel base.

A former hazardous materials storage area is located within the northern central portion of the SITE (east of Tank #1). A concrete-lined sump is also located south of the former hazardous materials storage area.

The SITE is bordered to the north by an access road, a cooling water intake canal, and the Alamitos Generating Station (AGS) power units 1 through 4; to the east by several AGS facilities including a large open retention basin, the San Gabriel River Channel, and the Los Angeles Department of Water and Power (LADWP) generating facilities immediately east of the channel; to the south by an access road, a parking area, a cooling water intake canal, AGS units 5 and 6; and the Pacific Energy Tank Farm and associated piping facilities; and to the west, by Studebaker Road, Los Cerritos Channel, and residential development beyond.

1.3 Proposed SITE Development

According to the development plan (CA-929v by Greenberg Farrow, 2004) the proposed Long Beach Home Depot commercial center will consist of the development of approximately 16.4-acres of the approximate 17.8-acre property. The proposed commercial center includes development of four building pad areas with an approximate total 157,529 square feet (sq. ft.) of commercial space. The four pads comprise the following: a Home Depot Home Improvement Center and an Outdoor Garden Center; building pad A for a sit-down restaurant, and building pads B and C for Major Retail Tenant buildings. A total of 742 parking spaces are also proposed for development.

An existing distribution facility for petroleum is to remain in operation along the SITE's northern boundary. This facility occupies approximately 1.49 acres of the 17.8-acre property. The facility is comprised of: a cutter oil tank, a heating unit, and a pumping and distribution piping system enclosed within a concrete-lined containment berm which provides a spill catchment basin. Landscaped earthen berms and fencing will screen these facilities from the retail center.

Prior to construction of the commercial center, the four large and one of the smaller ASTs and their associated piping, the containment berms, the former hazardous material storage facility, and sump will be removed. Contaminated soils that are determined to be hazardous are planed to be managed, transported and disposed to a state-approved facility, in accordance with applicable regulatory agency regulations.

The Long Beach Home Depot commercial center will include the construction of an access road extending Loynes Drive eastward toward the middle portion of the commercial center where open parking areas are to be established. This project also includes construction of the necessary infrastructure for the new commercial center including storm water drainage, sewerage, water, electricity, natural gas, and telecommunications.

2.0 SITE GEOLOGY AND HYDROGEOLOGY

2.1 SITE Geology and Soils

The SITE lies within the southwestern block of the Los Angeles Basin which is comprised of a low alluvial flood plain. The flood plain is punctuated by a line of elongated low hills, folds and faults, which delineate the northwest-trending Newport-Inglewood Structural Zone. This structural zone is located approximately 0.9 km southwest of the SITE and has been designated as an Alquist Priolo active fault zone (Hart and Bryant, 1999; Jennings, 1994; Wright, 1991; Yerkes, et al., 1965). Signal Hill, located northwest of the SITE, is one of the elongated hills within this structural zone.

Recent deposits underlying the SITE are comprised of alluvial and coastal marine sediments. Flood plain deposits from the Los Angeles River and the San Gabriel River have contributed to the formation of the coastal plain on which the SITE is located. Prior to local development, the general SITE area consisted of tidal marshes which received alternating deposits of marine sands, organic silts and clays, and fluvial deposits, similar to the near-surface sediments beneath the SITE (Poland, et al., 1956; CDWR, 1961; Randell, et al., 1983). Based upon review of historical documents, fill materials were placed on the SITE, elevating it out of the former tidal marshes.

A geotechnical investigation (GPI, 2003) conducted for the project encountered undocumented fill materials on the SITE to depths of 7 to 10 feet consisting of interbedded brown to dark brown to black sandy clay (CL in the Unified Soil Classification System), silty fine-grained sand (SM), and sand (SP) with consistencies ranging from loose to dense and very stiff. Underlying the fill materials generally is fine- to coarse-grained sand (SP/SW) with interbeds of silt (MH/OH) and clay (CL/CH). Similar lithological units were also encountered during MISSION's (2004) methane soil gas investigation conducted at the SITE (Section 4.4).

According to the United States Department of Agriculture, Soil Conservation Service (1969), the native soils beneath the SITE belong to the Chino association. This soil association occurs on nearly level valleys. Typically, the surface layers are gray and dark gray loam, silt loam or clay loam approximately 16 inches thick and underlain by gray and light brownish-gray silty clay loam and clay loam substratum. They are usually over 60 inches deep, calcareous throughout and mottled in the lower section. The soils are poorly drained and have a moderately slow permeability. The Chino association consists of 85% Chino soils, 10% Foster soils, and 5% Grangeville soils. The shrink-swell potential of the on-SITE soils is moderate, and their corrosivity potential for untreated pipe is high. Based upon the results of materials testing on selected on-SITE soil samples, the expansive index of the clay soils on-SITE was reported to range from medium to high, and the on-SITE soils are severely corrosive to steel (GPI, 2003).

2.2 Hydrogeology

The SITE lies within the Central Groundwater Basin of the Los Angles County Department of Public Works (LACDPW, 1996). According to the California Department of Water Resources, major fresh water-bearing zones beneath the Long Beach area include, from shallowest to deepest: the Gaspur, Gage, Lynwood and Silverado Aquifers (Poland, et al., 1956; Poland, 1959; CDWR, 1961). However, only the Lynwood and Silverado Aquifers underlie the SITE and its immediate vicinity (CDWR, 1961). Saltwater intrusion into these aquifers near the coastline has caused chloride, salinity and total dissolved solids (TDS) concentrations exceeding allowable CCR Title 22 maximum contaminant levels in these aquifers southwest of the Newport-Inglewood Structural Zone, and thus no domestic water-supply wells are present in the vicinity of, or hydraulically down-gradient from, the SITE (Piper, et al., 1953).

The operations of the Alamitos Barrier Project since 1970 have been aimed at preventing seawater intrusion through the Alamitos Gap area into the groundwater supplies of the Central Basin of Los Angeles County and the southwestern portion of the Orange County Coastal Plain. The barrier project facilities include a series of injection wells from near Westminster Avenue trending northward along the Alamitos Channel, then westward immediately north of the AGS complex crossing the San Gabriel River and Los Cerritos Channels. The injection wells when in operations formed a freshwater pressure ridge which prevents seawater intrusion. Extraction wells located along the southern section of the San Gabriel River Channel when in operation formed a trough which breaks the landward intrusion of seawater. The SITE is located southwest of this barrier, thus is not protected from seawater intrusion. The chloride concentrations in groundwater beneath the SITE are reported to range between 250 and 15,000 milligrams per liter (mg/l) (Kistenmacher and Bernabe, 2004).

The historical depth to groundwater beneath the SITE was reported to range from 4 feet to 18 feet below ground surface (bgs) (CH2M Hill, 1997; GPI, 2003). According to available data from the LACDPW, the nearest water production well is Well # 503H, located approximately 1,200 feet southeast of the SITE has been abandoned. The depth to groundwater in this well, gauged on November 25, 1986, was 20.7 feet bgs. Another well (Well #503A) and is presently active is located approximately ½ mile southeast of the SITE and was last gauged on April 1, 2003 with a reported depth to groundwater of 44.2 feet bgs. These levels of groundwater within the LACDPW wells are most likely piezometric surfaces (pressure levels) since the well perforations set were reportedly in the deeper aquifers. Shallow groundwater flow direction is generally south-southwest toward Alamitos Bay (Tinsley, et al., 1985), but varies with season and tides.

3.0 ACTIVE FAULTING AND CO-SEISMIC DEFORMATION

The potential seismic hazards at the site of the proposed Long Beach Home Depot commercial center have been evaluated by MISSION pursuant to the California Geological Survey (CGS) previously the California Division of Mines and Geology (CDMG) Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California (1997)*; *Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California* (SCEC, 1999); and, *Recommended Procedures for Implementing DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California* (SCEC and ASCE, 2002). The potential SITE ground response (e.g., estimates of strong ground shaking, liquefaction potential during earthquake, etc.) were further evaluated using recommended fault parameters published in the CGS's *"California Fault Parameters"* database referenced within the publication titled, *Probabilistic Seismic Hazard Assessment for the State of California* (Petersen, *et al.*, 1996).

The SITE is located in Section 2 of Township 5 South, Range 12 West with coordinates (latitude and longitude) of N33.7671^0 and W118.1017^0. The SITE is located within a seismically active region (Seismic Zone 4 pursuant to Table 16-1 and Figure 16-2 of the 2001 California Building Code), in a structural area where the Transverse Ranges and the Peninsular Ranges tectonic provinces of Southern California converge. This convergence results in a structurally complex region which manifests itself as compression and thrusting along the northern Los Angeles Basin, including localized uplifts, folding and faulting, generally along a northwesterly-southeasterly trend. The numerous faults in the Southern California region includes active, potentially active, and inactive faults, as categorized pursuant to the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1999). An active fault is one which has "had surface displacement within Holocene time (about 10,000 years)"; potentially active faults are those faults which showed evidence of surface displacement during Quaternary time (last 1.6 million years); and, those faults which have not moved for the last 1.6 million years may be reasonably defined as inactive faults (Hart and Bryant, 1999).

3.1 Regional Faults

The SITE is not located within a currently-designated Alquist-Priolo (AP) Earthquake Fault Zone (Hart and Bryant, 1999). The two nearest such AP Fault Zones of "well-defined and sufficiently active" surface faulting presently designated by the State of California are along the surface traces of the Newport-Inglewood Structural Zone located approximately 0.9 km southwest, and the Whittier-Elsinore Fault Zone, located approximately 25 km northeast of the SITE. Figures 3, "Potential Seismic Sources", illustrates the approximate positions of these two active faults, as well as other active and potentially active faults of significance to the SITE. Figure 4, Earthquake Fault Hazard Zones Map, shows the surface traces of Newport-Inglewood Structural Zone with respect to the SITE.

Table 1 on the following page tabulates those faults illustrated in Figures 3 considered to

potentially contribute the most significant ground-motion hazard to the SITE. Each significant fault is tabulated with its approximate distance from the SITE, significant segment length, current published slip rate estimate, and estimated moment magnitude (M_w) which may be expected during an earthquake event along these faults or segments. Each of these faults is described in the succeeding Sections 3.3.1 through 3.1.10.

Table 1
Seismic Parameters
Significant Potential SITE Seismic Sources

FAULT ZONE (FAULT SEGMENT)	SENSE OF DISPLACEMENT	NEAREST RUPTURE DISTANCE TO SITE (KM)	MAXIMUM MOMENT MAGNITUDE (MMAX)	SEGMENT LENGTH (KM)	REPORTED AVERAGE SLIP RATE (MM/YR)
Newport/Inglewood (entire onshore segment)	Right Lateral SS	0.9	6.9 (multiple segment)	64	1.0
Compton-Los Alamitos Blind Thrust	DS	5	6.8	39	1.5-2.5 (possibly inactive to the north; Foxall, 1998)
Palos Verdes-Coronado Bank Fault Zone	Oblique SS	14-57	6.8-7.2	96	3.0 (Stephenson, *et al.*, 1995)
Combined Elysian Park-Puente Hills Blind Thrust System	DS	17	6.5-6.6 (single segment) >7.0 (multiple segment) (Dolan, *et al.*, 2003)	15-50	0.6-1.0 (Oskin & Sieh, 1998) 0.5-2.0 (Shaw & Shearer, 1999)
Whittier-Elsinore (Whittier and Elsinore-Glen Ivy [E-GI] Segments combined)	Right Lateral, Oblique SS	25-44	6.8 (single segment) 7.4 (multiple segment)	37 (Whittier) 38 (E-GI)	2.0-2.5 (Whittier) 5.0 (E-GI)
Raymond Fault	Left Lateral, Oblique SS, Reverse	40	6.5-6.7 (Weaver & Dolan, 2000)	21	<1.5 (Weaver & Dolan, 2000) 0.4 (Dolan, *et al.*, 1995
Chino-Central Avenue Fault	Left Lateral, Oblique SS, Reverse	44	6.7	28	1.0
Sierra Madre Fault Zone	Reverse DS	45	7.0	85	3.0
Cucamonga Fault	Reverse DS	52	7.0	28	5.0
San Jacinto Fault Zone (San Bernardino Valley)	Right Lateral SS	75	6.7 (single segment) 7.45 (multiple segment)	35	12
San Andreas Fault Zone (San Bernardino)	Right Lateral SS	77	7.3 (single segment) 7.9 (multiple segment)	107	24

NOTE: Displacements are DS = Dip Slip, SS = Strike Slip; Sources of data specified in text.

3.1.1 Newport-Inglewood Structural Zone

The on-shore segment of the Newport-Inglewood Structural Zone is reportedly capable of generating a maximum moment magnitude (M_{max}) 6.9 earthquake, assumed to be distributed in time with a combined "characteristic" and log-normal recurrence (CDMG, 1996; Petersen, *et al.*, 1996). This fault segment was responsible for the 1933 M_W 6.2 Long Beach earthquake; and apparently also a minor (M_W 3.8) earthquake in 1990 (Hauksson, 1990; Hauksson, *et al.*, 1992). For purposes of the seismic estimates herein, a "cascading" or multiple-segment rupture of this fault zone is considered capable of generating a M_{max} 6.9 event (WGCEP, 1995; CDMG, 1996; Petersen, *et al.*, 1996). Most recent published data concerning the onshore segments of the Newport-Inglewood Structural Zone suggests a possible average recurrence interval of 2,200 years between large, surface-rupturing events (Grant, *et al.*, 1997).

3.1.2 Compton-Los Alamitos Blind Thrust Fault System

The Compton-Los Alamitos Blind Thrust System is inferred to be located along the southwestern margin of the Los Angeles basin extending from the Santa Monica coastline into southwestern Orange County. The presence of this structure is suggested by the subsurface deformation of a sequence of predominantly marine Pliocene through upper Cretaceous aged sedimentary rocks (Wright, 1991) overlain by a thick cover of Quaternary alluvial deposits. Rough estimates of seismic hazard based upon structural inverse models of this "blind" thrust suggest that it may be capable of a M_{max} 6.8 event (CDMG, 1996; Petersen, *et al.*, 1996). However, recent structural and geomorphic investigations suggest that it may no longer be an active seismogenic structure (K. Mueller, as summarized in Foxall, 1998), particularly in its northern (Long Beach and Torrance) extent.

Surface geomorphology of deformed Quaternary marine terraces in the northern San Joaquin Hills, 23 km southwest of the SITE, suggest that a "blind" thrust fault may also exist beneath this area, as well ("San Joaquin Hills Blind Thrust" of Grant, *et al.*, 1997; 1999; SCEC, 1997; Mueller, *et al.*, 1998). This blind fault may be a southern extension of the Compton-Los Alamitos Thrust, or a separate structure kinematically related to strain partitioning along the Newport-Inglewood Structural Zone. Inasmuch as no incontrovertible historical seismicity may be assigned to it, no magnitude or earthquake recurrence models have yet been published, although a tentative slip rate of 0.51 mm/year has been loosely estimated (Mueller, *et al.*, 1998). A recent study (Grant, *et al.*, 2002) identifies a possible M_{max}>7.0 earthquake along this fault between A.D. 1635 and 1855 to explain a deformed Holocene tidal marsh deposit within upper Newport Bay. It is postulated that this blind fault system may

also extend beneath, and partially explain deformations within the Santa Ana Mountains east of the SITE (Gath, 2003, pers. comm.).

3.1.3 Palos Verdes Fault

The Palos Verdes Fault is a right-lateral oblique-slip fault with a mapped length of approximately 96 km, from Santa Monica Bay to the San Pedro Channel. The fault is interpreted to have a slip rate of 2.5 to 3.5 mm/year, capable of generating a M_{max} 6.8 to 7.2 event, with a recurrence interval of 650 to 930 years (Dolan, et al., 1995; WGCEP, 1995; CDMG, 1996a; Petersen, et al., 1996).

3.1.4 Combined Elysian Park-Puente Hills Blind Thrust System

The 1987 Whittier Narrows and 1994 Northridge earthquakes demonstrated that "blind" thrust systems can be a major potential seismic hazard to the greater southern California area. The combined Elysian Park-Puente Hills Thrust Fault is one example of these blind thrust systems. Although not presently zoned under the Alquist-Priolo Earthquake Fault Zoning program because it does not rupture the ground surface in a well-defined zone, this major blind thrust system within the Los Angeles Basin is identified as being active (Dolan, *et al.*, 1995; WGCEP, 1995; Shaw and Shearer, 1999; Dolan, *et al.*, 2003).

The Elysian Park Thrust Fault has been identified as being active based on geodetic measurements, inverse structural modeling, tectonic geomorphology and historic seismicity (Dolan, *et al.*, 1995; WGCEP, 1995; Shaw and Shearer, 1999). Based upon geomorphologic analysis, Dolan and others (1995) reported that the Elysian Park Thrust Fault is comprised of two distinct thrust ramp segments which they identified as the Los Angeles segment and the Elysian Park-Puente Hills segment. It was initially interpreted to possess a slip rate of 1.7 mm/yr, and capable of generating a M_{max} 7.1 earthquake with an average recurrence of 1,475 years (Dolan, *et al.*, 1995). More recent studies by Oskin and Sieh (1998) concluded that a rupture of the entire length of this fault (i.e., both segments) is capable of generating a smaller M_{max} 6.5 to 6.8 earthquake with a return period of between 1,000 and 3,000 years.

Other recent investigations (Shaw and Shearer, 1999) identify the triple-segmented Puente Hills Blind Thrust as kinematically linked to, but structurally shallower than, the Elysian Park Fault. This recent study attributes the 1987 M6.1 Whittier Narrows earthquake to displacements along the "central" or "Santa Fe Springs" segment of this blind thrust system. A more current study has indicated that at least four seismic

events with moment magnitudes of M_{max} 7.2 - M7.5 have occurred due to probable multiple-segment ruptures of this fault system during the past 11,000 years (Dolan, *et al.*, 2003).

3.1.5 Whittier-Elsinore Fault Zone

The Whittier-Elsinore Fault Zone, a right-lateral oblique strike slip fault, is reportedly capable of generating a moment magnitude M_{max} 7.4 during a multiple-segment rupture involving both the Whittier Fault and the contiguous Glen Ivy North segment of the Elsinore Fault (WGCEP, 1995), or a characteristic earthquake of maximum moment magnitude M_{max} 6.8 during a "single-segment" rupture of either segment individually (CDMG, 1996; Petersen, *et al.*, 1996; 2000). The Whittier Fault segment has not ruptured historically; however, the Glen Ivy North segment ruptured during the M_L 5.5, 1938 Elsinore earthquake (WGCEP, 1995).

3.1.6 Raymond Fault

Another active fault within reasonable proximity to the SITE vicinity is the Raymond Fault (or Raymond Hill Fault), a predominately left-lateral strike slip fault with a minor reverse slip extending approximately 20 km through the San Gabriel Valley south of the San Gabriel Mountains. The most recent surface rupture along the fault occurred between 1,000 and 2,000 years ago. The fault is interpreted to have a slip rate of 0.4 mm/year (Dolan, *et al.*, 1995), and Petersen *et al.*, (1996) estimated a slip rate of 0.5 mm/year based upon a focal mechanism of the1988 Pasadena Earthquake and an assumed vertical component of offset reported by Crook, *et al.*, (1987). Weaver and Dolan (2000) reported that Raymond Fault is capable of generating a M_{max} 6.5 to 6.7 event. An average recurrence interval of 3,000 years was reported by Crook, *et al.*, (1987).

3.1.7 Chino-Central Avenue Fault

Another potential seismic source of significant SITE ground response is the Chino-Central Avenue Fault (Weber, 1977). This right lateral, oblique strike slip fault displays evidence of Late Quaternary displacement, but no significant historic earthquakes are known to have been generated by displacement along this fault.

Little is known about the Chino-Central Avenue Fault (as evidenced by its uncertain sense of displacement), and it has only a poorly-constrained/assumed slip rate based upon slip transfer and differing slip rates between the Whittier and Elsinore Fault

Zones (CDMG, 1996; Petersen, *et al.*, 1996). For purposes of the estimates herein, a full segment rupture of the Chino-Central Avenue Fault is considered capable of generating a M_{max} 6.7 event with a conservative 850-year "characteristic" return period assuming a 1 mm/yr slip rate (WGCEP, 1995; CDMG, 1996; Petersen, *et al.*, 1996).

3.1.8 Sierra Madre-Cucamonga Fault Zone

The Cucamonga Fault is a major east-west trending thrust fault system extending approximately 25 km along the south front of the eastern San Gabriel Mountains. Recent fault ruptures are expressed by fault scarps in late Pleistocene-Holocene alluvial fan surfaces. A net surface displacement of approximately 36 m in the past 11,000 to 13,000 years and a calculated slip rate of 4.5 to 5.5 mm/yr were reported by Morton and Matti (1987) (WGCEP, 1995). The Cucamonga Fault is considered capable of generating a maximum moment magnitude M_{max}7.0 earthquake with a characteristic return period of 650 years (CDMG, 1996; Petersen, *et al.*, 1996). Recent paleoseismic investigation of the adjacent, and possibly kinematically linked, easternmost Sierra Madre Fault segment has also yielded evidence of large (M_{max} = 7.0 or greater) infrequent earthquakes; it has been at least 8,000 years since the last such large event along the eastern Sierra Madre Fault (Tucker and Dolan, 2001). The combined Sierra Madre Fault-Cucamonga Fault is thus considered a likely candidate for a large-magnitude multiple-segment earthquake.

3.1.9 San Jacinto Fault Zone

The San Jacinto Fault Zone, a right-lateral, strike slip fault, is reportedly capable of a M_{max} 7.45 event during a multiple-segment rupture conjunctively involving the San Bernardino Valley, San Jacinto Valley, Anza, Coyote Creek and Borrego Segments (WGCEP, 1995). The San Bernardino Valley and San Jacinto Valley segments are reportedly independently capable of M_{max} 6.7 and 6.9 events (Petersen, *et al.*, 1996; CDMG, 1996), respectively. The San Bernardino Valley segment may have been the source of the M_L 6.4, July, 1899 earthquake, and the San Jacinto Valley segment may have been the source of the M_L 6.8, April, 1918 earthquake. A multiple-segment rupture of the San Jacinto Fault Zone may generate a M_{max} 7.45 earthquake (WGCEP, 1995; Petersen, et al., 1996; CDMG, 1996). Most recent published data from this fault zone suggest a characteristic return interval for the San Bernardino Valley and San Jacinto Valley segments of the San Jacinto Fault Zone of 100 and 83 years, respectively, between seismic events (Petersen, et al., 1996; CDMG, 1996). If the San Bernardino Valley segment was not the source of the 1899 earthquake, this segment may be at the end stages of a strain accumulation cycle, and likely to rupture

during the design life of proposed SITE structures.

3.1.10 San Andreas Fault Zone

The San Bernardino Mountains segment of the San Andreas Fault Zone, a right-lateral strike slip fault, is reportedly capable of a M_{max} 7.3 during a single rupture or M_{max} 7.9 during a multiple-segment rupture involving other segments of the San Andreas Fault Zone (WGCEP, 1995; CDMG, 1996). This segment of the San Andreas Fault has a complex rupture history; it has apparently produced its own earthquakes independent of other segments, but has also experienced multiple-segment ruptures with the Mojave Segment as during the 1912 Wrightwood event (WGCEP, 1995; Yule, et al., 2001).

3.2 Surface Faulting Potential

The potential for primary surface fault rupture on SITE is considered to be low because the SITE is not identified within an Alquist-Priolo Earthquake Fault Zone as defined presently by the State of California. Based on a limited SITE reconnaissance, MISSION has not identified topographic or geomorphic features on the SITE which may otherwise be indicative of historical surface rupture along nearby active faults, or related co-seismic deformation (e.g., ground surface warping due to active folding above blind structures, pressure or shutter ridges, tonal lineaments, offset or "beheaded" drainages, wind gaps, etc.). However, should a major seismic event occur along segments of the Newport-Inglewood Structural Zone which is located only 0.9 km southwest of the SITE, or a major seismic event along any of the other faults discussed in Section 3.1 of this report, significant ground shaking should be expected to occur at the SITE.

3.3 Significant Historic Earthquakes

Table 2 tabulates significant historic (e.g., local magnitude > 4.0) earthquakes known or suspected to have produced strong SITE ground shaking, and includes those events whose source parameters are at least fairly well-constrained.

Table 2
Significant Historic Earthquakes

EARTHQUAKE EVENT	EPICENTRAL DISTANCE TO SITE (KM)	MAGNITUDE
1812 San Andreas (Wrightwood)	70	6.9 (a)
1857 San Andreas (Fort Tejon)	237	7.8 (b)
1899 San Jacinto	101	6.8 (a)
1910 Glen Ivy Hot Springs	65	6 (a)
1918 San Jacinto	101	6.8 (b)
1923 Norwalk	82	6.0 (b)
1930 Anacapa	53	5.2 (a)
1933 Long Beach	20	6.2 (b)
1938 Elsinore	55	5.5 (a)
1948 Mission Creek	159	6.0 (b)
1952 White Wolf	32	7.5 (b)
1968 /San Jacinto/Borrego Mountain	173	6.5 (b)
1970 Lytle Creek	64	5.4 (b)
1971 San Fernando	87	6.7 (b)
1986 N. Palm Springs/Banning	119	6.2 (b)
1987 Whittier Narrows	39	6.1 (a)
1988 Pasadena	42	5.0 (a)
1990 Upland	55	6.2 (a)
1991 Sierra Madre	55	5.8 (a)
1992 Landers	161	7.3 (b)
1992 Big Bear	127	6.2 (b)
1994 Northridge	63	6.7 (b)
1998 Chino	41	4.3 (b)
1999 Hector Mine	191	7.1 (b)
2000 Yorba Linda	35	4.0 (b)

Note: Within 300-km radius of the SITE; (a)- Richter magnitude (M_L); (b)- Moment magnitude (M_W).
Sources: Gath (1992), WGCEP (1995), USGS-NEIC (2004).

3.4 Geologic Subgrade Classification and Soil Profile

The SITE subgrade within 30 meters of the surface is anticipated to be classified as S_D, as defined in Table 16-J of the 2001 California Building Code (CBC) (CBSC, 2002), based upon reported data from available publications (e.g., Sprotte, *et al.*, 1980; Fumal and Tinsley, 1985; Park and Elrick, 1998). This would be roughly equivalent to a shear wave velocity range of 180 to 360 meters per second, which is equivalent to Boore, *et al.* (1997) site class "C".

3.5 Seismic Zone

Based upon Figure 16-2 and Table 16-I of the 2002 CBC, the SITE is located within Seismic Zone 4, and therefore, the seismic zone Z factor for preliminary earthquake-resistant design would be 0.40.

3.6 Near-Source Effects

The near-source acceleration correction factor (N_a) and near-source velocity correction factor (N_v) are used in the determination of the seismic design coefficients (C_a and C_v) in Seismic Zone 4 as indicated in Tables 16-Q and 16-R (CBC, 2001), based upon seismic source types (i.e., fault types A, B or C, defined in Table 16-U of the 2001 CBC). Based upon the information included in Table 1 (above) there are for seismic sources which may be considered as "Type A" faults, namely the combined Whittier-Elsinore-Glen Ivy fault segments, the Cucamonga Fault, the San Jucinto Fault Zone and the San Andreas Fault Zone. Based upon the distances of the four nearest "Type A" near-source acceleration factor (N_a) and velocity correction (N_v) factors are not necessary as part of the seismic building design. All other potential seismic sources in Table 1 would classify as "Type B" faults, including the Newport-Inglewood Structural Zone which is 0.9 km southwest of the SITE. Based upon the distance of this nearest "Type B" seismic source to the SITE, a near-source acceleration (N_a) of 1.3 and a velocity correction (N_v) factor of 1.6 are required as part of the earthquake-resistant SITE building design as per Tables 16-S and 16-T of the 2001 CBC (CBSC, 2002).

3.7 Probabilistic Ground Response Estimate

MISSION has utilized the probabilistic software program FRISKSP© (ver. 4.0) to estimate preliminary seismic design ground motion as peak horizontal ground acceleration, by selecting a 475-year return period (a Poisson distributed 10% probability of exceedance in 50 years), as equivalent to the "design basis ground motion or design basis earthquake (DBE)" as defined in the 2001 CBC §1627A, 1629A.1, and 1631A.2 (CBSC, 2002). The standard fault database files which accompany this version of the FRISKSP© software are generally internally consistent with the published slip rates, M_{max}, return periods and other seismic source parameters presently listed in the CGS fault database. This database was thus selected by MISSION as appropriate for the preliminary probabilistic ground response analysis of the SITE.

MISSION selected three different current versions of conventional PHGA attenuation relationships available in the FRISKSP© software in our SITE estimates for comparative purposes: Boore, *et al.* (1997), Campbell and Bozorgnia (1994/1997), Abrahamsom and Silva (1997). The resultant PHGA values from DBE events using these three attenuation relationships range between 0.435g and 0.452g (Figures 7.1, 7.2, and 7.3). Based upon these results, the use of 0.45g may be considered as a reasonable PHGA to be used for preliminary seismic design at the SITE, in the absence of more detailed SITE-specific investigations. Details of this analysis are presented in Appendix A.

3.8 Liquefaction

Liquefaction is a phenomenon that occurs during strong ground shaking (repeated high cyclic stress ratio) most commonly in generally low- to medium-density, saturated, low cohesion soils, where the soils experience a considerable loss of shear strength and behave essentially as a fluid. This results from an increase in pore pressure which exceeds the intergranular, normal lithostatic forces (reduced effective stress). This phenomenon is typically triggered by an earthquake and may result in very large total and/or differential settlements of structures founded in or above the liquefied soils (Seed and Idriss, 1982; Tinsley, *et al.*, 1985; Youd and Idriss, 2001). In general, four conditions must be present or occur simultaneously to initiate the liquefaction of subsurface soils:

1. The presence of relatively young, unconsolidated soils. In general, soils which possess a relative density in excess of 75% are not generally considered susceptible to liquefaction (Seed and Idriss, 1982).

2. More specifically, poorly graded (i.e., well sorted) sediments are more susceptible to liquefaction than are well graded (poorly sorted) sediments. For poorly graded soils, fine sands tend to liquefy more easily than coarser sands and gravels. Cohesive soils (silts and clays) are generally considered to have a negligible liquefaction potential.

3. A relatively shallow groundwater condition in which the groundwater table is 30 feet or less below existing grade. Generally, most liquefaction and related settlement occurs in the upper 50 feet of a saturated sediment profile, where other conditions exist are favorable for liquefaction.

4. Strong ground shaking, and a significant duration of shaking, such as that experienced during a moderate or larger earthquake (i.e., M6.0 or greater).

According to U.S. Geological Survey, Professional Paper 1360 (Tinsley, *et al.*, 1985), the SITE liquefaction hazard potential is very high. As discussed in Section 2.2, the historical shallow groundwater beneath the immediate SITE vicinity was reported to occur at approximate depths of 4 to 18 feet bgs. In addition, according to the Seismic Hazard Zones Maps for Los Alamitos Quadrangle (published and released by CDMG on March 25, 1999), the SITE is located within an area where liquefiable materials are mapped and/or where liquefaction has occurred in the past, as illustrated in Figure 5. Therefore, it would be reasonable to conclude that liquefaction and settlement at the SITE and immediate vicinity would be a potential geotechnical hazard. Therefore, MISSION recommends that the liquefaction potential be evaluated during a detailed geotechnical investigation of the SITE.

4.0 GEOTECHNICAL CONSTRAINTS

4.1 Slope Stability

Since no significant slopes currently exist at or near the SITE, nor any planned as part of the commercial center development, no gross or surficial slope failure concerns are anticipated.

Based upon MISSION's review of the latest Grading Plan C-2.0 prepared by Madison Civil Engineering/Land Surveying and dated October 5, 2004, the ground surface is relatively flat with no manufactured slopes greater than 4:1 (horizontal:vertical). Furthermore, the potential for lateral spreading on SITE which may be caused by liquefaction was evaluated by GPI (2003). Based upon their study, GPI concluded that it was unlikely that lateral spreading would occur on the SITE. Thus, MISSION concludes that the potential hazard due to lateral spreading on the SITE is low.

4.2 Flood and Wave Run-Up Hazards

Due to the completion of the Los Angeles River levee restoration project, a federally sponsored flood control project, the SITE is now located within Flood Zone X effective January 11, 2002, as shown in the City of Long Beach Flood Zone Map (Figure 6). Considering that areas within Flood Zone X are outside the 100-Year Floodsplain, MISSION concludes that the potential of SITE flooding is low.

Tsunamis are generated wave trains generally caused by tectonic displacement of the sea floor associated with shallow earthquakes, sea floor landslides, rock falls, and exploding volcanic islands (McCulloch, 1985). Major tsunami are generated at plate boundaries along the circum-Pacific border (McCulloch, 1985). Review of tsunami records in California compiled from 1812 to 1975 indicated that run-up heights along the coast of the City of Long Beach were recorded as approximately 1.1 feet and 0.33 feet on October 25, 1925 and on March 10, 1933, respectively. The latter run-up height may be associated with the Long Beach earthquake along the Newport-Inglewood Structural Zone. Modeling study of simulated tsunamis show that for 100-year and 500-year tsunamis along the southern California coast, the predicted wave height along the coast south of the SITE is roughly 6 feet and 10 feet, respectively (McCulloch, 1985). Considering that the SITE is approximately 2 miles from Alamitos Bay and the Pacific Ocean at elevation of approximately 10 feet above msl, and considering further that infrastructures to prevent flooding exist in the general SITE area, the potential hazard due to tsunamis is low at the SITE.

4.3 Subsidence

Review of available reports indicated that the SITE is not located within an area of known subsidence which may be associated with groundwater or petroleum withdrawal, peat oxidation or hydrocompaction. No oil exploration has been reported at the SITE specifically, although the SITE is located within the limits of the greater Seal Beach Oil Field.

Known ground subsidence associated with oil withdrawal was recorded in the City of Wilmington area, approximately 8 miles west of the SITE (Randell, et al., 1983). Any historic land subsidence in the SITE area has been minimized as a result of fresh water injection through the operations of the Los Alamitos Barrier Project which is located near the SITE. Thus, the potential SITE constraint associated with land subsidence is considered low.

4.4 Methane Gas in Shallow On-SITE Soils

A preliminary methane soil gas investigation conducted by MISSION encountered methane at shallow soils at concentrations exceeding regulatory thresholds at the area of Tank #4 where the proposed Home Depot building pad is planned to be constructed. Thus, MISSION recommends that additional methane soil gas investigation be conducted following rough grading and prior to building construction and utility installation. The additional methane soil gas investigation should be performed in accordance with local industry standards and be approved by the City of Long Beach. Based upon the results of this additional investigation, mitigation measures may be necessary including providing conventional vapor barriers and venting systems beneath buildings and confined spaces. Methane mitigation measures should be approved by the City of Long Beach.

4.5 Expansive Soils

As discussed in Section 2.1, the on-SITE clayey soils have an expansion potential of medium to high, and the on-SITE soils are reported to be severely corrosive to steel (GPI, 2003), thus MISSION recommends that specific recommendations be provided in a comprehensive geotechnical report to mitigate these geotechnical constraints in the design and construction of on-SITE structures.

4.6 Undocumented Fills and Petroleum-Impacted Soils

Undocumented fills and petroleum hydrocarbon-impacted soils were reported to occur on-SITE (Randell, 1983; CH2M Hill, 1997; GP1, 2003). MISSION recommends that an on-SITE Soil and Air Monitoring Program to be approved by the City of Long Beach be prepared and implemented during SITE grading and excavation. Air monitoring should be in conformance with applicable rules and regulations of the South Coast Air Quality Management District. Petroleum hydrocarbon-impacted soils found to contain petroleum hydrocarbon constituents in excess of prevailing regulatory thresholds should be removed and recycled at an appropriate State-approved facility.

5.0 SUMMARY OF FINDINGS, CONCLUSIONS, & RECOMMENDATIONS

Based upon the information reviewed during the completion of this investigation, MISSION presents the following conclusions and recommendations:

- The SITE is not located within a currently-designated Alquist-Priolo (AP) Earthquake Fault Zone, nor is it currently identified by the regulatory community as being located within zones of either primary or secondary co-seismic surface deformation (i.e., pressure ridges, escarpments, fissures, etc.). Thus, the SITE is not expected to experience primary surface fault rupture or related ground deformation during the life of the proposed development. However, since the SITE is only 0.9 km northeast of the recognized surface traces of ground deformation within the Newport-Inglewood Structural Zone (NISZ) which is the nearest AP fault to the SITE significant ground shaking or secondary seismic ground deformation effects may be anticipated at the SITE should a major seismic event occur along the NISZ or any of the active faults discussed in Section 3.1 of this report.

- For preliminary design purposes, the strong ground shaking due to an earthquake expected on-SITE associated with a "design basis ground motion or design basis earthquake" (DBE, with a 10 percent probability of exceedance in 50 years), is estimated to be 0.45g. However, the ultimate SITE seismic design acceleration should be determined by the Project Structural Engineer. Earthquake-resistant design should be incorporated into final SITE drawings in accordance with the most current California Building Code and the recommended seismic design parameters of the Structural Engineers Association of California, at a minimum.

- Historic shallow groundwater beneath the SITE and vicinity is reported at approximate depths of 4 to 18 feet below ground surface (bgs). The SITE is located in an area where liquefiable materials occur and/or where liquefaction has occurred in the past, and the SITE liquefaction hazard potential has been identified in the literature to be very high. Therefore, MISSION recommends that the liquefaction potential be evaluated during a detailed geotechnical investigation of the SITE during project design and construction phases.

- Based upon MISSION's review of the latest Grading Plan C-2.0 prepared by Madison Civil Engineering/Land Surveying and dated October 5, 2004, the ground surface is relatively flat with no manufactured slopes greater than 4:1 (horizontal:vertical). Furthermore, the potential for lateral spreading on SITE which may be caused by liquefaction was evaluated by GPI (2003). Based upon their study, GPI concluded that it was unlikely that lateral spreading would occur on the SITE. Thus, MISSION concludes that the potential hazard due to lateral spreading on the SITE is low.

- Due to relatively flat SITE area topography, MISSION considers the potential hazards from either static or dynamic slope instability to be negligible.

- Considering that the SITE lies within Flood Zone X which is outside the 100-Year Flood Plain, MISSION concludes that the potential of SITE flooding is low.

- The on-SITE clayey soils have an expansion potential of medium to high, and are considered to be severely corrosive to steel (GPI, 2003); thus MISSION recommends that specific recommendations be provided in a comprehensive geotechnical report to mitigate these geotechnical constraints during the design and construction of SITE structures.

- High concentrations of methane exceeding regulatory limits in were detected shallow on-SITE soils during a preliminary methane soil gas investigation in the area where the proposed Home Depot building pad is planned to be constructed. Thus, MISSION recommends that additional methane soil gas investigation be conducted following rough grading and prior to building construction and utility installation. The additional methane soil gas investigation should be performed in accordance with local industry standards and be approved by the City of Long Beach. Based upon the results of this additional investigation, mitigation measures may be necessary including providing conventional vapor barriers and venting systems beneath buildings and confined spaces. Methane mitigation measures should be approved by the City of Long Beach.

- Undocumented fills and petroleum hydrocarbon-impacted soils were reported to occur on-SITE. MISSION recommends that an on-SITE Soil and Air Monitoring Program to be approved by the City of Long Beach be prepared and implemented during SITE grading and excavation. Air monitoring should be in conformance with applicable rules and regulations of the South Coast Air Quality Management District. Petroleum hydrocarbon-impacted soils found to contain petroleum hydrocarbon constituents in excess of prevailing regulatory thresholds should be removed and recycled at an appropriate State-approved facility.

6.0 LIMITATIONS

In the performance of our professional services, MISSION complies with the standard of care and skill normally exercised under similar circumstances by members of our profession currently practicing under similar conditions and in the same or similar localities. Our Clients recognize that subsurface conditions may vary from those encountered at the locations where our borings, surveys and explorations are made, and that MISSION's data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, our interpretations and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty is either expressed, implied, or intended in connection with the work performed by us, by our proposal for consulting, or by the furnishing of oral or written reports or findings. Furthermore, the accuracy of the results performed are constrained and limited by the level of care and professional skill exercised by the sub-consultants/sub-contractors retained by MISSION to perform these tasks.

7.0 REFERENCES

Abrahamson, N.A. and Silva, W., 1995, A consistent set of ground motion attenuation relations including data from the 1994 Northridge earthquake: Seismological Society of America 90th Annual Meeting Abstracts, p. 23.

Abrahamson, N.A. and Silva, W., 1997, Empirical response spectral attenuation relations for shallow crustal earthquakes: Seismological Research Letters, vol. 68, no. 1, p. 94-127.

Abrahamson, N.A. and Somerville, P.G., 1996, Effects of the hanging wall and footwall on ground motions recorded during the Northridge earthquake: Bulletin of the Seismological Society of America, vol. 86, no. 1B, p. S93-S99.

Blake, T.F., 2002, Preliminary fault-data for the software EQFAULT and FRISKSP ver. 4.0.

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1993, Estimation of response spectra and peak accelerations from western North America-- An interim report: U.S. Geol. Survey Open File Report 93-509, 72 p.

Boore, D.M., Joyner, W.B. and Fumal, T.E., 1994, Estimation of response spectra and peak acceleration from western North American earthquakes–An interim report: U.S. Geological Survey Open-File Report 93-509, updated by OFR 94-127; 40 p.

Boore, D.M., Joyner, W.B. and Fumal, T.E., 1997, Equations for estimating horizontal response spectra and peak acceleration from western North American earthquakes: A summary of recent work: Seismological Research Letters, vol. 68, no. 1; p. 128-153.

Bryant, W.A., 1988, Recently Active Traces of the Newport-Inglewood Structural Zone, Los Angeles and Orange Counties, California: California Division of Mines and Geology Open File Report 88-14, 15 p.

California Building Standards Commission, 2002, 2001 California Building Code, based on 1997 Uniform Building Code, effective November 1, 2002.

California Department of Water Resources, 1961, Bulletin No. 104, Planned utilization of the ground water basins of the coastal plain of Los Angeles County, Appendix A, Ground Water Geology, 181 p., 26 plates.

California Division of Mines and Geology, 1996, California fault parameters (draft version); CGS Internet Site.

California Division of Mines and Geology, 1986, Earthquake fault zones (formerly Special Studies Zone), Los Alamitos quadrangle, revised official map effective July 1, 1986; scale 1:24,000.

California Division of Mines and Geology, 1999, Seismic hazard zones, Los Alamitos quadrangle, official map released on March 25, 1999; scale 1:24,000.

Campbell, K.W. and Bozorgnia, Y., 1994, Near-source attenuation of peak horizontal acceleration from worldwide accelerograms recorded from 1957 to 1993: Proceedings of the 5th National Conference on Earthquake Engineering (Volume III), p. 283-292.

Campbell, K.A., 1997, Empirical near-source attenuation relationships for horizontal and vertical components of peak ground acceleration, velocity and pseudo-absolute acceleration response spectra: Seismological Research Letters, vol. 68, no. 1, p.154-179.

City of Long Beach, Department of Public Works, 2002, City of Long Beach Flood Zone Map (Effective 1/11102). Available at City of Long Beach Website (http://cms.long beach.gov).

Dames & Moore, 1986, Hydrogeologic assessment report, Alamitos Generating Station, 28 p.

Dolan, J.F. and 7 others, 1995, Prospect for larger or more frequent earthquakes in the metropolitan Los Angeles Region: Science, vol. 267, p. 203-205.

Dolan, J.F., Christofferson, and Shaw, J.H., 2003, Recognition of paleoearthquakes on the Puente Hills blind thrust fault, California: Science, vol. 300, p. 115-118, April 4, 2003.

Foxall, B., 1998, Uncertainty in earthquake source characterization for the Los Angeles basin: SCEC Winter 1997/98 Quarterly Newsletter, vol. 3, no. 3, 9 p.

Fumal, T.E. and Tinsley, J.C., 1985, Mapping shear-wave velocities of near-surface geologic materials: J.I. Ziony (ed.) Evaluating Seismic Hazards in the Los Angeles Region-An Earthquake Science Perspective; U.S. Geological Survey Professional Paper 1360; p. 127-150.

Gath, E., 1992, Geologic hazards and hazard mitigation in the Los Angeles Region: B.W. Pipkin & R.J. Proctor (eds.) Engineering Practice in Southern California; AEG Special Publication No. 4; p.3-32.

Grant, L.B. and Sieh, K.E., 1994, Paleoseismic evidence of clustered earthquakes on the San Andreas fault in Carrizo Plain, California: Journal of Geophysical Research, vol. 99, no. B4, p. 6819-6841.

Grant, L.B. and 3 others, 1997, Paleoseismicity of the north branch, Newport-Inglewood Structural Zone, Huntington Beach, California, from cone penetrometer test data: Bulletin of the Seismological Society of America, vol. 87, no. 2, p. 277-293.

Grant, L.B and 3 others, 1997, Neotectonics and earthquake potential of the San Joaquin Hills, Orange county, California: Seismological Research Letters, SSA Annual Meeting Abstracts, vol.68, no.2, p. 315.

Grant, L.B. and 8 others, 1999, Late Quaternary uplift and earthquake potential of the San Joaquin Hills, southern Los Angeles, California: Geology, vol. 27, no.11, p. 1031-1034, November 1999.

Grant, L.B., Ballenger, L.J., and Runnerstrom, E.E., 2002, Coastal uplift of the San Joaquin Hills, southern Los Angeles basin, California, by a large earthquake since A.D. 1635: Bulletin of the Seismological Society of America, vol. 92, no. 2, p. 590-599.

Greenberg Farrow, 2004, The Home Depot Long Beach, CA Studebaker Road & Loynes Drive Site Plan, at a scale of 1"=50', dated February 13, 2004.

Hart, E.W. and Bryant, W., 1999, Fault-rupture hazard zones in California; California Division of Mines and Geology Special Publication 42, 38 p.

Hauksson, E., 1990, Earthquakes, faulting and stress in the Los Angeles basin: Journal of Geophysical Research, vol. 95, B10, p. 15,365-15,394.

Hauksson , E. Hutton, K., Douglass, K. And Jones, L., 1992, Earthquake atlas of southern California, 1978-1990: B. Pipkin & R. Proctor (eds.), Engineering Geology Practice in Southern California; AEG Special Publication No. 4; p. 181-190.

Jackson, D.D, 1996, Opinion: the case for huge earthquakes: Seismological Research Letters, vol. 67, no. 1, p. 3-5.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas: California Division of Mines and Geology Geologic Data Map No. 6.

Kagan, Y.Y. and Jackson, D.D., 1994, Long-term probabilistic forecasting of earthquakes: Journal of Geophysical Research, vol. 99, p.13685-13700.

Los Angeles County Department of Public Works, 1996, Hydrologic report 1994-1996, prepared by Hydraulic/Water Conservation Division.

Madison Civil Engineering, 2002, Site Plan, dated November 21, 2002.

Matti, J. C., Morton, D. M., and Cox, B. F., 1985, Distribution and geological relations of fault systems in the vicinity of the Central Transverse Ranges, southern California: USGS Open File Report 85-365, 23 p.

McCulloch, 1985, Evaluating tsunamis potential: J.I. Ziony (ed.) Evaluating Seismic Hazards in the Los Angeles Region-An Earthquake Science Perspective; USGS Professional Paper 1360, p. 375413.

Mission Geoscience, Inc., 2004, Phase I Environmental site assessment, Long Beach Home Depot site, 400 Studebaker Road, Long Beach, California, MISSION File Number 03-475.

Mueller, K., Grant, L.B., and Gath, E., 1998, Late Quaternary growth of the San Joaquin Hills anticline-A new source of blind thrust earthquakes in the Los Angeles basin: Seismological Research Letters, vol. 69, no.2, SSA 1998 Annual Meeting Abstracts, p. 161.

Oskin, M. and Sieh, K., 1998, The Elysian Park anticlinorium: Surficial evidence of an active blind reverse fault beneath downtown Los Angeles: 1998 GSA Abstracts with Programs, Cordilleran Section, p. 57-58.

Park, S. and Elrick, J., 1998, Predictions of shear-wave velocity in southern California using surface geology: Bulletin of the Seismological Society of America, vol. 88, no. 3; p. 677-685.

Petersen, M.D., and 8 others, 1996, Probabilistic seismic hazard assessment for the State of California: California Division of Mines and Geology Open-File Report 96-08; also USGS Open-File Report 96-706.

Piper, A.M., Garrett, A.A., and others, 1953, Native and contaminated groundwater in the Long Beach-Santa Ana area, California, United States Geological Survey Water Supply Paper 1136, 320 p.

Poland, J.F., 1959, Hydrology of the Long Beach-Santa Ana area, California: United States Geological Survey Water Supply Paper 1471, 258 p.

Poland, J.F., Piper, A.A., and others, 1956, Groundwater geology of the coastal zone, Long Beach-Santa Ana area, California: USGS Water-Supply Paper 1109; 162 p.

Randell, D.H., Reardon, J.B. and 5 others, 1983, Geology of the City of Long Beach, California, United States of America: Bulletin of the Association of Engineering Geologists, vol. xx, number1, February 1983, p. 13-94.

Schwartz, D., 1997, Earthquake recurrence; Seismological Society of America Annual Meeting, (Abstract): Seismological Research Letters, vol. 68, no. 2, p. 301.

Seed, R.B. and Idriss, I.M., 1982, Ground motions and soil liquefaction during earthquakes: Earthquake Engineering Research Institute, Oakland, California, 134 p.

Shaw, J.H. and Suppe, J., 1996, Earthquakes hazards of active blind thrusts under the central Los Angeles, California: Journal of Geophysical Research, vol. 101, p. 8623-8642.

Shaw, J.H. and Shearer, P.M., 1999, An elusive blind-thrust fault beneath metropolitan Los Angeles: Science, vol. 283, p.1516-1518.

Shaw, J.H. and 4 others, Puente Hills blind-thrust system, Los Angeles, California: Bulletin of the Seismological Society of America, vol. 92, no. 8, p. 2846-2960, December 2002.

Sieh, K.E., Stuiver, M. and Brillinger, D., 1992, Implications of the precise chronology of earthquakes produced by the San Andreas fault at Pallett Creek: Pipkin, B.W. and Proctor, R.J. (eds.), Engineering Geology Practice in Southern California, AEG Special Publication No. 4, p. 195-198.

Sprotte, E.C., and 3 others, 1980, Classification and mapping of Quaternary sedimentary deposits for purposes of seismic zonation, south coastal Los Angeles basin, Orange county, California: California Division of Mines and Geology Open-File Report 80-19.

Stephenson, W.J. and others, 1995, Seismic reflection and geomorphic characterization of the onshore Palos Verdes fault zone, Los Angeles, California: Bulletin of Seismological Society of America, vol. 85, p. 943-950.

Structural Engineers Association of California, 1996, Recommended lateral force requirements and commentary: Sixth Edition, Report of the SEAOC Seismology Committee, 503 p.

Sydnor, R.H., 2004, Engineering geology and seismology for public schools and hospital in California to accompany California Geological Survey Note 48 Checklist, 185 p.

Tinsley, J.C., and 3 others, 1985, Evaluating liquefaction potential: J.I. Ziony (ed.) Evaluating Seismic Hazards in the Los Angeles Region-An Earthquake Science Perspective; USGS Professional Paper 1360, p. 262-315.

Tucker, A.Z. and Dolan, J.F., 2001, Paleoseismologic evidence for a >8Ka age of the most recent surface rupture of the eastern Sierra Madre fault, northern Los Angeles metropolitan region, California: Bulletin of Seismological Society of America, vol. 91, no. 2, p. 232-249, April 2001.

United States Department of Agriculture, Soil Conservation and Forest Service, 1969, Report and general soil map, Los Angeles, California, 70 p., 1 map sheet.

United States Geological Survey, National Earthquake Information Center, 2004, Earthquake search results (1800 - 2004), Internet site.

United States Geological Survey, 1964, 7.5 Minute series topographic map, Los Alamitos quadrangle, California, photorevised 1981, Scale 1:24,000.

Weaver, K.D. and Dolan, J.F., 2000, Paleoseismology and geomorphology of the Raymond fault, Los Angeles county, California: Bulletin of the Seismological Society of America, vol. 90, no. 6, p. 1409-1429.

Weber, Jr., F.H., 1977, Seismic hazards related to geologic factors, Elsinore and Chino fault zones, northwestern Riverside county, California; CDMG Open-File Report 77-4, 96 p.

Wesnousky, S.G., 1994, The Gutenberg-Richter or characteristic earthquake distribution, which is it?: Bulletin of the Seismological Society of America, vol. 84, p. 1940-1959.

Working Group on California Earthquake Probabilities, 1995, Seismic hazards in southern California: Probable earthquakes, 1994 to 2024: Bulletin of the Seismological Society of America, vol. 85, p. 379-439.

Wright, T.L., 1991, Structural geology and tectonic evolution of the Los Angeles basin, California: K.T. Biddle (ed.), Active Margin Basins, American Association of Petroleum Geologists Memoir, vol. 52, p. 35-134.

Yerkes, R.F., and 3 others, 1965, Geology of the Los Angeles basin, California-An introduction: USGS Professional Paper 420-A, 57 p, 2 plates.

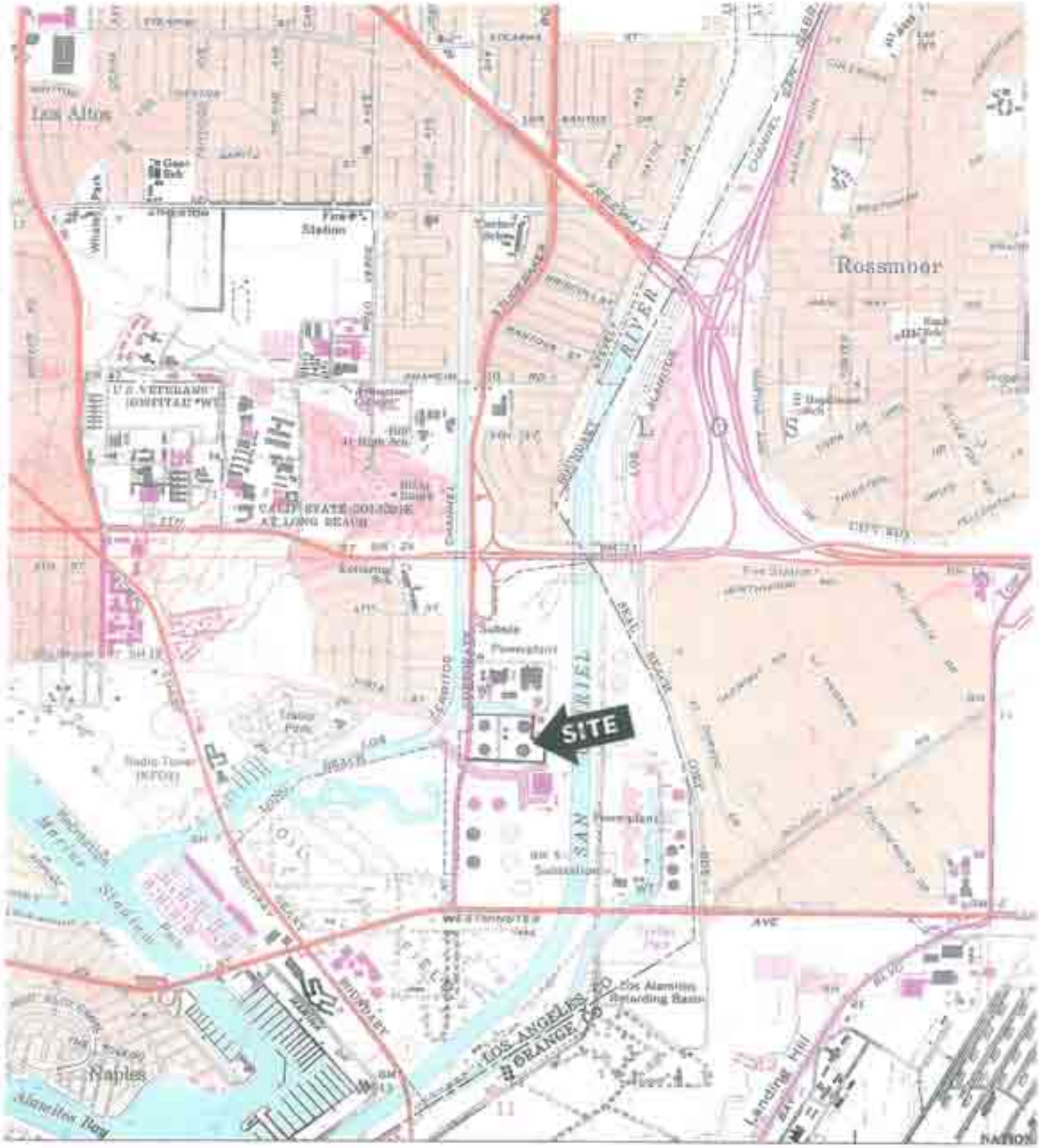
Youd, T.L. and Idriss, I.M., 2001, Liquefaction resistance of soils: Summary report from the 1996 NCEER and 1998 NCEER/NSF Workshops on evaluation of liquefaction resistance of soils: Journal of Geotechnical and Geoenvironmental Engineering, p. 297-313, April 2001.

Youngs, R.R. and Coppersmith, K.J., 1985, Implications of fault slip rates and earthquake recurrence models to probabilistic seismic hazard estimates: Bulletin of the Seismological Society of America., vol. 75, no. 4, p. 939-964.

MISSION GEOSCIENCE, INC.

ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

FIGURES

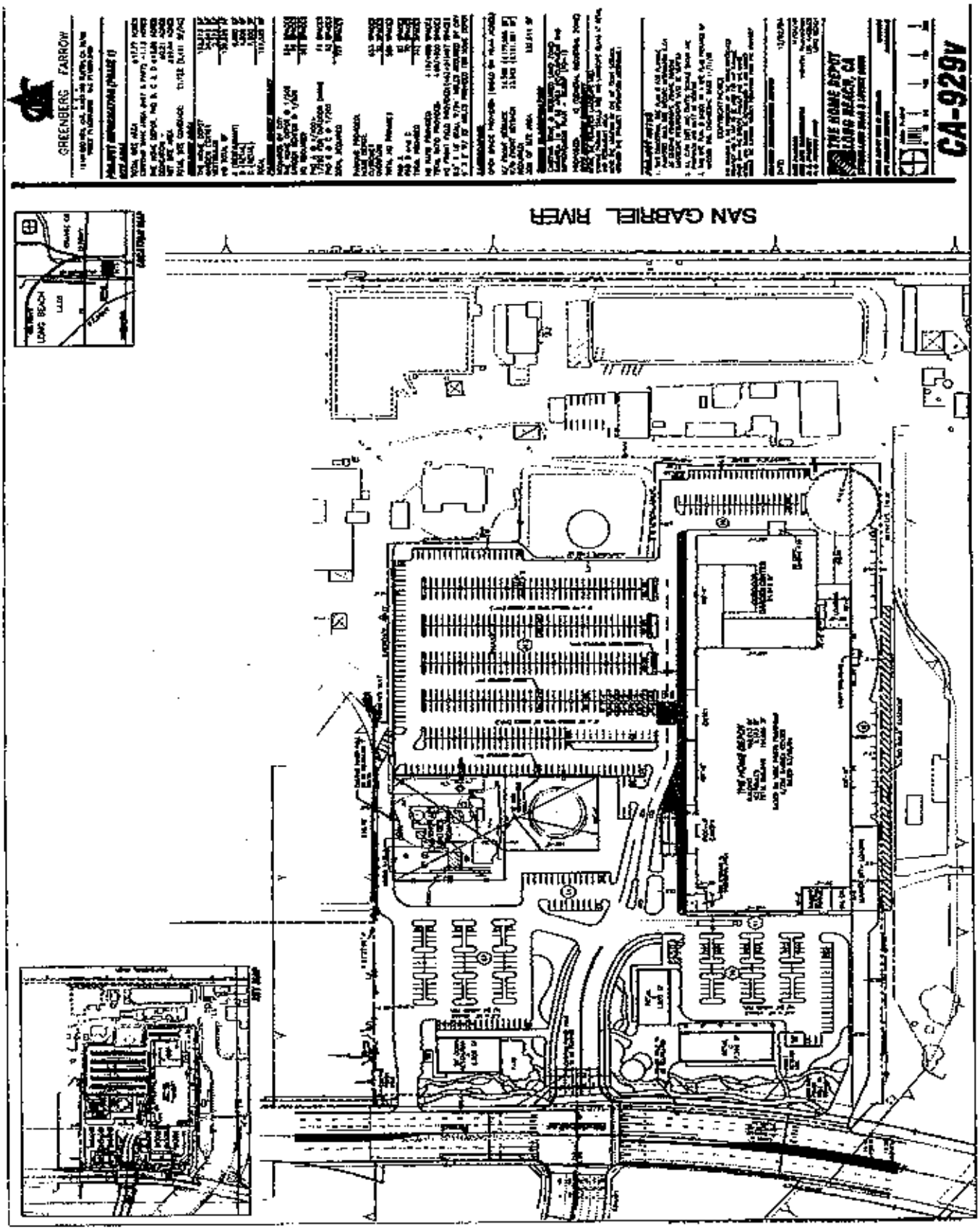


Reference:
USGS, 7.5 Minute Series Topographic Map
Los Alamitos Quadrangle, California
dated1964, photorevised 1981

MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SITE LOCATION MAP
LONG BEACH HOME DEPOT SITE
400 Studebaker Road
Long Beach, California

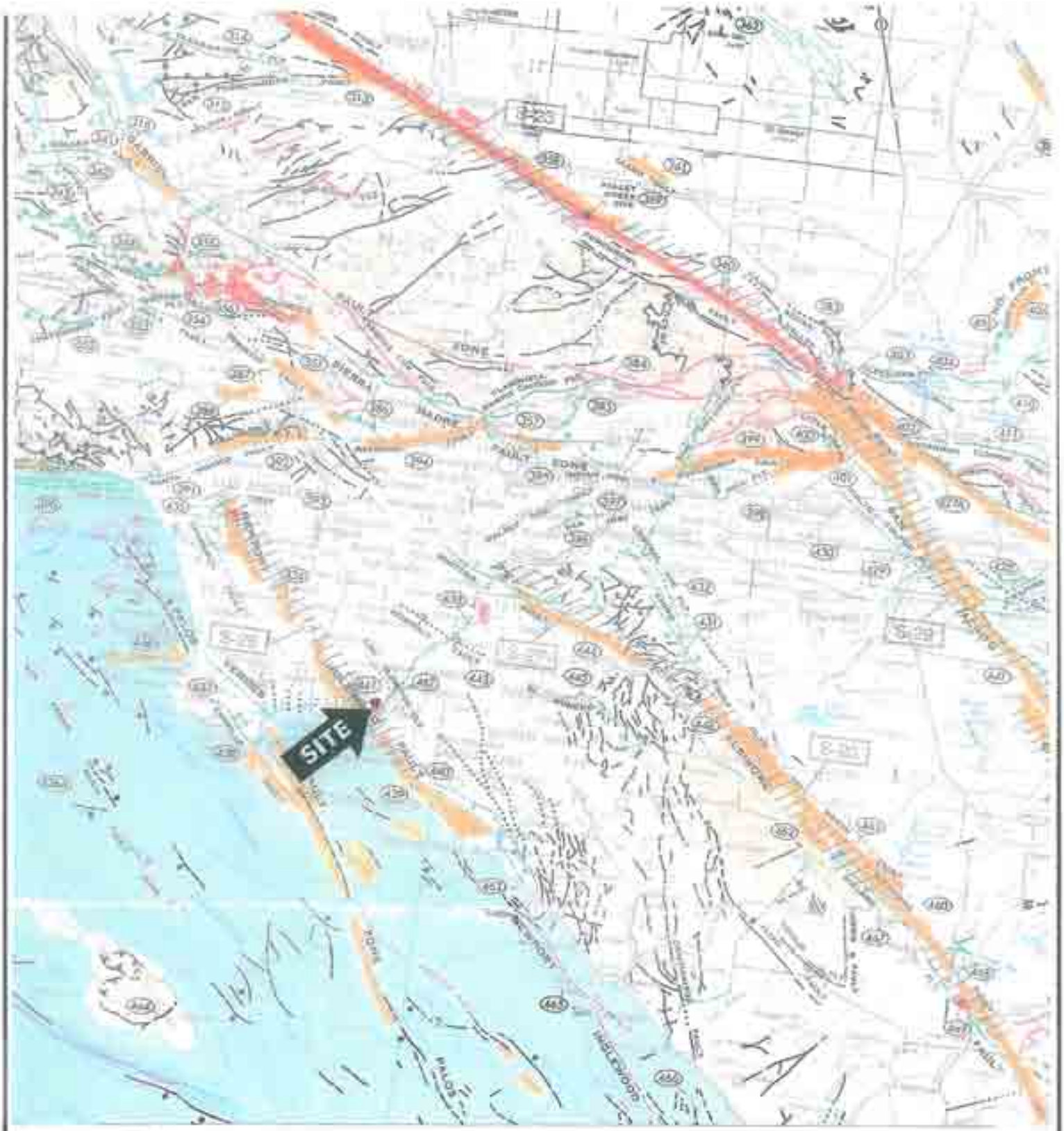
Figure:	1
File No.:	03-475
Date:	March 2004



MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SITE PLAN
Long Beach Home Depot
Studebaker & Loynes,
Long Beach, CA

File No.:	03-475
Figure No.:	2
Date:	December, 2004



EXPLANATION:

Scale (Approx.) 1 inch = 12 miles (19 km)

Pink band indicates historic (last 200 years) fault displacement

Orange band indicates Holocene (past 10,000 years) fault displacement

Purple fault traces indicate Quaternary faults (<1.6 million years)

Black fault traces indicate pre-Quaternary faults (>1.6 million years)

Reference: Fault Activity Map of California and Adjacent Areas, Jennings, 1994, California Geologic Data Map Series

MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

POTENTIAL SEISMIC SOURCES
LONG BEACH HOME DEPOT SITE
400 Studebaker Road
Long Beach, California

Figure:	3
File No.:	03-475
Date:	March 2004

Reference:
Fault-Rupture Hazard Zones
(Special Studies Zones)
Los Alamitos Quadrangle
(CDMG, 1986)

0 1000 2000 3000 4000 5000 6000 7000 FEET

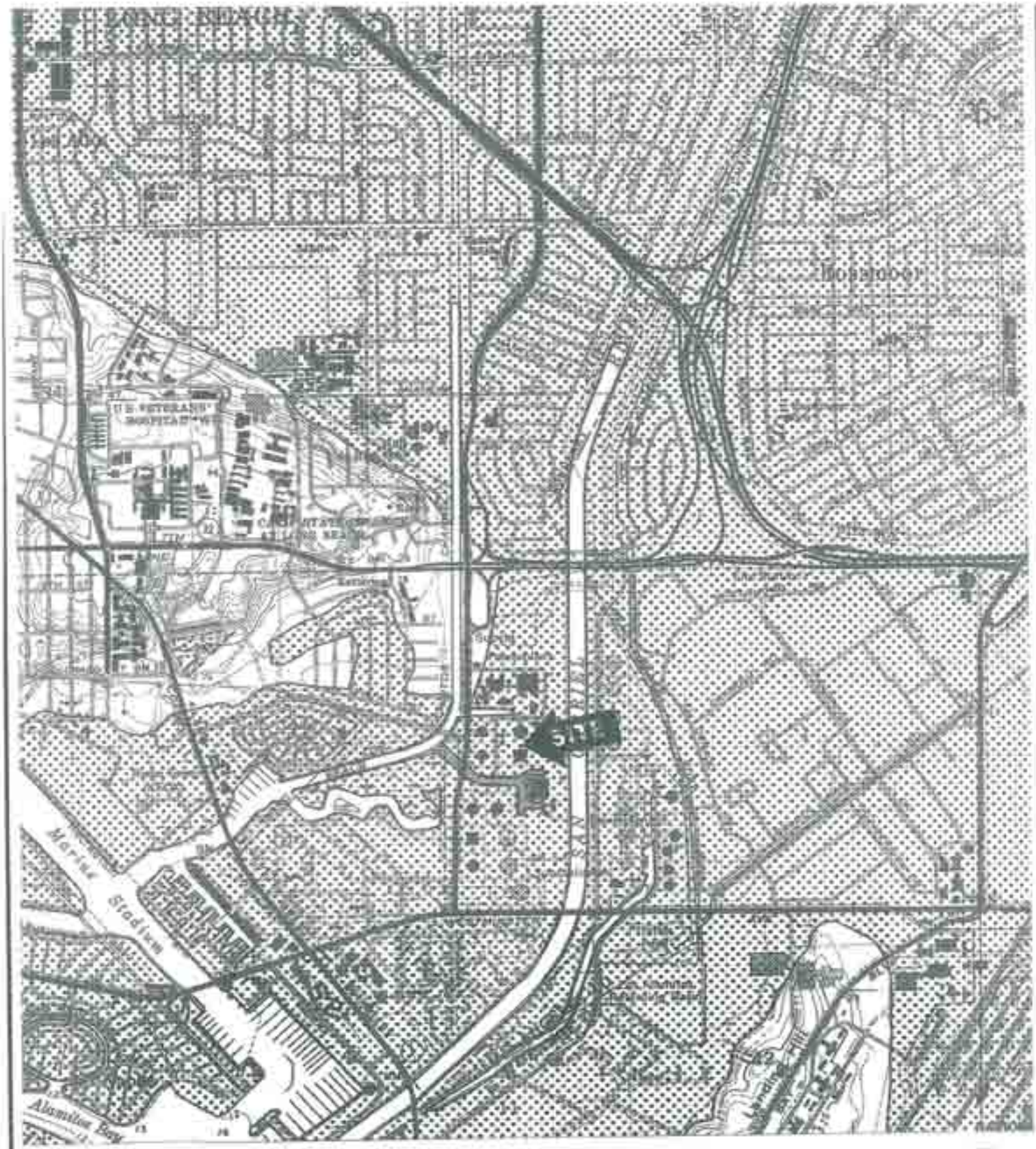
SCALE 1:24 000

N

MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

EARTHQUAKE FAULT ZONES MAP
LONG BEACH HOME DEPOT SITE
400 Studebaker Road
Long Beach, California

Figure:	4
File No.:	03-475
Date:	March 2004



Reference:
Seismic Hazard Zones Map
Los Alamitos Quadrangle
March 25, 1999 (CDMG)

0 1000 2000 3000 4000 5000 6000 7000 FEET

SCALE 1:24 000

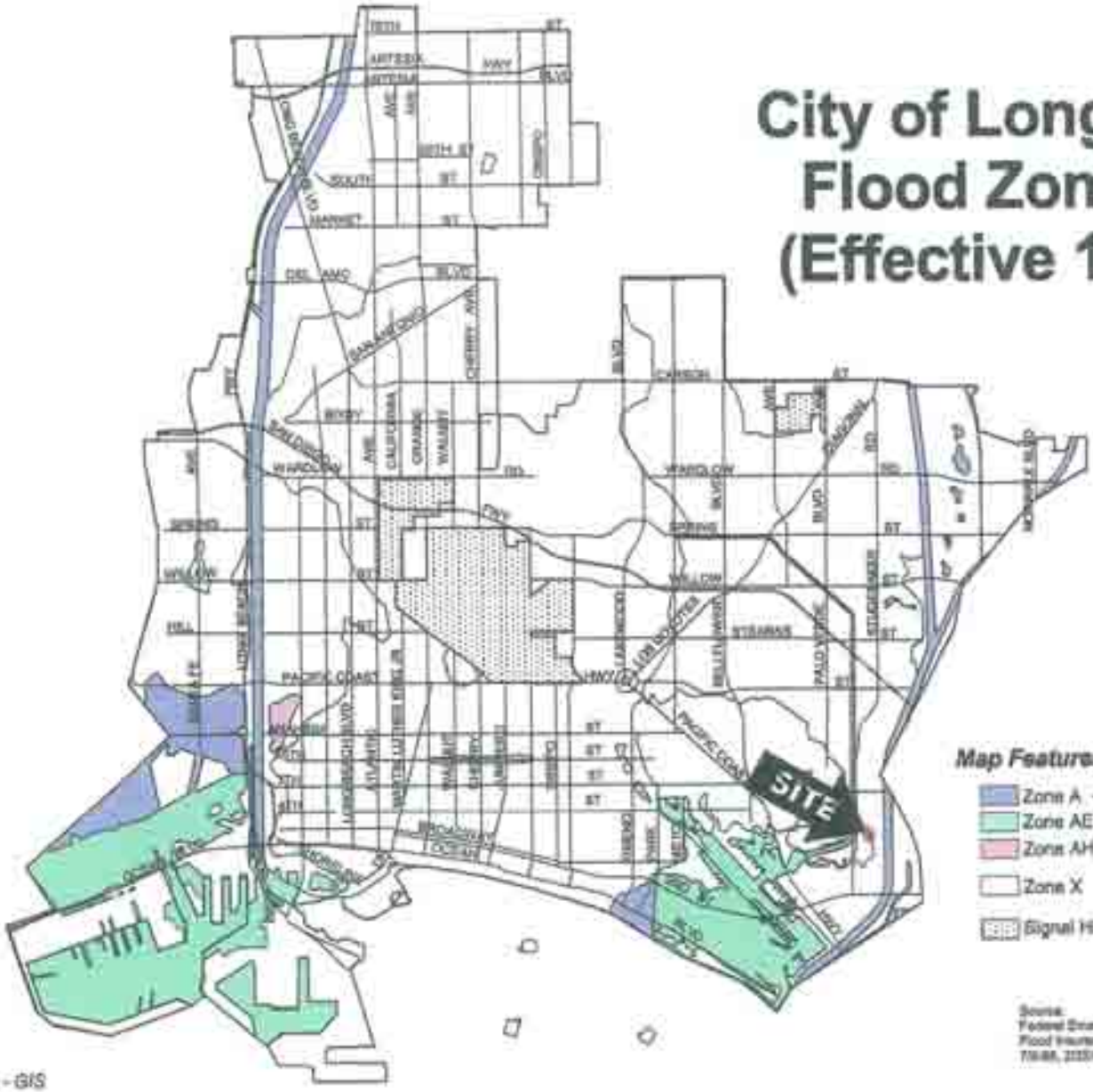
N

MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SEISMIC HAZARD ZONES MAP
LONG BEACH HOME DEPOT SITE
400 Studebaker Road
Long Beach, California

Figure: 5
File No.: 03-475
Date: March 2004

City of Long Beach Flood Zone Map (Effective 1/11/02)



Source:
Federal Emergency Management Agency
Flood Insurance Rate Maps dated
7/9/88, 2/23/00, 9/1/00 and 1/11/02

Department of Public Works - GIS

REFERENCE:
City of Long Beach Web Site:
http://cms.longbeach.gov/community/floodzonelookup.htm

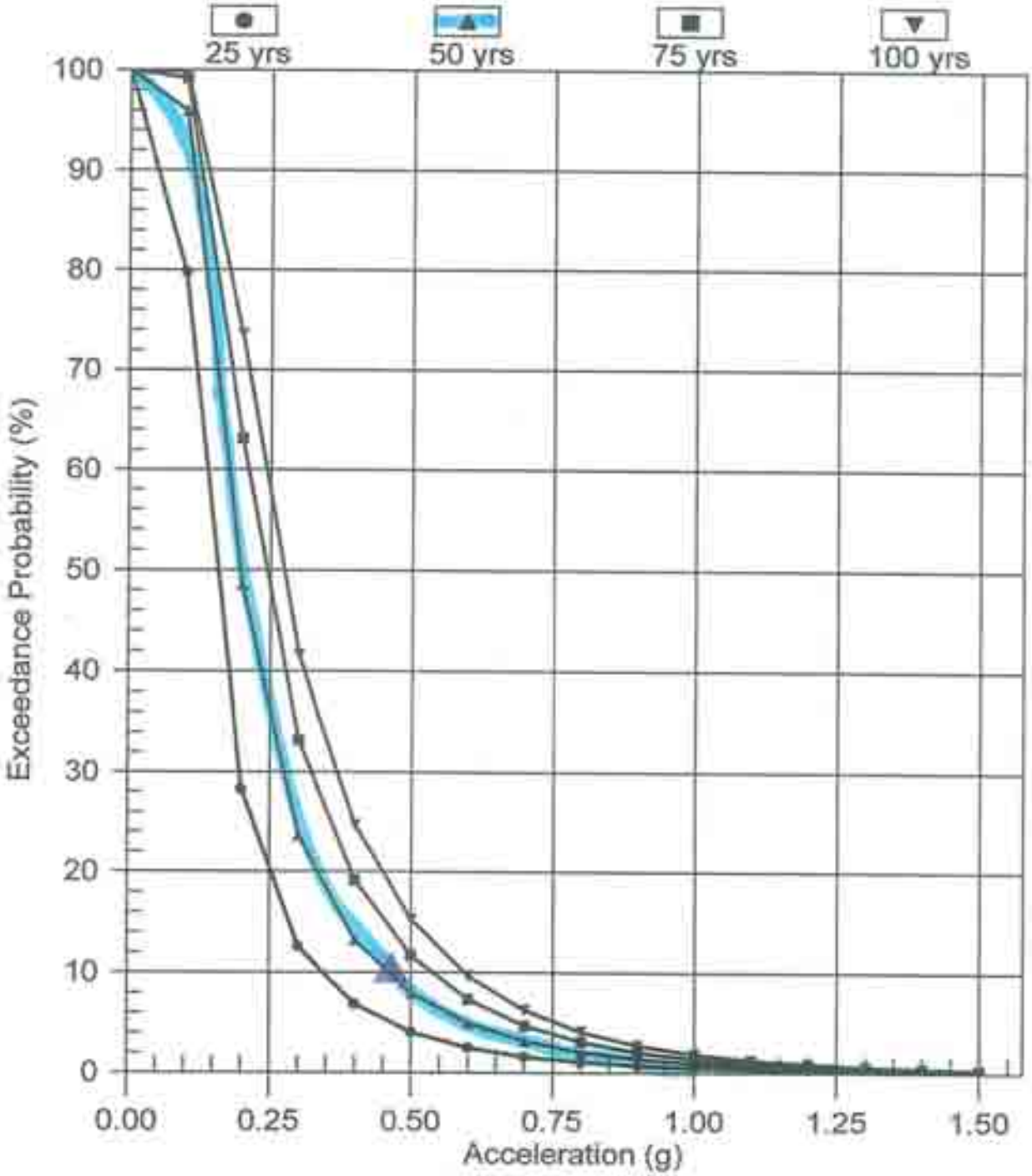
ECOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

FLOOD HAZARD ZONES MAP
LONG BEACH HOME DEPOT SITE
400 Studebaker Road
Long Beach, California

Figure: 6
File No.: 03-475
Date: March 2004

PROBABILITY OF EXCEEDANCE

BOORE ET AL. (1997) SOIL (310)1



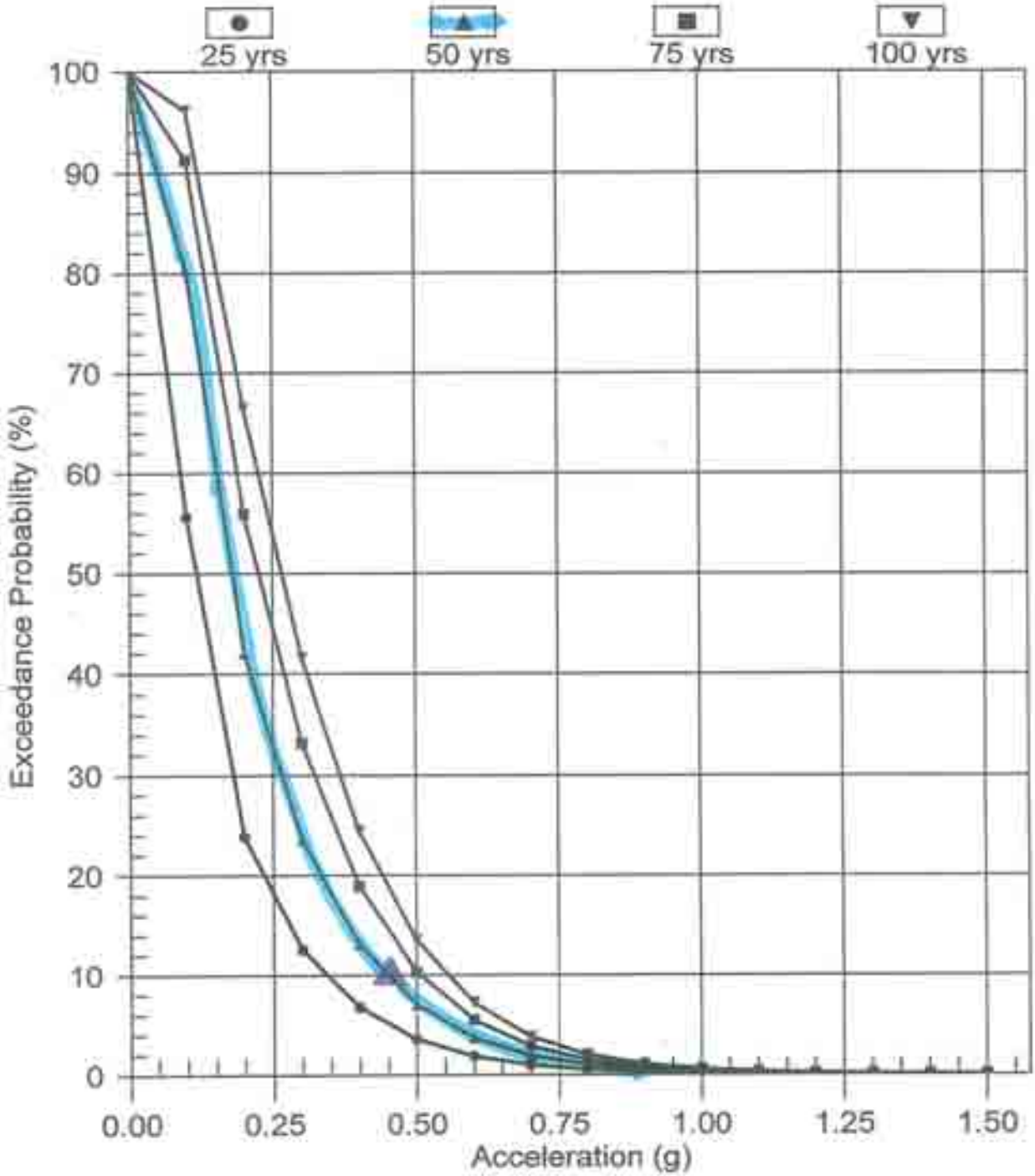
NOTES:

1) Curves represent exceedance probabilities for peak horizontal ground acceleration during various exposure periods.
2) Blue triangle indicates Design Basis Earthquake (DBE); 2001 CBC Sections 1627A, 1629A.1, and 1631A.2.
3) Curves based on attenuation relationship cited and fault parameters in California Geological Survey (formerly CDMG) fault database incorporated in PSHA software FRISKSP v. 4.0.

MISSION GEOSCIENCE, INC. ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS	PROBABILISTIC GROUND RESPONSE LONG BEACH HOME DEPOT SITE 400 Studebaker Road Long Beach, California	Figure: 7.1 File No.: 03-475 Date: March 2004

PROBABILITY OF EXCEEDANCE

CAMP. & BOZ. (1994/1997) AL 1



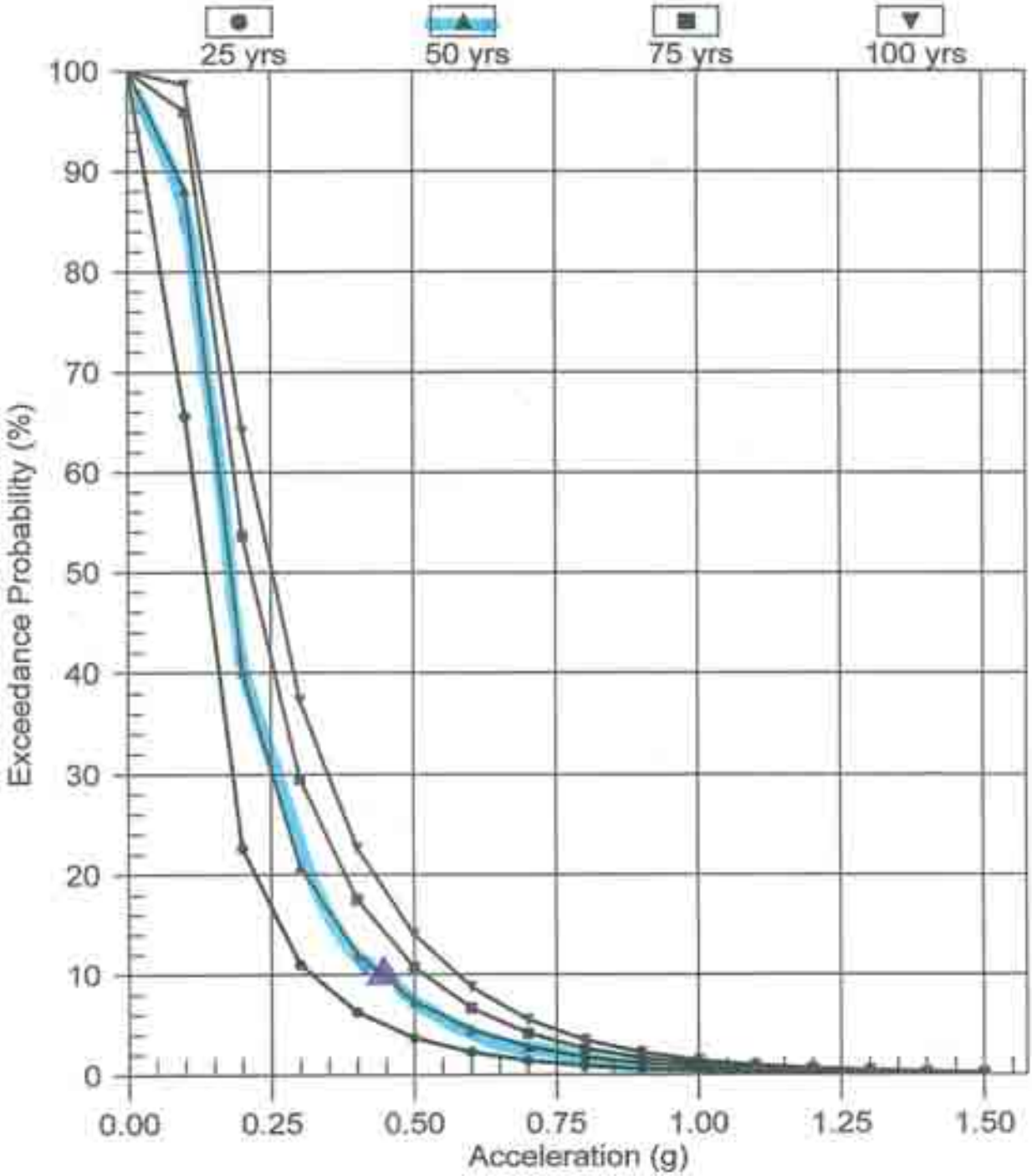
NOTES:

1) Curves represent exceedance probabilities for peak horizontal ground acceleration during various exposure periods.
2) Blue triangle indicates Design Basis Earthquake (DBE): 2001 CBC Sections 1627A, 1629A.1, and 1631A.2.
3) Curves based on attenuation relationship cited and fault parameters in California Geological Survey (formerly CDMG) fault database incorporated in PSHA software FRISKSP v. 4.0.

HEATON GEOSCIENCE, INC. ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS	PROBABILISTIC GROUND RESPONSE LONG BEACH HOME DEPOT SITE 400 Studebaker Road Long Beach, California	Figure: 7.2 File No.: 03-475 Date: March 2004

PROBABILITY OF EXCEEDANCE

ABRAHAMSON & SILVA (1997) SOIL 1



NOTES:

1) Curves represent exceedance probabilities for peak horizontal ground acceleration during various exposure periods.
2) Blue triangle indicates Design Basis Earthquake (DBE): 2001 CBC Sections 1627A, 1629A.1, and 1631A.2.
3) Curves based on attenuation relationship cited and fault parameters in California Geological Survey (formerly CDMG) fault database incorporated in PSHA software FRISKSP v. 4.0.

MILLER GEOSCIENCE, INC. ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS	PROBABILISTIC GROUND RESPONSE LONG BEACH HOME DEPOT SITE 400 Studebaker Road Long Beach, California	Figure: 7.3 File No.: 03-475 Date: March 2004

MISSION GEOSCIENCE, INC.

ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

APPENDIX A

APPENDIX A

GROUND RESPONSE ESTIMATION TECHNIQUE

GROUND RESPONSE ESTIMATION TECHNIQUE

MISSION has utilized the probabilistic software program FRISKSP© (ver. 4.0) to evaluate median ground motion as PHGA, by selecting a 475-year return period (equivalent to 10% probability of exceedance in 50 years; also equivalent to "Design Basis Earthquake (DBE)" in 1997 UBC and 2001 CBC) via three comparative, current standard PHGA attenuation techniques. Fault parameters utilized are those believed and reported to be internally consistent with those of the most recent published statewide fault database (e.g., CDMG, 1996; Petersen, *et al.*, 1996). MISSION has selected a "characteristic" earthquake occurrence rate (magnitude-frequency) distribution (Youngs and Coppersmith, 1985) for our probabilistic hazard evaluation for many of these faults considered capable of impacting the SITE. MISSION believes this rate distribution to be justified, given that earthquake occurrence rates calculated using this type of distribution are typically higher than rates predicted using a more traditional "truncated exponential (log-normal) distribution" (e.g., Gutenberg-Richter; Wesnousky, 1994), <u>particularly within the typical time period of conventional earthquake-resistant engineering concern</u>. However, for those faults or segments of faults where reliable paleoseismic data have been published or "convincing" arguments have been made using other published geologic or geomorphic data, log-normal earthquake rate distributions are substituted for the probabilistic estimates. Regardless of the earthquake rate distribution selected for statistical treatment, all distributions are limited in their applications, because the time period of the observed historical seismic record is typically far less than the recurrence interval of the largest earthquakes possible on most faults of interest to SITE seismic design. Although a large body of evidence suggests that large earthquake occurrence rates may vary sharply with time (Sieh, *et al.*, 1992; Grant and Sieh, 1994; Kagan and Jackson, 1994; Jackson, 1996; Schwartz, 1997), it may not be inaccurate to assume stationarity of either fault slip rates or earthquake occurrence rates within the time period of engineering concern.

The three PHGA attenuation relationships selected by MISSION are those of Campbell and Bozorgnia (1994/1997, modified for Northridge earthquake data) for alluvial sites in general; Abrahamson and Silva's (1995; 1997) and Abrahamson and Somerville's (1996) relationships, which incorporate near-field observations from the 1994 Northridge earthquake and permit distinction of sites which may experience higher ground accelerations due to their occurrence within the hanging-wall of thrust faults; and Boore, Joyner and Fumal's (1993; 1994;1997) "random method" for their "Site Class C". This Site Class C corresponds to soils with a shear-wave velocity within the range of 180 to 360 meters per second. MISSION selected these attenuation relationships because of their consistency with known SITE geologic conditions. The first two methods emphasizes typical ground motions associated with "short-distance" earthquakes and the type of fault displacement during an earthquake (particularly "blind" thrust faults), whereas the third method emphasizes soil type and "long-distance" earthquake effects.

Draft Report of Geotechnical Investigation
Proposed Home Depot
Oil Tank Farm
SEC Loynes Drive and Studebaker Road
Long Beach, California
GPI Project No. 1878.I

GEOTECHNICAL PROFESSIONALS, INC.

GPI GEOTECHNICAL PROFESSIONALS INC.

September 29, 2003

RECEIVED

OCT 0 2 2003

DFA

Home Depot
3800 W. Chapman Avenue
Orange, California 92868

Atte

Draft Report of Geotechnical Investigation
Proposed Home Depot
Oil Tank Farm
SEC Loynes Drive and Studebaker Road
Long Beach, California
GPI Project No. 1878.I

Transmitted herewith is a copy of our draft report of geotechnical investigation for the subject project. We are also forwarding five copies to Mr. Barney Michalchuck of Greenberg Farrow Architecture. The report presents our evaluation of the foundation conditions at the site and recommendations for design and construction.

As discussed, the estimated cumulative settlements due to liquefaction and static settlement exceed Home Depot's Criteria by a small amount. The total settlements are the same or less than some other projects where the settlement was not mitigated. As requested, we have assumed conventional foundations and no mitigation of the liquefaction settlement. We should also note that raising grades significantly, will also induce static settlement due to surcharging effects of the fill.

We appreciate the opportunity of offering our services on this project and look forward to seeing the project through its successful completion. Feel free to call us if you have any questions regarding our report or need further assistance.

Very truly yours,
Geotechnical Professionals Inc.

James E. Harris, G.E.
Principal

JEH:sph

cc: (5) Mr. Barney Michalchuck, Greenberg Farrow Architecture
1878-I-02L.doc (9/03)

5736 Corporate Avenue • Cypress, CA 90630 • (714) 220-2211, FAX (714) 220-2122

DRAFT
GEOTECHNICAL INVESTIGATION
PROPOSED HOME DEPOT
OIL TANK FARM
SEC LOYNES DRIVE AND STUDEBAKER ROAD
LONG BEACH, CALIFORNIA

Prepared for:
Home Depot
3800 W. Chapman Avenue
Orange, California 92868

Prepared by:
Geotechnical Professionals Inc.
5736 Corporate Avenue
Cypress, California 90630
(714) 220-2211

Project No. 1878.1

September 29, 2003

TABLE OF CONTENTS

			PAGE
1.0	INTRODUCTION		1
1.1	GENERAL		1
1.2	PROJECT DESCRIPTION		1
1.3	PURPOSE OF INVESTIGATION		1
2.0	SCOPE OF WORK		2
3.0	SITE CONDITIONS		3
3.1	SURFACE CONDITIONS		3
3.2	SUBSURFACE SOILS		3
3.3	GROUNDWATER AND CAVING		3
4.0	CONCLUSIONS AND RECOMMENDATIONS		4
4.1	GENERAL		4
4.2	SEISMIC CONSIDERATIONS		5
	4.2.1	General	5
	4.2.2	Strong Ground Motion Potential	5
	4.2.3	Potential for Ground Rupture	6
	4.2.4	Liquefaction and Dynamic Settlement	6
	4.2.5	Seismic Ground Subsidence	7
4.3	EARTHWORK		7
	4.3.1	Clearing and Grubbing	8
	4.3.2	Excavations	8
	4.3.3	Subgrade Preparation	9
	4.3.4	Material for Fill	10
	4.3.5	Placement and Compaction of Fills	10
	4.3.6	Wet Weather Grading	11
	4.3.7	Shrinkage and Subsidence	11
	4.3.8	Trench/Wall Backfill	12
	4.3.9	Observation and Testing	12
4.4	SHALLOW FOUNDATIONS		12
	4.4.1	General	12
	4.4.2	Allowable Bearing Pressures	12
	4.4.3	Minimum Footing Widths and Embedments	13
	4.4.4	Estimated Settlements	13
	4.4.5	Lateral Load Resistance	13
	4.4.6	Foundation Concrete	14
	4.4.7	Footing Excavation Observation	14
4.5	BUILDING FLOOR SLABS		14
4.6	LATERAL EARTH PRESSURES		15
4.7	CORROSIVITY		15
4.8	DRAINAGE		16
4.9	EXTERIOR CONCRETE AND MASONRY FLATWORK		16
4.10	PAVED AREAS		16
5.0	LIMITATIONS		18

REFERENCES

APPENDICES

A CONE PENETRATION TESTS
B EXPLORATORY BORINGS
C LABORATORY TESTING

DRAFT

LIST OF FIGURES

FIGURE NO.

1	Site Location Map
2	Site Plan

APPENDIX A

A-1	Cone Penetrometer Diagram
A-2 to A-7	Logs of Cone Penetration Tests

APPENDIX B

B-1 to B-6	Logs of Borings

APPENDIX C

C-1	Atterberg Limits Test Results
C-2	Direct Shear Test Results
C-3 to C-6	Consolidation Test Results

DRAFT

1.0 INTRODUCTION

1.1 GENERAL

This report presents the results of a geotechnical investigation performed by Geotechnical Professionals Inc. (GPI) for the proposed Home Depot to be located at a former fuel oil tank farm at the Alamitos Generating Station in Long Beach, California. The geographical site location is shown on Figure 1.

1.2 PROJECT DESCRIPTION

The proposed development will consist of the construction of a Home Depot with an associated outdoor garden center. Other improvements will include landscaping and paved vehicular areas. **Other buildings are planned for the site; however, as requested, those improvements are not included with this report.** The proposed site configuration is shown on the Site Plan, Figure 2.

Based on a site plan prepared by Perkowitz + Ruth Architects, dated July 2003, the proposed Home Depot store will consist of a 117,000± square foot single-story building. Adjoining the east side of the building will be a 34,643 square foot outdoor garden center area. We have assumed tilt-up walls with slab-on-grade floors for the building.

Based on the Home Depot Criteria (February 21, 2002), maximum column loads of 120 kips and maximum wall loads of 5 kips per linear foot are expected for the store. Floor loads up to 650 pounds per square foot have been assumed for the slab-on-grade floor.

Finish grade information was not available at the time this report was prepared. We have assumed that finish grades will be raised about 2 feet above existing site grades.

Our recommendations are based upon the above structural and grading information. We should be notified if the actual loads and/or grades change during the project design to either confirm or modify our recommendations.

1.3 PURPOSE OF INVESTIGATION

The primary purpose of this investigation and report is to provide an evaluation of the existing geotechnical conditions at the site as they relate to the design and construction of the proposed development. More specifically, this investigation was aimed at providing geotechnical recommendations for planning earthwork, and design of foundations, floor slabs, and pavements.

2.0 SCOPE OF WORK

Our scope of work for this investigation consisted of review of available geotechnical data, field exploration, laboratory testing, engineering analysis, and the preparation of this report.

We reviewed available geotechnical data pertaining to the site. Pertinent information was incorporated herein where appropriate.

As approved by Home Depot, a reduced exploration program was performed due to access constraints (berms and tanks) and the anticipated subsurface conditions (need for deep foundations or ground improvement). The field exploration consisted of six Cone Penetration Tests (CPT's) and six exploratory borings. The locations of the subsurface explorations are shown on the Site Plan, Figure 2.

The CPT's were advanced to depths ranging from 10 to 65 feet below existing site grades. Detailed logs of the CPT's and a summary of the equipment used are presented in Appendix A. The borings were drilled using truck-mounted rotary wash equipment and extended to depths of 10 to 71 feet below existing site grades. Details of the drilling and Logs of Borings are presented in Appendix B.

Laboratory soil tests were performed on selected representative samples as an aid in soil classification and to evaluate the engineering properties of the soils. The geotechnical laboratory testing program included determinations of moisture content and dry density, Atterberg Limits, expansion potential, percent fines, shear strength (direct shear), compressibility (consolidation), compaction (maximum density/optimum moisture), and soil corrosivity. Laboratory testing procedures and results are summarized in Appendix C.

Soil corrosivity testing was performed by M.J. Schiff and Associates, under subcontract to GPI. The test results are presented in Appendix C.

Engineering evaluations were performed to provide preliminary earthwork criteria, foundation and slab design parameters, preliminary pavement sections and assessments of seismic hazards. The results of our evaluations are presented in the remainder of the report.

3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

The site is currently an existing oil tank farm. Asphalt pavements are also present. Soil berms, on the order of 7 to 10 feet in height, surround each tank. The soil berms are covered with an oil-based emulsion. Evidence of buried utilities exists at the site. The site is bounded by the Alamitos Generating Station to the north and east, Studebaker Road to the west, and a water supply channel to the south.

According to available topographic information, the ground surface elevation is estimated to be near Elevation +10 feet, relative to the bottom of the berms.

3.2 SUBSURFACE SOILS

Our field investigation disclosed a subsurface profile consisting of undocumented fills overlying natural soils comprised of clays, silts, sands and their mixtures. Detailed descriptions of the subsurface conditions encountered in our explorations are provided in the Logs of CPT's and Logs of Borings in Appendices A and B, respectively.

Undocumented fill soils were encountered within the upper 7 to 10 feet of existing site grades, relative to the base of the existing soil berms. These materials consist of very moist to moist mixtures of clay and silty sand. According to References 2 and 3, the existing fuel oil tanks are supported on 12-inches of crushed aggregate/rock overlying 5 feet of compacted fill soils, which extends 10 feet beyond the tanks. Documentation regarding the placement and compaction of the fill materials (beneath the tanks and site-wide) is not available from Southern California Edison, the former property owner.

The on-site clays exhibit a medium to high expansion potential whereas the silty sand and sands exhibit a very low expansion potential.

The natural soils consist of soft to very stiff clays and silts and medium dense to dense silty sands, with dense to very dense sands at depth. Locally, organics and elastic silts were encountered. These materials are very moist to wet. The cohesive soils between depths of 11 to 25 feet are moderately compressible.

3.3 GROUNDWATER AND CAVING

Groundwater was encountered in our borings at depths of 10½ to 18 feet. The groundwater depths were measured at various time intervals ranging between 0 to 20 hours, after completion of the borings. Based on published information (Reference 1), a historical shallow groundwater depth of about 10 feet below existing grade can be expected.

Caving was not encountered in our exploratory borings due to the use of rotary wash drilling. However, excavations/borings below the groundwater (without a positive head of water) are expected to cave, especially in sandy soils.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 GENERAL

Based on the results of our investigation, it is our opinion that from a geotechnical viewpoint it is feasible to develop the site, provided the recommendations discussed herein are incorporated into the design and construction of the project. The proposed structures can be supported on shallow foundations provided the geotechnical constraints discussed below are mitigated. The most significant geotechnical issues that will affect the design and construction of the proposed structures are as follows:

- Fill soils were encountered within the upper 7 to 10 feet below existing site grades. Based on our review of available documents (References 2 and 3), approximately 6-feet of fill soils are present below the former fuel oil tanks. Documentation regarding the placement of these materials was not available. Low density/compressible natural soils were encountered at depths of 7 to 10 feet. These materials will require densification in order to provide uniform support of new footings and slab-on-grade floors. We recommend that these materials be removed and replaced as properly compacted fill.

- The majority of the on-site soils exhibit above-optimum moisture conditions. Some special handling of these materials will be required, including drying and mixing using a disc, and the use of steel track/wheel equipment during grading.

- The site is located within an area identified by the State of California as having a potential for liquefaction (Seismic Hazards Mapping Act). Based on our findings, some 1- to 2-foot thick sandy soils exhibit a potential for liquefaction when subjected to a design level earthquake. If liquefaction were to occur, we estimate dynamic settlements will range between ½-inch to ¾-inch.

- Finish grade information or grading plans were not available at the time this report was prepared. Prior to finalizing this report, finish grade information will be needed, as significant adverse impacts to the structure can result from placement of fill soils, as discussed below.

- The site is underlain by compressible clays. Due to areal settlement considerations, we recommend that finish grades be maintained within 2 feet above existing site grades. If finish grades are raised more than 2 feet above existing, we estimate that approximately ½-inch of areal settlement will occur for every foot of fill placed. Settlement of the ground surface will occur over a period of approximately one year. The extended settlement period is due to the consolidation characteristics of the subsurface clayey soils. If grades are to be raised, recommendations can be provided to help reduce the time period needed for settlements of the ground surface to occur.

- Based on our evaluations, we estimate that total settlements ranging from 1¼ to 1½ inches will occur. These settlements are due to a combination of static and liquefaction-induced (dynamic) settlements, and will exceed the Home Depot Criteria of 1-inch. Even higher settlements will occur if grades are raised, as discussed above. We understand that Home Depot has accepted higher settlement criteria on other projects. If these settlements are not tolerable, additional recommendations can be provided to help mitigate both static and dynamic settlements in order to maintain settlements to 1-inch maximum, in accordance with the Criteria.

- Clay soils encountered at the site exhibit a medium to high expansion potential. To maintain heaving within Home Depot Criteria, we recommend that the upper 3 feet of subgrade soils supporting slab-on-grade floors consist of on-site or imported, relatively non-expansive granular soils. Based on our explorations and observations, sandy soils were encountered in the berms at the southwestern side of the project (vicinity of Fuel Oil Tank No. 2). Additional investigation is needed during demolition or grading to determine whether the quantity of sandy soils is enough to provide the required 3-foot cap.

- The on-site soils are deleterious to concrete and buried metal utilities.

Our recommendations related to the geotechnical aspects of the development of the site are presented in the subsequent sections of this report.

4.2 SEISMIC CONSIDERATIONS

4.2.1 General

The site is located in a seismically active area and is likely to be subjected to strong ground shaking due to earthquakes on nearby faults.

We assume the seismic design of the proposed development will be in accordance with U.B.C. criteria, 1997 edition. The site is located within Seismic Zone No. 4. A site soil profile S_D should be assumed (Table 16-J). Based on "Maps of Known Active Fault Near-Source Zones in California..." (addendum to the 1997 UBC), the site is located within 2 kilometers from a Type B fault (N_a = 1.3, N_v = 1.6). The actual method of seismic design should be determined by the Project Structural Engineer.

4.2.2 Strong Ground Motion Potential

Based on information provided in Reference 4, the most significant fault in the proximity of the site is the Newport-Inglewood Fault, which is located about one-half mile from the project site.

A peak ground acceleration of 0.52g can be expected at the site (Reference 5). This acceleration has a 10 percent chance of exceedence in 50 years.

4.2.3 Potential for Ground Rupture

There are no known active faults crossing or projecting through the site. The site is not located in or immediately adjacent to an Alquist-Priolo Earthquake Fault Zone. Therefore, ground rupture due to faulting is considered unlikely at this site.

4.2.4 Liquefaction and Dynamic Settlement

Soil liquefaction is a phenomenon in which saturated cohesionless soils undergo a temporary loss of strength during severe ground shaking and acquire a degree of mobility sufficient to permit ground deformation. In extreme cases, the soil particles can become suspended in groundwater, resulting in the soil deposit becoming mobile and fluid-like. Liquefaction is generally considered to occur primarily in loose to medium dense deposits of saturated cohesionless soils. Thus, three conditions are required for liquefaction to occur: (1) a cohesionless soil of loose to medium density; (2) a saturated condition; and (3) rapid large strain, cyclic loading, normally provided by earthquake motions.

The site is located within an area mapped as having a potential for soil liquefaction, as defined by the Seismic Hazards Mapping Act (Act). As defined by the Act, characteristics of the site require investigation for the potential hazard and, if a hazard exists, that its effects be mitigated. Specifically, the site is mapped on the Seismic Hazards Zone, Los Alamitos Quadrangle (dated March 25, 1999).

For design ground motion, a peak ground acceleration (PGA) having a 10 percent chance of exceedence in 50 years and a Magnitude Weighting (M7.5) was used. We performed a probabilistic evaluation of the potential ground motions that may affect the site using FRISKSP (Reference 5). The following ground motions were determined using the three referenced attenuation relationships.

ATTENUATION RELATIONSHIPS	PGA* (g)	PGA** (g)
Boore, et al (1997)	0.53	0.42
Campbell (1997)	0.52	0.41
Sadigh, et al (1997)	0.51	0.40
Average	**0.52**	**0.41**

* 10 percent chance of exceedence in 50 years, unweighted
** 10 percent chance of exceedence in 50 years, magnitude weighted (M = 7.5).

The potential for soil liquefaction under earthquake shaking at the site was evaluated using Reference 6, using a PGA of 0.41g, and modifications provided in Reference 7. As required by the Act, historical groundwater levels were used. For our evaluations, we used a historical depth to groundwater of 10 feet below existing grades.

The majority of the subsurface soils are either cohesive soils that do not satisfy the characteristics necessary for liquefaction (Chinese Criteria) or are dense to very dense granular soils. However, based on the CPT's and our evaluations, 1- to 2-foot thick sand layers at depths between 11 and 33 feet below grade exhibit marginal resistance to liquefaction. Should liquefaction of these layers occur, the estimated magnitude of total dynamic settlement is expected to range between ½ - to ¾ -inch. The variation in dynamic settlement is due to the variability of the subsurface soils across the site. The main impact would be settlement of the ground surface. Therefore, mitigation of the potential for liquefaction is not necessary.

Lateral Spreading

A potential result of soil liquefaction at the site is lateral spreading. Lateral spreading is the differential movement of the ground surface due to open face excavations. At this site, the ground surface would move laterally down gradient towards the river, along the southern site boundary. A topographic map is currently not available. Based on our observations, the height of the open face excavation at the southern boundary of the project site is estimated to be 8 feet. The project site is essentially flat, however, since a topographic map is not available, we have assumed a ground slope of approximately 1 percent.

We analyzed the potential for lateral spreading using an empirical method of analysis presented in Reference 8. The methods are based on very limited data (case histories). For lateral spreading to occur, the layers subject to liquefaction should be continuous across the site and have an overburden-normalized standard penetration test blowcount (sandy soils) of less than 15.

Based on our evaluations, two layers found in CPT C-5 used in our liquefaction evaluations exhibit an equivalent normalized standard penetration test blowcount of less than 15. However, since these layers are not continuous across the site, lateral spreading is not considered likely for this site.

4.2.5 Seismic Ground Subsidence

Seismic ground subsidence (not related to liquefaction induced settlements) occurs when strong earthquake shaking results in the densification of loose to medium dense sandy soils above the groundwater. Provided the recommended earthwork is performed and due to the predominant cohesive consistencies of the on-site soils, such subsidence is not expected to occur at the site.

4.3 EARTHWORK

This section of the report provides detailed earthwork recommendations. The reader is urged to review Section 4.0 of this report for a summary of the geotechnical constraints and considerations.

The earthwork anticipated at the project site will consist of clearing and grubbing, excavation of undocumented fill soils, subgrade preparation, and placement and

compaction of fill. Because of the cohesive consistencies of the on-site soils, earthwork performed during the rainy season will require significantly longer time for completion.

4.3.1 Clearing and Grubbing

Prior to grading, the areas to be developed should be stripped of any vegetation and cleared of all debris and pavements. All buried obstructions, such as footings, utilities and tree roots, should be removed. All deleterious material generated during the clearing operation should be removed from the site. Inert demolition debris, such as concrete and asphalt, may be crushed for the re-use in engineered fills in accordance with the criteria presented in the "Material for Fill" section of this report.

Although none were encountered, any cesspools or septic systems encountered during grading should be removed in their entirety. The resulting excavation should be backfilled as recommended in the "Subgrade Preparation" and "Placement and Compaction of Fill" sections of this report. At the conclusion of the clearing operations, the representative of the geotechnical engineer should observe and accept the site prior to any further grading.

4.3.2 Excavations

Excavations at the site will include removal of undocumented fill soils and upper compressible soils, footing excavations, and trenching for utility lines.

Prior to placement of fills or construction of buildings or walls, all undocumented soils and upper compressible soils within the proposed Home Depot pad (defined by Home Depot to include the building, garden center, customer pick-up-lane and sidewalk at front of building, porte-cochere, and loading dock retaining walls), should be removed and replaced as properly compacted fill. These materials require densification to provide uniform and adequate support of foundations, slab-on-grade floor, and pavements. For planning purposes, we recommend that removals extend to 10 feet below existing grades. In proposed pavement areas, removals should extend to 12 inches below existing grades. Existing grade refers to elevations at locations of explorations. The actual depths of removal will need to be confirmed in the field during grading.

Subjecting the materials at the base of the excavation to heavy rubber-tire equipment will probably encounter mobilization difficulties and induce pumping and rutting. We recommend that steel track/wheel equipment be used during grading to minimize disturbance of these materials and permit travel across the subgrade.

Stabilization of the subgrade will probably be needed prior to placement of any fills. Recommendations are provided in the next section of this report.

Where not removed by the aforementioned excavations, existing utility trench backfill should be removed and replaced as properly compacted fill. This is especially important for deeper fills associated with existing sewers and storm drains. For planning purposes, removals over the utilities should extend to within 1-foot of the top of the pipe. For utilities, which are 5 feet or shallower, the removal should extend laterally 1-foot beyond both sides of the pipe. For deeper utilities, the removals should include a zone defined by a 1:1

projection upward (and away from the pipe) from each side of the pipe. The actual limits of removal will need to be confirmed in the field. We recommend that all known utilities be shown on the grading plan.

The base of removals should extend laterally beyond the building line a minimum distance of 5 feet or equal to the depth of overexcavation/compaction below finish grade (i.e., a 1:1 projection below the top edge of footings), whichever is greater. Building lines include all canopies, loading dock, customer pick-up, etc., as defined above. The project surveyor should confirm the limits of removal, both vertically and laterally relative to the actual building or retaining wall location to confirm that the recommended remedial excavations have been performed. This is especially important at the corners of buildings and at property lines as these areas have been missed on previous projects.

Temporary construction excavations may be made vertically without shoring to a depth of 5 feet below adjacent grade. For deeper cuts up to 10 feet, the slopes should be properly shored or sloped back at least 1:1 (horizontal:vertical) or flatter. No surcharge loads should be permitted within a horizontal distance equal to the height of cut from the top of the excavation or 5 feet from the top of the slopes, whichever is greater, unless the cut is properly shored. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site facilities should be properly shored to maintain support of adjacent elements. All excavations and shoring systems should meet the minimum requirements given in the most current State of California Occupational Safety and Health Standards.

4.3.3 Subgrade Preparation

The subgrade expected to be exposed at the base of removals will require some type of stabilization to facilitate fill placement and support earthmoving equipment.

Several methods of stabilization are available including drying/discing and recompaction with steel wheeled equipment, lime/cement stabilization and the placement of rock/aggregate base over fabric. The method used can be based on available construction time and costs. For the drying option, the upper 12 to 18 inches of the subgrade should be disced and dried until optimum moisture contents are achieved. The layer should then be compacted using steeled-wheeled equipment such as a Caterpillar 815 or 825. This method works best for large areas and when drying time is available (weather permitting, preferably summer), such as pavement areas. For chemical modification, the soils could be treated with lime (3%) or cement (6%) to a depth of 12 to 18 inches below subgrade. If lime treatment is used, the treated zone should be mixed twice. For smaller areas where time is a constraint, 12 to 18 inches of rock/aggregate base over a woven geofabric (Mirafi 600x or equivalent) can be used. This method can also be used for large areas, however, it is expensive.

After removals are complete and prior to placing any fills or construction of proposed structures or pavements, the subgrade soils exhibiting near optimum moisture conditions should be scarified to a depth of 12 inches, moisture-conditioned, and compacted to at least 90 percent of the maximum dry density in accordance with ASTM D1557 and to a firm and unyielding condition.

4.3.4 Material for Fill

The on-site soils are suitable for use as compacted fill. Drying and mixing of these materials will be required to obtain near optimum moisture conditions. The on-site clayey soils should not be used as wall backfill or in the upper 3 feet of the building pads. Wall backfill and the upper 3 feet of the building pad should be capped with on-site or imported, granular (less than 40 percent fines passing the No. 200 sieve), and relatively non-expansive (Expansion Index of 20 or less) soil. Sandy soils satisfying these requirements are available on-site.

The above-ground soil berms are suitable as fill material provided the oil-emulsion cover and vegetation is removed prior to placement as fill.

Imported fill material should be predominately granular (less than 40 percent fines passing the No. 200 sieve) and relatively non-expansive (E.I. less than 20). The import should exhibit an R-value of at least 20 if used in pavement areas. The Geotechnical Engineer should be provided with a sample (at least 50 pounds) and notified of the location of any soils proposed for import at least 72 hours in advance. Each proposed import source should be sampled, tested and accepted for use prior to delivery of the soils to the site. Soils imported prior to acceptance by the Geotechnical Engineer may be rejected if not suitable.

Both imported and existing on-site soils to be used as fill should be free of debris and any pieces larger than 6 inches in greatest dimension.

Provided it is acceptable to the reviewing governmental agencies and owner, crushed, inert demolition debris, such as concrete and asphalt, may be used in fills <u>outside</u> the building areas with the following processing requirements:

- If the inert debris is crushed to a well graded mixture with maximum particle size of 1½ inches, the crushed material may be used directly in the fill without further blending.

- Inert debris up to a maximum size of 6 inches may also be used in fills, provided it is thoroughly blended with sandy soil to form a well graded mixture.

4.3.5 Placement and Compaction of Fills

All fill soils should be placed in horizontal lifts, moisture-conditioned, and mechanically compacted to at least 90 percent of maximum dry density (95 percent for aggregate base and for sandy soils in the upper 12 inches below floor slab areas and aggregate base) in accordance with ASTM D-1557. The optimum lift thickness will depend on the compaction equipment used and can best be determined in the field. The following uncompacted lift thickness can be used as preliminary guidelines.

Plate compactors	4-6 inches
Small vibratory or static rollers (including sheepsfoot)	6-8 inches
Heavy vibratory rollers, scrapers and loaders	6-12 inches

The maximum lift thickness should not be greater than 12 inches. Each lift should be thoroughly compacted and accepted prior to subsequent lifts.

The moisture content of the on-site clayey materials should be placed at least 2 to 3 percentage points over the optimum moisture content to readily achieve the required degree of compaction and to help reduce the potential for expansion. The on-site clayey soils are, in general, significantly above the optimum moisture content. Therefore, drying of the on-site clayey soils during grading will be required. Sandy soils should be moisture-conditioned to slightly over the optimum moisture content. The contractors should allow for active drying of all soils, to reduce the moisture contents by 5 to 40 percent. Discing and processing for drying should be included in all earthwork bids.

After placement and compaction, the surface of fills must be maintained in the over optimum moisture condition described above, until covered. Should these materials be allowed to dry, reprocessing of the subgrade will be required.

During backfill of excavations, the fill should be properly benched into the construction slopes as it is placed in lifts.

4.3.6 Wet Weather Grading

The majority of the existing soils are cohesive (silts and clays) and, at the time of our field investigation, exhibit above optimum moisture conditions. Because the soils are predominantly cohesive, drying periods will be longer as compared to soils that are granular (sandy). If grading is planned to be performed during the rainy season, weather-related delays should be expected. Therefore, the grading contractor should take into account typical weather for the period during which grading will be performed and include all anticipated costs in the bid. Typically, wet weather grading should include discing of soil to accelerate drying during favorable weather conditions. Protection of the completed pad surface from rain with a layer of aggregate base has been successful on other projects.

4.3.7 Shrinkage and Subsidence

Shrinkage is the loss of soil volume caused by compaction of fills to a higher density than before grading. Subsidence is the settlement of in-place subgrade soils caused by loads generated by large earthmoving equipment. For earthwork volume estimating purposes, an average shrinkage value of 15 to 20 percent and subsidence of 0.1 foot to 0.2 feet may be assumed for the surficial soils. These values are estimates only and exclude losses due to removal of vegetation or debris. Actual shrinkage and subsidence will depend on the types of earthmoving equipment used and should be determined during grading.

4.3.8 Trench/Wall Backfill

Utility trench and wall backfill should be mechanically compacted in lifts. Wall backfill should consist of the on-site or imported, non-expansive silty sands or sands. The on-site clayey/silty soils should not be used as wall backfill material. Drying and mixing of the on-site soils should be anticipated prior to recompaction. Lift thickness should not exceed those values given in the "Compacted Fill" section of this report. Jetting or flooding of backfill materials should not be permitted. The Geotechnical Engineer should observe and test all trench and wall backfills as they are placed.

In backfill areas where mechanical compaction of soil backfill is impractical due to space constraints, sand-cement slurry may be substituted for compacted backfill. The slurry should contain one sack of cement per cubic yard and have a maximum slump of 5 inches. When set, such a mix typically has the consistency of compacted soil.

4.3.9 Observation and Testing

A representative of the project Geotechnical Engineer should observe all excavations, subgrade preparation, and fill placement activities. Sufficient in-place field density tests should be performed during fill placement and in-place compaction to evaluate the overall compaction of the soils. Soils that do not meet minimum compaction requirements should be reworked and retested prior to placement of any additional fill.

4.4 SHALLOW FOUNDATIONS

4.4.1 General

The proposed structures may be supported on conventional isolated and/or continuous shallow footings, provided the subsurface soils are prepared in accordance with the recommendations given in this report and the estimated settlements are tolerable. All footings should be supported on properly compacted fill. Provided the recommended earthwork is performed, heaving of foundations are expected to conform to Home Depot Criteria. However, total settlements will not conform to Home Depot Criteria.

Strip footings for tilt-up structures should be designed not only for distributed wall loads, but also for concentrated temporary loads that are likely to be experienced during panel erection operations. Alternatively, the contractor should provide intermediate supports (additional grout pads, shims, etc.), in addition to end support of the panels at grout pads, between the footing and the panel. These footings should be adequately sized and reinforced at panel joint locations so that the bearing pressures would not exceed the recommended static allowable pressure even under the temporary concentrated loads.

4.4.2 Allowable Bearing Pressures

Based on the shear strength and elastic settlement characteristics of the recompacted on-site soils, a static allowable net bearing pressure of up to 2,500 pounds per square foot (psf) may be used for both continuous footings or isolated column footings. These bearing pressures are for dead load-plus-live load, and may be increased one-third for short-term,

transient, wind and seismic loading. The actual bearing pressure used may be based on economics and structural loads, and will determine the minimum width for footings as discussed below. The maximum edge pressures induced by eccentric loading or overturning moments should not be allowed to exceed these recommended values.

4.4.3 Minimum Footing Widths and Embedments

The following minimum footing widths and embedments are recommended for the corresponding allowable bearing pressure.

STATIC BEARING PRESSURE (psf)	MINIMUM FOOTING WIDTH (inches)	MINIMUM FOOTING* EMBEDMENT (inches)
2,500	24	24
2,000	18	18
1,500	15	15

* Refers to minimum depth below lowest adjacent grade.

A minimum footing width of 15 inches should be used even if the actual bearing pressure is less than 1,500 psf.

4.4.4 Estimated Settlements

Static settlements on the order of ¾-inch can be expected for the more heavily loaded column (120 kips) and wall (5 kips per lineal foot) footings. As discussed above, dynamic settlements are expected to range between ½- to ¾-inch. When combined, the total settlements (1¼ to 1½ inches) are expected to exceed Home Depot Criteria. We understand that past Home Depot projects have accepted these settlements. Recommendations for mitigation of settlements can be provided if these settlements are not tolerable.

The above estimates are based on the assumption that the recommended earthwork will be performed and that the footings will be sized in accordance with our recommendations.

4.4.5 Lateral Load Resistance

Soil resistance to lateral loads will be provided by a combination of frictional resistance between the bottom of footings and underlying soils and by passive soil pressures acting against the embedded sides of the footings. For frictional resistance, a coefficient of friction of 0.35 may be used for design. In addition, an allowable lateral bearing pressure equal to an equivalent fluid weighing of 300 pounds per cubic foot, may be used, provided the footings are poured tight against compacted fill soils. These values may be used in combination without reduction.

4.4.6 Foundation Concrete

Laboratory testing by M.J. Schiff and Associates (Appendix C) indicates that the near surface soils exhibit a soluble sulfate content of 2,532 mg/kg (0.25 percent by weight). Foundation concrete should conform to the requirements outlined in Table 19-A-4 of the 1997 UBC for severe levels of soluble sulfate exposure from the on-site soil.

In addition, the corrosivity testing indicates a chloride content of 1,330 mg/kg, which is considered to be significantly above negligible levels for protection of reinforcing steel. GPI does not practice corrosion engineering. We recommend a corrosion engineer, such as M.J. Schiff and Associates, be contacted regarding corrosion protection measures.

4.4.7 Footing Excavation Observation

Prior to placement of concrete and steel, a representative of the project Geotechnical Engineer should observe and approve all footing excavations.

4.5 BUILDING FLOOR SLABS

Building floor slabs should be supported on a minimum of 3 feet of granular soils (silty sand or sand) or aggregate base.

A vapor/moisture barrier should be placed under any slabs that are to be covered with moisture-sensitive floor coverings (parquet, vinyl, tile, etc.). The vapor barrier should consist of a polyethylene sheet (visqueen) having a minimum thickness of 10 mils. This material should be covered by a layer of clean sand (less than 5 percent passing No. 200 sieve) having a minimum thickness of 2 inches. The function of the sand layer is to protect the vapor barrier during construction and to aid in the uniform curing of the concrete. The sand should be nominally compacted using light-weight equipment.

For elastic design of a slab-on-grade supporting sustained concentrated loads, a modulus of subgrade reaction (k) of 200 pounds per cubic inch (pounds per square inch per inch of deflection) may be used, provided the recommended earthwork is performed. The structural design of the floor slabs should consider both long-term loads related to store operations and short-term construction loads. For example, if tilt-up contractors are allowed to lift wall panels by operating a crane on the slab, the adequacy of the slab to support the anticipated crane outrigger loads should be verified in advance of construction. In general, the concentrated loads imposed by cranes lifting wall panels are much greater than concentrated loads associated with store operations.

Based on maximum slab loads of 650 pounds per square foot, total and differential (over distance of 50 feet) settlement of the slab is expected to be less than ½ and ¼ of an inch, respectively. Total and differential heaving is expected to also be less than 1- and ½-inch, respectively. The estimates are based on the assumption that the recommended earthwork will be performed.

For lateral resistance design, a coefficient of friction of 0.35 between select fill and concrete may be used. For a slab on a visqueen moisture barrier, a coefficient of 0.1 should be used.

Provided the recommended earthwork is performed (i.e., non-expansive soil cap), reinforcement to resist expansive soils is not needed.

4.6 LATERAL EARTH PRESSURES

Based on information available to us at the time this report was prepared, no major retaining walls or basements are planned for the project. The following recommendations are provided for walls less than 10 feet in height. We recommend that all walls be backfilled with non-expansive sandy soils.

Active earth pressures can be used for designing walls that can yield at least 1-inch laterally in 10 feet of wall height under the imposed loads. For level backfill comprised of on-site or imported granular soils (see "Material For Fill"), the magnitude of active pressures are equivalent to the pressures imposed by a fluid weighing 35 pounds per cubic foot (pcf).

At-rest pressures should be used for restrained walls that remain rigid enough to be essentially non-yielding. At-rest pressures imposed by a fluid weighing 50 pounds per cubic foot should be used for level backfill derived from on-site or imported granular backfill (see "Material For Fill").

Walls subject to surcharge loads should be designed for an additional uniform lateral pressure equal to one-third and one-half the anticipated surcharge pressure for unrestrained and restrained walls, respectively.

The wall backfill should be well-drained to relieve possible hydrostatic pressure or designed to withstand these pressures. A drain consisting of perforated pipe and gravel wrapped in filter fabric should be used. One cubic foot of rock should be used for each lineal foot of pipe. The fabric (non-woven filter fabric, Mirafi 140N or equivalent) should be lapped at the top. We prefer pipe and gravel drains to weep holes to avoid any potential for constant flow of surface water.

The wall designer should specify the use of select, granular wall backfill on the plans. Wall footings should be designed as discussed in the "Foundations" section.

4.7 CORROSIVITY

Resistivity testing (see Appendix C) of a representative sample of the on-site soils indicate that they are severely corrosive to steel. We understand, however, that steel pipe is typically not used for Home Depot sites. GPI does not practice corrosion engineering. Therefore, should the use of buried steel pipe be proposed, a corrosion engineer such as M.J. Schiff and Associates should be consulted.

4.8 DRAINAGE

Positive surface gradients should be provided adjacent to all structures so as to direct surface water run-off and roof drainage away from foundations and slabs toward suitable discharge facilities. Long-term ponding of surface water should not be allowed on pavements or adjacent to buildings.

4.9 EXTERIOR CONCRETE AND MASONRY FLATWORK

Exterior concrete and masonry flatwork should be supported on a zone of non-expansive, compacted fill. Prior to placement of concrete, the subgrade should be prepared as recommended in "Subgrade Preparation". The use of clayey soils in the slab subgrade should not be permitted.

4.10 PAVED AREAS

Preliminary pavement design has been based on an assumed R-value of 20 and axle counts provided in the Criteria. The California Division of Highways Design Method was used for design of the recommended preliminary pavement sections. These recommendations are based on the assumption that the pavement subgrades will consist of existing on-site soils. Final pavement design should be based on R-value testing performed near the conclusion of rough grading. The following pavement sections are recommended for planning purposes only.

PAVEMENT AREA	TRAFFIC INDEX	SECTION THICKNESS (inches)	
		ASPHALT CONCRETE	AGGREGATE BASE COURSE
Asphalt Concrete			
Standard Duty	6.5	3.0	13
Heavy Duty	7.5	3.5	15
Portland Cement Concrete		Concrete	
Standard Duty*	6.5	7.5	---
Heavy**	7.5	7.5	---

Note: * includes balance of the porte-cochere
** includes loading dock, lumber off-loading, and pavement serving entrance at porte-cochere (width of door, from door to driveway areas only)

The use of lime treatment for clayey soils can significantly reduce the thickness of base required under pavements in addition to stabilizing wet subgrade soils. However, lime treatment is typically cost-effective for reduction of base sections only if its use reduces or eliminates the export of on-site soils. If grading quantities result in significant export, recommendations related to the use of lime treatment can be provided. If lime treatment is used for subgrade stabilization, a reduction in section thickness may still be possible.

The pavement subgrade underlying the aggregate base or concrete should be properly prepared and compacted in accordance with the recommendations outlined under "Subgrade Preparation".

The pavement base course should be compacted to at least 95 percent of maximum density (ASTM D-1557). Aggregate base should conform to the requirements of Section 26 of the California Department of Transportation Standard Specifications for Class II aggregate base (three-quarter inch maximum) or Section 200-2 of the Standard Specifications for Public Works Construction (Green Book) for untreated base materials, excluding processed miscellaneous base.

The portland cement concrete pavement should be placed over compacted sandy soils to promote drainage during curing. The concrete should have a modulus of rupture of at least 550 psi (equivalent to an approximate compressive strength of 3,700 psi at the time the pavement is subjected to traffic. The upper 12 inches of subgrade soils should be compacted to at least 90 percent of maximum density (ASTM D-1557).

The above recommendations are based on the assumption that the base course and compacted subgrade will be properly drained. The design of paved areas should incorporate measures to prevent moisture build-up within the base course, which can otherwise lead to premature pavement failure. For example, curbing adjacent to landscaped areas should be deep enough to act as a barrier to infiltration of irrigation water into the adjacent base course.

5.0 LIMITATIONS

The report, exploration logs, and other materials resulting from GPI's efforts were prepared exclusively for use by The Home Depot and their consultants in designing the proposed development. The report is not intended to be suitable for reuse on extensions or modifications of the project or for use on any project other than the currently proposed development as it may not contain sufficient or appropriate information for such uses. If this report or portions of this report are provided to contractors or included in specifications, it should be understood that they are provided for information only. This report cannot be utilized by another entity without the express written permission of GPI. This report is an instrument of our services and remains the property of GPI.

Soil deposits may vary in type, strength, and many other important properties between points of exploration due to non-uniformity of the geologic formations or to man-made cut and fill operations. While we cannot evaluate the consistency of the properties of materials in areas not explored, the conclusions drawn in this report are based on the assumption that the data obtained in the field and laboratory are reasonably representative of field conditions and are conducive to interpolation and extrapolation.

Furthermore, our recommendations were developed with the assumption that a proper level of field observation and construction review will be provided during grading, excavation, and foundation construction by GPI. If field conditions during construction appear to be different than is indicated in this report, we should be notified immediately so that we may assess the impact of such conditions on our recommendations. If construction-phase services are performed by others they must accept full responsibility for all geotechnical aspects of the project including this report.

Our investigation and evaluations were performed using generally accepted engineering approaches and principles available at this time and the degree of care and skill ordinarily exercised under similar circumstances by reputable Geotechnical Engineers practicing in this area. No other representation, either expressed or implied, is included or intended in our report.

Respectfully submitted,
Geotechnical Professionals Inc.

DRAFT

Christopher L. Magdosku, P.E.
Project Engineer

Reviewed by:

DRAFT

James E. Harris, G.E.
Principal

JEH/CLM:sph/sh

REFERENCES

1. California Division of Mines and Geology, "Seismic Hazard Evaluation of the Los Alamitos 7.5-minute Quadrangle, Los Angeles County," Open File Report 98-10.

2. Dale Hinkle, P.E., Inc., "Tank Investigation, Fuel Oil Tank #3, Alamitos Generating Station," dated September 27, 1990.

3. ----------, "Baseline Tanks Study Report, Above Ground Oil Storage Tanks Numbers 1, 2, 4 and 8, Alamitos Generating Station," dated October 31, 1995.

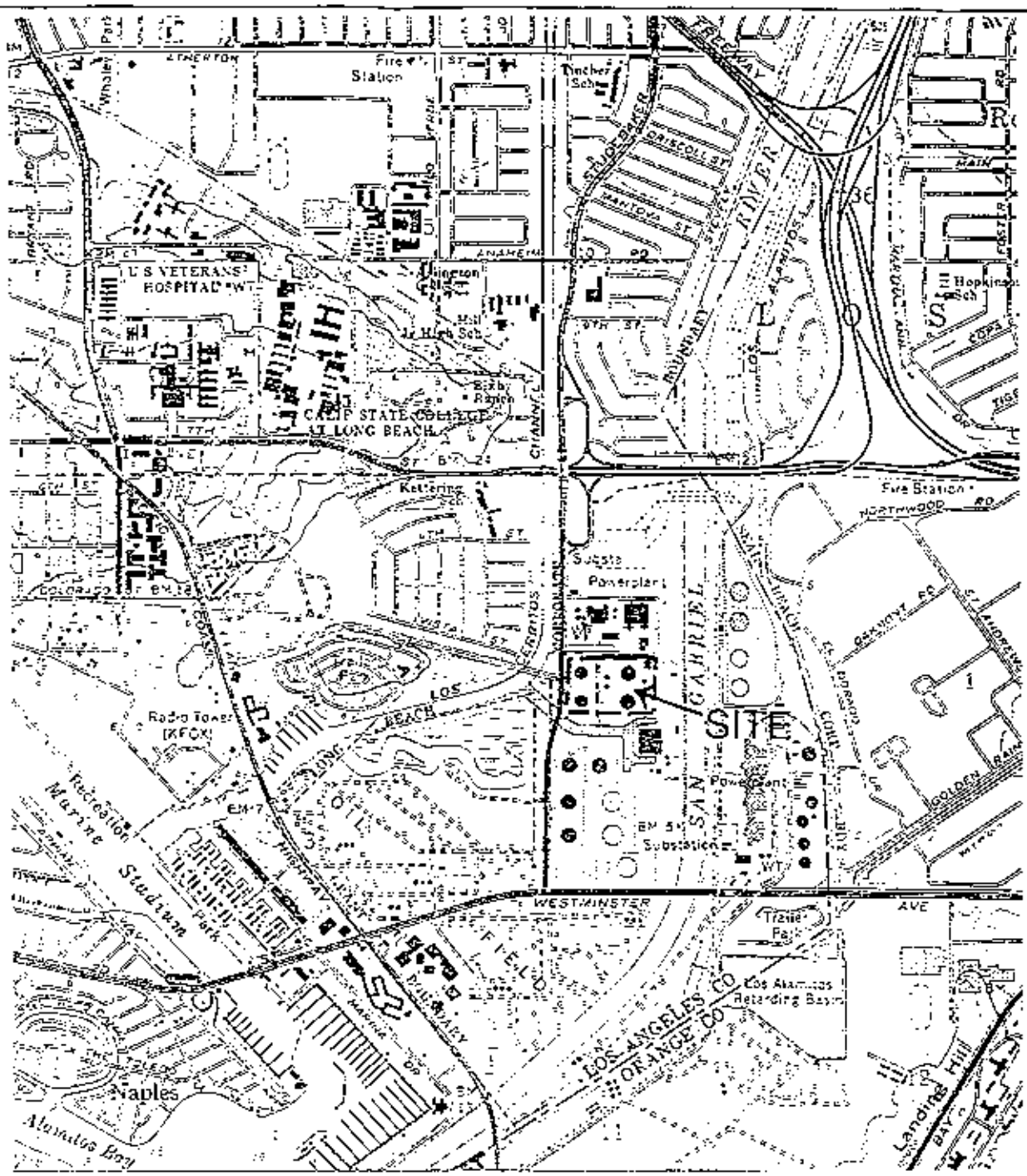
4. Blake, T.F. (1989), "EQFAULT, A Computer Program for the Deterministic Prediction of Peak Horizontal Acceleration from Digitized California Faults," Unpublished Private Program: Updated 2000.

5. Blake, T.F. (2000), "FRISKSP, A Computer Program for the Probabilistic Estimation of Uniform-Hazard Spectra Using Faults as Earthquake Sources, User's Manual," Version 4.00.

6. Seed, H.B. and DeAlba, P.L. (1986), "Use of SPT and CPT Tests for Evaluating the Liquefaction Resistance of Sands: ASCE Geotechnical Special Publication No. 6 on Use of In Situ Tests in Geotechnical Engineering," pp. 263-315.

7. Youd, T.L. and Idriss, I.M. (1997), "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils," Technical Report NCEER-97-0022.

8. Youd, T.L. et al (1999), "Revised MLR Equations for Predicting Lateral Spread Displacement," Proceedings from the 7th U.S.-Japan Workshop on Earthquake Resistance Design of Lifeline Facilities and Countermeasures Against Soil Liquefaction, Multi-disciplinary Center for Earthquake Engineering Research Technical Report.



SITE PLAN REPRODUCED FROM U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP

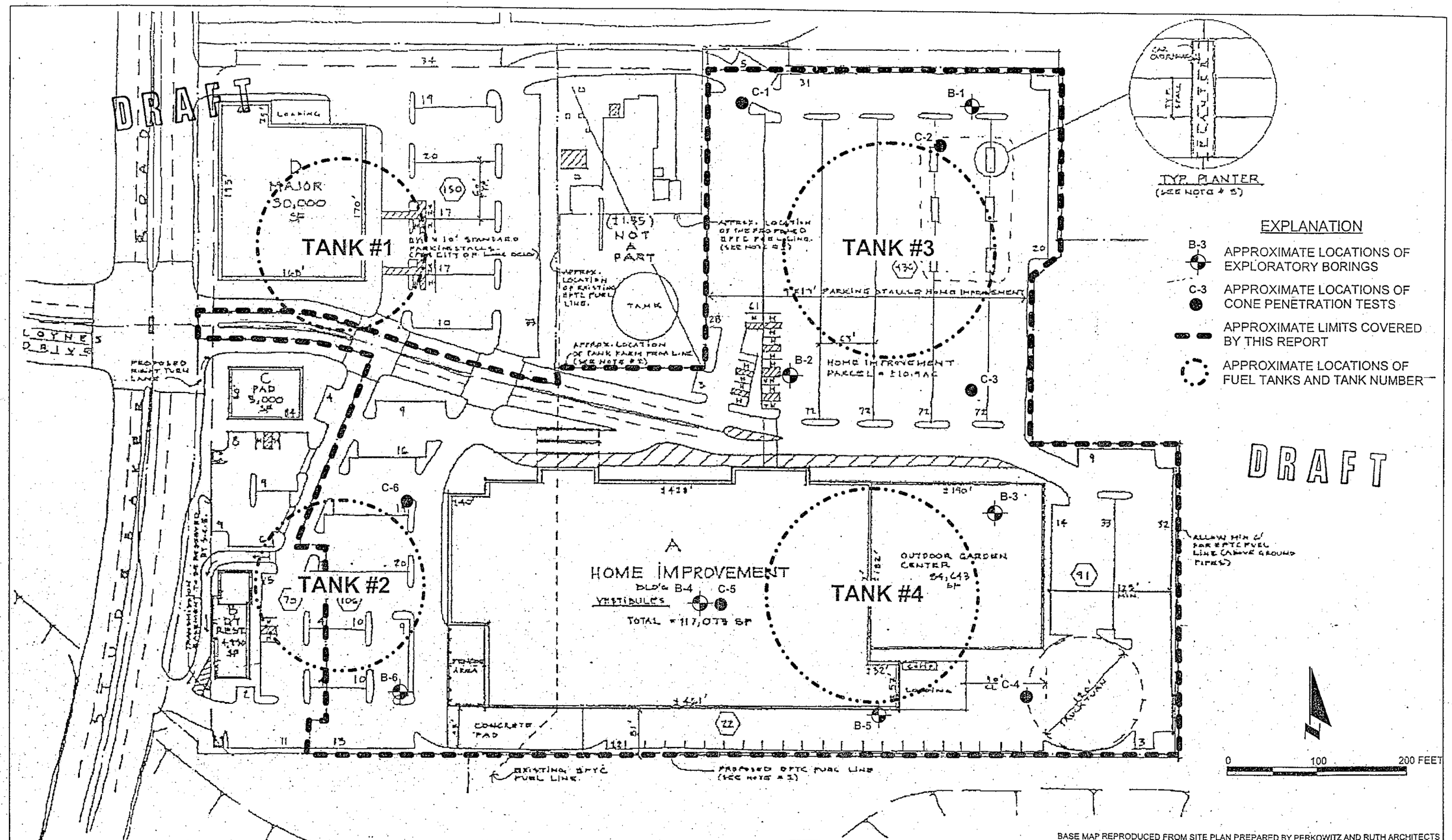
GPI GEOTECHNICAL PROFESSIONALS, INC.

HOME DEPOT - LONG BEACH

GPI PROJECT NO.: 1878 | 1" = 2000'

SITE LOCATION MAP

FIGURE 1



BASE MAP REPRODUCED FROM SITE PLAN PREPARED BY PERKOWITZ AND RUTH ARCHITECTS

GPI GEOTECHNICAL PROFESSIONALS, INC.

HOME DEPOT - LONG BEACH

GPI PROJECT NO.: 1878.I

SCALE 1"=100'

SITE PLAN

FIGURE 2

APPENDIX A

APPENDIX A

CONE PENETRATION TESTS

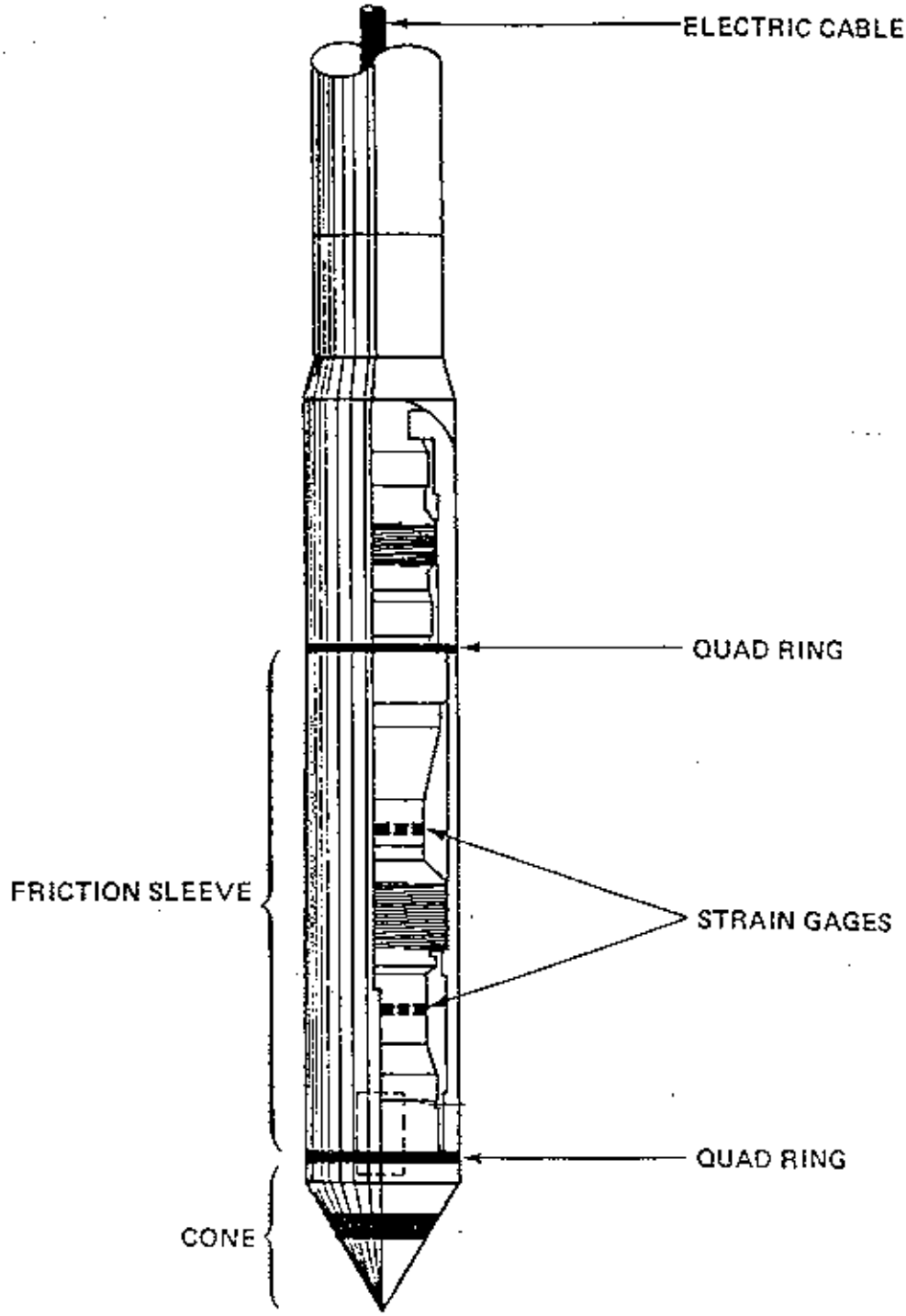
Six Cone Penetration Tests (CPT's) were performed at the site during the investigation. The locations of the CPT's are shown on the Site Plan, Figure 2. These soundings were advanced to depths ranging from 10 to 66 feet below existing grades. Refusal in dense sandy soils was encountered in our deeper CPT's (planned 70-foot depths).

The CPT consists of pushing a cone-tipped probe into the soil deposit while simultaneously recording the cone tip resistance and side friction resistance of the soil to penetration (refer to Figure A-1). The CPT's described in this report were conducted in general accordance with ASTM specifications (ASTM D3441-79) using an electric cone penetrometer.

The CPT equipment consists of a cone assembly mounted at the end of a series of hollow sounding rods. A set of hydraulic rams is used to push the cone and rods into the soil while a continuous record of cone and friction resistance versus depth is obtained in both analog and digital form at the ground surface. A specially designed all-wheel drive truck is used to transport and house the test equipment and to provide a 23-ton reaction to the thrust of the hydraulic rams.

Data obtained during a CPT consists of continuous stratigraphic information with close vertical resolution. Stratigraphic interpretation is based on relationships between cone tip resistance and friction resistance. The calculated friction ratio (CPT friction sleeve resistance divided by cone tip resistance) is used as an indicator of soil type. Granular soils typically have low friction ratios and high cone resistance, while cohesive or organic soils have high friction ratios and low cone resistance. These stratigraphic material categories form the basis for all subsequent calculations, which utilize the CPT data.

Computer plots of the reduced CPT data acquired for this investigation are presented in Figures A-2 through A-7 of this appendix. The field testing and computer processing was performed by the Fugro Geosciences, Inc., under subcontract to Geotechnical Professionals Inc. (GPI). The interpreted soil descriptions were prepared by GPI. Ground surface elevations at the exploration locations were estimated from the USGS topographic map, Los Alamitos Quadrangle.

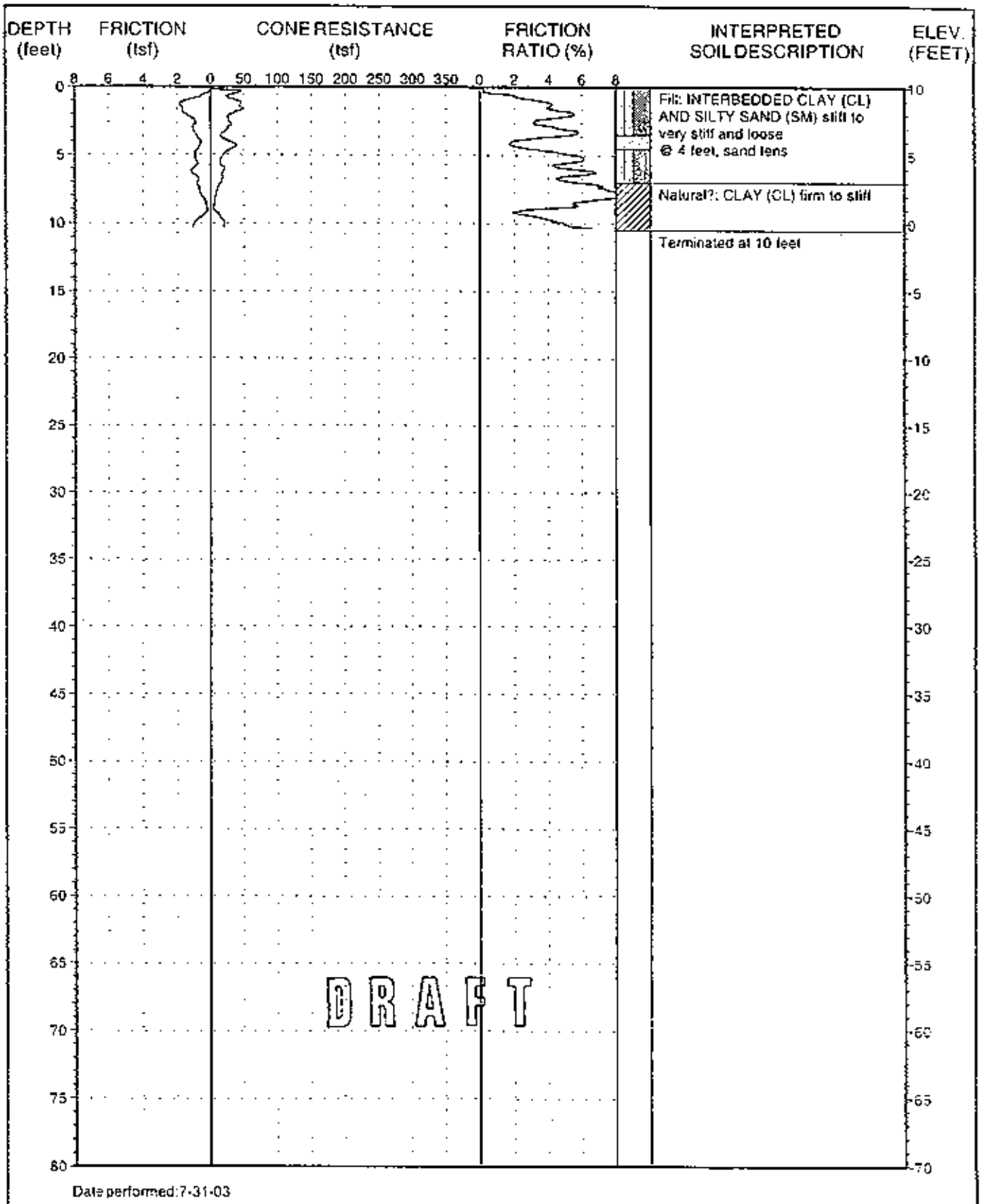


DRAFT

GPI GEOTECHNICAL PROFESSIONALS INC.

CONE PENETROMETER

FIGURE A-1



Date performed: 7-31-03

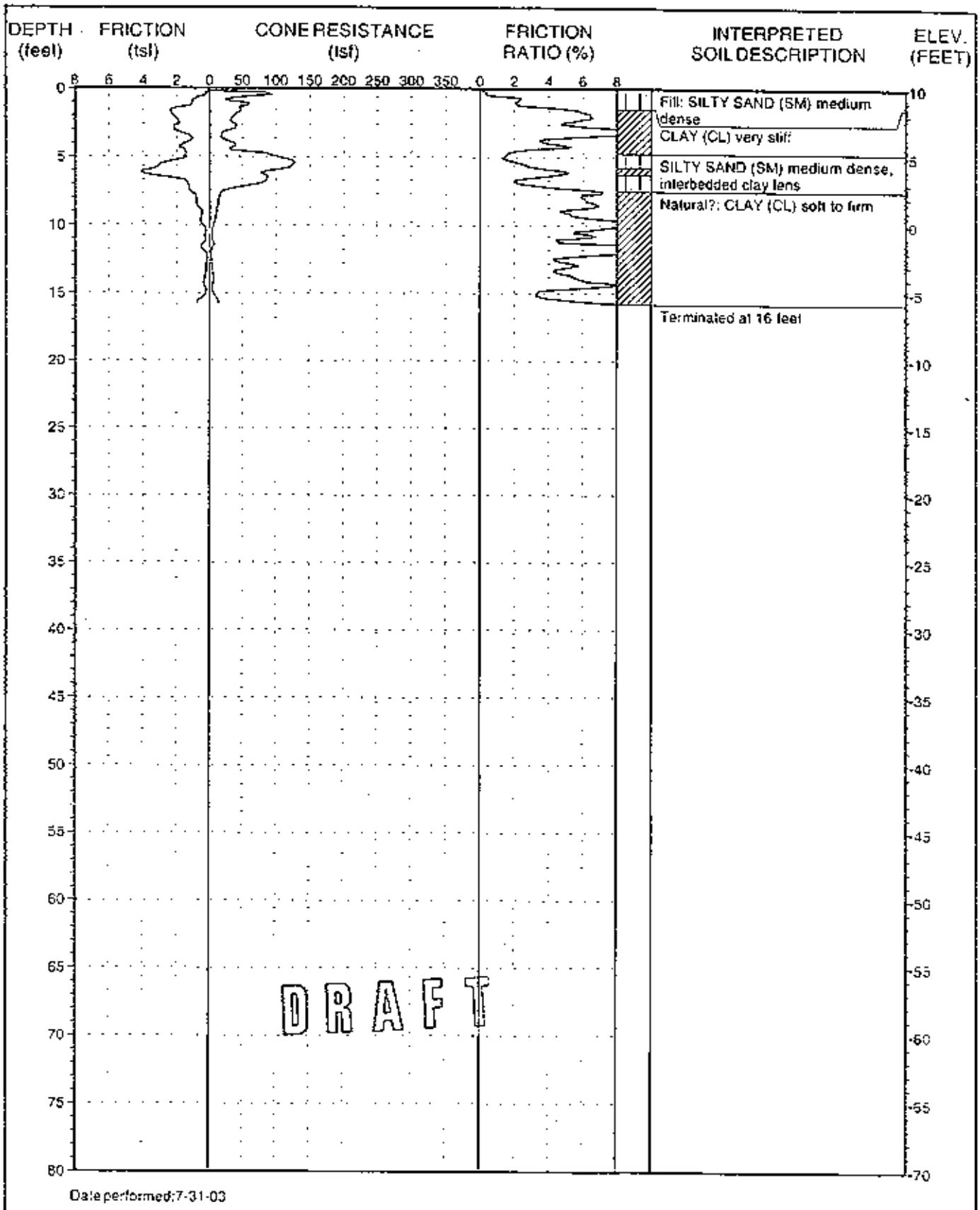
This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF CPT NO. C-1

FIGURE A-2



Date performed:7-31-03

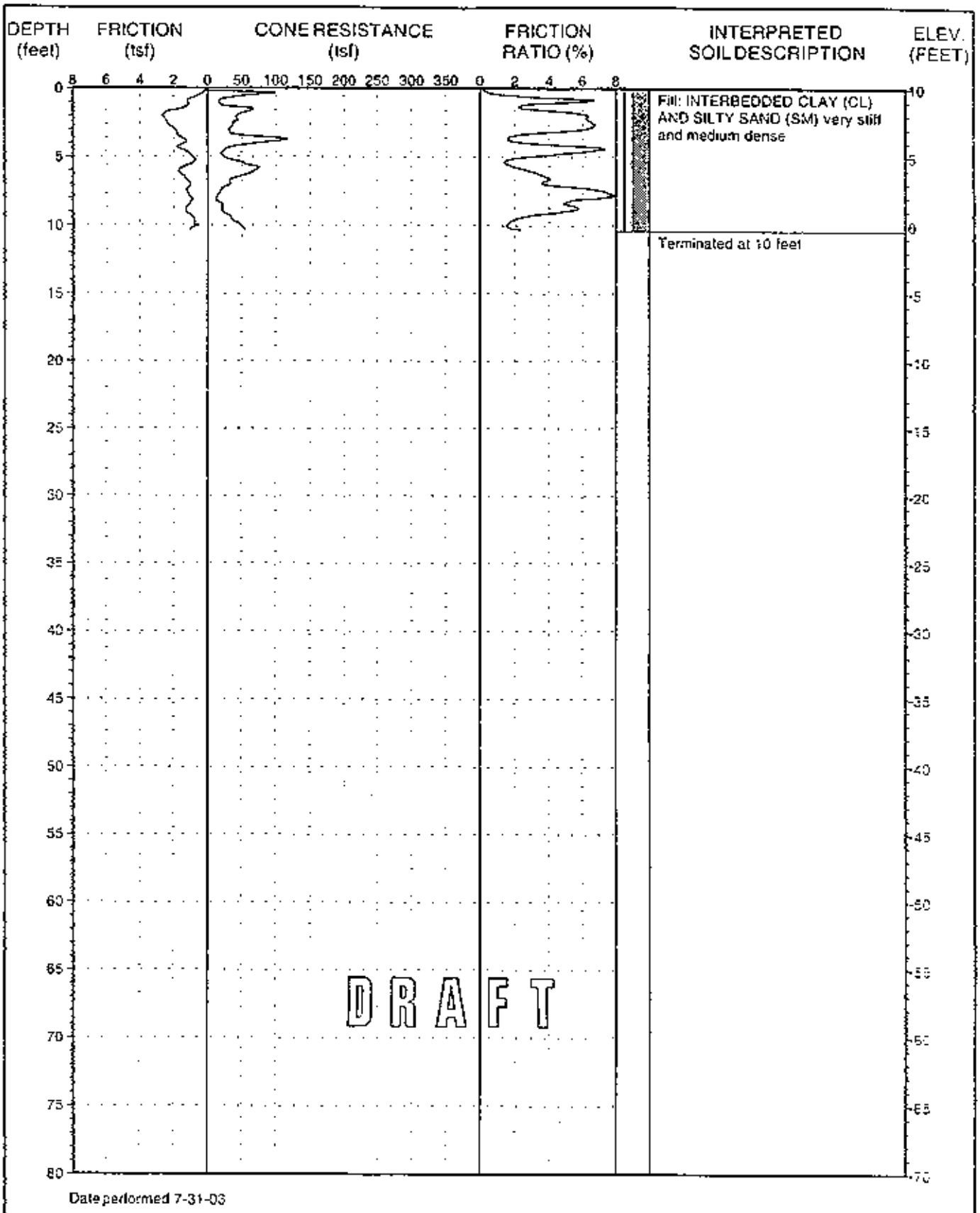
This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF CPT NO. C-2

FIGURE A-3



Date performed 7-31-03

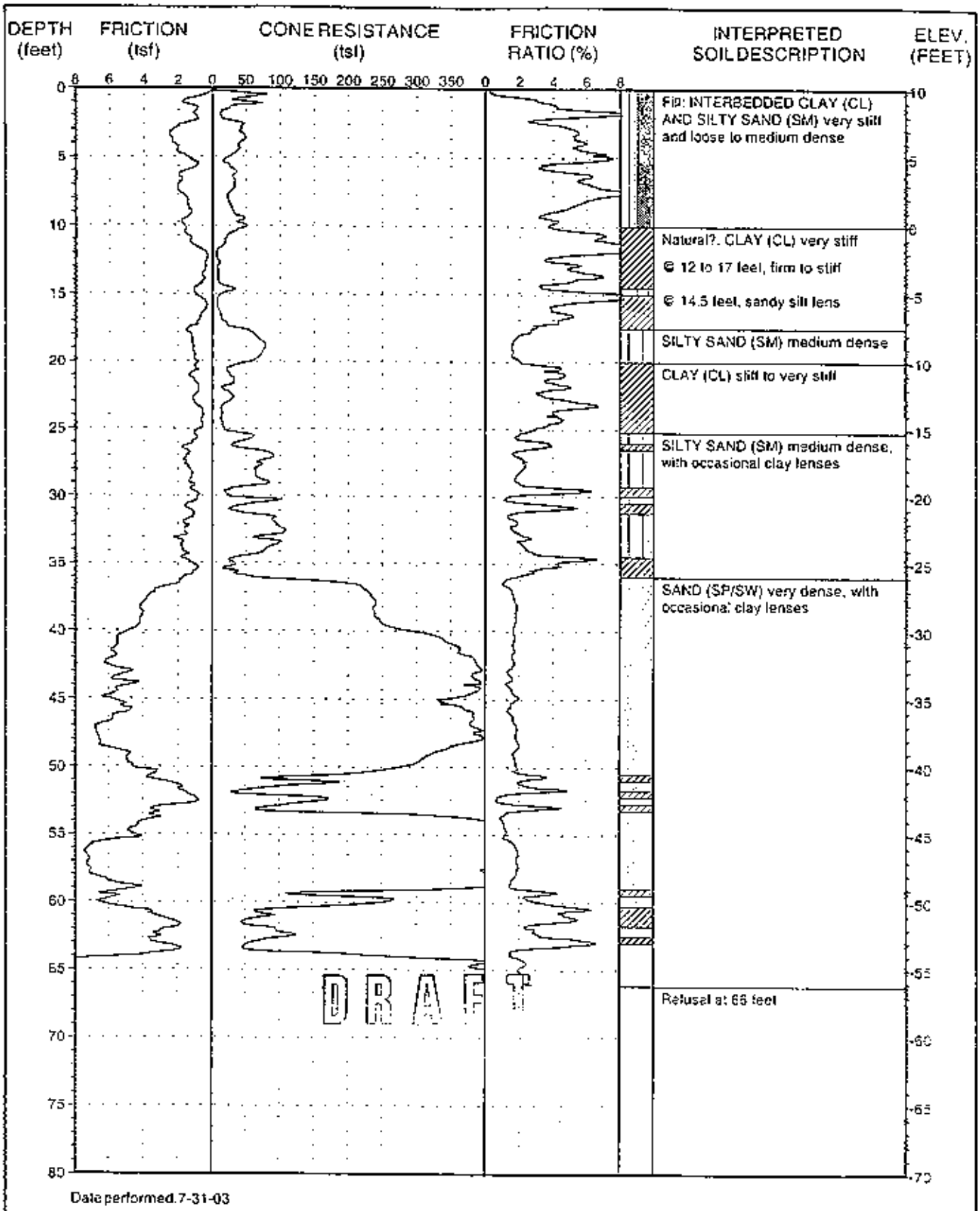
This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

GPI

PROJECT NO.: 1878 I
HOME DEPOT-LONG BEACH

LOG OF CPT NO. C-3

FIGURE A-3



Date performed 7-31-03

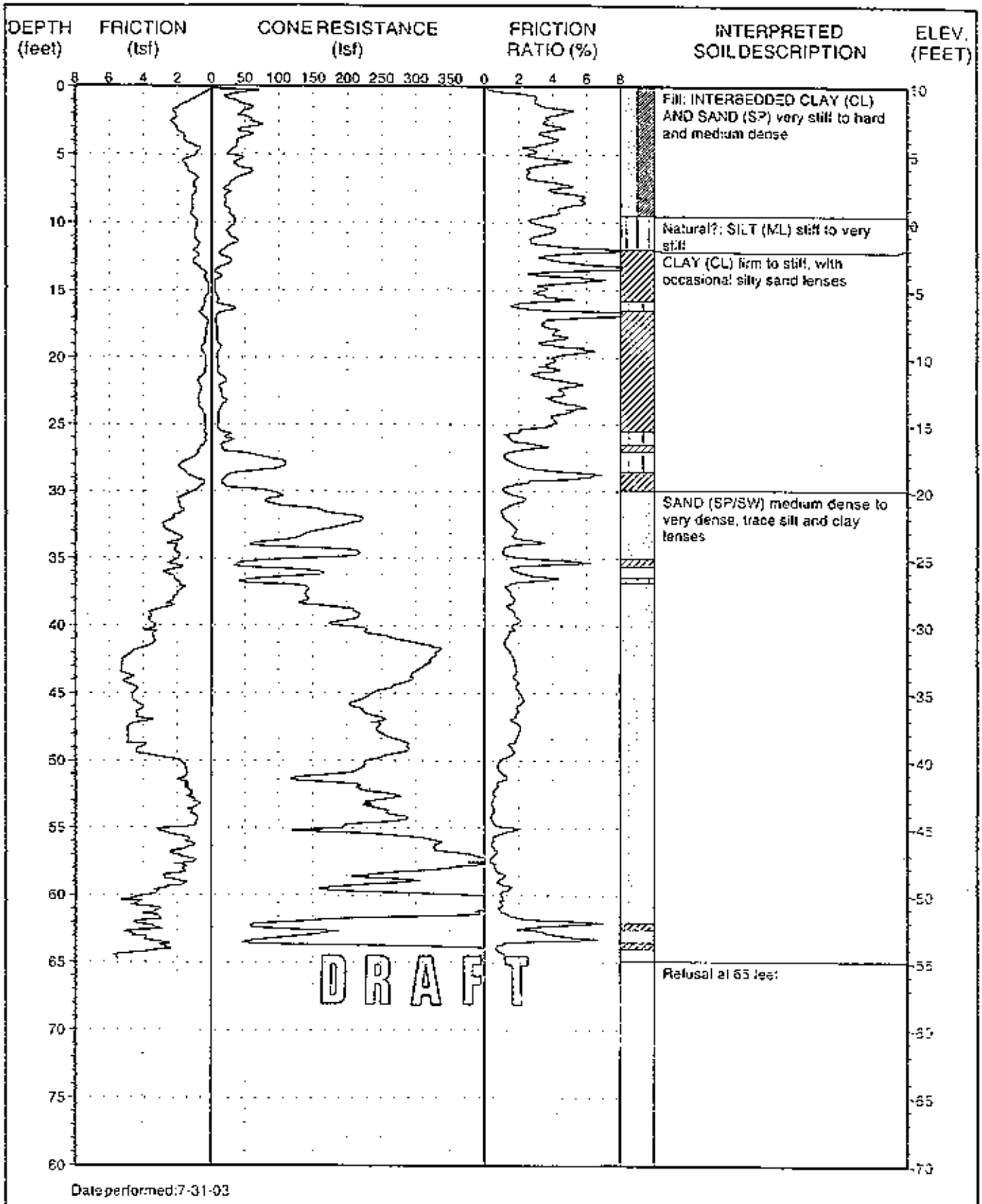
This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

GPI

PROJECT NO.: 1878 I
HOME DEPOT-LONG BEACH

LOG OF CPT NO. C-4

FIGURE A-5



Date performed: 7-31-03

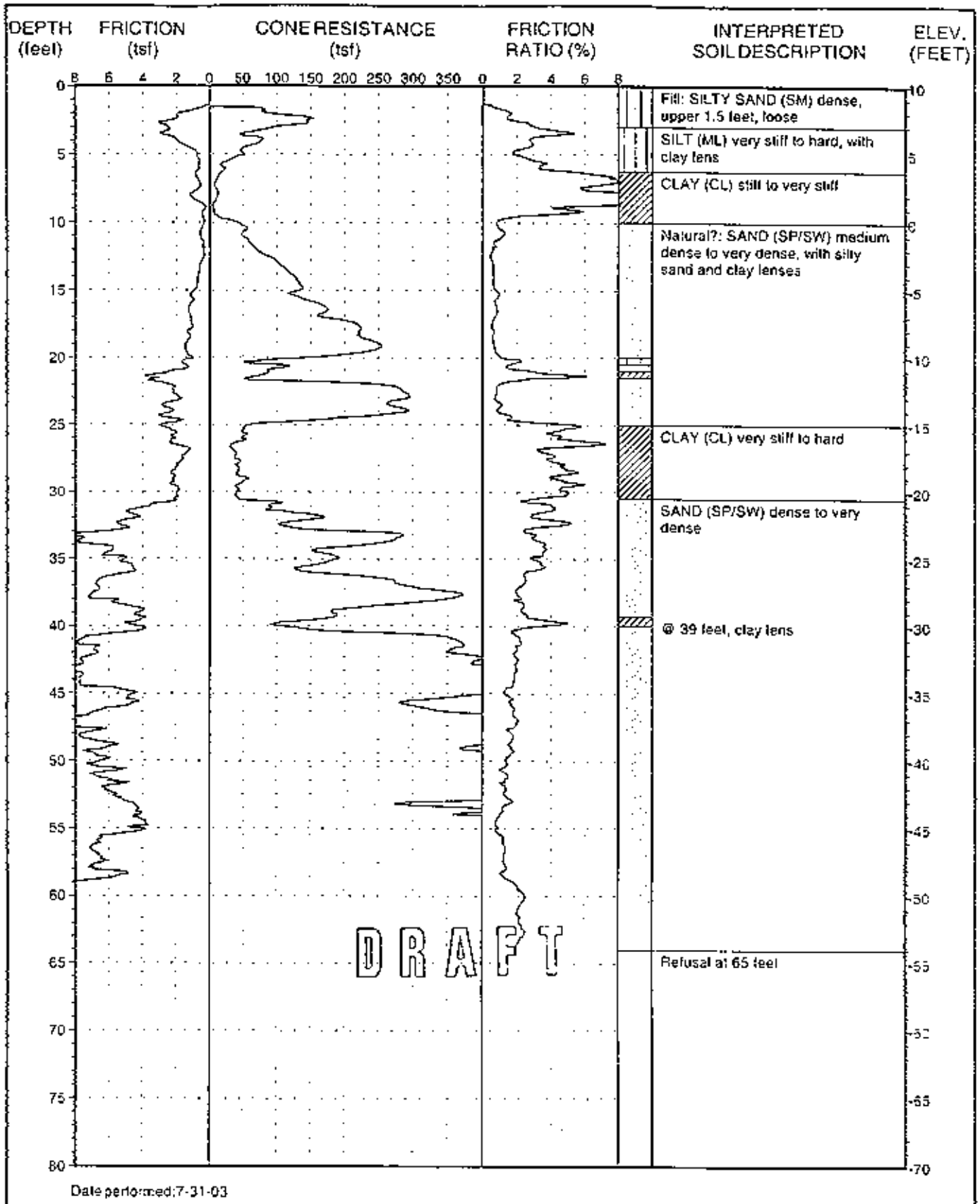
This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

GPI

PROJECT NO.: 1878 i
HOME DEPOT-LONG BEACH

LOG OF CPT NO. C-5

FIGURE A-6



Date performed:7-31-03

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF CPT NO. C-6

FIGURE A-7

APPENDIX B

APPENDIX B

EXPLORATORY BORINGS

The subsurface conditions at the site were investigated by drilling and sampling six exploratory borings. The boring locations are shown on the Site Plan, Figure 2. The borings were advanced to depths ranging from 10 to 71 feet below the existing ground surface.

The borings were drilled using truck-mounted rotary wash drilling equipment. Relatively undisturbed samples were obtained using a brass-ring lined sampler (ASTM D3550). The brass rings have an inside diameter of 2.42 inches. The ring samples were driven into the soil by a 400-pound Kelly bar dropping 12 inches. The number of blows needed to drive the sampler into the soil a depth of 12 inches was recorded as the penetration resistance.

Higher quality relatively undisturbed samples of the softer cohesive soils were taken with thin walled tubes (ASTM D1587-83). The thin-wall tubes have an outside diameter of 3.00 inches and an inside diameter of 2.875 inches. The tubes were pushed by hydraulic down pressure.

Standard Penetration Test (SPT's) were also conducted at selected intervals in the borings. The SPT's were conducted in general accordance with ASTM D 1586-84. The standard split spoon sampler (1⅜-inch inside diameter) was driven into the soil using a 140-pound weight (above ground) dropping 30 inches. The number of blows required to drive the sampler for 18 inches was counted and recorded for each 6-inch interval. The number of blows for the last 12 inches of the drive interval is presented on the boring logs.

The field explorations for the current investigation were performed under the continuous technical supervision of GPI's engineer, who visually inspected the site, maintained detailed logs of the borings, classified the soils encountered, and obtained relatively undisturbed samples for examination and laboratory testing. The soils encountered in the borings were classified in the field and through further examination in the laboratory in accordance with the Unified Soils Classification System. Detailed logs of the borings are presented in Figures B-1 to B-6 in this appendix.

The borings were laid out in the field by measuring from existing site features. The ground surface elevations at the boring locations were estimated from the USGS topographic map, Los Alamitos Quadrangle. Upon completion, the borings were backfilled with neat cement/bentonite slurry up to existing grades. The drilling "mud" and soil cuttings were disposed on-site.

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
				0		10
21.8	100	13	D		Fill: SANDY CLAY (CL) black and grey, very moist, stiff, mottled, with organics and debris	
			B			
20.1	104	20	D			
				5	SAND (SP/SW) brown, slightly moist to moist, medium dense	5
					SANDY CLAY (CL) black and brown, moist	
		13	D	10	Natural: CLAY (CL) grey and brown, slightly moist to moist, stiff to very stiff, with organics and iron staining	0
					Total Depth 10 feet	

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-8-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Not Encountered

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-1

FIGURE B-1

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
				0		10
17.5	114	21	D		Fill: CLAY (CL) AND SAND (SP/SW) black, brown, and grey, slightly moist to moist, medium dense and stiff to very stiff	
			B			
24.6	101	12	D			
				5		5
					@ 6 feet, sand lens	
		11	D		@ 9 feet, very moist	
				10	Natural?: CLAY (CL) brown and grey, moist to very moist, stiff	0
					Total Depth 10 feet	

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-8-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (▽): Not Encountered

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-2

FIGURE B-2

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered	ELEVATION (FEET)
				0		10
15.3	104	33	D		Fill: **SILTY SAND (SM)** brown, very moist, dense, with clay lenses	
17.7	102	7	D	5	**CLAY (CL)** dark brown, moist, firm to stiff	5
32.8	87	12	D		Natural: **CLAY (CL)** brown and olive-grey, wet, firm, with silty sand and sandy silt lenses	
32.3	89	10	D	10		0
43.0 28.3	74 92	10	D	15		-5
27.6	93	13	D	20	**SANDY SILT (ML)** grey to dark grey, very moist to wet, stiff	-10
20.8	106	44	D	25	**SILTY SAND (SM)** grey, wet, dense	-15
14.8	119	54	D	30		-20
27.6	96	58	D	35	@ 35 feet, clay lens	-25
						-30

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-7-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Water at 13 feet

GPI

PROJECT NO.: 1878.I
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-3

FIGURE B-3

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered	ELEVATION (FEET)
26.7	98	80	D	40	SAND (SP/SW) grey, wet, very dense	-30
		76	D	45		-35
		39	D	50		-40
					Total Depth 51 feet	

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-7-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Water at 13 feet

GPI

PROJECT NO.: 1875.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-3

FIGURE B-3

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
				0	3 inches AC	10
17.0	106	15	D		Fill: SILTY SAND (SM) brown to dark brown, moist, medium dense, mottled, with clay lenses	
19.3	104	21	D	5		5
42.4	75	15	D		CLAY (CL/CH) dark brown, moist, very stiff	
24.6	94	15	D	10	Natural: SANDY SILT (ML) brown, very moist, medium dense, porous	0
33.6	83	Push	T	15	CLAY (CL) grey, very moist, firm	-5
30.3	93	13	D	20	CLAY WITH SAND (CL) grey, wet, stiff	-10
26.7	98	13	D		CLAY (CL) grey to dark grey, very moist to wet, firm	
		Push	T	25		-15
17.6	113	36	D	30	SILTY SAND (SM) grey, wet, dense	-20
		65	D	35	@ 35 feet, very dense	-25
					SAND (SP/SW) grey, wet, very dense	-30

DRAFT

SAMPLE TYPES
- C: Rock Core
- S: Standard Split Spoon
- D: Drive Sample
- B: Bulk Sample
- T: Tube Sample

DATE DRILLED: 8-7-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Water at 18 feet

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-4

FIGURE B-4

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
		84	S	40		-30
				45		-35
					DRAFT	
		80	S	50		-40
					@ 53 to 60 feet, with gravel	
				55		-45
		80	S	60	CLAY (CL) grey, wet, hard	-50
					SAND (SP/SW) grey, wet, very dense	
				65		-55
		80/6"	S	70		-60
					Total Depth 71 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED
8-7-03

EQUIPMENT USED:
6" Rotary Wash

GROUNDWATER LEVEL (ft):
Water at 18 feet

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-4

FIGURE B-4

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
				0	Fill: **SANDY CLAY (CL)** brown, moist, stiff	10
13.5	111	22	D			
16.3	96	12	D	5	**SILTY SAND (SM)** grey, moist, medium dense	5
38.6	79	16	D		Natural?: **CLAY (CL)** grey and dark brown, slightly moist to moist, stiff, slight organic odor	
26.5	93	14	D	10	Natural: **SANDY SILT (ML)** grey, wet, stiff, fine sand	0
32.8	88	12	D	15		-5
		24	D	20	**SILTY SAND (SM)** grey, wet, medium dense	-10
26.2	97	19	D	25	**SANDY CLAY (CL)** grey, wet, stiff	-15
33.9	95	29	D	30	**CLAY (CL)** grey, wet, very stiff, with sand lenses	-20
		44	D	35	**SAND (SP/SW)** grey, wet, dense **CLAY (CL)** grey, wet, hard **SILTY SAND (SM)** dark grey, wet, dense	-25

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-7-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Water at 10 1/2 feet

GPI

PROJECT NO.: 1875.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-5

FIGURE B-5

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
		60/6"	S	40	SAND (SP/SW) grey, wet, very dense	-30
		60/6"	S	45		-35
		70/7"	S	50		-40
					Total Depth 51 feet	

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-7-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Water at 10 1/2 feet

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-5

FIGURE B-5

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
				0		10
15.3	108	24	D		Fill: **SILTY SAND (SM)** grey-brown, moist, dense, mottled, with clay lenses	
17.4	100	26	D	5	**SAND (SP/SW)** white and grey, very moist, dense	5
37.4	81	5	D	10	Natural: **CLAY (CL/CH)** grey, very moist, firm, with organics	0
65.7	53	7	D	15	**SILT (MH/OH)** black, wet, firm, with organics	-5
			T			
		23	D	20		-10
29.9	94	12	D		**CLAY WITH SAND (CL)** dark grey, moist to very moist, stiff, with fine sand	
28.3	95	38	D	25	**SAND WITH SILT (SP/SW-SM)** grey, very moist, very dense	-15
24.3	101	50	D	30	**SAND (SP/SW)** white and grey, wet, very dense	-20
21.4	104	60/6"	D	35	@ 35 to 50 feet, coarse grained	-25
						-30

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-8-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Water at 11 feet

GPI

PROJECT NO.: 1878.1
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-6

FIGURE B-6

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
23.3	101	65/6"	D	40		-30
23.0	103	70/7"	D	45		-35
23.7	104	70/7"	D	50		-40
					Total Depth 51 feet	

DRAFT

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 8-8-03

EQUIPMENT USED: 6" Rotary Wash

GROUNDWATER LEVEL (ft): Water at 11 feet

GPI

PROJECT NO.: 1878.I
HOME DEPOT-LONG BEACH

LOG OF BORING NO. B-6

FIGURE B-5

APPENDIX C

APPENDIX C

LABORATORY TESTS

INTRODUCTION

Representative undisturbed samples and bulk samples were carefully packaged in the field and sealed to prevent moisture loss. The samples were then transported to our Cypress office for examination and testing assignments. Laboratory tests were performed on selected representative samples as an aid in classifying the soils and to evaluate the physical properties of the soils affecting foundation design and construction procedures. Detailed descriptions of the laboratory tests are presented below under the appropriate test headings. Test results are presented in the figures that follow.

MOISTURE CONTENT AND DRY DENSITY

Moisture content and dry density were determined from a number of the ring samples. The samples were first trimmed to obtain volume and wet weight and then were dried in accordance with ASTM 2216. After drying, the weight of each sample was measured, and moisture content and dry density were calculated. Moisture content and dry density values are presented on the boring logs in Appendix B.

PASSING NO. 200 SIEVE

Representative samples were dried, weighed and soaked in water until individual soil particles were separated and then washed on the No. 200 sieve. That portion of the material retained on the No. 200 sieve was oven dried and weighed. The percentage passing the No. 200 sieve are as follows:

BORING NO.	DEPTH (ft.)	SOIL TYPE	% FINER THAN NO. 200
B-3	20	Sandy Silt (ML)	51
B-3	25	Silty Sand (SM)	21
B-4	20	Clay with Sand (CL)	75

ATTERBERG LIMITS

Liquid and plastic limits were determined for selected samples in accordance with ASTM D4318. The test results are summarized on Figure C-1.

EXPANSION INDEX

Three expansion index tests were performed on representative bulk samples. The tests were performed in accordance with ASTM 4829, to assess the expansion potential of on-site soils. The result of the tests are summarized below:

BORING/ LOCATION NO.	DEPTH (ft)	SOIL DESCRIPTION	EXPANSION INDEX
B-2	1-6	Clay (CL)	105
Tank #2 North Stockpile/Berm	0-3	Silty Sand (SM)	7
Tank #4 North Berm	1-4	Sandy Clay (CL)	75

DIRECT SHEAR

Direct shear tests were performed on a remolded bulk sample in accordance with ASTM D3080. The bulk sample was remolded to approximately 90 percent of maximum dry density (ASTM D1557). The samples were placed in the shear machine, and pre-selected normal loads were applied. The sample was submerged, allowed to consolidate, and then was sheared to failure. Shear stress and sample deformation were monitored throughout the test. The results of the direct shear tests are presented in Figure C-2.

CONSOLIDATION

Four one-dimensional consolidation tests were performed on undisturbed samples in accordance with ASTM D 2435. One of the samples was tested from a thin-walled Shelby tube. After trimming the ends, the samples were placed in the consolidometer and loaded to 0.25 or 0.4 ksf. Thereafter, the samples were incrementally loaded to a maximum load of up to 25.6 or 32.0 ksf. The samples were inundated under loads ranging between 0.25 to 3.2 ksf. Sample deformation was measured to 0.0001 inch. Rebound behavior was investigated by unloading the sample back to 0.4 or 0.5 ksf. Results of the consolidation tests, in the form of percent consolidation versus log pressure, are presented in Figures C-3 to C-6.

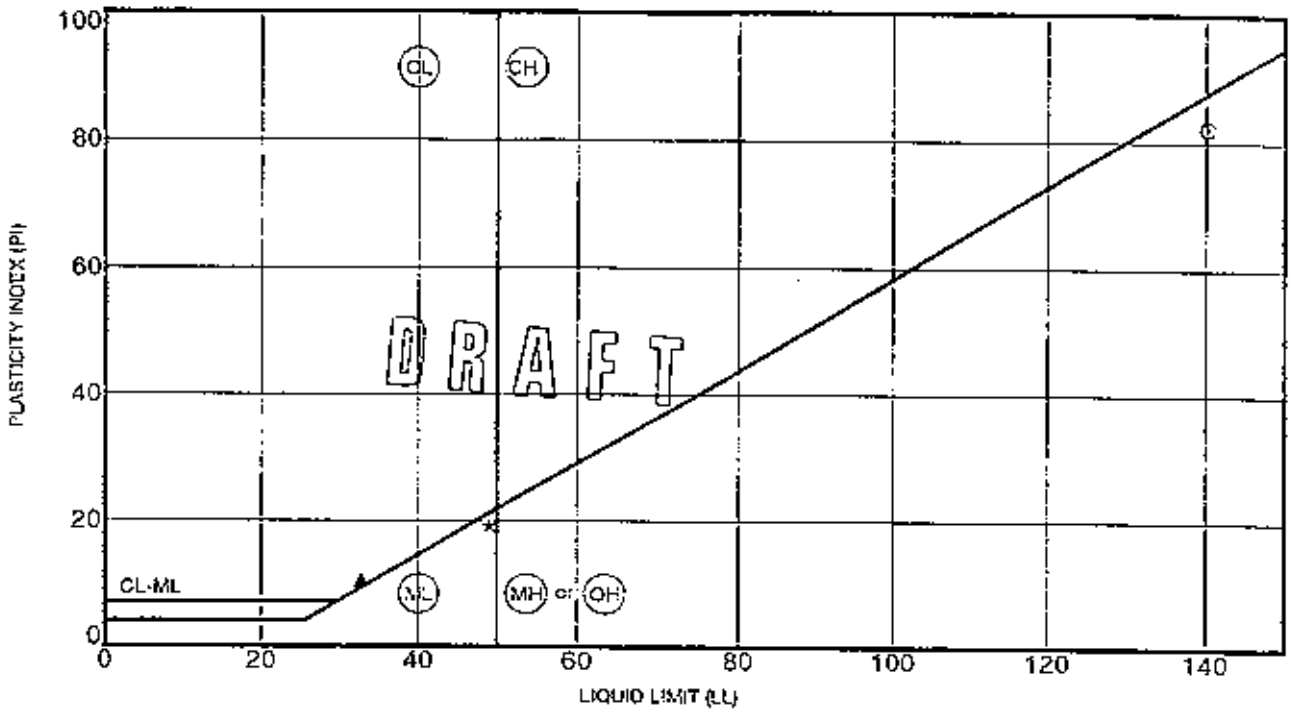
COMPACTION TEST

A maximum density/optimum moisture test was performed in accordance with ASTM D1557 on a representative bulk sample of the surficial soils. The test results are as follows:

BORING NO	DEPTH (ft)	SOIL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)
B-1	2-4	Blend: Sandy Clay (CL) and Silty Sand (SM)	126	10

CORROSIVITY TESTING

Soil corrosivity testing was performed by M.J. Schiff and Associates on a soil sample provided by GPI. The test results are enclosed in Table 1 of this appendix.



	SAMPLE LOCATION		LL	PL	PI	Fines, %	Classification
▲	B-4	20.0	33	22	10	75	LEAN CLAY WITH SAND (CL)
*	B-5	15.0	49	30	19	-	SANDY SILT (ML)
⊖	B-6	15.0	140	58	82		SILT (MH/OH)

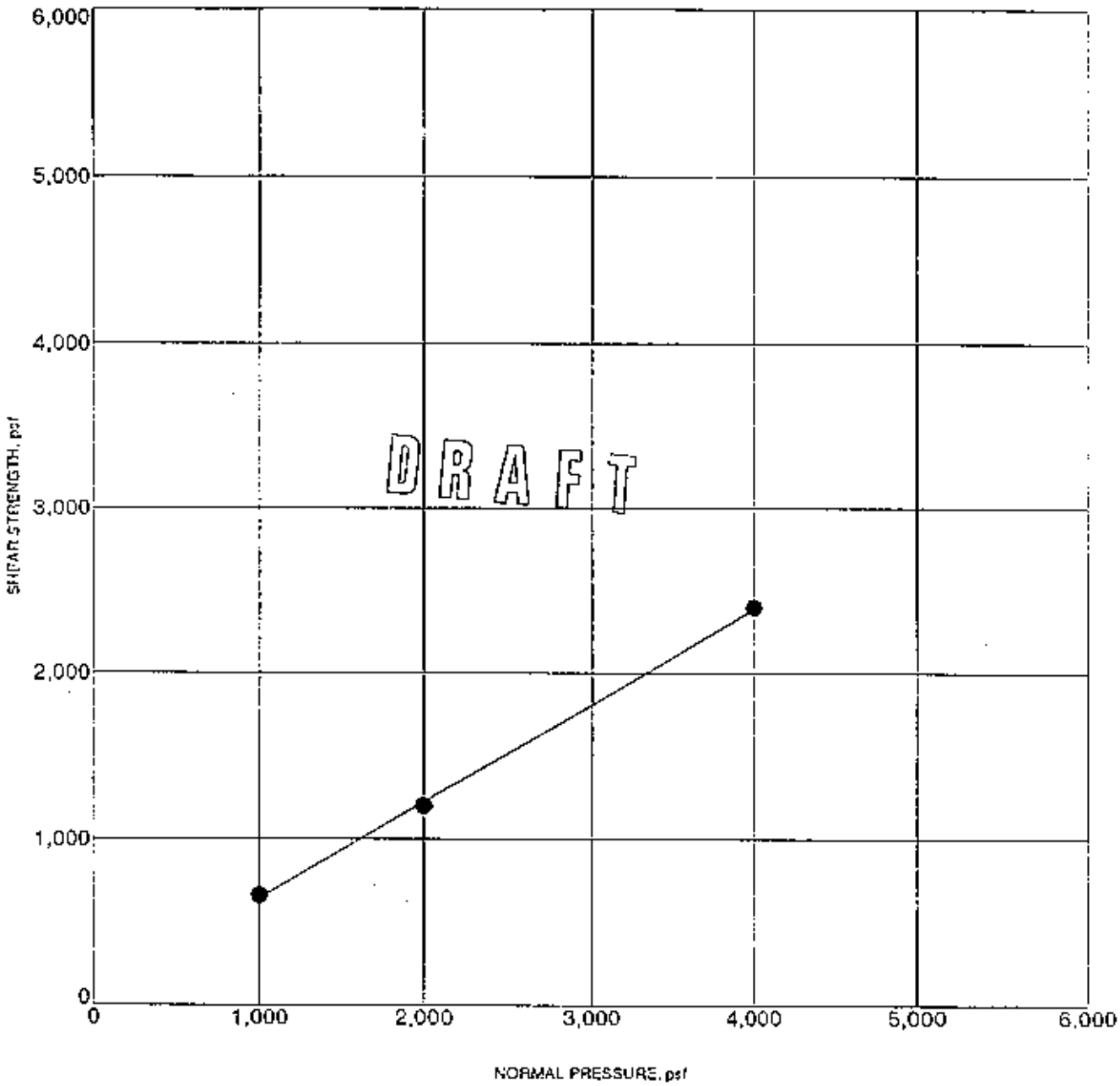
PROJECT: HOME DEPOT-LONG BEACH

PROJECT NO. 1878.1

GPI

ATTERBERG LIMITS TEST RESULTS

FIGURE C-1



Friction Angle= 30 degrees
Cohesion= 60 psf

Note: Samples remolded to 90% of maximum dry density

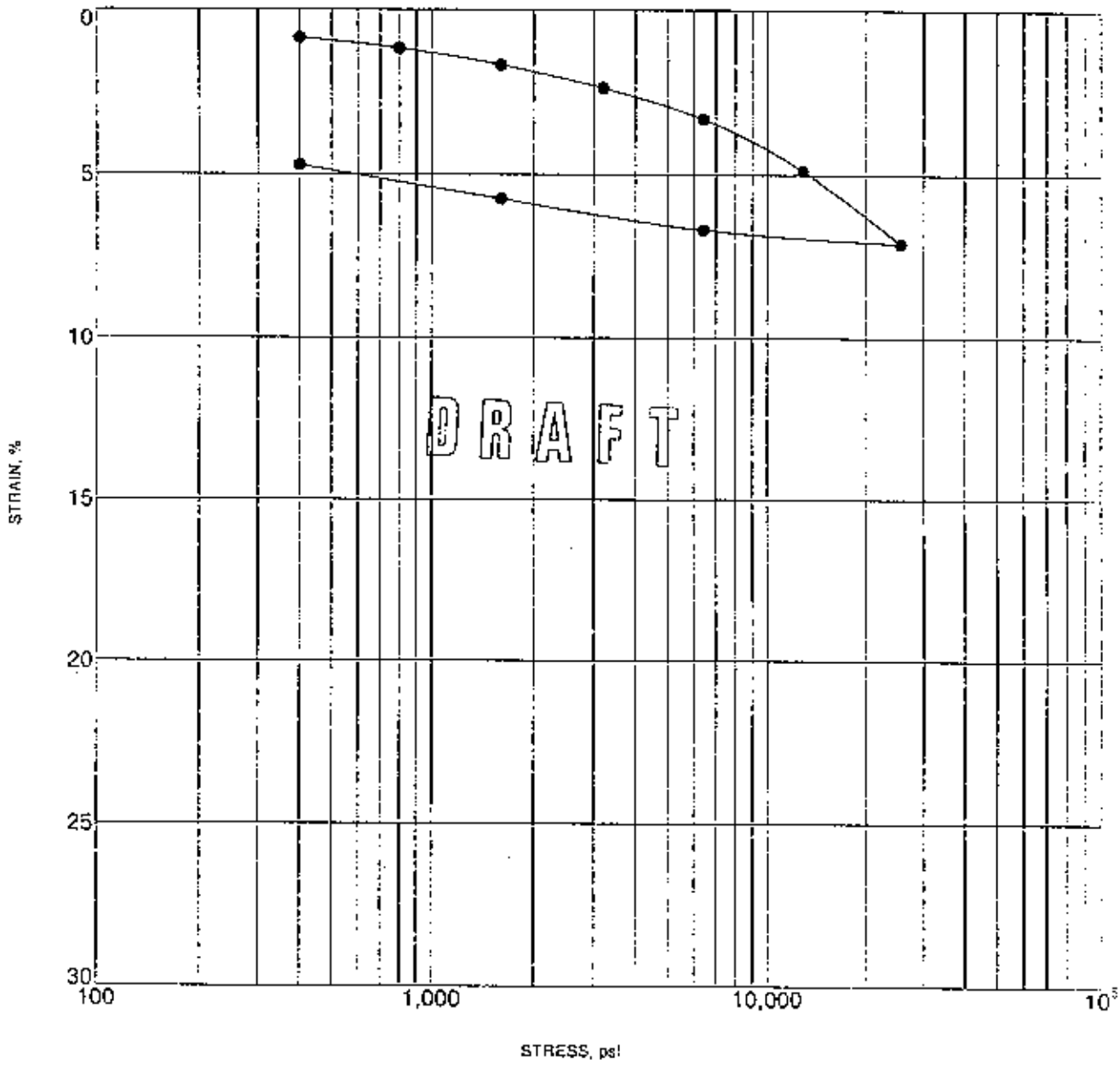
	Sample Location		Classification	DD,pcf	MC,%
●	B-1	2.0 - 4.0	Blend: SILTY SAND (SM)/SANDY CLAY (CL)	113	10.0

PROJECT: HOME DEPOT-LONG BEACH PROJECT NO.: 1878.I

GPI

DIRECT SHEAR TEST RESULTS

FIGURE C-2



Sample inundated at 3200 psf

	Sample Location		Classification	DD,pcf	MC,%
●	B-3	5.0	Fill: CLAY (CL)	102	17.7

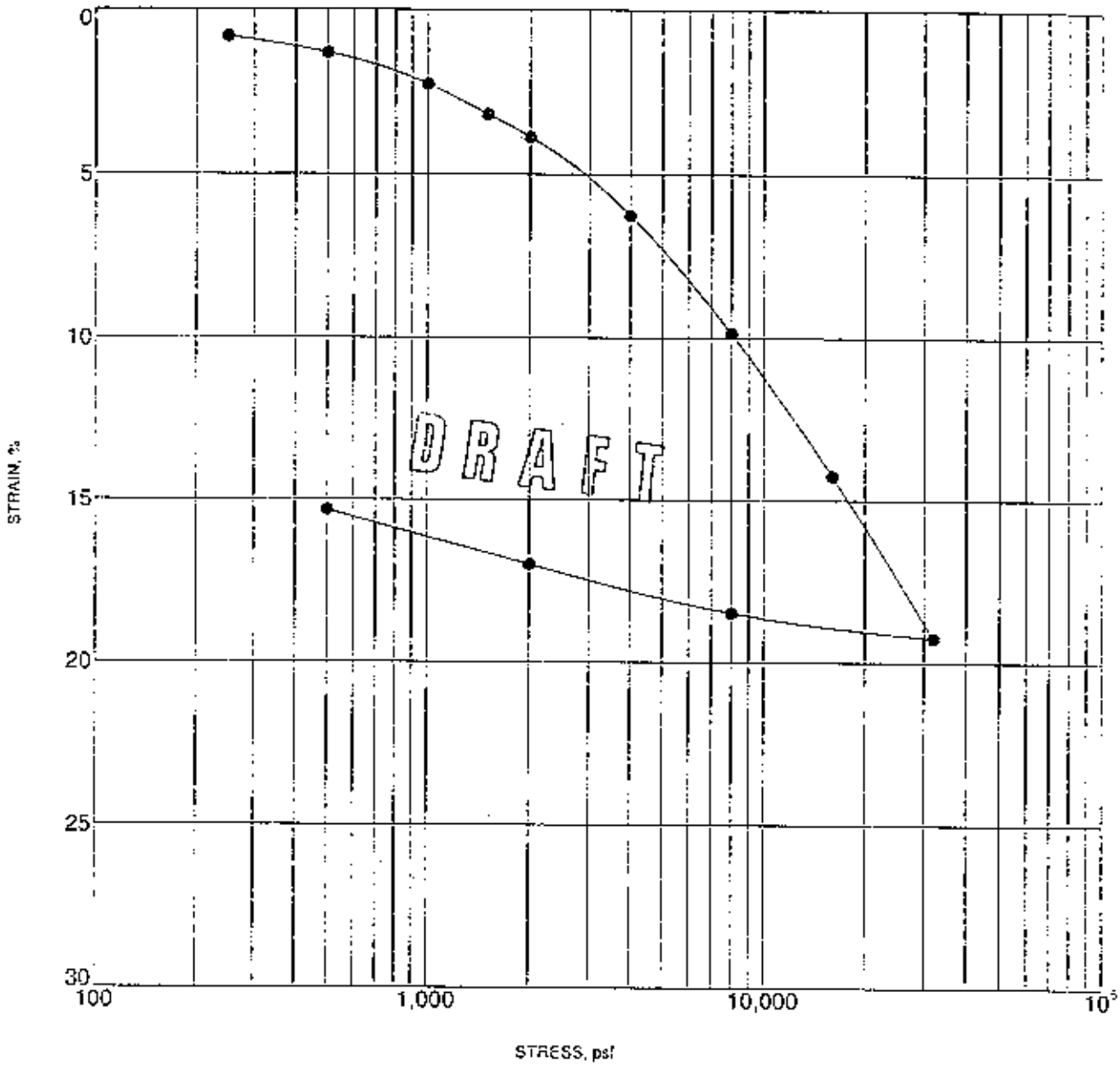
PROJECT: HOME DEPOT-LONG BEACH

PROJECT NO.: 1878.1

GPI

CONSOLIDATION TEST

FIGURE C-3



Sample inundated at 250 psf

	Sample Location		Classification	DD,pcf	MC,%
●	B-4	15.0	CLAY (CL)	83	33.6

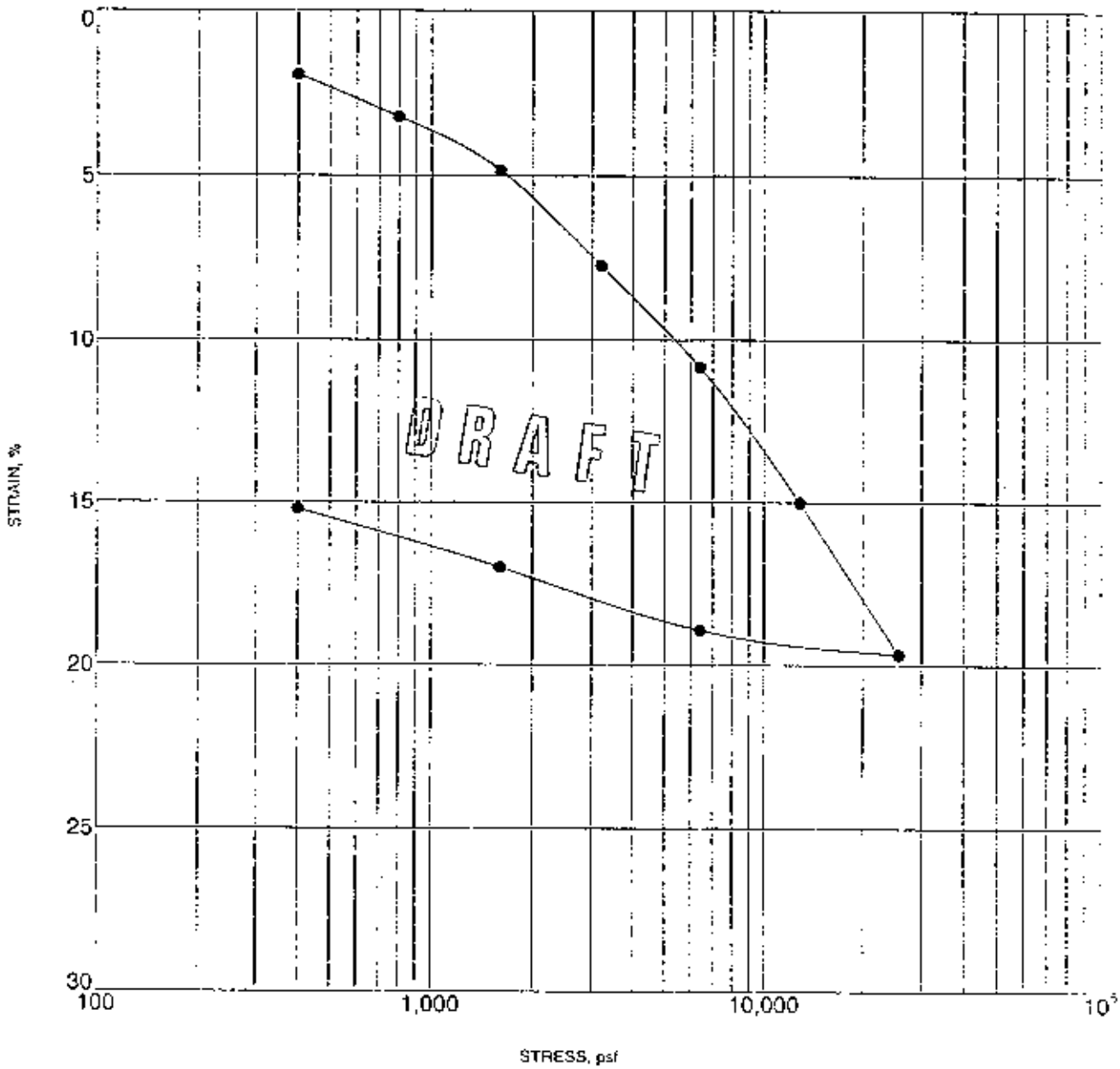
PROJECT: HOME DEPOT-LONG BEACH

PROJECT NO.: 1878.1

GPI

CONSOLIDATION TEST

FIGURE C-4



Sample inundated at 400 psf

Sample Location			Classification	DD,pcf	MC,%
●	B-6	9.0	CLAY (CL/CH)	81	37.4

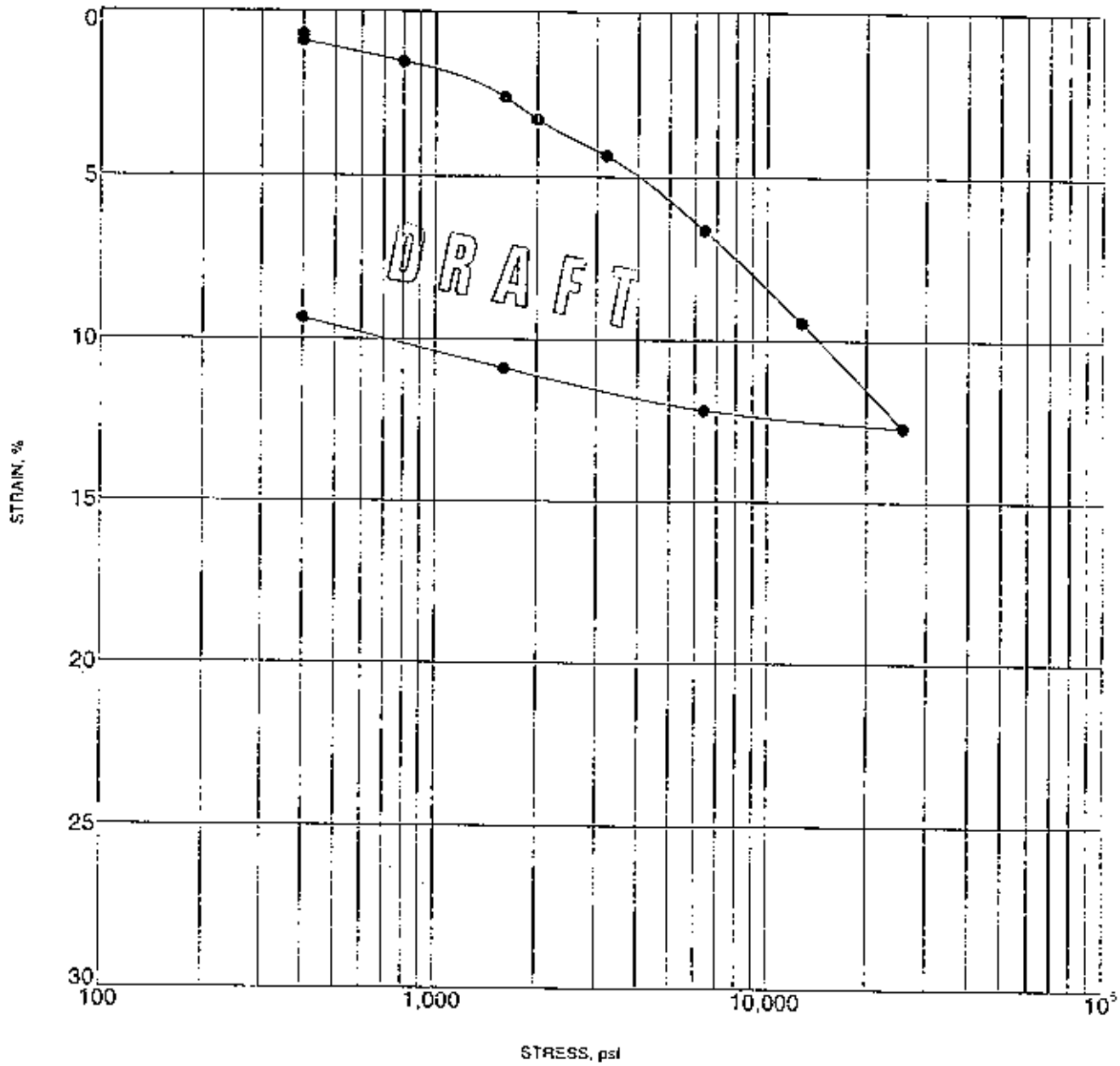
PROJECT: HOME DEPOT-LONG BEACH

PROJECT NO.: 1878.I

GPI

CONSOLIDATION TEST

FIGURE C-5



Sample inundated at 400 psf

	Sample Location		Classification	DD,pcf	MC,%
●	B-6	21.0	CLAY WITH SAND (CL)	94	29.9

PROJECT: HOME DEPOT-LONG BEACH

PROJECT NO.: 1878.1

GPI

CONSOLIDATION TEST

FIGURE C-6

M. J. Schiff & Associates, Inc.

Consulting Corrosion Engineers - Since 1959
431 W. Baseline Road
Claremont, CA 91711

Phone: (909) 626-0967 Fax: (909) 626-3316
E-mail lab@mjschiff.com
website: mjschiff.com

Table 1 - Laboratory Tests on Soil Samples

Tank Farm-Long Beach
Your #1878.1, MJS&A #03-0973LAB
20-Aug-03

Sample ID			B-2 @ 1-6' Blend (Silty Sand&Clay)
Resistivity		Units	
as-received		ohm-cm	3,000
saturated		ohm-cm	290
pH			7.7
Electrical Conductivity		mS/cm	1.89
Chemical Analyses			
Cations			
calcium	Ca^{2+}	mg/kg	854
magnesium	Mg^{2+}	mg/kg	109
sodium	Na^{1+}	mg/kg	1,140
Anions			
carbonate	CO_3^{2-}	mg/kg	ND
bicarbonate	HCO_3^{1-}	mg/kg	668
chloride	Cl^{1-}	mg/kg	1,330
sulfate	SO_4^{2-}	mg/kg	2,532
Other Tests			
ammonium	NH_4^{1+}	mg/kg	na
nitrate	NO_3^{1-}	mg/kg	na
sulfide	S^{2-}	qual	na
Redox		mv	na

DRAFT

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX F

PHASE I ENVIRONMENTAL SITE ASSESSMENT (WITHOUT APPENDICES)

PHASE I ENVIRONMENTAL SITE ASSESSMENT WITH PRELIMINARY METHANE SOIL GAS & AIR SAMPLING

LONG BEACH HOME DEPOT SITE
400 STUDEBAKER ROAD
LONG BEACH, CALIFORNIA

Prepared for:
CITY OF LONG BEACH
DEPARTMENT OF PLANNING & BUILDING
333 West Ocean Boulevard, 7th Floor
Long Beach, California 90802
Attn: Ms. Angela Reynolds, AICP
Environmental & Advance Planning Officer

MISSION File Number 03-475

December 20, 2004

Prepared by:
MISSION GEOSCIENCE, INC.
2082 Michelson Drive, 4th Floor
Irvine, CA 92612

December 20, 2004

Ms. Angela Reynolds, AICP
Environmental & Advance Planning Officer
CITY OF LONG BEACH
DEPARTMENT OF PLANNING & BUILDING
333 West Ocean Boulevard, 7th Floor
Long Beach, California 90802

RE: PHASE I ENVIRONMENTAL SITE ASSESSMENT WITH PRELIMINARY METHANE SOIL GAS & AIR SAMPLING LONG BEACH HOME DEPOT SITE
400 Studebaker Road, Long Beach, CA
MISSION File Number 03-475

Dear Ms. Reynolds:

In accordance with your request and authorization, Mission Geoscience, Inc. (MISSION) is pleased to provide this *Phase I Environmental Site Assessment (Phase I) with Preliminary Methane Soil Gas and Air Sampling Report* to you, and the City of Long Beach, and to LSA Associates, Inc. (LSA) as the lead consultant for the proposed Long Beach Home Depot Site located at 400 Studebaker Avenue, Long Beach, California (the SITE). The SITE is currently a petroleum Tank Farm with a total area of approximately 17.8 acres, and adjoins the Alamitos Generating Station (AGS) to the north and east. The SITE is located immediately east of the intersection of Loynes Drive and Studebaker Road.

This Phase I has been performed in accordance with ASTM Standard E 1527-00, at a minimum, with respect to the access and review of reasonably available information concerning the potential for hazardous wastes and substances on or in the vicinity of the SITE, in an effort to identify potential recognized environmental conditions (RECs). Appropriate inquiries into existence of prior ownership and usage of the subject property have been made in an effort to provide exemption from liability pursuant to United States Code 42, § 9601 (35)(A) [SARA Amendments], known as the "Innocent Landowner Defense". This environmental assessment was conducted by MISSION, and consisted solely of the activities described in Section 1.2 of this report. The findings, conclusions and recommendations herein are subject to limitations contained within Section 10.0.

MISSION appreciates this opportunity to be of professional service to you, the City of Long Beach, and LSA on this proposed commercial development project. Should you have any questions or desire additional information, please contact us at your earliest convenience.

Respectfully Submitted,
MISSION GEOSCIENCE, INC.

Ronaldo A. Almero, RG, CEG, REA
Senior Engineering Geologist

John Jay Roberts, RG, CEG, REA
Associate Geologist

DISTRIBUTION: 3 copies - Addressee
1 copy - Ms. Lisa D. Williams, REHS, REA/ LSA Associates, Inc.

RAA/JJR/03-475PhILong Beach HD.wpd

EXECUTIVE SUMMARY

This report presents the findings of a Phase I Environmental Site Assessment (Phase I) conducted by Mission Geoscience, Inc. (MISSION) in accordance with ASTM Standard Practice E 1527-00, at a minimum, for an approximate 17.8-acre property proposed to be developed as a commercial center for the Long Beach Home Depot. The property is located at 400 Studebaker Road, City of Long Beach, California to the east of the intersection of Loynes Drive and Studebaker Road (the SITE). The SITE, which is currently developed as a petroleum storage tank farm with associated fuel oil pumping and piping facilities, lies within the southern part of the Alamitos Generating Station (AGS) complex. MISSION's assessment represents an appropriate inquiry into the previous ownership and uses of the SITE consistent with good commercial and customary practices. The purpose and focus of MISSION's assessment has been, per the Superfund Authorization and Reorganization Amendments (SARA) 42 USC § 9601 (35) (A) (the "Innocent Landowner Defense"), to evaluate the presence of potential "Recognized Environmental Conditions" (RECs), as defined in ASTM Standard Practice E 1527-00, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.*

The scope of this assessment consisted of reviewing reasonably ascertainable and available information and environmental data relating to the SITE, including but not limited to "Standard Historical Sources" as defined per the ASTM Standard Practice, such as review of historical aerial photographs and maps, and federal, state, and local regulatory agency records regarding the SITE and SITE vicinity. MISSION also conducted a visual SITE reconnaissance for evidence of potential hazardous materials or waste.

Because the SITE lies within an oil field, and because organic clays were reported to have been placed at the SITE as backfill materials as an additional task to this investigation, a preliminary methane soil gas investigation was conducted at the SITE. Air sampling was also performed via Summa canisters to determine the background or ambient air quality both on-SITE and off-SITE.

MISSION has not reviewed the Title Report and Chain of Title Report as part of our research of ASTM-defined "standard historical sources". MISSION assumes that the current owner of the property has ordered and/or reviewed the SITE Title Report and/or Chain of Title Report, and has already been advised of any potential environmental liens which may exist for the SITE through their independent review of these reports during the course of the purchase negotiation/process. Thus, MISSION is unable to provide conclusions concerning any such environmental liens on the SITE.

Based upon information reviewed by MISSION during the performance of this SITE assessment, we conclude the following:

CONCLUSIONS

On-SITE Observations:

- The SITE consists of an approximate 17.8-acre property currently improved with four large and two small petroleum aboveground storage tanks, aboveground petroleum pipelines and associated pumping facilities situated within the Alamitos Generating Station (AGS) complex. The tanks are currently inactive, and are scheduled for removal prior to SITE development. Based upon review of historical documents, the SITE has been a Tank Farm for almost 50 years; thus MISSION concludes that the potential for hazardous materials or wastes in groundwater and/or soils beneath the SITE from this continuous usage of the SITE as a tank farm constitutes a REC for the SITE.

- Methane soil gas concentrations were detected within the Tank #4 area, at concentrations as high as 40,000 parts per million in air by volume (ppm) during our preliminary methane soil gas investigation. Considering that this level of concentration exceeds current, usual regulatory threshold of 5,000 ppm, MISSION concludes that the presence of methane in the shallow soils in the areas investigated constitutes a potential health and safety hazard for the SITE.

- Review of readily available environmental reports provided by LSA indicates that shallow soils beneath and around on-SITE tanks were impacted by #6 fuel oil. Maximum TPH concentrations of 5,800 mg/kg, 49,000 mg/kg, 4,500 mg/kg, and 33,000 mg/kg were reported to have impacted the underlying soils beneath Tank #1, #2, #3, and #4, respectively. Considering that in the case of Tank #3, contaminated soils were removed and replaced with clean, imported crushed gravel and soils, MISSION concludes that this reported impact is no longer be a REC for the SITE subject to appropriate regulatory agency approval of remedial efforts performed. However, an available report (SCEC, 1995) reviewed by MISSION recommended leaving contaminated soils reported beneath Tanks #1, #2 and #4 in place. MISSION concludes that the presence of elevated TPH concentrations in soils beneath and around Tank #1, #2, and #4 are considered a REC for the SITE.

- An empty hazardous material storage facility and a concrete-lined sump were observed at the SITE east of Tank #1. MISSION concludes that the presence and former usage of this facility constitutes a potential REC for the SITE.

- Four concrete pad mounted transformers were observed during the SITE visit. One of these transformers is on-SITE, south of the concrete-lined sump. Due to the suspected presence of PCB-containing oil, this transformer represents a potential REC for the SITE.

- Sampling and analysis of Asbestos-Containing Materials (ACMs) and Lead-Containing Materials (LCMs), including Lead-Based Paint (LBP) was not included in the scope of work for this Phase I Report. However, during the SITE visit MISSION observed suspected ACMs used in the insulation for the on-SITE tanks and pipelines. In addition, due to the age of SITE improvements (pre-1978), suspected LCMs (primarily LBPs) were also observed as possibly applied to some SITE improvements. MISSION considers the presence of suspected ACMs as a REC for the SITE, and suspected LCMs to represent a potential REC.

- MISSION retained Environmental Data Resources, Inc. (EDR) of Southport, Connecticut, to conduct a search of environmental regulatory databases for sites within or in excess of the minimum specified ASTM E 1527-00 search radii relative to the SITE. The SITE is not specifically listed on the EDR Report. However, the "AGS" facility, of which the SITE is a part, is listed as a RCRIS-LQG, RCRIS-SQG, SLIC, CHMIRS, and Toxic Pits site within the most recent versions of the Federal, State, or local databases of the EDR Report. Due to the lack of additional information concerning the AGS and active status listed on the database, the listing of AGS on the CHMIRS, SLIC and Toxic Pits databases represents a potential REC for the SITE.

- Three incidents of accidental releases/spills of petroleum hydrocarbon products were reported on December 6, 1997, August 20, 1998, and April 12, 1999. The first reported incident involved oil overflow which flowed into the drain and was trapped inside the facility. The other incidents involved rupture of pipeline and leak through valve within the generating station causing release of fuel oil into the water intake canal. The EDR Report indicated that the spills were contained and cleaned up. Based on the information in the EDR database indicating that the reported spills contained and cleaned up, MISSION concludes that these reported spills do not represent a REC for the SITE.

- Two on-SITE and one off-SITE air samples were collected via Summa canisters to determine air quality at the SITE and vicinity. Considering that none of the target volatile constituents or methane were detected at concentrations equal to or above their respective reporting detection limits in the air samples collected, and considering further that MISSION's review of the records provided by the South Coast Air Quality Management District (SCAQMD) indicated regular facility inspections and that air emissions surveillance by SCAQMD is on-going, MISSION concludes that the air quality on-SITE is not currently considered a REC for the SITE.

Off-SITE Observations:

- The immediate off-SITE vicinity contains power generating facilities including generating units, boilers, tanks, intake canals, retention ponds, and other permitted equipment; tidal flood channels, roads and residential development. No visual indications of the mismanagement of observed hazardous materials or wastes were noted on properties in the immediate vicinity of the SITE observed during our SITE reconnaissance.

- No properties were identified within the search radii from the SITE (as specified by ASTM Standard Practice E 1527-00) within the following environmental regulatory databases research for this Phase I: NPL, CERCLIS, CERCLIS-NFRAP, CORRACTS, RCRA-TSD, ERNS, AWP, LUST, UST, and AST. In the EDR Report, EDR considered and reported the AGS facility which includes the SITE as a portion of the "target property" (as discussed above). The EDR Report identified off-SITE properties as follows: three properties in the WMUDS/SWAT, two properties in the SWF/LF, eight State Spills (CHMIRS) sites, seven in the CORTESE database, and one in the Toxic Pits database. Considering their distances and positions hydrogeologically down gradient or cross gradient with the anticipated groundwater flow beneath the "target property", and/or their reported regulatory status, these off-SITE facilities are not considered a REC for the SITE. The WMUDS/SWAT sites, Studebaker/Loynes Disposal Site and Studebaker-Cerritos Channel, were identified as located 122 feet west and 145 feet west-northwest of the SITE. Based upon their close proximity to the SITE, MISSION conducted a review of available records/files for these facilities at the offices of the LARWQCB and the Los Angeles County Department of Health Services-Public Health (LACDHSPH). These two landfills which are currently closed were previously operated until 1960 by City Dump and Salvage, Inc. (no longer in business) as Class II Sanitary Landfills. As Class II landfills only the following wastes were accepted for disposal: ordinary households and commercial refuse (e.g., garbage), non-soluble, non-decomposable inert solids (e.g., construction debris). No liquid, semi-liquid, and hazardous wastes were permitted for disposal in these facilities. Considering the types of wastes that were accepted at the landfills and the extensive environmental investigations for the sites under the oversight of regulatory agencies, and considering further that they are located cross-gradient with respect to the anticipated flow of shallow groundwater beneath the SITE, MISSION concludes it is unlikely that these two nearby closed landfills have significantly impacted the SITE. Thus, MISSION recommends no further investigation relative to these landfill sites.

RECOMMENDATIONS

Based upon the available information gathered during the performance of this Phase I and the above-mentioned conclusions, MISSION presents the following recommendations:

- Prior to the grading and construction of the SITE, and after the removal of the on-SITE ASTs, pipeline conveyance systems and hazardous material facilities, a detailed soil matrix investigation for petroleum hydrocarbons and Title 22 metals at a minimum should be conducted beneath the former footprints of all on-SITE tanks, the area of the hazardous material storage facility, along pipelines, and each of the spill sites reported in the regulatory database (Section 7.2.7). The primary purpose of this investigation is to confirm the previously reported remediation in Tanks #3, and to delineate the reported soil impact around and beneath Tanks #1, #2, and #4. This investigation should also assess the area beneath the sump in order to determine whether the shallow soils have been impacted as the result of its previous operation.

  Within the areas of the on-SITE tanks and the hazardous material storage facility, continuous core samples of soil should be collected from borings advanced on a 50-foot grid spacing. Continuous core samples of soil should be collected from borings advanced every 100 feet along pipelines and at significant pipeline joints and terminations. Two borings should be advanced beneath the sump to collect continuous core samples of soil. Each core sample should be examined in detail by a California Registered Geologist who is experienced and qualified to perform hazardous waste investigations for indications of chemical impact. Samples of the cores indicating suspected impact (from the surface and each five-foot depth thereafter, if not visually impacted) should be retained and analyzed for petroleum hydrocarbons and Title 22 metals at a minimum by a laboratory with a California Department of Health Services Environmental Laboratory Accreditation Program (DOHS-ELAP) Certifications for the analysis they performed. In addition, sampling and analysis for PCBs of the oil inside the transformer and/or immediately underlying soil should also be performed to determine if PCBs are present.

- Undocumented fills and petroleum hydrocarbon-impacted soils were reported to occur on-SITE. MISSION recommends that an on-SITE Soil and Air Monitoring Program (to be approved by the City of Long Beach) be prepared and implemented during SITE grading and excavation. Air monitoring should be in conformance with applicable rules and regulations of the SCAQMD. Petroleum hydrocarbon-impacted soils found to contain petroleum hydrocarbon constituents in excess of prevailing regulatory thresholds should be removed and recycled at an appropriate State-approved facility.

- High concentrations of methane exceeding regulatory limits were detected in shallow on-SITE soils during a preliminary methane soil gas investigation in the area where the proposed Home Depot building pad is planned to be constructed. Thus, MISSION recommends that additional methane soil gas investigation be conducted following rough grading and prior to building construction and utility installation. A workplan for the additional methane soil gas investigation should be prepared, reviewed and approved by the City of Long Beach prior to its implementation. The additional methane soil gas investigation should be performed in accordance with the local industry standards. The results should be presented in a formal report which includes recommendations to mitigate potential hazards from methane, if required. The report should be reviewed and approved by the City of Long Beach. Based upon the results of this additional investigation, mitigation measures may be necessary including providing conventional vapor barriers and venting systems beneath buildings and confined spaces. Methane mitigation measures should be approved by the City of Long Beach.

- Prior to the demolition and removal of the ASTs and the pipeline conveyance system, thorough sampling and analysis of all suspected ACMs should be conducted, and an Operating & Maintenance Plan (O & M) be prepared for all ACMs to be left in place, and specifications for the removal of all ACMs should be prepared. The results of the asbestos analysis and the O & M Plan will provide specifications and procedures on handling ACMs encountered during demolition, including protection of workers and the general public from exposure to airborne asbestos. All ACMs should be removed (abated) by an appropriately licensed asbestos removal contractor in accordance with applicable regulations. Air monitoring for the detection of airborne asbestos fibers should similarly be conducted during all ACM removal under the direction of a California Certified Asbestos Consultant, pursuant to EPA/AHERA Section 206 and CCR Title 8, Article 2.6, to ensure both adherence to applicable regulations and the safety of all personnel in the ACM abatement area, and the general public as well.

- Prior to the demolition and removal of the SITE improvements, thorough sampling and analysis of all suspected LCMs should be conducted. Appropriate specifications should be prepared to incorporate the stabilization of all LCMs to be left in place or for the removal of the LCMs. LCMs should be managed and disposed of according to proper waste characterization/stream analyses for total threshold limit concentration (TTLC); soluble threshold limit concentration (STLC), and toxicity characteristic leaching procedure (TCLP). Appropriate work practices and worker protection should be utilized.

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

1.0 INTRODUCTION 1
1.1 General 1
1.2 Purpose and Scope of Work 1

2.0 SITE DESCRIPTION 3
2.1 SITE Location and Description 3
2.2 SITE Development 4
2.2 SITE Vicinity Characteristics 5
2.3 SITE Characteristics 5
2.3.1 SITE Improvements 5
2.3.2 Current Use 5
2.3.3 Utilities 6
2.3.4 Drainage Pathways 6
2.3.5 SITE Access 6

3.0 ENVIRONMENTAL SETTING 6
3.1 Physical SITE Characteristics 6
3.2 Geology 7
3.3 Hydrogeology 8
3.4 Surface Water Resources and Drainage 9
3.5 Sensitive Environmental Receptors 9
3.6 Mineral Resources 9

4.0 SITE RECONNAISSANCE 10
4.1 SITE Surface Conditions 10
4.2 Aboveground Storage Tanks (ASTs) 11
4.3 Underground Storage Tanks (USTs) 11
4.4 Use, Storage and Disposal of Hazardous Materials 11
4.5 Unidentified Materials or Containers 11
4.6 Suspect PCB-Containing Equipment 12
4.7 Air Emissions 12
4.8 Solid Waste 12
4.9 Storm Drains, Waste Water and Sanitary Sewer 12

TABLE OF CONTENTS (*Cont'd.*)

5.0 HISTORICAL SITE USAGE 13
5.1 Aerial Photographs 13
5.2 Historical Fire Insurance Maps 15
5.3 United States Geological Survey (USGS) Topographic Maps 15
5.4 Building Department Records 17
5.5 Fire Department Records 17
5.6 City Directories 17
5.7 Title Report and Chain of Title Report 18
5.8 Summary of Historical Sources 18

6.0 OTHER ENVIRONMENTAL ASSESSMENTS 18
6.1 Previous Environmental Assessment Reports 18
6.2 Asbestos-Containing Materials and Lead-Containing Materials 20
6.3 Radon 20
6.4 Oil and Gas 20

7.0 REGULATORY AGENCY RESEARCH 21
7.1 Federal Regulatory Databases 22
7.1.1 Superfund National Priority List (NPL) 22
7.1.2 CERCLIS (NFRAP) 22
7.1.3 RCRA Corrective Action Sites List (CORRACTS) 23
7.1.4 RCRIS-TSD Facilities (TSD) 23
7.1.5 RCRIS-LQG and RCRIS-SQG Facilities 24
7.1.6 Emergency Response Notification System (ERNS) 24
7.2 State Regulatory Databases 24
7.2.1 CAL-SITES (Annual Work Plan - AWP) 24
7.2.2 Waste Management Unit Database (WMUDS/SWAT) 25
7.2.3 Municipal Solid Waste Facilities/Landfill Facilities (SWF/LF) 25
7.2.4 Leaking Underground Storage Tank File Listing (LUST) 26
7.2.5 Permitted Underground Storage Tanks (UST) 26
7.2.6 Permitted Aboveground Storage Tanks (AST) 26
7.2.7 State Spills List (CHMIRS) 27
7.2.8 State Hazardous Wastes & Substances Sites (CORTESE) 28
7.2.9 State Toxic Pit Cleanup Act Sites (Toxic Pits) 30
7.2.10 Spills, Leaks, Investigation & Cleanup (SLIC) 31

TABLE OF CONTENTS (*Cont'd.*)

7.3 Local Agencies 31
7.3.1 City of Long Beach Fire Department 31
7.3.2 City of Long Beach Department of Building & Planning 32
7.3.3 Department of Toxic Substances Control (DTSC) 32
7.3.4 Los Angeles Regional Water Quality Control Board (LARWQCB) 33
7.3.5 South Coast Air Quality Management District (SCAQMD) 33

8.0 METHANE SOIL GAS INVESTIGATION AND AIR SAMPLING 33
8.1 Methane Soil Gas Investigation 33
8.1.1 Soil Gas Sampling and Analysis 34
8.1.2 Laboratory Analytical Results 35
8.2 Air Quality Sampling 36

9.0 CONCLUSIONS AND RECOMMENDATIONS 37
9.1 On-SITE Observations 37
9.2 Off-SITE Observations 39
9.3 Recommendations 40

10.0 LIMITATIONS 42

11.0 REFERENCES 43

FIGURES

Figure	Description
1	Site Location Map
2	Site Plan
3.1	1952 Aerial Photograph
3.2	1975 Aerial Photograph
3.3	1988 Aerial Photograph

TABLE OF CONTENTS (*Cont'd.*)

TABLES

Table	Description
1	Historical Aerial Photographs
2	Historical USGS Topographic Maps
3	Databases Searched

APPENDICES

Appendix	Description
A	SITE Photographs
B	Correspondence and Pertinent SITE Documents
C	Historical Maps Report
D	Regulatory Agency Research Report
E	Laboratory Analytical Results-Methane Soil Gas Investigation
F	Laboratory Analytical Results-Air Quality Sampling

1.0 INTRODUCTION

1.1 General

This report presents the findings of a Phase I Environmental Site Assessment (Phase I) conducted by Mission Geoscience, Inc. (MISSION) on behalf of the City of Long Beach Department of Planning and Building (LBDPB) and LSA Associates, Inc. (LSA) for an approximate 17.8-acre former Tank Farm property currently located within the Alamitos Generating Station (AGS) facility complex. The property is located at 400 Studebaker Road, City of Long Beach, California to the east of the intersection of Loynes Drive and Studebaker Road (the SITE). It is MISSION's understanding that the property is presently owned by Studebaker LB, LLC, and is proposed to be developed for the Long Beach Home Depot commercial center.

MISSION's Phase I was performed in accordance with ASTM Standard Practice E 1527-00, at a minimum, and is based upon a visual reconnaissance of the SITE and vicinity, review of currently available historical documents, review of readily available agency files and correspondence with appropriate regulatory officials, and review of environmental and geotechnical reports provided by LSA to MISSION. Because the SITE lies within an oil field, and because organic clays were reported to have been placed at the SITE as backfill materials as an additional task to this Phase I, a preliminary methane soil gas investigation was conducted at the SITE. Air sampling was also performed via Summa canisters to determine ambient air quality both on-SITE and off-SITE.

1.2 Purpose and Scope of Work

The purpose and focus of MISSION's assessment has been, per the Superfund Authorization and Reorganization Amendments (SARA) 42 USC § 9601 (35) (A) (the "Innocent Landowner Defense"), to evaluate the presence of potential "Recognized Environmental Conditions" (RECs), as defined in ASTM Standard Practice E 1527-00, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.*

Specifically, representatives of MISSION performed the following tasks:

- Reviewed available published geologic and hydrogeologic reports regarding information on SITE geology, soil and groundwater conditions.
- Reviewed available environmental and geotechnical reports of the SITE and vicinity provided by LSA.

- Reviewed reasonably ascertainable information within federal, state and local environmental regulatory agency databases for known hazardous waste disposal sites or reported hazardous materials releases on or within a minimum of a ⅛-mile radius of the SITE.

- Reviewed appropriate and accessible local agency databases regarding any permitted underground storage tanks (USTs) or aboveground storage tanks (ASTs) located on the SITE or within a ¼ mile radius, and their status or disposition, if present and if known.

- Personally contacted representatives of select local administering agencies and reviewed their available SITE records regarding any permitted USTs/ASTs, LUSTs, hazardous materials releases, emergency responses, and other environmental issues pertaining to the SITE. Specifically, MISSION contacted the following agencies:

    - City of Long Beach Fire Department - Bureau of Fire Prevention (HazMat Unit)
    - City of Long Beach Department of Planning & Building
    - Los Angeles Regional Water Quality Control Board
    - South Coast Air Quality Management District
    - Department of Toxic Substances Control
    - Los Angeles County Department of Health Services-Public Health

- Reviewed readily available, selected vertical black and white aerial photographs covering the SITE and immediately adjoining properties in order to document local land use history.

- Reviewed readily available, selected historical topographic maps for the SITE and adjoining properties to documents local land use history.

- Conducted a SITE reconnaissance, including obtaining photographs of the SITE (Appendix A), for visible signs of suspected hazardous materials or waste on SITE. In addition, MISSION also conducted a brief visual reconnaissance from public thoroughfares of properties immediately adjoining the SITE.

- Performed a methane soil gas investigation of shallow on-SITE soils, and air quality sampling at the SITE and off-SITE.

- Compiled pertinent information into this report, with accompanying illustrations and appendices summarizing our findings, conclusions and recommendations regarding the potential for hazardous materials or wastes and RECs on the SITE.

The findings herein are based on observations of existing conditions at the SITE and surrounding areas by qualified personnel at the time of our SITE visit. This assessment was conducted on behalf of, and for the exclusive use of the City of Long Beach Department of Planning & Building and LSA Associates, Inc., solely as a Phase I Environmental Site Assessment of the SITE. MISSION's findings, conclusions and recommendations contained herein are subject to the Limitations in Section 10.0.

2.0 SITE DESCRIPTION

2.1 SITE Location and Description

The Long Beach Home Depot commercial center is proposed to be developed as a 16.7-acre Site on a generally rectangular, approximate 17.8-acre property, located at 400 Studebaker Road, City of Long Beach, California (Figure 1). The SITE is located east of the intersection of Loynes Drive and Studebaker Road. The SITE is a former Tank Farm developed with four large and two small aboveground petroleum storage tanks (ASTs) and associated pumping, piping, and heating facilities. The four large ASTs are identified as Tanks # 1, #2, #3, and #4, and located on the northwest, southwest, northeast, and southeast quadrants of the property, respectively. The storage tanks have capacities of approximately 5.9 million (M) gallons each for Tanks #1 & #2 and 9.4 M gallons each for Tanks #3 & #4 (CH2M Hill, 1997). The two smaller tanks are situated between Tank #1 and Tank #3. The capacity of the northen smaller AST is 1.2 M gallons. The southern smaller AST is owned and operated by the Los Angeles City Department of Water and Power (LADWP) and has a capacity of 840,000 gallons (Section 4.2). Each of the tanks is enclosed by an approximate 10-foot high earthen containment berm. The tanks are reported to be constructed of steel with insulation between the steel and the outer fiber glass shell. The ground surface around the tanks is paved with asphalt. Along the inner side of the berms are drainage systems and containment area gate valves. During the SITE reconnaissance on January 27, 2004, the tanks and the piping directly connected to the tanks were observed to be inactive, partly damaged, and exposing the inner insulation materials. The asphalt paved surfaces around the tanks were deteriorated exposing the gravel base.

2.2 SITE Development

According to the development plan (CA-929v, Greenberg Farrow, 2004) the proposed Long Beach Home Depot commercial center will consist of the development of approximately 16.4-acres of the approximate 17.8-acre property. The proposed commercial center includes development of four building pad areas with an approximate total 157,529 square feet (sq. ft.) of commercial space. The four pads comprise the following: a Home Depot Home Improvement Center and an Outdoor Garden Center; building pad A for a sit-down restaurant, and building pads B and C for Major Retail Tenant buildings. A total of 742 parking spaces are also proposed for development.

An existing distribution facility for petroleum is to remain in operation along the SITE's northern boundary. This facility occupies approximately 1.49 acres of the 17.8-acre property. The facility is comprised of: a cutter oil tank, a heating unit, and a pumping and distribution piping system enclosed within a concrete-lined containment berm which provides a spill catchment basin. Landscaped earthen berms and fencing will screen these facilities from the retail center.

MISSION understands that according to the project description, prior to construction of the commercial center, structures and ancillary equipment associated with the petroleum tank farm will be removed. The predominant structures to be removed include: four large ASTs; one smaller AST; and five lined retention basins to capture accidental petroleum spills. Ancillary equipment includes: a former hazardous material storage area; a depressed sump area; and pipelines that are connected to the ASTs. Contaminated soils that are determined to be hazardous will be removed and transported to a state-approved facility.

Development of the retail commercial center will result in the excavation of approximately 40,460 cubic yards (cy) of soil on-SITE. Approximately 18,490 cy of the excavated soil will be used for the construction of on-SITE embankment. Approximately 21,970 cy of clean soil are to be imported.

The Long Beach Home Depot commercial center will include the construction of an access road extending Loynes Drive eastward toward the middle portion of the commercial center where open parking areas are to be established. This project also includes construction of the necessary infrastructure for the new commercial center including storm water drainage, sewerage, water, electricity, natural gas, and telecommunications.

2.2 SITE Vicinity Characteristics

The SITE is located within Subarea 19 of the Southeast Area Development and Improvement Plan (SEADIP), which is a part of the Local Coastal Program. The SITE is zoned General Industrial (IG). The SITE is bordered to the north by a peripheral road, north intake canal, and the Alamitos Generating Station (AGS); to the east by several AGS facilities including a large open retention basin, San Gabriel River Channel, and the Los Angeles Department of Water and Power generating facilities immediately east of the channel; to the south by a parking area, south intake canal, and the Pacific Energy Tank Farm and associated piping facilities; and to the west, by Studebaker Road, vacant land and the Los Cerritos Channel. Adjacent to the southwest corner of the SITE (across Studebaker Road) is the Los Cerritos Wetlands. Although not considered adjacent to the SITE, the University Park Estates residential development is across Studebaker Road and the Los Cerritos Channel, to the northwest of the SITE.

2.3 SITE Characteristics

2.3.1 SITE Improvements

The SITE is currently improved with four large ASTs and two small petroleum ASTs enclosed within approximately 10-foot high earthen containment earth berms. Other SITE improvements are fuel oil conveyance facilities consisting of aboveground petroleum pipelines and associated pumping facilities. The ASTs are currently inactive, and will be removed prior to SITE development. The existing aboveground pipelines are planned to be removed and/or relocated underground along the perimeter of the SITE.

2.3.2 Current Use

The SITE is currently an inactive petroleum fuel Tank Farm.

2.3.3 Utilities

The SITE is serviced by the following utilities:

• Potable water	City of Long Beach
• Electric	Southern California Edison
• Telephone	Verizon
• Gas	Southern California Gas Company

2.3.4 Drainage Pathways

The SITE ground surface is generally flat with a very gentle slope towards the southwest. Surface runoff flows toward concrete-lined swales located along both the interior and exterior perimeters of the earth berms, and ultimately flow to the intake channel to the south.

2.3.5 SITE Access

The SITE is currently accessible through an asphalt-paved access road to the AGS facility complex, and through intra- and peripheral roads to the SITE. Access to the tank areas is through access ramps.

3.0 ENVIRONMENTAL SETTING

3.1 Physical SITE Characteristics

According to the USGS 7.5 minute series topographic map, Alamitos Quadrangle (USGS, 1964), the SITE is situated on generally flat topography at elevations between 5 and 10 feet above mean sea level (msl) (Figure 1). An available grading plan (Madison, 2002) indicates that ground surface elevations at the SITE range from 7.5 to 10.5 feet above msl. The top of the earth berms enclosing the Tank Farm have an elevation of approximately 18. 5 feet. The ground surface gradient in the SITE vicinity consists of very gentle slopes generally toward the southwest.

3.2 Geology

The SITE lies within the southwestern block of the Los Angeles Basin which is comprised of a low alluvial flood plain. The flood plain is punctuated by a line of elongated low hills, folds and faults, which delineate the northwest-trending Newport-Inglewood Structural Zone. This structural zone is located approximately 0.9 km southwest of the SITE and has been designated as an Alquist Priolo active fault zone (Hart and Bryant, 1999; Jennings, 1994; Wright, 1991; Yerkes, et al., 1965). Signal Hill, located northwest of the SITE, is one of the elongated hills within this structural zone.

Recent deposits underlying the SITE are comprised of alluvial and coastal marine sediments. Flood plain deposits from the Los Angeles River and the San Gabriel River have contributed to the formation of the coastal plain on which the SITE is located. Prior to local development, the general SITE area consisted of tidal marshes which received alternating deposits of marine sands, organic silts and clays, and fluvial deposits, similar to the near-surface sediments beneath the SITE (Poland, et al., 1956; CDWR, 1961; Randell, et al., 1983). Based upon review of historical documents, fill materials were placed on the SITE, elevating it out of the former tidal marshes.

A geotechnical investigation (GPI, 2003) conducted for the project encountered undocumented fill materials on the SITE to depths of 7 to 10 feet consisting of interbedded brown to dark brown to black sandy clay (CL in the Unified Soil Classification System), silty fine-grained sand (SM), and sand (SP) with consistencies ranging from loose to dense and very stiff. Underlying the fill materials generally is fine- to coarse-grained sand (SP/SW) with interbeds of silt (MH/OH) and clay (CL/CH). Similar lithological units were also encountered during MISSION's (2004) methane soil gas investigation conducted at the SITE.

According to the United States Department of Agriculture, Soil Conservation Service (1969), the native soils beneath the SITE belong to the Chino association. This soil association occurs on nearly level valleys. Typically, the surface layers are gray and dark gray loam, silt loam or clay loam approximately 16 inches thick and underlain by gray and light brownish-gray silty clay loam and clay loam substratum. They are usually over 60 inches deep, calcareous throughout and mottled in the lower section. The soils are poorly drained and have a moderately slow permeability. The Chino association consists of 85% Chino soils, 10% Foster soils, and 5% Grangeville soils. The shrink-swell potential of the on-SITE soils is moderate, and their corrosivity potential for untreated pipe is high. Based upon the results of materials testing on selected on-SITE soil samples, the expansive index of the clay soils on-SITE was reported to range from medium to high, and the on-SITE soils are severely corrosive to steel (GPI, 2003).

3.3 Hydrogeology

The SITE lies within the Central Groundwater Basin of the Los Angles County Department of Public Works (LACDPW, 1996). According to the California Department of Water Resources, major fresh water-bearing zones beneath the Long Beach area include, from shallowest to deepest: the Gaspur, Gage, Lynwood and Silverado Aquifers (Poland, et al., 1956; Poland, 1959; CDWR, 1961). However, only the Lynwood and Silverado Aquifers underlie the SITE and its immediate vicinity (CDWR, 1961). Saltwater intrusion into these aquifers near the coastline has caused chloride, salinity and total dissolved solids (TDS) concentrations exceeding allowable CCR Title 22 maximum contaminant levels in these aquifers southwest of the Newport-Inglewood Structural Zone, and thus no domestic water-supply wells are present in the vicinity of, or hydraulically down-gradient from, the SITE (Piper, et al., 1953).

The operations of the Alamitos Barrier Project since 1970 have been aimed at preventing seawater intrusion through the Alamitos Gap area into the groundwater supplies of the Central Basin of Los Angeles County and the southwestern portion of the Orange County Coastal Plain. The barrier project facilities include a series of injection wells from near Westminster Avenue trending northward along the Alamitos Channel, then westward immediately north of the AGS complex crossing the San Gabriel River and Los Cerritos Channels. The injection wells when in operations formed a freshwater pressure ridge which prevents seawater intrusion. Extraction wells located along the southern section of the San Gabriel River Channel when in operation formed a trough which breaks the landward intrusion of seawater. The SITE is located southwest of this barrier, thus is not protected from seawater intrusion. The chloride concentrations in groundwater beneath the SITE are reported to range between 250 and 15,000 milligrams per liter (mg/l) (Kistenmacher and Bernabe, 2004).

The historical depth to groundwater beneath the SITE was reported to range from 4 feet to 18 feet below ground surface (bgs) (CH2M Hill, 1997; GPI, 2003). According to available data from the LACDPW, the nearest water production well, Well # 503H, located approximately 1,200 feet southeast of the SITE has been abandoned. The depth to groundwater in this well, gauged on November 25, 1986, was 20.7 feet bgs. Another well (Well #503A) is presently active and is located approximately ½ mile southeast of the SITE, and was last gauged on April 1, 2003 with a reported depth to groundwater of 44.2 feet bgs. These levels of groundwater within the LACDPW wells are most likely piezometric surfaces (pressure levels) since the well perforations set were reportedly in the deeper aquifers. Shallow groundwater flow direction is generally south-southwest toward San Pedro Bay (Tinsley, et al., 1985), but varies with season and tides.

3.4 Surface Water Resources and Drainage

The nearest surface water features are the adjoining north and south intake channels. The Los Cerritos Channel is approximately 300 feet west of the SITE and the San Gabriel River Channel approximately 700 feet to the east of the SITE. Both channels empty into the Alamitos Bay and the Pacific Ocean to the south.

3.5 Sensitive Environmental Receptors

There were no sensitive environmental receptors (e.g., riparian habitats, domestic water supply reservoirs, groundwater production wells, etc.) observed on or adjacent to the SITE at the time of MISSION's SITE visit, with the exception of the Los Cerritos Wetlands which is located adjacent to the southwest corner of the SITE (across Studebaker Road). The Los Cerritos Wetlands is considered a sensitive receptor.

3.6 Mineral Resources

The SITE is situated within the Seal Beach Oil Field, thus oil and gas deposits may potentially occur beneath the SITE vicinity. However, there are no records at the California Division of Oil, and Gas Geothermal Resources (DOGGR) that natural gas or oil wells have existed or been drilled at the SITE. According to the DOGGR Field Map 132 (1992), productive oil wells are located approximately 0.70 miles to the southwest of the SITE. Based upon MISSION's research and review of the readily available DOGGR records, no oil or natural gas exploration wells have ever been conducted at the SITE. The nearest wildcat well to the SITE is an abandoned dry well located approximately 2,000 feet southwest of the SITE. Thus the potential loss of existing oil or gas resources as a result of the Long Beach Home Depot project is considered to be low. In addition, should such deposits exist beneath the SITE, they would occur at such a depth as to be accessible from nearby oil-company-owned properties via slant drilling. Since a SITE Title Report was not reviewed, we are unable to comment concerning the ownership of Oil, and Gas or Mineral Rights on the SITE.

Another potential mineral resource at the SITE is the alluvial deposits which underlie the SITE. However, considering that the SITE was a former marsh, and due to the presence of organic clays, fines, and fill materials, the SITE would not be suitable as a potential source for sand and gravel deposits. Furthermore, MISSION's review of published aggregate resources in the Los Angeles metropolitan area indicates that the SITE vicinity is not located in areas designated by the Mining and Geology Board as "regionally significant aggregate resources" (Beeby, et al., 1999). Thus, the SITE as a potential resource for sand and gravel is negligible. No other mineral resources are known to have any potential for exploitation at the SITE.

4.0 SITE RECONNAISSANCE

The SITE visit was conducted by MISSION's Senior Engineering Geologist in the company of Lisa D. Williams, REHS, REA (Project Manager), Nicole Dubois and Jason Lui of LSA, David D. Mackenbach, Director, Cushman & Wakefield, and Jerome Pitt, Engineer, URS Corporation. The SITE visit, conducted on January 27, 2004 consisted of a walk-through survey of the SITE. A brief visual reconnaissance from public thoroughfares of the immediately adjoining properties was also conducted by MISSION's engineering geologist. Selected photographs obtained during the SITE visit are presented in Appendix A.

4.1 SITE Surface Conditions

MISSION did not observe during SITE visit leachate, seeps, surface staining, distressed vegetation, hummocky topography, closed depressions, pits, ponds, lagoons and other visual indications nor smell strong petroleum hydrocarbon odors that would indicate potential waste dumping on the SITE.

4.2 Aboveground Storage Tanks (ASTs)

The SITE is a Tank Farm consisting of four large and two small ASTs and associated pipelines and pumping facilities. The four large ASTs have storage capacities of approximately 5.9M gallons (Tanks # 1 & #2) and 9.4 M gallons (Tanks # 3 & #4). The large tanks reportedly contained #6 fuel oil and the smaller tanks contained cutter oil. The two smaller tanks are situated between Tank #1 and Tank #3. The capacity of the northen smaller AST is 1.2 M gallons. The southern smaller AST is owned and operated by the Los Angeles City Department of Water and Power (LADWP) and has a capacity of 840,000 gallons. An inventory of equipment containing petroleum products (CH2M Hill, 1997), listed an LACDPW cutter fuel tank to have a capacity of 840,000 gallons. MISSION was informed on-SITE by a Pacific Energy employee that one of the smaller tanks on-SITE was formerly owned by LACDPW.

4.3 Underground Storage Tanks (USTs)

No visual indications of existing or former on-SITE USTs were observed during MISSION's SITE visit. No direct evidence of historic USTs at the SITE was found during MISSION's review of historical (e.g., aerial photographs) and local agency records (Section 5.0).

4.4 Use, Storage and Disposal of Hazardous Materials

No hazardous materials or petroleum products were observed directly on-SITE during MISSION's SITE visit. However, according to the information from Mr. Mackenbach of Cushman & Wakefield, the on-SITE ASTs contain petroleum residues and one of the large ASTs contains approximately 28 to 30 inches of water and oil. MISSION also observed exposed suspected asbestos containing materials (ACM) between the inner steel and the outer fiberglass liners of the tanks and the associated piping. A former chemical storage facility on-SITE was observed during our SITE visit on January 27, 2004. The storage facility is located adjacent to the hose house in the northern portion of the SITE and west of the existing pumping and distribution facility.

4.5 Unidentified Materials or Containers

No unidentified materials or containers were observed during MISSION's SITE visit. However, a roll-off bin (8' by 20' by 10' high) was observed south of the hazardous material storage facility. The bin contained old office furniture, cut trees and weeds.

4.6 Suspect PCB-Containing Equipment

Standard equipment generally suspected of potentially containing PCBs includes industrial capacity transformers, fluorescent light ballasts, and oil-cooled machinery. During MISSION's SITE visit, four concrete pad mounted transformers were observed, two of which were inactive. No indications of leaks or spills were observed within the vicinity of the transformers during MISSION's SITE visit. Three of the transformers are located within the pumping facility (not a part of the SITE development) along the northern portion of the SITE which will remain in operation. The fourth transformer was observed south of the former hazardous materials storage area.

In general, all PCB-designated transformers were required to be replaced with non-PCB-designated transformers when PCBs were designated as a carcinogen by the EPA in 1977. Transformers are currently classified as PCB-containing if their cooling oils contain greater that 50 milligrams per liter total PCBs. Because the transformer is suspected to contain PCB-containing oil and due to the possibility of past leaks or spill, this transformer is considered a potential REC for the SITE.

4.7 Air Emissions

No sources of potentially regulated air emissions were observed on-SITE during MISSION's SITE visit. However the adjacent AGS and the nearby generating plant of the City of Los Angeles Department of Water and Power are issued operating permits by the SCAQMD for their facilities.

4.8 Solid Waste

MISSION did not observe any non-hazardous solid waste storage (rubbish) on-SITE during MISSION's SITE visit, except for a roll-off-bin which contained old office furniture, cut trees and weeds.

4.9 Storm Drains, Waste Water and Sanitary Sewer

MISSION did not observe any sources of industrial wastewater or liquid discharge on-SITE. There are provisions to catch or collect petroleum discharge in case of spills through a lined retention basin and a catch basin. Review of regulatory databases indicates that petroleum product release(s) or spills could have potentially occurred at the SITE during the operations of the Tank Farm, as discussed in Section 7.2.7.

5.0 HISTORICAL SITE USAGE

5.1 Aerial Photographs

Black and white aerial photographs were reviewed by MISSION at Continental Aerial Photo (CAP) in Los Alamitos, California. Available aerial photographs included the years between 1952 and 1999 (Table 1), which covered the earliest identified period of SITE development.

TABLE 1
AERIAL PHOTOGRAPHS

DATE	FLIGHT NUMBER	FRAME NUMBER	SCALE
11/18/52	AXK-1K	4 & 5	1" = 1666'
10/19/53	AXJ-13K	200	1" = 1666'
3/24/59	261	1-2-8/9	1" = 1000'
4/3/60	311-4	49-3	1" = 1000'
5/1/67	-	286/287	1" = 2000'
1/31/70	61-7	176/177	1" = 2000'
10/26/73	132	11/12	1" = 2000'
12/28/76	181-1	19/20	1" = 2000'
2/19/83	218-1	12/13	1" = 2000'
1/27/86	F-354-355	354/355	1" = 2800'
7/7/88	19178	-	1" = 2000'
6/9/93	C93-12	198/199	1" = 2000'
1/29/95	C103-36	14/15	1" = 2000'
2/24.99	C134-36	158/159	1" = 2000'

1952 & 1953

The SITE is vacant and appears to have been backfilled. Vacant lands and scattered farms lie to the north. Los Cerritos and San Gabriel River Channels, 7th Street and the Pacific Coast Highway have already been constructed. To the east of the San Gabriel River Channel, the land appears to have been backfilled and improved with a single AST and a rectangular retention pond. To the southwest of the SITE are marshes and beyond the Los Cerritos Channel are farm lots. The adjacent area to the south is vacant land. According to CH2M Hill, 1997, in a 1954 aerial photograph, the SITE was reported to be still undeveloped.

1959 & 1960

The SITE is improved with four large and one small AST. The 22 Freeway and the AGS to the north are under construction. There are grading activities east of San Gabriel Channel at the future site of the generating plant of the City of Los Angeles Department of Water and Power (LADWP). To the west of the SITE and beyond Los Cerritos Channel, there is residential development and Loynes Drive appears to be under construction. The land to the south and adjoining the SITE is still vacant.

1967 & 1970

A small AST has been added to the on-SITE Tank Farm, now consisting of four large and two small ASTs. In the 1970 photograph a small AST is apparently adjacent and to the east of the SITE. The adjoining intake canals for cooling water are in-place as well as the AGS facility complex, the 22 Freeway and the 405 Freeway to the north. Studebaker Road and Westminster Avenue are also shown on these aerial photographs. The previously vacant land to the south of the SITE is now developed with four large ASTs, although there are still some construction activities in the area. Loynes Drive and the residential development to the west of the SITE are now established. There is grading activity to the southwest of the SITE adjacent and south of Loynes Drive. The generating plant and the associated ASTs of the LADWP east of the San Gabriel River Channel are also shown in the aerial photographs.

1973, 1976, 1983 & 1986

MISSION viewed four aerial photographs over this time period; each depicted the SITE as relatively unchanged. The areas immediately surrounding the SITE are also relatively unchanged except that three more large ASTs have been added to the Tank Farm to the south of the SITE. There is also residential development east of the San Gabriel River Channel beyond the LADWP generating complex.

1988, 1993, 1995 & 1999

These four photographs depicted the SITE and the surrounding areas to be relatively unchanged. The residential development to the east and west of the SITE beyond the two channels is now in-place. The road which separates the LADWP facilities and the residential development to the east is completed as indicated on the 1988 photograph. In general, the SITE and the immediate areas are shown on these aerial photographs as they appear to date.

5.2 Historical Fire Insurance Maps

MISSION retained EDR to perform a search of historical fire insurance maps for the subject property. EDR reported that the SITE has "no coverage" since no Sanborn Fire Insurance Maps depicting the SITE were identified. EDR report is included in Appendix C.

5.3 United States Geological Survey (USGS) Topographic Maps

MISSION reviewed USGS Topographic Quadrangle Maps for years 1925, 1947, 1950, 1951, 1964, and 1964 (photorevised 1970 and 1981) provided by EDR as historical reference for information regarding previous SITE development and usage. Copies of the historical topographic maps are included in Appendix D.

TABLE 2
USGS HISTORICAL TOPOGRAPHIC MAPS

YEAR	QUADRANGLE	SERIES	SCALE
1925	Los Alamitos	6 Minute	1:24,000
1947	Los Alamitos	15 Minute	1:50,000
1950	Los Alamitos	7.5 Minute	1:24,000
1951	Los Alamitos	7.5 Minute	1:24,000
1964	Los Alamitos	7.5 Minute	1:24,000
1964 (Photorevised 1972)	Los Alamitos	7.5 Minute	1:24,000
1964 (Photorevised 1981)	Los Alamitos	7.5 Minute	1:24,000

1925

The SITE is shown as undeveloped and part of the tidal marshes. There is residential development further west of the SITE, along the Pacific Electric Line railroad tracks.

1947

The SITE is still undeveloped and part of the marsh. Southwest of the SITE are numerous oil wells.

1950 & 1951

The SITE is still undeveloped. Los Cerritos Channel passing through the marsh is now shown as well as the San Gabriel River Channel. A Naval Hospital and Bixby Ranch are located to the northeast of the SITE. Oil wells are still present to the southwest of the SITE.

1964 (Photorevised in 1972 & 1981)

The SITE is shown with four large tanks and two small tanks. AGS and the LADWP generating station are also shown.

5.4 Building Department Records

MISSION conducted a file review of available records (dated during 1974 and 1975, and 1980s) at the City of Long Beach Department of Planning & Building. Except for a map which shows the SCE facilities including the SITE (Tank Farm), no other documents specific to the SITE were available. Available records consist of building permits for different building structures and foundations, certificates of occupancy, and permit application to remove two underground fuel storage tanks (USTs) consisting of 10,000-gallon gasoline and 500-gallon waste oil tanks. All available documents were for off-SITE different facilities related to the generating station.

5.5 Fire Department Records

MISSION also conducted a file review of available records (dated during 1975, 1982, 1986, 1987, 1993, 1994, and 1998 to 2003) at the City of Long Beach Fire Department. Available documents which specified the SITE are the Bulk Storage Fire Permit Application (dated April 23, 1987) for aboveground storage of flammable, combustible, and hazardous liquids. This permit covered the operations of the four on-SITE ASTs operated by SCE's Fuel Pipeline operations. Another Permit Application (dated December 27, 1982) which included the four large ASTs is for the "storage, handling, use or sale of flammable and combustible liquids in commercial and industrial establishments". Other available documents which are non-SITE specific include a UST Closure Report (dated April 15, 2003), Business Emergency Plans and Hazardous Inventory Reports (1998-2003), UST Upgrade Compliance Certificate (dated December 23, 1998), and List of Hazardous Chemicals (dated December 1, 1975).

5.6 City Directories

MISSION conducted a search of available city street and telephone directories to identify any previous SITE occupants and gather information regarding former land use. Directories were referenced at the Sherman Library, Newport Beach, California.

Available directories were reviewed for the dates 1945, 1955, 1965 (Polk's Long Beach City Directory) and for 1962, 1967-1969, 1970, 1976, 1982-1984, 1991 (GTE of California Street and Telephone Directories). Studebaker Road is not listed on the directories from 1945 to 1970. Studebaker Road first appeared in the 1976 directory; however neither the SITE address (400 Studebaker) nor the AGS address (690 Studebaker) were not listed. Only the 690 Studebaker address is listed in the July 1982 directory as occupied by "Metal Clad Insulation" and in the July 1991 directory as occupied by "Ultra System Western".

5.7 Title Report and Chain of Title Report

The scope of this Phase I did not include a review of Title Report or Chain of Title Report as part of our research of ASTM-defined "standard historical sources." MISSION assumes that the current owner of the property is already aware of any environmental liens which may exist for the SITE, or has been made aware of such potential liens through their independent review of title reports during the course of the purchase negotiation process. Thus, MISSION is unable to provide conclusions concerning any such environmental liens on the SITE.

5.8 Summary of Historical Sources

The earliest available historical document reviewed for this Phase I is a 1925 USGS topographic map showing the SITE to be a marsh. Based upon review of historical aerial photographs and USGS topographic maps, the SITE appears to have been developed between the years 1954 and 1959. No records were readily available during the Phase I which indicate the actual date when the on-SITE ASTs were constructed. Since the period the ASTs were constructed, possibly almost 50 years, the SITE has been used as tank farm for petroleum products, based upon review of readily available historical documents.

6.0 OTHER ENVIRONMENTAL ASSESSMENTS

6.1 Previous Environmental Assessment Reports

MISSION was provided by LSA with the following environmental reports covering the entire AGS facilities (addressed at 690 Studebaker Road). While the reports were not SITE-specific, they also included discussions pertaining to the four large tanks on-SITE. The environmental reports reviewed by MISSION are as follows:

- "Phase I Environmental Site Assessment Alamitos Generating Station", dated May 1997. Prepared by CH2M Hill and submitted to Southern California Edison Company.

- "Alamitos Generating Station Phase II Environmental Site Assessment", dated June 1997. Prepared by CH2M Hill and submitted to Southern California Edison Company (Figures accompanying this document were not provided).

- "Site Investigation Report for Soil and Groundwater Alamitos Generating Station, Long Beach, California", dated April 1998. Prepared by Woodward-Clyde and submitted to Morrison & Foster. (Figures and several tables accompanying this document were not provided).

Review of environmental reports indicated the following potential environmental concerns for the SITE:

- Citing previous environmental baseline reports for the tanks within the AGS complex (including the SITE tank farm), CH2M Hill (1997) reported that total petroleum hydrocarbon (TPH) contamination was detected in soils in the vicinity of Tanks #1, #2 and #4 at a depth of 3 feet bgs, with maximum concentration of 49,000 milligrams/kilogram (mg/kg). Arsenic was also reported to have impacted the shallow soils.

- TPH-affected soils were excavated and removed from the bottom of Tank #3 due to previous release. Soil samples collected contained TPH in excess of 10,000 mg/kg. The maximum depth of excavation was 3.5 feet bgs conducted in and around the tank area. It was reported that the impacted soil was limited to within a distance of 5 feet from the edge of the tank. Confirmation sampling and analytical results of on-SITE soils after removals indicated concentrations ranging from non-detect to 4,500 mg/kg of TPH.

- A release of natural gas condensate from aboveground pipelines which trend east-west along the intake canal was reported in 1993. TPH was reported in soils at a concentration of 34,000 mg/kg. Approximately 3,250 pounds of mercaptan-affected soils were excavated from the area, transported and disposed at the Chemical Waste Management facility in Kettleman City, California. Because the report provided to MISSION did not include the location map, MISSION could not determine the specific location of this reported release or its potential impact to the SITE.

- A "hazardous waste storage area" was reported to have been impacted by arsenic. It was also reported that no evidence existed that the shallow soils within this area were impacted by petroleum hydrocarbons or VOCs. In the absence of the location map, MISSION could not ascertain whether the "hazardous waste storage area" referred to in the report is the same hazardous material storage facility located on-SITE (Photo #5, Appendix A).

In November 2004, LSA also provided MISSION with the following reports for our review. These reports were briefly cited by CH2MHill (1997) in their environmental site assessment reports.

- "Phase 3 Tank Investigation, Fuel Oil Tank #3, Alamitos Generating Station", dated June 10, 1992. Prepared by Dale Hinkle P.E., Inc. and submitted to Southern California Edison Company.

- "Executive Report and Analysis of Remediation of Oil Tank No. 3", dated January 28, 1993 and prepared by Mr. Gorman L. Wallace, P.E. of the Engineering and Construction Division, Southern California Edison Company.

- "Baseline Tank Study Report Above Ground Oil Storage Tank No's 1, 2, 4 and 8, Alamitos Generating Station", dated October 31, 1995, and prepared by Southern California Edison Company EPE & C Geotechnical Group.

Review of these reports indicated the following environmental issues:

- Oil-soaked gravel with #6 fuel oil was reported beneath Tank #3 during retrofitting with leak detection system and double-wall bottom in 1990. TPH concentrations ranging from non-detect to 4,500 mg/kg were reported in 1990 and 1992.

- The fuel oil was reported to have leaked into the 12-inch thick gravel base (3/4-inch aggregate) and generally the upper 2 feet of compacted native soil, and extended 5 feet beyond tank perimeter. Fuel oil was also locally detected at a depth of 8 feet bgs.

- In 1993, the contaminated materials beneath and around Tank #3 was reportedly remediated by reclaiming approximately 40,000 gallons of oil from the aggregate, processing the contaminated aggregate into cold mix asphalt concrete, and thermally treating the contaminated soils for use as engineered fill. The processed asphalt concrete was used to pave Tank #3 and #4 basins.

- Soil excavation was generally limited to a depth of 5 feet below the bottom of the tank due to the tank structural concern. The excavated materials were replaced with clean, imported 3/4-inch aggregate and sandy soils compacted to 95% maximum density. Deeper portions of the excavations were backfilled with sand-cement slurry

- The report did not indicate whether the remedial measures was conducted under regulatory oversight (e.g, DTSC). It was reported that an application for a disposal permit for the thermally treated soils was denied by the Los Angeles Regional Water Quality Control Board (LARWQCB) because additional confirmatory sampling requested by the LARWQCB showed analytical results of 100 to 500 ppm TPH. The treated soil was ultimately placed as engineered fill at a site in Irvine with the approval of the Santa Ana Regional Water Quality Board (SARWQCB).

- TPH concentrations were reported in soils beneath and around Tanks #1, #2, and #4. High viscosity of the oil and the low permeability of the subsoils were reported to limit oil migration generally within the upper 12 inches of the gravel fill and extending 2 to 5 feet beyond the tank perimeters.

- Detectable TPH concentrations ranging from 10 to 5,800 mg/kg were reported around Tank #1 with maximum concentration encountered at the northern tank perimeter at a depth of 2 feet bgs.

- Detectable TPH concentrations ranging from 20 to 49,000 mg/kg were reported around Tank #2 with maximum concentration encountered at the western tank perimeter at a depth of 2.5 feet bgs.

- Detectable TPH concentrations ranging from 10 to 33,000 mg/kg were reported within the perimeter of Tank #4. Elevated concentrations of 32,000 and 33,000 mg/kg were found within the northern and southwestern tank perimeter at depths of 0.5 and 2.5 feet bgs, respectively.

- TPH-impacted soils beneath and around Tanks #1, #2 and #4 were recommended to be left in place until the tanks are removed.

6.2 Asbestos-Containing Materials and Lead-Containing Materials

Sampling and analysis of Asbestos-Containing Materials (ACMs) and Lead-Containing Materials (LCMs), including Lead-Based Paint (LBP) was not included in the scope of work for this Phase I Report. However, during the SITE visit MISSION observed suspected ACMs used in the insulation for the on-SITE tanks and pipelines. In addition, due to the age of SITE improvements (pre-1978), suspected LCMs (primarily LBPs) were also observed as possibly applied to some SITE improvements. MISSION considers the presence of suspected ACMs as a REC for the SITE, and suspected LCMs to represent a potential REC.

6.3 Radon

Sampling for radon was not included in the scope of work for this Phase I. However, a survey conducted by the U.S. Department of Health Services (DHS, 1991), indicates the SITE is located in Sampling Region 9, where it is estimated that only 0.5% of homes are predicted to have more than 4 pico curies of radon per liter of air (pCi/l). This value of 4 pCi/l is the level at which the U.S. EPA recommends action be taken to reduce radon levels. According to the California EPA, Los Angeles County is classified as a zone 2 county. Zone 2 counties have a predicted average screening level of 2-4 pCi/l. The SITE, therefore, is located in an area with a relatively moderate risk for radon. It should be noted, however, that both the California DHS and U.S. EPA recommend that any given structure for human occupancy be individually tested to determine whether there is a potential to be impacted by the presence of radon regardless of the regional or county zonal classification.

6.4 Oil and Gas

A search of California Division of Oil, Gas and Geothermal Resources (DOGGR) records was undertaken to determine whether any oil or gas fields or wells were located on or near the SITE. According to Map 132 (1992), the SITE is located within the Seal Beach Oil Field. The nearest abandoned exploratory or "wildcat" well and producing oil well are located approximately 2,000 and 2,400 feet, respectively, southwest of the SITE.

7.0 REGULATORY AGENCY RESEARCH

MISSION subcontracted with Environmental Data Resources, Inc. (EDR) of Southport, Connecticut, to obtain a search of environmental regulatory agency sources and databases for sites within or in excess of the minimum ASTM E 1527-00 search radii. A copy of the EDR environmental database report is provided in Appendix C. Table 3 below lists the regulatory databases researched for this report; the number of unique facilities identified in the databases within the search radii; and the section of the report that describes the database findings in detail.

TABLE 3
DATABASES SEARCHED

DATABASES REVIEWED	SEARCH RADII	SITES LISTED WITHIN SEARCH RADII	REFERENCE SECTION OF REPORT
Federal NPL Site List (**NPL**)	1.0 Mile	None	7.1.1
Federal CERCLIS List (**CERCLIS & CERCLIS-NFRAP**)	½ Mile	None	7.1.2
Federal RCRA CORRACTS Facilities List (**CORRACTS**)	1.0 Mile	None	7.1.3
Federal RCRIS Treatment, Storage & Disposal Facilities List (**TSD**)	½ Mile	None	7.1.4
Federal RCRIS Generators List (**SQG & LQG**)	⅛ Mile	1	7.1.5
Federal ERNS List (**ERNS**)	SITE Only	None	7.1.6
State-equivalent NPL (**AWP**)	1.0 Mile	None	7.2.1
Waste Management Unit Database (**WMUDS/SWAT**)	½ Mile	3	7.2.2
State Solid Waste Landfill Facilities Lists (**SWF/LF**)	½ Mile	2	7.2.3
State LUST List (**LUST**)	½ Mile	None	7.2.4
State UST List (**UST**)	¼ Mile	None	7.2.5
State AST List (**AST**)	SITE Only	None	7.2.6
State Spills List (**CHMIRS**)	1 Mile	9	7.2.7
State Hazardous Waste & Substances Sites List (**CORTESE**)	1 Mile	7	7.2.8
State Toxic Pit Cleanup Act Sites (**Toxic Pits**)	1 Mile	2	7.2.9
Spills, Leaks, Investigation & Cleanup (**SLIC**)	½ Mile	1	7.2.10

Pursuant to ASTM Standard Practice E 1527-00, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* the following databases were searched by EDR and reviewed by MISSION personnel. Additional databases were also accessed and searched by EDR and MISSION, which include National Priority List (NPL) Liens and Record of Decision (ROD) sources (Appendix C).

7.1 Federal Regulatory Databases

7.1.1 Superfund National Priority List (NPL)

The NPL is the United States Environmental Protection Agency's (EPA) list of prioritized Superfund sites with significant risk to human health and the environment. These sites receive remedial funding under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This list was reviewed for properties within a one mile radius of the SITE. The most current agency release date for this database was October 2003.

No NPL sites are listed on the environmental database report within a one mile radius of the SITE.

7.1.2 CERCLIS (NFRAP)

Comprehensive Environmental Response, Compensation, and Liability Act Information System List (CERCLIS) is a general database used by the Federal EPA to track activities conducted under its Superfund program. Sites included on this database are initially identified by the reporting requirements of RCRA hazardous waste Treatment, Storage and Disposal (TSD) facilities, site-specific hazardous substance releases with volumes larger than regulatory reportable quantities, and/or water quality data reported by State and local Health or Environmental Protection Agencies.

The EPA sets priority for cleanup using the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). The sites are rated according to a quantitative Hazard Ranking System based upon the potential health risk via any one or more of potential exposure pathways, including groundwater, air, surface water, direct contact and fire/explosion.

Also included on this database search are CERCLIS sites with an assigned status of "No Further Remedial Action Planned" (NFRAP). NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. These lists were reviewed for properties within a ½ mile radius of the SITE. The most current agency release date for the CERCLIS & NFRAP database was September 2003.

No CERCLIS/NFRAP sites are listed on the environmental database report within a ½ mile radius of the SITE.

7.1.3 RCRA Corrective Action Sites List (CORRACTS)

The EPA maintains this database of RCRA facilities which are undergoing corrective actions. A corrective action order is issued pursuant to RCRA Section 3008(h) when there has been a significant release of hazardous waste or constituents into the environment from a RCRA facility. Corrective actions may be required beyond the facility's boundary and can be required regardless of when the release occurred, even if it predates RCRA. This list was reviewed for properties within a one mile radius of the SITE. The most current agency release date for these sites was September 2003.

No RCRA CORRACTS sites are listed on the environmental database report within a one mile radius of the SITE.

7.1.4 RCRIS-TSD Facilities (TSD)

The Federal EPA's Resource Conservation and Recovery Act (RCRA) program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA TSD Facilities database is a compilation of facilities which report generation, storage, transportation, treatment or disposal of hazardous waste. This list was reviewed for properties within a ½ mile radius of the SITE. The most current agency release date for this list was December 2003.

No RCRA-TSD facilities are listed on the environmental database report within a ½ mile radius of the SITE.

7.1.5 RCRIS-LQG and RCRIS-SQG Facilities

RCRIS Large Quantity Generators (LQGs) are facilities which generate at least 1,000 kilograms per month of non-acutely hazardous waste or 1 kilogram per month of acutely hazardous waste. RCRA Small Quantity Generators are facilities which generate less than 1,000 kilograms, but more than 100 kilograms per month, of non-acutely hazardous waste. These lists were reviewed for properties within a ⅛ mile radius of the SITE. The most current agency release date for this list was March 2003.

The Alamitos Generating Station (AGS) is listed on the environmental database report as the "target property", although the power plants are within the immediate vicinity of the SITE. Four types of wastes (D001, D002, D008, and D018), (see Appendix C, following page 48 for explanation of waste codes) were reported to range from 350 to 50,959 lbs. Asbestos-and oil-containing wastes were also reported. No violations were reported.

7.1.6 Emergency Response Notification System (ERNS)

The Emergency Response Notification System (ERNS) is a national database used to collect information on reported releases of oil and hazardous substances. The database contains information on releases of oil and hazardous substances. This list was reviewed for the SITE property. The most current agency release date for these sites was January 2003.

No information on the release of oil and/or hazardous materials was reported on the ERNS database for the SITE.

7.2 State Regulatory Databases

7.2.1 CAL-SITES (Annual Work Plan - AWP)

This database is provided by the California Environmental Protection Agency (CalEPA), Department of Toxic Substances Control (DTSC), and is known as the state-equivalent of the CERCLA or Superfund National Priorities List. This database includes all high-priority CalEPA Annual Work plan Sites with significant hazardous waste or substance releases and corrective action. This list was reviewed for properties within a one mile radius of the SITE. The most current agency release date for the State Hazardous Sites List was November 2003.

No AWP sites are listed on the environmental database report within a one mile radius of the SITE.

7.2.2 Waste Management Unit Database (WMUDS/SWAT)

The WMUDS/SWAT database is used by the State Water Resources Control Board staff and the Regional Water Quality Control Board for program tracking and inventory of solid waste management units. WMUDS is composed of the following sub-databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, Toxic Pits Cleanup Act (TPCA) Program Information, Closure Information, and Interested Parties Information. The most current agency release dates for these various databases were between July 1995, and April 2000.

Three WMUDS/SWAT sites are listed on the environmental database report within a ½ mile radius of the SITE. These are identified on the databases as "Studebaker-Cerritos Channel", "Studebaker-Loynes Disposals", and "City Dump & Salvage #4". These three facilities are approximately 122 to 975 feet west of the SITE. Except for the Waste Discharge Identification for the "Studebaker-Cerritos Channel"Site, no other information was provided. The other two Sites were reportedly owned by Bixby Ranch and also listed in the SWF/LF database (Section 7.2.3).

Based upon the reported nearby location of two of these properties 122 feet west and 145 feet west-northwest of the SITE and lack of regulatory agency closure status provided in the EDR database, MISSION conducted a review of available records/files for these facilities at the offices of the LARWQCB and the Environmental Health of the Los Angeles County Department of Health Services-Public Health (LACDHSPH).

These two landfills which are currently closed were previously operated by City Dump and Salvage, Inc. (no longer in business) between 1949 and 1960 as Class II Sanitary Landfills pursuant to Subchapter 15 of Chapter 3, Title 23 of the California Administrative Code. As Class II landfills only the following wastes were accepted at these facilities: ordinary households and commercial refuse (e.g., garbage), and non-soluble, non-decomposable inert solids (e.g., construction debris). No liquid, semi-liquids, and hazardous wastes were permitted for disposal in these facilities. The landfills were reported to be opened to the public. The two facilities nearest the SITE are:

- *Studebaker-Loynes Sanitary Landfill (AKA Studebaker-Cerritos Channel Dump, Studebaker-Loynes Disposal Site, City Dump and Salvage No. 3, and Middough Dump)*

  The records in the LACDHSPH file identified this landfill as City Dump Salvage No. 4 with Facility No. 19-AK-5004.

  The Studebaker-Loynes Sanitary Landfill (EDR Report listed this facility as two separate sites) is located adjoining and along Studebaker Road to the west. It consists of an approximate 6.9-acre rectangular parcel, approximately 1,500 feet long and 200 feet wide. Its northern portion which is bisected by Loynes Drive is situated to the west of the SITE. This landfill was operated from 1959 to 1960 pursuant to LARWQCB Resolution No. 59-63. The landfill contained a total of 160,000 cubic yards of wastes. During the operations of the Studebaker-Loynes Sanitary Landfill, the five on-SITE ASTs were already in-place. Thus, it is unlikely that wastes from this landfill could have been placed at the SITE. According to available regulatory records, Solid Waste Assessment Test (SWAT) investigation and groundwater monitoring were conducted within the landfill site between 1988 and 1995. No USTs, pits, sumps, and other subsurface containment facilities were reported to occur in the disposal site. It was also reported that no administrative civil liability complaints were filed for the site.

- *City Dump and Salvage No. 1 (AKA Bixby Village Disposal Site and as Loynes-Bixby Village Landfill)*

  The City Dump and Salvage No. 1 is located approximately 1,000 feet west-northwest of the SITE. The former landfill occupied an irregularly-shaped parcel approximately 4,000 feet long and 2,000 feet wide of its widest point, bounded by Los Cerritos Channel to the south and the Pacific Coast Highway to the west. The landfill was operated by City Dump and Salvage, Inc. between 1949 and 1956 pursuant to the LARWQCB Board Resolution No. 56-35. This former landfill has been developed with golf course, condominium, mobile

home park, hotel and restaurants. According to available regulatory records, SWAT investigation and groundwater monitoring were conducted in 1988 to early 1990s. No USTs, pits, sumps, and other subsurface containment facilities were reported in the disposal site. During our review of regulatory files, MISSION did not find any records of administrative civil liability complaints for the site.

Considering the types of wastes that were previously accepted at the landfills which consisted of solid, inert, non-hazardous wastes, and the extensive environmental investigation conducted for the sites under the oversight of regulatory agencies, and considering further that they are located cross-gradient with respect to the anticipated flow of shallow groundwater beneath the SITE, MISSION concludes it is unlikely that these two nearby landfills have significantly impacted the SITE. Thus, MISSION recommends no further investigation relative to landfill sites.

7.2.3 Municipal Solid Waste Facilities/Landfill Facilities (SWF/LF)

This database is a compilation of information supplied from the CalEPA-California Integrated Waste Management Board and State Water Resources Control Board, and contains lists of both active and inactive landfills. The list includes: Closed Solid Waste Landfills, Closed Solid Waste Dumps, Municipal Solid Waste Landfills, Rubbish Landfills, and Private Solid Waste Landfills. This list was reviewed for properties within a ½ mile radius of the SITE. The most current agency release date for this database is March 2003.

Two SWF/LF sites, listed on the environmental database report within a ½ mile radius of the SITE, are the "Studebaker-Loynes Disposals", and "City Dump & Salvage #4" (Section 7.2.2). These facilities were permitted and were reported to be closed.

7.2.4 Leaking Underground Storage Tank File Listing (LUST)

The Leaking Underground Storage Tanks (LUST) File Databases are maintained by the State Water Resources Control Board, and sites are locally enforced by the Los Angeles Regional Water Quality Control Board. These lists were reviewed for properties within a ½ mile radius of the SITE. The most recent agency release date for these listings was April 2003.

No LUST sites are listed on the environmental database report within a ½ mile radius of the SITE.

7.2.5 Permitted Underground Storage Tanks (UST)

This database is provided by the State Water Resources Control Board and contains a listing of registered USTs located within the area of the SITE. This list was reviewed for properties within a ¼ mile radius of the SITE. The most recent agency release date for registered UST sites was April 2003.

No registered UST sites are listed on the environmental database report within a ¼ mile radius of the SITE.

7.2.6 Permitted Aboveground Storage Tanks (AST)

This database is provided by the State Water Resources Control Board and contains a listing of registered ASTs at the SITE. The most recent agency release date for AST sites was December 2003.

The SITE is not listed on the environmental database report for ASTs. However the SITE contains four large and two small ASTs probably installed in late 1950s.

7.2.7 State Spills List (CHMIRS)

This database is a compilation of two databases provided by state regulatory agencies including the State Office of Emergency Services (California Hazardous Material Incident Reporting System - CHMIRS) and the California Regional Water Quality Control Board (SLIC). The CHMIRS database contain information on reported hazardous material incidents (accidental releases or spills). These databases were reviewed for properties within a one mile radius of the SITE. The most current agency release date for this database is December 2002.

The EDR report identified nine listings on the State Spills List (CHMIRS) database within the recommended ASTM search distance within one mile of the SITE. According to the EDR report the listed CHMIRS properties are:

- *Alamitos Generating Station, 690 N. Studebaker Road, Long Beach*
  Three incidents of accidental releases/spills of petroleum hydrocarbon products were reported on December 6, 1997, August 20, 1998, and April 12, 1999. The first reported incident involved oil overflow which flowed into the drain and was trapped inside the facility. The other incidents involved rupture of pipeline and leak through valve within the generating station causing release of fuel oil into the water intake canal. The EDR report indicated that

the spills were contained and cleaned up. Based on the information in the EDR database indicating that the reported spills contained and cleaned up, MISSION concludes that these reported spills do not represent a REC for the SITE.

- *6230 Parima Street, Long Beach*
  3,380 feet northwest of the SITE.
  Paint and water was reported to have been intentionally dumped through the storm drain on May 5, 1998. No other information was given.

- *6401 E. Pacific Coast Highway, Long Beach*
  3,964 feet southwest of the SITE.
  Gasoline was reported to have been spilled into the storm drain on June 30, 1995. No other information was given.

- *6264 E. Pacific Coast Highway (Basin 6 Key 19), Long Beach*
  4,032 feet west-southwest of the SITE. Two acres of diesel sheen was reported on June 15, 1999; The source was unknown. No other information was given.

- *6201 E. 2nd Street (Slip #103), Long Beach*
  4,630 feet, southwest of the SITE. Gasoline was reported to have been spilled when a pleasure craft sank at the dock due to heavy rain on February 13, 2001. No other information was given.

- *6201 E. 2nd Street (Boat Launch Ramp), Long Beach*
  4,630 feet southwest of the SITE. Diesel was spilled when a 14-foot boat was sinking and was leaking on May 15, 2002. Source was unknown. No other information was given.

- *6201 E. 2nd Street, Long Beach*
  4,630 feet southwest of the SITE. Motor oil was spilled when a motor was dropped while taking out an old engine causing a spill on May 14, 2002. No other information was given.

- *6228 Napoli Court (Slip 21-25), Long Beach*
  4,913 feet west-southwest of the SITE. Oil based paint was spilled into a waterway on May 25, 1998. Source was unknown. No other information was given.

- *6201 Marina Drive (Near Shipyard adjacent to Gangway), Long Beach*
  5,082 feet southwest of the SITE. 50 yard by 50 yard diesel sheen was discovered by a rescue boat on October 12, 1999. Source was unknown. No other information was given.

MISSION also concludes that the spill events reported on properties other than AGS and appearing on the CHMIRS database do not represent a REC, based upon the distance from the SITE, and the nature where the spills were discovered (e.g., waterways).

7.2.8 State Hazardous Wastes & Substances Sites (CORTESE)

The sites for the CORTESE list are designated by the State Water Resources Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

The EDR report identified seven unique properties from the CORTESE database within the recommended ASTM search distance of one mile of the SITE. According to the EDR report the listed CORTESE properties are:

- *Exxon Sta No. 73047; 6401 E. Pacific Coast HWY, Long Beach*
  3,964 feet southwest of the SITE.
  MTBE was reported in groundwater (1996) which was impacted by gasoline. Floating product was reportedly removed, and remedial action (cleanup) was initiated in December 1999.

- *Chevron #9-0016: 6901 Westminster Avenue, Long Beach*
  4,085 feet southwest of the SITE.
  Gasoline was reported to have impacted groundwater in 1987. According to the available information the status of this site is "case closed" as of January 11, 1995.

- *76 Products Station #5379: 6280 2nd Street, Long Beach*
  4,223 feet southwest of the SITE.
  Gasoline was reported to have impacted groundwater in 1987. According to the available information the status of this site is "remedial action" is underway and the date of "enforcement action" is July 28, 2000.

- *Golden Rain Foundation: 1280 Golden Rain Road, Seal Beach*
  4,524 feet east-southeast of the SITE.
  Waste oil was reported to have impacted subsoils in January 1987. According to the available information the status of this site is "case closed" as of May 7, 1987.

- *GTE Corporation: 2400 Beverly Manor, Seal Beach*
  4,558 feet northeast of the SITE.
  The environmental database listed hazardous wastes consisting of asbestos-

containing materials (ACMs), tank bottom waste, and PCB-containing materials. The Waste oil was reported to have impacted subsoils in January 1987. According to the available information the status of this site is "case closed" as of May 7, 1987. Disposal methods indicated in the database are landfill disposal for ACMs, treatment for tank bottom waste, and recycling for PCB-containing wastes.

- *Alamitos Bay Maintenance Yard: 6204 E. 2ND Street, Long Beach*
  4,616 feet southwest of the SITE.
  Gasoline (containing MTBE) was reported to have impacted groundwater in August 1987. According to the available information the status of this site is "case closed" as of November 25, 1997.

- *Marina Shipyard: 6400 Marina Drive, Long Beach*
  4,798 feet southwest of the SITE.
  Gasoline (containing MTBE) was reported to have impacted groundwater in 1985. According to the available information the status of this site is "case closed" as of September 22, 1997.

Based upon the distances from the SITE, the hydrogeologically downgradient locations of these properties with respect to the anticipated groundwater flow from the SITE, or the regulatory status of "case closed", MISSION concludes that these off-SITE properties listed on the CORTESE database do not represent a REC for the SITE.

7.2.9 State Toxic Pit Cleanup Act Sites (Toxic Pits)

The State Toxic Pit Cleanup Act Sites (Toxic Pits) database identifies sites suspected of containing hazardous substances where cleanup has not been yet been completed.

The EDR report identified one property from the Toxic Pits database within the recommended ASTM search distance within one mile of the SITE. According to the EDR report the listed Toxic Pit property is:

- *SCE, Alamitos Generating Station: 690 Studebaker Road, Long Beach*
  Toxic pits were reported to be located within the AGS complex. According to the available information, the final geological assessment review was completed on May 27, 1988 and this site was ordered to cease discharge to the pits on February 26, 1995. Closure of the toxic pits was not reported.

- *Haynes Generating Station: 6801 Westminster Avenue, Long Beach*
  2,709 south-southeast of the SITE
  The generation station where the toxic pits were located is owned by the Los Angeles City Department of Water and Power. According to the available information, cease discharge was completed in May 1985 and the final geological assessment review was completed on June 15, 1989. Closure of the toxic pits was completed as of October 18, 1990.

Based upon the completion of the geological assessment review and the cease discharge order in the toxic pits, MISSION concludes that the listing of the AGS on the Toxic Pits database represents a potential REC for the SITE. Considering its distance and position hydrogeologically down/cross gradient with the anticipated groundwater flow, the Haynes site is not considered to represent a REC for the SITE.

7.2.10 Spills, Leaks, Investigation & Cleanup (SLIC)

The Spills, Leaks, Investigation & Cleanup (SLIC) Cost Recovery database is compiled by the California Regional Water Quality Control Board - Los Angeles Region (LARWQCB). The SLIC database contains information concerning any site with reported surface spills of hazardous wastes which impact groundwater or have the potential to impact groundwater. This database was reviewed for properties within a ½ mile radius of the SITE. The most current agency release dates for this database was October 2003.

The EDR report identified one property from the SLIC database:

- *SCE - Los Alamitos: 690 Studebaker Road, Long Beach*
  This property has been identified as the target property. The status of this SLIC site is under site assessment of TPH. Because the SITE is part of the target property, this listing represents a potential REC for this SITE.

7.3 Local Agencies

7.3.1 City of Long Beach Fire Department

MISSION contacted the City of Long Beach Fire Department, Bureau of Fire Prevention (LBFD) for information regarding storage of hazardous materials, emergency responses, notices of violation, or permitted USTs or ASTs at the SITE (Appendix B).

Except for two permit applications which included the SITE, no other SITE specifics documents were found in the LBFD records. These two documents are: 1) Bulk Storage Fire Permit Application (April 23, 1987) for the aboveground storage of flammable, combustible, and hazardous liquid; and, 2) Permit Application (December 27, 1982) for the storage, handling, use or sale of flammable and combustible liquids in commercial and industrial establishments, as discussed in Section 5.5.

MISSION did not find any information from these documents that would constitute a REC for the SITE.

7.3.2 City of Long Beach Department of Building & Planning

MISSION contacted the City of Long Beach Building Department for information regarding building, UST and AST permits or any other records issued for the SITE (Appendix B).

MISSION did not find any permit for the on-SITE ASTs. The available building permits and other documents are those related to the generating station as discussed in Section 5.4.

MISSION did not find any information from these documents that would constitute a REC for the SITE.

7.3.3 Department of Toxic Substances Control (DTSC)

MISSION contacted the DTSC for information regarding any environmental issues regarding the SITE (e.g., USTs, spills, investigations and cleanups).

No records were found in DTSC files which specifically pertain to the SITE (Tank Farm). All of the records found are for the facilities of the AGS. The available files reviewed by MISSION consist of the following: "Hydrogeologic Assessment Report, Alamitos Generating Station" (January 27, 1986) which pertains to the investigation of the Chemical Cleaning Basins in accordance with the Toxic Pits Cleanup Act of 1984; "Quarterly Sampling Report, Groundwater Monitoring Program" (May, September and November 2001) which pertains to the groundwater sampling and monitoring at the four AGS basins; DTSC Inspection Reports (2001, 2002); and Report of Violation (1992). Documents of the Los Angeles Regional Water Quality Control (LARWQCB) were found in the DTSC files. These LARWQCB documents include a copy of NPDES Permit (CA 0001139) issued to AGS; NPDES Compliance Reports and Inspection Reports for years 1981-1984; Waste Analysis Plan; and analytical results (Appendix B).

MISSION did not find any information from these documents that would constitute a REC for the SITE.

7.3.4 Los Angeles Regional Water Quality Control Board (LARWQCB)

MISSION contacted the LARWQCB to request an appointment to review of available files or records pertaining to any environmental issues for the SITE.

Mr. C. Campos of the LARWQCB responded on February 6 and 8, 2004 that they did not have any records for the SITE in their databases. A note regarding the agency's reply is included in Appendix B.

7.3.5 South Coast Air Quality Management District (SCAQMD)

MISSION contacted the SCAQMD for information regarding permits to operate, inspection reports, and notices of violations, or any other records issued for the SITE. *MISSION reviewed the records sent to us by SCAQMD in response to our request. These records are for permitted equipment including storage tanks, inspectors' reports, records of public complaints and action taken, and notices of violation. All of the documents refer to the generating plants, and no specific records were available for the SITE.*

MISSION did not find any information from these documents that would constitute a REC for the SITE.

8.0 METHANE SOIL GAS INVESTIGATION AND AIR SAMPLING

8.1 Methane Soil Gas Investigation

MISSION retained American Analytics, Inc., a California Department of Health Services (DOHS) Environmental Laboratory Accreditation Program (ELAP)-certified laboratory to assist MISSION in a preliminary methane soil gas investigation conducted at the SITE on March 1, 2004. The primary objective of this investigation was to determine the presence and concentrations of suspected methane gas which may be present beneath the SITE considering that the SITE lies within an oil field, and that the SITE was reportedly backfilled with highly organic soils. The presence of methane above regulatory threshold may impact the design and construction of the commercial center.

As shown in Figure E-1 (Appendix E), eight soil gas probe locations (SV-1 through SV-8) and six "step-out" probes (SV-1A, SV-1B, SV-1C, SV-2A, SV-2B, and SV-3A) were advanced at the SITE. The soil gas probes were located within the footprints of proposed building or pad and in selected areas to effect a SITE-wide coverage. Probe SV-1 was located at the southeast corner of the Tank #4 area and SV-2 was located within the footprint of the Home Depot Building west of Tank #4. Due to very high methane concentrations detected in these two initial probes, "step-out" probes from SV-1 and SV-2 were advanced in locations ranging from 50 to 180 feet from either of the initial probes. Tank #3 area was investigated by two probes (SV-3 and SV-3A). SV-4 was advanced near the former hazardous materials storage area along the northern boundary of the SITE. Tank #1 area was investigated by probes SV-5 and SV-6 and Tank #2 area by probes SV-7 and SV-8.

8.1.1 Soil Gas Sampling and Analysis

The soil gas (vapor) probes were installed using a van-mounted, direct-push/hydraulic sampling system by driving a 1⅛-inch outer diameter, stainless steel probe into the subsurface down to the sampling target depth of 5 feet bgs. After reaching the sampling depth, the probe was retracted to expose soil section to be sampled. Dedicated, virgin Teflon™ tubing was inserted down the borehole through the stainless steel probe string, and mated to the point holder adapter mounted on the distal (deep) end of the sampling train. O-ring connections were used to enable the system to deliver a vacuum-tight seal to assure that the sample is collected at the bottom (sampling depth interval).

SITE-specific probe purging and sample volume calibration were performed to evaluate the appropriate minimum volume of soil vapor to be purged from each probe prior to sample collection in order not to disturb the soil vapor condition existing in the soil. Purging was conducted with a vacuum pump at an optimum flow rate (estimated to be less than 100 ml/min) in an effort to ensure representative vapor samples were collected from the selected sampling depth, and that the "zone of sampling influence" was restricted such that it did not intersect the ground surface, or other sampling locations (i.e., its radius of influence was minimized).

Soil gas samples during AA's sampling event were collected in 10-cc gas-tight, glass syringes from the sample port of a 3-way stainless steel valve, located upstream from the purge pump. The 3-way valve was equipped with a shut-off valve at each end and a vacuum gauge located between the shut-off valve and the purge pump. Following purging of the appropriate tubing volume, the vacuum gauge was allowed to reach normal pressure (within 2 seconds) before the purge tubing valve was closed and the soil gas sample was collected. The vacuum gauge was monitored to ensure that the sample was not influenced by ambient air. Each sample was immediately transferred to the on-SITE mobile laboratory for analysis within one hour following sample

collection. Samples were directly injected from the syringe into the gas chromatograph (Appendix E).

8.1.2 Laboratory Analytical Results

The preliminary soil gas investigation shows the following results:

- Methane was reported by AA laboratory at concentrations below detection limit ("non-detect" or ND) in soil gas probes SV-5 through SV-8 located within the areas of Tank # 1 and Tank #2.

- A soil gas sample could not be collected from soil gas probe SV-4 located near the Hazardous Material Storage facility due to the clayey nature of the subsoils.

- Two soil probe locations (SV-3 and SV-3A) in the Tank #3 area indicated methane at concentrations of 540 parts per million in air volume (ppm) and 1,400 ppm, respectively. These levels of concentration are below usual regulatory threshold of 5,000 ppm (e.g., OCFA, 2003; RCODEH, 2001).

- Soil probes SV-1, SV-1A, SV-1B, SV-1C, SV-2, and SV-2A, S-2B were located within the Tank #4 area in the southeast portion of the SITE. Soil gas samples collected from probes SV-1A, SV-1B, SV-1C and SV-2A were reported to contain methane at concentrations of 800 ppm to 4,600 ppm, which is below usual regulatory threshold. Soil gas samples collected from probes SV-1, SV-2, and SV-2B were reported to contain methane at concentrations of 18,000 ppm, 5,000 ppm, and 40,000 ppm, respectively which are well above regulatory limit.

Based upon the results of the methane soil gas investigation, MISSION concludes that the presence of methane at concentrations exceeding regulatory threshold could impact the construction of the SITE and constitutes a potential health and safety hazard. Presence of methane may require mitigation measures, based upon the results of a recommended detailed methane soil gas investigation which should be performed following rough grading of the SITE.

8.2 Air Quality Sampling

In order to investigate the air quality on the SITE, two air samples were collected by MISSION on March 1, 2004 in open areas using Summa canister containers. Air sample SC-1 was collected near the ramps to Tank #1 and Tank #2, and SC-2 was collected east of Tank #4 inside the berm enclosure area. An off-SITE sample (SC-3) was also collected in an open area north of the SITE in the vicinity of Studebaker Road and Freeway 22 to determine ambient air quality. The three Summa canisters were analyzed for volatile organic compounds (VOC) via EPA method TO-14A and methane via ASTM D1946 in an off-SITE laboratory of Severn Trent Laboratory (STL) of Los Angeles, a California DOHS ELAP-certified laboratory. STL reported that none of the VOCs constituents and methane were detected at concentrations equal to or above their respective detection reporting limits (Appendix F).

Based upon the results of the preliminary air quality sampling and analysis, MISSION concludes that the air quality within the areas investigated does not currently represent a REC for the SITE.

9.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon information obtained by MISSION during the performance of this assessment, we present our observations and conclusions:

9.1 On-SITE Observations

- The SITE consists of an approximate 17.8-acre property currently improved with four large and two small petroleum aboveground storage tanks, aboveground petroleum pipelines and associated pumping facilities situated within the Alamitos Generating Station (AGS) complex. The tanks are currently inactive, and are scheduled for removal prior to SITE development. Based upon review of historical documents, the SITE has been a Tank Farm for almost 50 years; thus MISSION concludes that the potential for hazardous materials or wastes in groundwater and/or soils beneath the SITE from this continuous usage of the SITE as a tank farm constitutes a REC for the SITE.

- Methane soil gas concentrations were detected within the Tank #4 area, at concentrations as high as 40,000 parts per million in air by volume (ppm) during our preliminary methane soil gas investigation. Considering that this level of concentration exceeds current, usual regulatory threshold of 5,000 ppm, MISSION concludes that the presence of methane in the shallow soils in the areas investigated constitutes a potential health and safety hazard for the SITE.

- Review of readily available environmental reports provided by LSA indicates that shallow soils beneath and around on-SITE tanks were impacted by #6 fuel oil. Maximum TPH concentrations of 5,800 mg/kg, 49,000 mg/kg, 4,500 mg/kg, and 33,000 mg/kg were reported to have impacted the underlying soils beneath Tank #1, #2, #3, and #4, respectively. Considering that in the case of Tank #3, contaminated soils were removed and replaced with clean, imported crushed gravel and soils, MISSION concludes that this reported impact is no longer be a REC for the SITE subject to appropriate regulatory agency approval of remedial efforts performed. However, an available report (SCEC, 1995) reviewed by MISSION recommended leaving contaminated soils reported beneath Tanks #1, #2 and #4 in place. MISSION concludes that the presence of elevated TPH concentrations in soils beneath and around Tank #1, #2, and #4 are considered a REC for the SITE.

- An empty hazardous material storage facility and a concrete-lined sump were observed at the SITE east of Tank #1. MISSION concludes that the presence and former usage of this facility constitutes a potential REC for the SITE.

- Four concrete pad mounted transformers were observed during the SITE visit. One of these transformers is on-SITE, south of the concrete-lined sump. Due to the suspected presence of PCB-containing oil, this transformer represents a potential REC for the SITE.

- Sampling and analysis of Asbestos-Containing Materials (ACMs) and Lead-Containing Materials (LCMs), including Lead-Based Paint (LBP) was not included in the scope of work for this Phase I Report. However, during the SITE visit MISSION observed suspected ACMs used in the insulation for the on-SITE tanks and pipelines. In addition, due to the age of SITE improvements (pre-1978), suspected LCMs (primarily LBPs) were also observed as possibly applied to some SITE improvements. MISSION considers the presence of suspected ACMs as a REC for the SITE, and suspected LCMs to represent a potential REC.

- MISSION retained Environmental Data Resources, Inc. (EDR) of Southport, Connecticut, to conduct a search of environmental regulatory databases for sites within or in excess of the minimum specified ASTM E 1527-00 search radii relative to the SITE. The SITE is not specifically listed on the EDR Report. However, the "AGS" facility, of which the SITE is a part, is listed as a RCRIS-LQG, RCRIS-SQG, SLIC, CHMIRS, and Toxic Pits site within the most recent versions of the Federal, State, or local databases of the EDR Report. Due to the lack of additional information concerning the AGS and active status listed on the database, the listing of AGS on the CHMIRS, SLIC and Toxic Pits databases represents a potential REC for the SITE.

- Three incidents of accidental releases/spills of petroleum hydrocarbon products were reported on December 6, 1997, August 20, 1998, and April 12, 1999. The first reported incident involved oil overflow which flowed into the drain and was trapped inside the facility. The other incidents involved rupture of pipeline and leak through valve within the generating station causing release of fuel oil into the water intake canal. The EDR Report indicated that the spills were contained and cleaned up. Based on the information in the EDR database indicating that the reported spills contained and cleaned up, MISSION concludes that these reported spills do not represent a REC for the SITE.

- Two on-SITE and one off-SITE air samples were collected via Summa canisters to determine air quality at the SITE and vicinity. Considering that none of the target volatile constituents or methane were detected at concentrations equal to or above their respective reporting detection limits in the air samples collected, and considering further that MISSION's review of the records provided by the South Coast Air Quality Management District (SCAQMD) indicated regular facility inspections and that air emissions surveillance by SCAQMD is on-going, MISSION concludes that the air quality on-SITE is not currently considered a REC for the SITE.

9.2 Off-SITE Observations

The immediate off-SITE vicinity contains power generating facilities including generating units, boilers, tanks, intake canals, retention ponds, and other permitted equipment; tidal flood channels, roads and residential development. No visual indications of the mismanagement of observed hazardous materials or wastes were noted on properties in the immediate vicinity of the SITE observed during our SITE reconnaissance.

- No properties were identified within the search radii from the SITE (as specified by ASTM Standard Practice E 1527-00) within the following environmental regulatory databases research for this Phase I: NPL, CERCLIS, CERCLIS-NFRAP, CORRACTS, RCRA-TSD, ERNS, AWP, LUST, UST, and AST. In the EDR Report, EDR considered and reported the AGS facility which includes the SITE as a portion of the "target property" (as discussed above). The EDR Report identified off-SITE properties as follows: three properties in the WMUDS/SWAT, two properties in the SWF/LF, eight State Spills (CHMIRS) sites, seven in the CORTESE database, and one in the Toxic Pits database. Considering their distances and positions hydrogeologically down gradient or cross gradient with the anticipated groundwater flow beneath the "target property", and/or their reported regulatory status, these off-SITE facilities are not considered a REC for the SITE. The WMUDS/SWAT sites, Studebaker/Loynes Disposal Site and Studebaker-Cerritos Channel, were identified as located 122 feet west and 145 feet west-northwest of the SITE. Based upon their close proximity to the SITE, MISSION conducted a review of available records/files for these facilities at the offices of the LARWQCB and the Los Angeles County Department of Health Services-Public Health (LACDHSPH). These two landfills which are currently closed were previously operated until 1960 by City Dump and Salvage, Inc. (no longer in business) as Class II Sanitary Landfills. As Class II landfills only the following wastes were accepted for disposal: ordinary households and commercial refuse (e.g., garbage), non-soluble, non-decomposable inert solids (e.g., construction debris). No liquid, semi-liquid, and hazardous wastes were permitted for disposal in these facilities. Considering the types of wastes that were accepted at the landfills and the extensive environmental investigations for the sites under the oversight of regulatory agencies, and considering further that they are located cross-gradient with respect to the anticipated flow of shallow groundwater beneath the SITE, MISSION concludes it is unlikely that these two nearby closed landfills have significantly impacted the SITE. Thus, MISSION recommends no further investigation relative to these landfill sites.

9.3 Recommendations

Based upon the available information gathered during the performance of this Phase I and the above-mentioned conclusions, MISSION presents the following recommendations:

- Prior to the grading and construction of the SITE, and after the removal of the on-SITE ASTs, pipeline conveyance systems and hazardous material facilities, a detailed soil matrix investigation for petroleum hydrocarbons and Title 22 metals at a minimum should be conducted beneath the former footprints of all on-SITE tanks, the area of the hazardous material storage facility, along pipelines, and each of the spill sites reported in the regulatory database (Section 7.2.7). The primary purpose of this investigation is to confirm the previously reported remediation in Tanks #3, and to delineate the reported soil impact around and beneath Tanks #1, #2, and #4. This investigation should also assess the area beneath the sump in order to determine whether the shallow soils have been impacted as the result of its previous operation.

  Within the areas of the on-SITE tanks and the hazardous material storage facility, continuous core samples of soil should be collected from borings advanced on a 50-foot grid spacing. Continuous core samples of soil should be collected from borings advanced every 100 feet along pipelines and at significant pipeline joints and terminations. Two borings should be advanced beneath the sump to collect continuous core samples of soil. Each core sample should be examined in detail by a California Registered Geologist who is experienced and qualified to perform hazardous waste investigations for indications of chemical impact. Samples of the cores indicating suspected impact (from the surface and each five-foot depth thereafter, if not visually impacted) should be retained and analyzed for petroleum hydrocarbons and Title 22 metals at a minimum by a laboratory with a California Department of Health Services Environmental Laboratory Accreditation Program (DOHS-ELAP) Certifications for the analysis they performed. In addition, sampling and analysis for PCBs of the oil inside the transformer and/or immediately underlying soil should also be performed to determine if PCBs are present.

- Undocumented fills and petroleum hydrocarbon-impacted soils were reported to occur on-SITE. MISSION recommends that an on-SITE Soil and Air Monitoring Program (to be approved by the City of Long Beach) be prepared and implemented during SITE grading and excavation. Air monitoring should be in conformance with applicable rules and regulations of the SCAQMD. Petroleum hydrocarbon-impacted soils found to contain petroleum hydrocarbon constituents in excess of prevailing regulatory thresholds should be removed and recycled at an appropriate State-approved facility.

- High concentrations of methane exceeding regulatory limits were detected in shallow on-SITE soils during a preliminary methane soil gas investigation in the area where the proposed Home Depot building pad is planned to be constructed. Thus, MISSION recommends that additional methane soil gas investigation be conducted following rough grading and prior to building construction and utility installation. A workplan for the additional methane soil gas investigation should be prepared, reviewed and approved by the City of Long Beach prior to its implementation. The additional methane soil gas investigation should be performed in accordance with the local

industry standards. The results should be presented in a formal report which includes recommendations to mitigate potential hazards from methane, if required. The report should be reviewed and approved by the City of Long Beach. Based upon the results of this additional investigation, mitigation measures may be necessary including providing conventional vapor barriers and venting systems beneath buildings and confined spaces. Methane mitigation measures should be approved by the City of Long Beach.

- Prior to the demolition and removal of the ASTs and the pipeline conveyance system, thorough sampling and analysis of all suspected ACMs should be conducted, and an Operating & Maintenance Plan (O & M) be prepared for all ACMs to be left in place, and specifications for the removal of all ACMs should be prepared. The results of the asbestos analysis and the O & M Plan will provide specifications and procedures on handling ACMs encountered during demolition, including protection of workers and the general public from exposure to airborne asbestos. All ACMs should be removed (abated) by an appropriately licensed asbestos removal contractor in accordance with applicable regulations. Air monitoring for the detection of airborne asbestos fibers should similarly be conducted during all ACM removal under the direction of a California Certified Asbestos Consultant, pursuant to EPA/AHERA Section 206 and CCR Title 8, Article 2.6, to ensure both adherence to applicable regulations and the safety of all personnel in the ACM abatement area, and the general public as well.

- Prior to the demolition and removal of the SITE improvements, thorough sampling and analysis of all suspected LCMs should be conducted. Appropriate specifications should be prepared to incorporate the stabilization of all LCMs to be left in place or for the removal of the LCMs. LCMs should be managed and disposed of according to proper waste characterization/stream analyses for total threshold limit concentration (TTLC); soluble threshold limit concentration (STLC), and toxicity characteristic leaching procedure (TCLP). Appropriate work practices and worker protection should be utilized.

10.0 LIMITATIONS

This Phase I Site Assessment was performed in accordance with ASTM E 1527-00. The purpose of ASTM E 1527-00 is to define good commercial and customary practice for conducting the environmental site assessment of a parcel of commercial real estate with respect to the range of contaminants within the scope of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and petroleum products. As such, this practice is intended to permit a user to satisfy one of the requirements to qualify for the innocent landowner defense of CERCLA liability: that is, the practices that constitute "all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice" as defined in United States Code 42, §9601 (35)(B).

MISSION's investigation represents a review of reasonably ascertainable, practically reviewable and accessible information concerning potential hazardous wastes and material on or in the immediate vicinity of the SITE.

The results of the assessment provided herein are in no way intended to represent a guarantee that the subject property is free from past, present or future hazardous waste contamination, but only that a reasonable inquiry has been conducted to assess the likelihood of such potential contamination under current applicable law. Furthermore, the accuracy of the results of the regulatory agency database searches, the soil gas investigation conducted, and the laboratory analyses performed are constrained and limited by the level of care and professional skill exercised by the sub-consultants/sub-contractors retained by MISSION to perform these tasks.

11.0 REFERENCES

Technical References

Beeby, D.J, Miller, R.V., Hill, R.L., and Grunwald, R.E., 1999, Aggregate resources in the Los Angeles metropolitan area, Division of Mines and Geology Miscellaneous Map No. 010.

California Department of Conservation, 1992, Division of Oil & Gas Map # 132, Seal Beach, Los Angels, and Orange counties, scale: 1 inch = 500 feet.

California Department of Health Services, 1991, California statewide radon survey screening results, 9 p.

California Department of Water Resources, 1961, Bulletin No. 104, Planned utilization of the groundwater basins of the Coastal Plain of Los Angeles County, Appendix A, Ground Water Geology, 181 pp., 26 pl.

Dames & Moore, 1986, Hydrogeologic assessment report, Alamitos Generating Station, 28 p.

Geotechnical Professionals, Inc. 2003, Draft report geotechnical investigation proposed Home Depot, Oil Tank Farm SEC Loynes Drive and Studebaker Road, Long Beach, California, GPI Project No. 1878.1.

Greenberg Farrow, 2004, The Home Depot Long Beach, CA Studebaker Road & Loynes Drive Site Plan, at a scale of 1"=50', dated February 13, 2004.

Hart, E.W. and Bryant, W.A., 1999, Fault-rupture hazard zones in California: California Division of Mines and Geology, Special Publication 42 (1999 Revision), 38 p.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas, California Division of Mines and Geology, Geologic Data Map No. 6.

Los Angeles County Department of Public Works, 1996, Hydrologic report 1994-1996, prepared by Hydraulic/Water Conservation Division.

Madison Civil Engineering, 2002, Site Plan, dated November 21, 2002.

Orange County Fire Authority, 2003, Combustible soil gas hazard mitigation, Guideline C-03, 17 p.

Piper, A.M., Garrett, A.A., et al., 1953, Native and contaminated groundwater in the Long Beach-Santa Ana Area, California, United States Geological Survey Water Supply Paper 1136, 320 p.

Poland, J.F., Piper, A.M., et al., 1956, Ground water geology of the Coastal Zone, Long Beach-Santa

Ana Area, California, United States Geological Survey Water Supply Paper 1109, 162 p.

Poland, J.F., 1959, Hydrology of the Long Beach-Santa Ana Area, California; United states Geological Survey Water Supply Paper 1471, 257 p.

Randell, D.H., Reardon, J.B., and five Others, 1983, Geology of the City of Long Beach, California, United States of America, in: Bulletin of the Association of Engineering Geologists, vol. xx, number 1, February 1983, p.13-94.

Riverside County Department of Environmental Health, 2001, Preliminary methane investigation protocols, 7 p.

Tinsley, J.C., Youd T.L., et al., 1985, Evaluating liquefaction potential, in: Ziony, J. (Ed.), Evaluating Earthquake Hazards in the Los Angeles Region; U.S. Geological Survey Professional Paper 1360; pp. 263-315.

United States Department of Agriculture, Soil Conservation and Forest Service, 1969, Report and general soil map, Los Angeles, California 70 pp., 1 map sheet.

United States Geological Survey, 1964, 7.5 Minute series topographic maps, Los Alamitos Quadrangle, California., photorevised 1981, Scale 1:24,000.

Wright, T.L., 1991, Structural geology and tectonic of the Los Angels Basin, California, in: K. Biddle, ed., Active Margin Basins, AAPG Memoir 52, p. 35-135.

Yerkes, R.F., McCulloh, T.H., and others, 1965, Geology of the Los Angeles Basin, California-An Introduction: U.S. Geological Survey Professional Paper 420-A, 57 p, 2 plates.

Regulatory Research References

California Environmental Protection Agency (CalEPA), Department of Toxic Substances Control (DTSC), Annual Work Plan (AWP)State Equivalent NPL, March 2003.

California Environmental Protection Agency (CalEPA) California Integrated Waste Management Board and the State Water Resources Control Board (SWF/LF), March 2003.

California Water Resources Control Board, Leaking Underground Storage Tank (LUST), April 2003.

California Water Resources Control Board, Underground Storage Tanks (UST), April 2003.

California Water Resources Control Board, Aboveground Storage Tanks (AST), December 2003.

California Office of Emergency Services (California Hazardous Material Incident Reporting System - CHMIRS) and the California Regional Water Quality Control Board (SLIC), December 2002.

United States Environmental Protection Agency Office of Solid Waste and Emergency Response; National Priority List - (NPL), October 2003.

United States Environmental Protection Agency Office of Solid Waste and Emergency Response; National Priority List, Superfund - (CERCLIS), September 2003.

United States Environmental Protection Agency, Office of Enforcement; (CERCLIS) No further Remedial Action Planned Sites - (NFRAP), September 2003.

United States Environmental Protection Agency Office of Solid Waste and Emergency Response; Resource Conservation and Recovery Information System - Corrective Action Sites List - (CORRACTS), September 2003.

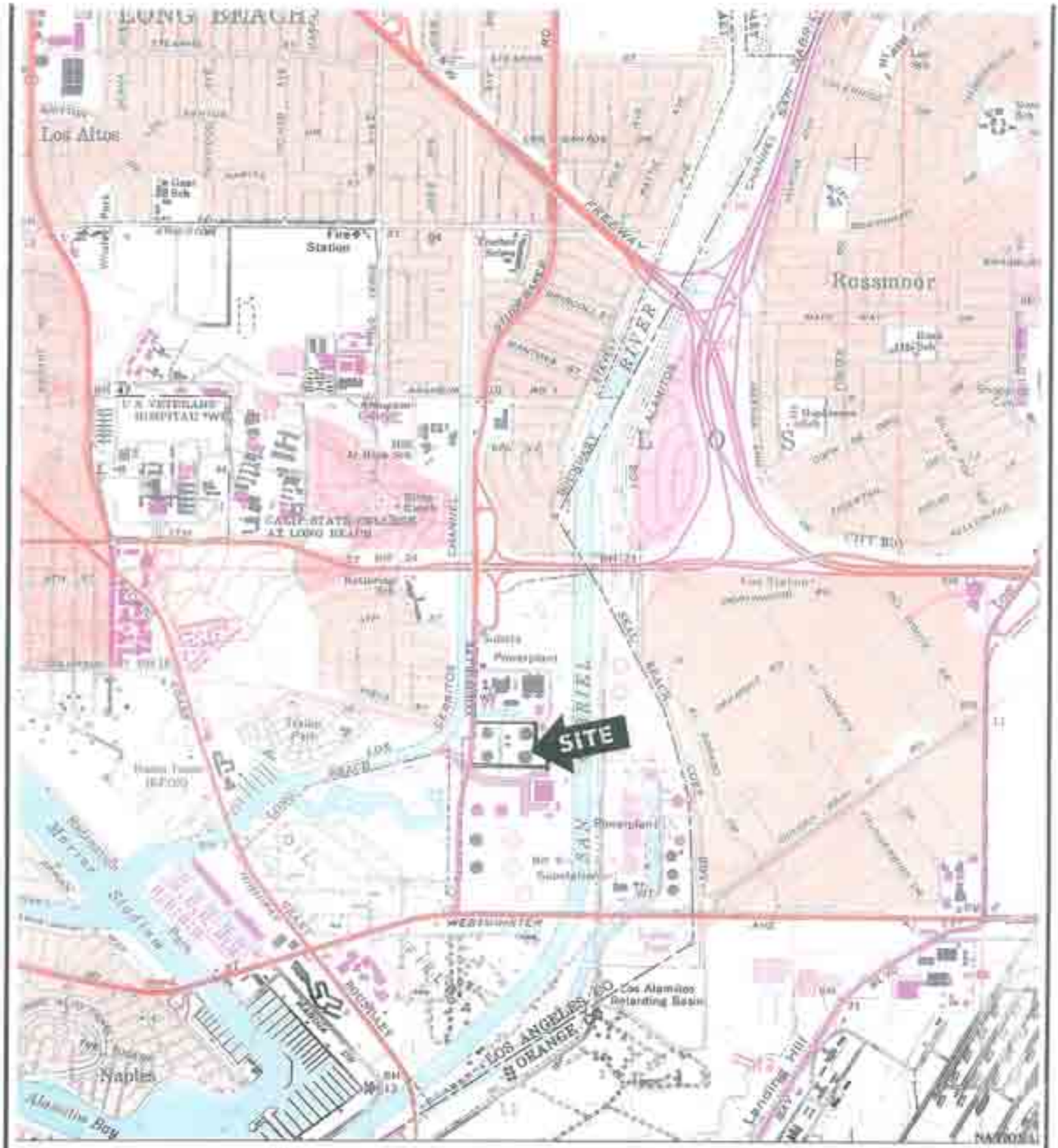
United States Environmental Protection Agency Office of Solid Waste and Emergency Response; Treatment, Storage and Disposal Facilities (RCRA-TSD) and Large Quantity Generator/Small Quantity Generator (RCRA-LQG/SQG), December 2003.

United States Environmental Protection Agency Office of Solid Waste and Emergency Response; Emergency Response Notification System - (ERNS), January 2003.

FIGURES

FIGURE 1

SITE LOCATION MAP



Reference:
USGS, 7.5 Minute Series Topographic Map
Los Alamitos Quadrangle, California
dated 1964, photorevised 1981

0 1000 2000 3000 4000 5000 6000 7000 FEET

SCALE 1:24 000

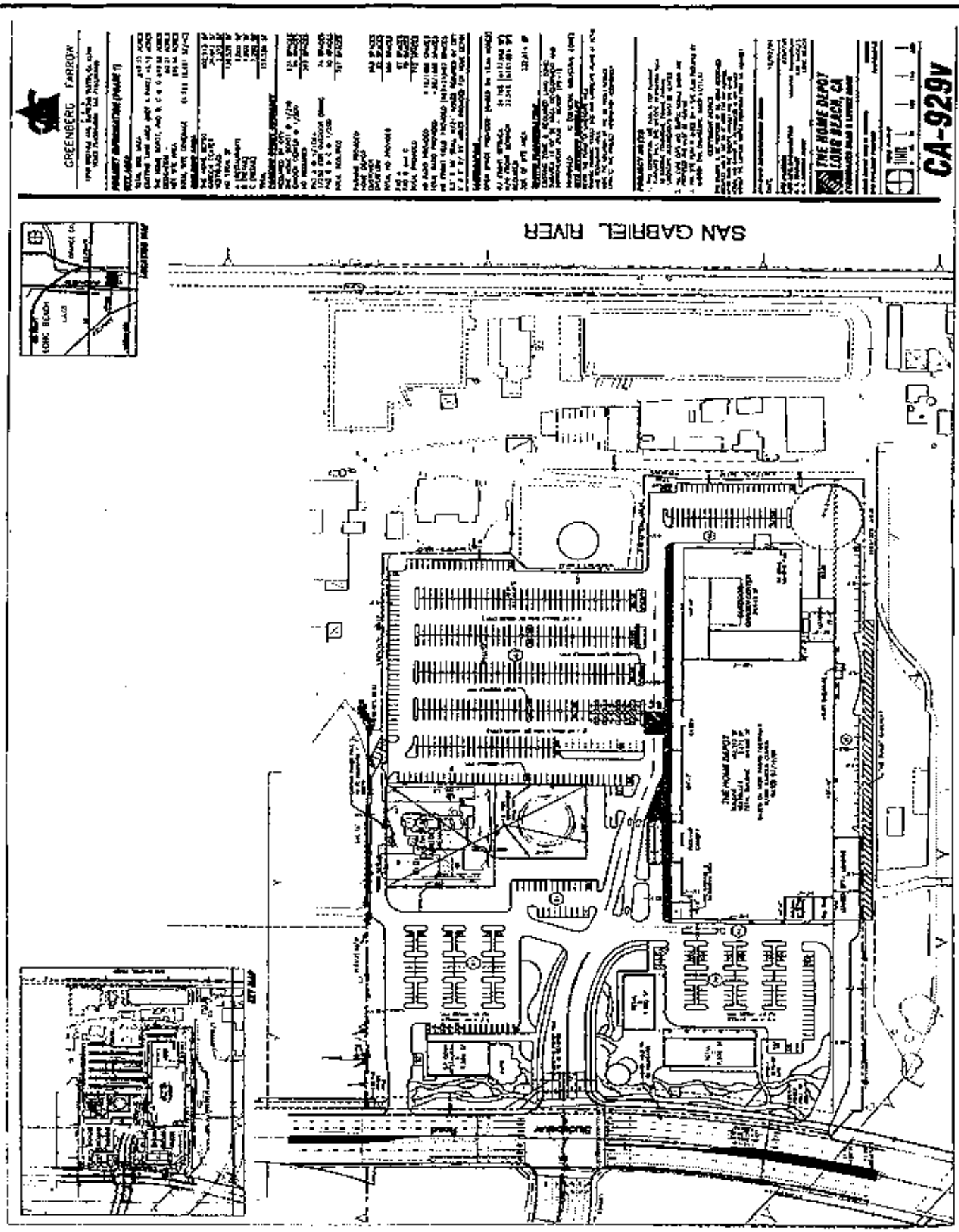
MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SITE LOCATION MAP
LONG BEACH HOME DEPOT SITE
400 Studebaker Road
Long Beach, California

Figure:	1
File No.:	03-475
Date:	March 2004

FIGURE 2

SITE PLAN



MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SITE PLAN
Long Beach Home Depot
Studebaker & Loynes,
Long Beach, CA

File No.:	03-475
Figure No.:	2
Date:	December, 2004

FIGURE 3.1

1952 AERIAL PHOTOGRAPH

Source:
Continental Aerial Photo, Inc.
Flight Number AXK-1K

SCALE (approx.)
1 Inch=1,666 Feet

N

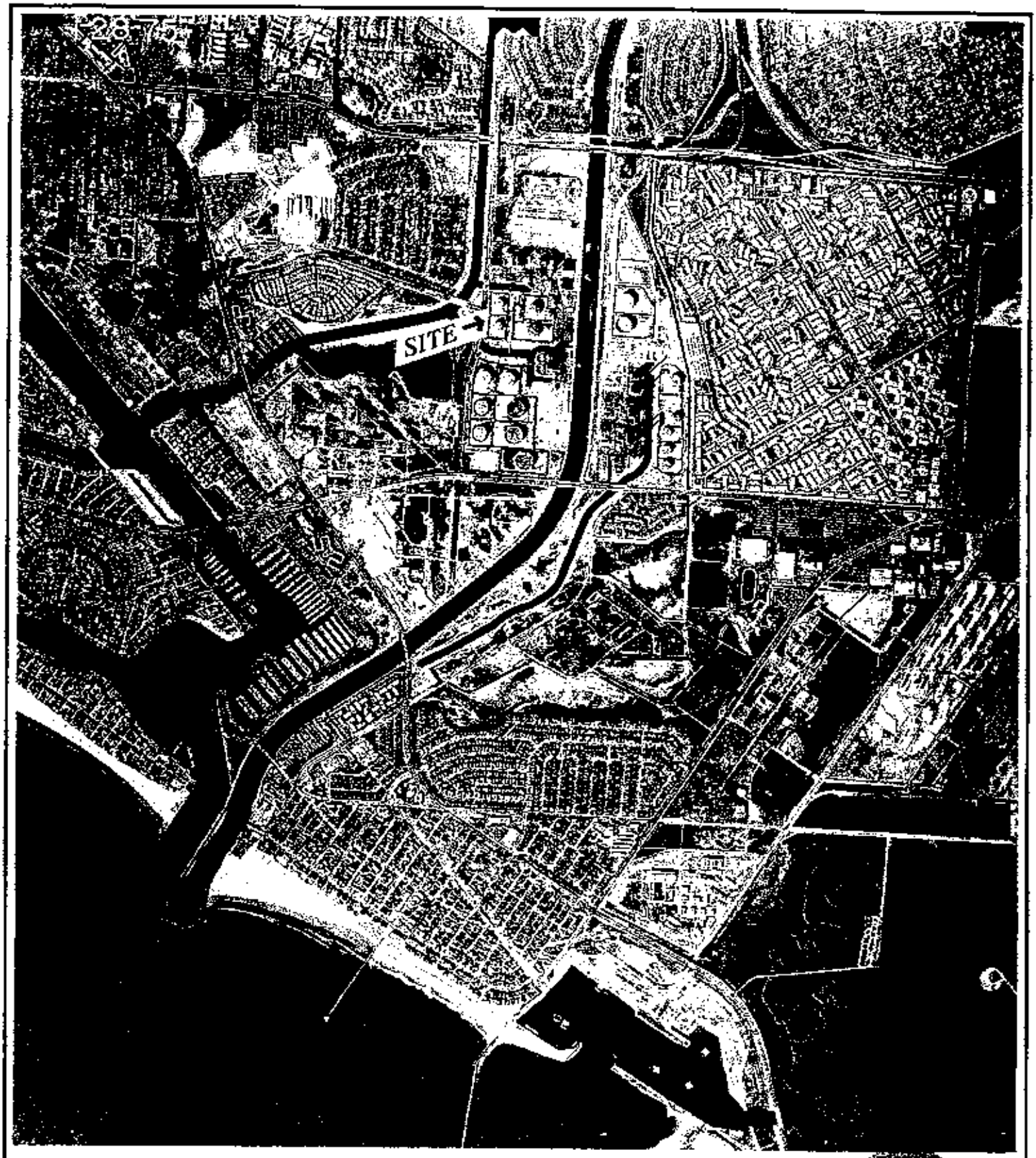
MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SITE AERIAL PHOTOGRAPH - 1952
Long Beach Home Depot Site
400 Studebaker Road
Long Beach, California

Figure:	3.1
File No.:	03-475
Date:	March 2004

FIGURE 3.2

1975 AERIAL PHOTOGRAPH



Source:
Continental Aerial Photo, Inc.
Flight Number 157

SCALE (approx.)
1 Inch=2,000 Feet

N

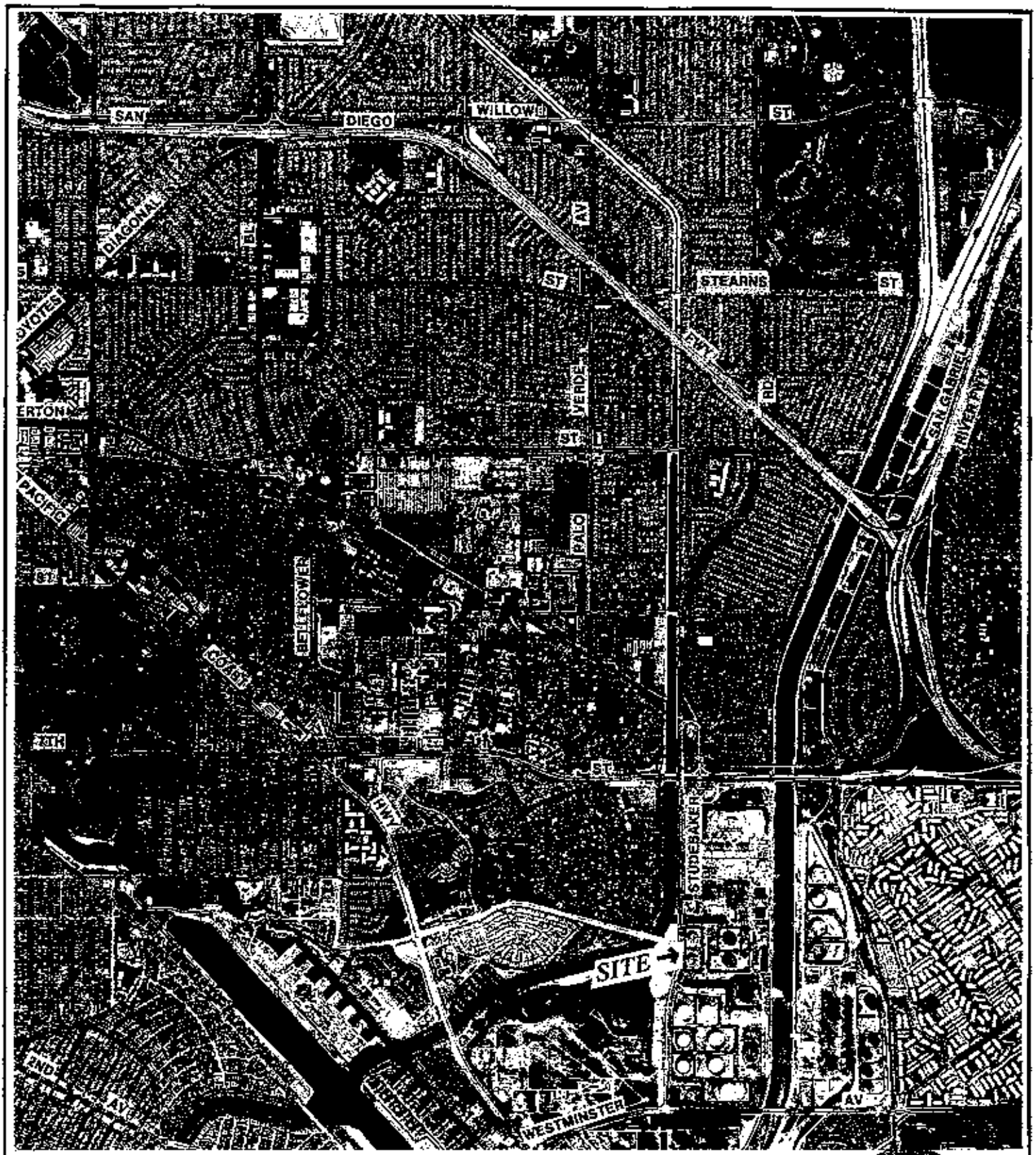
MISSION GEOSCIENCE, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SITE AERIAL PHOTOGRAPH -1975
Long Beach Home Depot Site
400 Studebaker Road
Long Beach, California

Figure:	3.2
File No.:	03-475
Date:	March 2004

FIGURE 3.3

1988 AERIAL PHOTOGRAPH



Source:
Aerial Graphics, Aerial Foto-Book
Los Angeles County, 1987-1988

SCALE (approx.)
1 Inch=2,000 Feet

N

MISSION GEOSCIENCE, INC
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

SITE AERIAL PHOTOGRAPH - 1988
Long Beach Home Depot Site
400 Studebaker Road
Long Beach, California

Figure:	3.3
File No.:	03-475
Date:	March 2004

APPENDIX G

WATER QUALITY IMPACT ANALYSIS REPORT

URS

FINAL REPORT

WATER QUALITY IMPACT ANALYSIS
REPORT
HOME DEPOT, LONG BEACH, CALIFORNIA

PREPARED FOR:

LSA ASSOCIATES, INC.

URS PROJECT NO. 27672007.05000

JANUARY 28, 2005

FINAL REPORT

WATER QUALITY IMPACT ANALYSIS REPORT HOME DEPOT LONG BEACH, CALIFORNIA

Prepared for

LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, CA 92614

URS Project No. 27672007.05000

January 28, 2005

URS

1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108-4314
619.294.9400 Fax: 619.293.7920

URS

January 28, 2005

Ms. Lisa Williams
LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, CA 92614

Subject: Water Quality Impact Analysis Report
Home Depot, Long Beach
Long Beach, California
URS Project No. 27672007.05000

Dear Ms. Williams:

Enclosed is the Water Quality Impact Analysis Report (WQIAR) regarding the development of a Home Depot located in Long Beach, California. The WQIAR was prepared for LSA Associates, Inc., as part of an Environmental Impact Report. This WQIAR has been revised from a previous draft report dated June 10, 2004 based on revisions in the design layout which include an increase in the landscape areas. The WQIAR includes a characterization of project runoff, water quality modeling results, and an evaluation of post-construction BMPs to mitigate stormwater runoff impacts. The stormwater modeling efforts (using PCSWMM 2002) assisted in evaluating the potential impact from the proposed development and the effectiveness of BMPs.

If you have any comments regarding this report, please call us at (619) 294-9400.

Sincerely,

URS CORPORATION

Elizabeth Zurcick

Elizabeth Zurcick, P.E.
Project Engineer

Jerome L. Pitt

Jerome L. Pitt
Senior Engineer

EAZ/JLP:afs

URS Corporation
1615 Murray Canyon Road
Suite 1000
San Diego, CA 92108
Tel: 619 294.9400
Fax: 619 293.7920

TABLE OF CONTENTS

Executive Summary **ES-1**

Section 1 Project Description **1-1**

1.1 Pre-Construction Physical Features and Drainage 1-1
1.1.1 Drainage to the Los Cerritos Channel 1-1
1.2 Post-Construction Land Use and Drainage 1-2

Section 2 Water Quality Environment **2-1**

2.1 Surface Waters 2-1
2.2 Groundwater Resources 2-3
2.3 303(d) Status and Existing Water Quality Data 2-3

Section 3 Characterization of Site Runoff and Pollutants of Concern **3-1**

3.1 Pollutant Sources 3-1
3.1.1 Commercial Land Use 3-1
3.1.2 Parking Lots 3-1
3.1.3 Landscaping 3-3
3.1.4 Other Potential Pollutant Sources 3-4
3.2 Pollutants of Concern 3-4

Section 4 Proposed and Recommended BMPs **4-1**

4.1 Site Design BMPs 4-1
4.2 Source Control BMPs 4-1
4.3 Treatment Control BMPs 4-2

Section 5 Modeling Results and BMP Effectiveness **5-1**

5.1 Design Storm 5-1
5.2 Constituents Modeled 5-1
5.3 Buildup Rates and Comparable EMCs 5-2
5.4 BMP Effectiveness 5-2
5.5 Stormwater Modeling Results 5-4

Section 6 Modeling and BMP Implementation Results **6-1**

Section 7 References **7-1**

Tables

Table 3-1	Average Concentrations of Commercial Land Use Runoff Constituents
Table 3-2	Average Concentrations of Parking Lot Runoff Constituents
Table 3-3	Average Concentrations of Industrial Land Use Runoff Constituents
Table 5-1	Removal Efficiency Factors for Treatment BMPs Based on Concentration
Table 5-2	Results of Water Quality Modeling

Figures

Figure 1	Project Vicinity Map
Figure 2	Existing Site Layout
Figure 3	Surface Water Resources in Project Vicinity
Figure 4	Proposed Home Depot Development

Appendices

Appendix A	Photos of Existing Site
Appendix B	Photos of Water Resources and Drainage Features

µg/L	micrograms per liter
BMP	best management practice
COD	chemical oxygen demand
Cu	copper
CWA	Clean Water Act
EIR	Environmental Impact Report
EMC	event mean concentration
EPA	U.S. Environmental Protection Agency
HA	hydrologic area
HU	hydrologic unit
HSA	hydrologic unit subarea
LSA	LSA Associates, Inc.
mg/L	milligrams per liter
NO_3	nitrate
P	phosphorus
Pb	lead
O&G	oil and grease
RWQCB	Regional Water Quality Control Board
SUSMP	Standard Urban Storm Water Mitigation Plan
SWMM	Storm Water Management Model
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
Zn	zinc
TSS	total suspended solids
WMA	Watershed Management Area
WQIAR	Water Quality Impact Analysis Report

EXECUTIVE SUMMARY

This Final Water Quality Impact Analysis Report was prepared for LSA Associates, Inc., as part of an Environmental Impact Report for the proposed development of a Home Depot within the City of Long Beach, County of Los Angeles, California. The development is located east of the intersection of Studebaker Road and Loynes Drive adjacent to the AES power generating facility. This report provides an evaluation of post-construction best management practices (BMPs) proposed by Madison Engineering, results of water quality modeling under pre- and post-construction scenarios, and recommendations for BMPs (structural and nonstructural) to mitigate stormwater runoff impacts from the project.

Water quality modeling was performed using PCSWMM 2002, which uses the U.S. EPA Storm Water Management Model (SWMM). Criteria for BMP performance and evaluation of modeling results were based on current and potential requirements of the City of Long Beach, County of Los Angeles (e.g., Standard Urban Storm Water Mitigation Plan requirements), and the California Regional Water Quality Control Board – Region 4, Los Angeles Basin. Many aspects of this report address BMP issues similar to requirements for permitting under the Standard Urban Storm Water Mitigation Plan under the County of Los Angeles and the City of Long Beach. This document, however, does not provide complete permitting requirements.

As a result of the proposed and recommended BMPs, the Home Depot development in Long Beach located east of the intersection of Studebaker Road and Loynes Drive does not appear to adversely affect water quality in receiving water bodies. Maintenance of structural and nonstructural BMPs, however, will be required to mitigate water quality impacts from dry weather and stormwater runoff.

SECTION 1 PROJECT DESCRIPTION

A City of Long Beach (City) development, Home Depot, within the County of Los Angeles (County) is proposed just east of the intersection of Studebaker Road and Loynes Drive. The project site is within an inactive fuel tank facility once used to store fuels for the adjacent active AES power generating plant. The development consists of 16.7 acres on a 17.9 acre parcel that will house the Home Depot building and three additional commercial retail buildings. Approximately 1.3 acres will remain under the existing condition of an aboveground storage tank and associated equipment. Figure 1, Project Vicinity Map, illustrates the existing project site location.

1.1 PRE-CONSTRUCTION PHYSICAL FEATURES AND DRAINAGE

The existing site consists of four large inactive storage tanks that are surrounded by protective berms, two smaller inactive tanks surrounded by protective berms, and material storage buildings and pipelines associated with transporting fuels and fluids for power generation. The buildings and pipelines are either currently inactive or will be relocated. The largest of the four large storage tanks stores as much as 223,800 gallons. The berms surrounding the tanks were designed to protect against spills or releases impacting areas outside the tank vicinity. The surface along the berms is coated with a degraded oil-based emulsion. Areas within the berms consist of gravel driving surfaces, asphalt driving surfaces, and a mixture of vegetation that has developed with fuel tank facilities out of service. A gate valve operable from the top of the berm regulates drainage from within the bermed areas. Figure 2, Existing Site Layout, is a drawing of the existing facility provided by Madison Engineering (Madison Engineering, 2004b). Appendix A includes several photos of the existing facility.

An asphalt covered road extends north to south between fuel tank berms, and is adjacent to pipelines, fuel pumping and monitoring equipment, and material storage buildings. Runoff from the entire project area is directed to an existing stormwater collection system via drainage inlets or as surface runoff to the north or south. Although the berms are surfaced with an oil-based emulsion, the emulsion has degraded, leaving behind some exposed soil surfaces. The surfaces within the bermed areas are predominantly pervious to a limited depth and runoff is eventually conveyed to the existing stormwater collection system.

1.1.1 Drainage to the Los Cerritos Channel

The project site drains to the north or south to two distinct cooling water supply channels hydraulically connected to the Los Cerritos Channel. The existing stormwater collection system conveys stormwater within and outside the bermed areas to outfalls as surface runoff to the water supply channels. These cooling water supply channels are illustrated in several figures including Figure 1. The cooling water used by the power plant is eventually discharged to the San Gabriel River via NPDES regulated outfalls. Evidence of these discharge outfalls is shown on Figure 1. The existing stormwater collection system conveys stormwater to both the northern and southern cooling water supply channels via outfall pipes. Appendix B shows a series of photos associated with the existing water bodies in the vicinity of the project site.

More information regarding the existing drainage characteristics can be found in the hydrology summary provided by Madison Engineering (Madison Engineering, 2004a).

Watershed

The Home Depot project site is adjacent to a narrow strip of land with power plant facilities that borders the San Gabriel River. The Regional Water Quality Control Board – Region 4 (RWQCB) designates this lower reach of the San Gabriel River, as the San Gabriel River, Reach 1 – Estuary to Firestone Blvd.. Hydrologic Unit Subarea (HSA 405.15). The San Gabriel River and Estuary at this location is channelized for flood control. Runoff from the existing site does influence the San Gabriel River via discharge from the power plant outfalls. However, the project site actually lies within another watershed designated by the RWQCB as the Los Cerritos Channel and Alamitos Bay Watershed Management Area (WMA) (HSA 405.12) (RWQCB, 1995). Figure 1 shows the local drainage areas in the immediate site vicinity, and Figure 3, Surface Water Resources in Project Vicinity, shows the watershed boundaries. A more detailed description of the watershed and water resources is provided in Section 2.

Soils

Soil descriptions for the area are relatively vague based on the NRCS State Soil Geographic (STATSGO) database. However, the power plant site is predominantly fill material as is much of the area along the flood control channel of the lower San Gabriel River. Soil related studies have been performed for the project area to evaluate soil contamination and groundwater impacts (CH2M Hill, 1997; Woodward-Clyde, 1998), and more recently a geotechnical investigation was performed for the Home Depot project development (GPI, 2003). Subsurface soils are predominantly clays with silty sand and groundwater is generally reached at approximately 7 to 10 feet below the surface. These soil types are typically associated with low infiltration characteristics as would be the case for soils that support the flood control channel and existing structures, which partly explains a perched water table described in the area (Woodward-Clyde, 1998). Soils are generally described within a WQIAR to address the behavior of passive BMPs such as infiltration basins. In the case of this development bioswales are proposed. Bioswales rely in part on infiltration as a treatment component, but not to the extent to influence the subsurface soils.

1.2 POST-CONSTRUCTION LAND USE AND DRAINAGE

The 17.9-acre development will consist of one Home Depot building covering approximately 3.2 acres and three other commercial retail buildings covering approximately 0.4 acres. Approximately 1.3 acres will remain under the existing conditions of an aboveground storage tank and associated equipment. The remaining approximate 13.13 acres will consist of a parking lot, driving surfaces and related landscaping and features. Figure 4, Proposed Development Home Depot Long Beach, is provided by Madison Engineering and illustrates the layout of the development.

Stormwater runoff from the Home Depot site will be conveyed via a new stormwater collection system that will discharge at two separate outfalls at the cooling water sources of the Los Cerritos Channel, north and south of the site. As shown in Figures 1 through 4 and previously described, the site is bordered on the north and south by cooling water supply channels from the Los Cerritos Channel. The water supply channels generally flow to the east toward the power plants as water is pumped in at both locations for cooling water for the AES power generating plants.

Approximately 9.0 acres will convey runoff to the southern outfall, designated as outfall A, while approximately 8.9 acres will convey runoff to the northern outfall, designated as outfall B (Madison Engineering, 2004a). Figure 4 shows the drainage inlets, BMPs, and outfalls.

The two drainage areas include roof runoff that will be conveyed to the stormwater collection system that will discharge to outfall A or B. Parking lot runoff will be directed to vegetated bioswales and then to storm drain inlets. Near each outfall a continuous deflective system (CDS™ unit) will be installed. The vegetated bioswales and continuous deflective systems are part of the proposed BMPs and are further discussed in later sections.

The Home Depot is a commercial establishment that will involve the storage and transport of a large variety of home supply products. The Home Depot will include a garden center that is partly outdoors. The parking lot will be predominantly paved with asphalt. The identification of the remaining three commercial retail buildings is currently not confirmed, but one will likely be a restaurant.

The proposed development will increase roof surfaces and increase paved surfaces, which will increase runoff volume and peak flow rates from impervious surfaces. Also, storage previously provided within the bermed areas of the tank farm will be removed. However, the design of the site will include pervious landscaped areas, pervious areas for channeling storm water runoff, which will reduce runoff from the site.

SECTION 2 WATER QUALITY ENVIRONMENT

2.1 SURFACE WATERS

The Home Depot site is between the operating areas of the AES power generating facility. The site is surrounded on the north and south by channels from the Los Cerritos Channel that serve as the cooling water sources for the power plant operations. These two cooling water supply channels terminate at the intake to the power plant operations. The two cooling water supply channels are shown on Figures 1 through 4. Cooling water from the power generating facilities is discharged through outfalls to the adjacent San Gabriel River. The eastern border of the Home Depot site is approximately 400 feet from the San Gabriel River and is separated from the river by active plant operations. Runoff from the site does not directly flow to the San Gabriel River, but will influence cooling water that is discharged via the power plant outfalls.

The Los Cerritos Channel is hydraulically connected to Alamitos Bay as shown on Figure 3. The cooling water intake south of the project site is approximately 2,000 feet west of the confluence of the south water supply channel and the Los Cerritos Channel. The Los Cerritos Wetland is located in the area south of this confluence as shown on Figure 1. The RWQCB recognizes the Los Cerritos Channel and the Alamitos Bay WMA as a distinct watershed for related environmental watershed programs.

The Los Cerritos Channel and Alamitos Bay WMA is identified as HSU 405.12 encompassing an area of approximately 33.5 square miles. The San Gabriel River Reach 1 watershed is identified as HSU 405.15. The entire San Gabriel watershed is approximately 689 square miles. Runoff from the Home Depot project could influence both the Los Cerritos Channel and Alamitos Bay WMA and the San Gabriel River Reach 1 watersheds. When cooling water is withdrawn from a channel, water in the channel will flow toward the power plant and will eventually be discharged to the San Gabriel River. Contribution of runoff from the site will be a relatively small portion of the cooling water from the channel. This flow scenario will be an indirect discharge of stormwater to the San Gabriel River because the stormwater will pass through the cooling system. If intake pumps are not in operation, stormwater runoff would flow from the project area to the Los Cerritos Channel and eventually to Alamitos Bay. Therefore, influence to both watersheds must be addressed. The water supply channels have trash collection booms and screens near Studebaker Road to reduce debris that enters the power plant cooling water systems (as shown in photos in Appendix B).

The RWQCB Region 4 Basin Plan designates the following beneficial uses for each of the watersheds:

Los Cerritos Channel and Alamitos Bay WMA (HSU 405.12)

- Contact and Noncontact Water Recreation
- Industrial Service Supply
- Navigation
- Commercial and Sport Fishing
- Estuarine Habitat
- Marine Habitat
- Wildlife Habitat

- Preservation of Rare and Endangered Species
- Migration of Aquatic Organisms
- Spawning Habitat
- Shellfish Harvesting
- Wetland Habitat

San Gabriel River, Reach 1, Estuary to Firestone Blvd. (HSU 405.15)

- Contact and Noncontact Water Recreation
- Industrial Service Supply
- Navigation
- Commercial and Sport Fishing
- Estuarine Habitat
- Marine Habitat
- Wildlife Habitat
- Migration of Aquatic Organisms
- Spawning Habitat

The Los Cerritos Channel and Alamitos Bay WMA include the Los Cerritos Wetland (HSU 405.12) consisting of a natural preserve, which houses a diversity of birds including some protected species. Alamitos Bay includes several marine recreation and boating facilities including the Marine Stadium, Long Beach Marina, and the Alamitos Yacht Club. There are also bathing beaches, clamming operations and wildlife habitat areas. The mouth of the bay connects to the ocean adjacent to the San Gabriel channel but is structurally separated via a riprap barrier.

The San Gabriel River is a relatively large watershed of 689 square miles and is divided into three separate reaches. The project area is within Reach 1 of the San Gabriel River. Reach 1 is approximately 13 miles long and includes the area from the estuary to Firestone Boulevard. Reach 1 also includes the concrete-lined Coyote Creek, which joins the San Gabriel reach near the tidal prism. Reach 1 consists of a concrete lined channel in the upper portion, which transitions into a soft-bottomed channel within the tidal prism. The tidal prism is channeled with flood control berms at the Home Depot site. Five Publicly Owned Treatment Works (POTWs) discharge to the San Gabriel Watershed. The POTW closest to the project site is the Los Coyotes Plant on Coyote Creek. Although base flow in the San Gabriel River is largely contributed by POTW discharges, these treatment facilities currently include tertiary treatment.

2.2 GROUNDWATER RESOURCES

The Home Depot site is located within Los Angeles Coastal Plain (Basin #4-11) Groundwater Basin as designated in the Basin Plan (RWQCB, 1995). There are no known groundwater uses in the local area of the Home Depot site. Some groundwater recharge wells are located near the coastal area of the San Gabriel Estuary to prevent salt-water intrusion. According to the RWQCB (RWQCB, 1995), beneficial uses for groundwater in the area are:

- Municipal
- Industrial
- Potential for Industrial Process Supply
- Agricultural

Because of the past industrial activity, including power plant operations, industrial-related pollutants have impacted local groundwater. Studies performed in 1997 and 1998 (CH2M Hill, 1997; Woodward Clyde 1998) indicate elevated levels of petroleum hydrocarbons and several metals evident in soils, and likely in local groundwater.

Groundwater is approximately 7 to 10 feet below the surface. Although groundwater is not used as a potable water source, groundwater is within close proximity to the surface and will have to be addressed if BMPs of extensive infiltration are proposed.

2.3 303(d) STATUS AND EXISTING WATER QUALITY DATA

Section 303(d) of the Clean Water Act (CWA) requires identification of impaired waters and associated constituents of impairment. A list of impaired waters (303(d) list) is typically prepared by the State or other recognized authorities to meet specific Federal and State requirements. The 303(d) list provides the initial information and status for developing total maximum daily loads (TMDLs) that may be discharged to the impaired water body.

Los Cerritos Channel and the San Gabriel River Reach 1 are included on the California 2002 303(d) list for various pollutants. The following lists the 2002 303(d) reasons for impairment for the water bodies.

Los Cerritos Channel

- Coliform
- Ammonia
- Metals

Reach 1 of the San Gabriel River

- Abnormal fish histology
- Algae
- Coliform
- Toxicity

TMDLs have been established for each of the water bodies. The schedules for implementing the TMDLs are at different phases for the reasons of impairment.

Several monitoring programs are involved with collection of data within the San Gabriel River including ambient stream monitoring, POTW regulatory sampling, and other special studies. The following is a summarization of receiving water quality monitoring data collected for Los Cerritos Channel and San Gabriel River within the vicinity of the Home Depot site in relation to pollutants of concern.

Coliform levels exceed standards within Reach 1 of the San Gabriel River and the estuary. Coliform levels in the order of magnitude of 10^6 MPN/100mL have been detected (RWQCB, 2000). There is concern that the coliform may have a detrimental effect on the bathing beaches in Orange County that are downgradient of the San Gabriel River.

A toxicity study prepared in 1996 (RWQCB, 1996) assessed toxicity and fish histology within the San Gabriel River. Results from samples collected in Reach 1 of the San Gabriel River indicated variable toxicity to test organisms for samples collected upstream and downstream of the project site. Fish collected within the tidal prism upstream and downstream of the project site exhibited abnormal fish histology. Ammonia, some metals, and organophosphate pesticides are discussed as possible water quality impairments causing toxicity and impaired histological results. POTW and industrial discharges and urban runoff are indicated as potential sources of the related pollutants. TMDL and other regulatory activities have focused on reducing pollutants of concern such as ammonia and organophosphate pesticides from the POTWs.

In the previous 2000 303(d) list ammonia was listed in Reach 1 of the San Gabriel River. Improvements in POTW discharges are a predominant reason for improvements in instream ammonia levels. Ammonia is not included on the 2002 303(d) list for Reach 1 of the San Gabriel River.

Some metals (silver and arsenic) have been targeted as problematic in the estuary and upstream San Gabriel Reaches. But, elevated metals have not been identified as causing an impairment within Reach 1 of the San Gabriel River.

The Los Cerritos Channel has exhibited elevated levels of ammonia (as high as 2.3 mg/L), with pH and temperature conditions that are associated with chronically toxic conditions. NPDES dischargers to the Los Cerritos Channel may be associated with the elevated ammonia levels.

Lead and zinc levels as high as 690 µg/g in sediment have been observed in the Los Cerritos Channel. Copper above appropriate criteria has been detected in tissue. Paint from boat hulls are often cited as pollutant sources, which can typically be associated with elevated levels of copper or other metals. Metals stored in sediment can also be indicative of historic sources. Urban stormwater runoff can also contribute metals such as copper, lead, or zinc.

Coliform levels as high as 170,000 MPN/100 mL have been detected in the Los Cerritos Channel. Discharging POTWs currently disinfect (RWQCB, 2001). Coliform sources can be associated with urban runoff, wildlife, or dry weather discharges which are often more evident in calm waters like that of the channel.

SECTION 3 CHARACTERIZATION OF SITE RUNOFF AND POLLUTANTS OF CONCERN

3.1 POLLUTANT SOURCES

The general sources of pollutants for the post-construction Home Depot site include the parking lot, commercial facilities of the Home Depot and three other commercial facilities, and landscaping. The existing portion consisting of the aboveground storage tank and associated equipment will still influence runoff as an industrial land use. Event Mean Concentrations (EMCs) for commercial land use are available from national and regional sources. Likewise, industrial EMCs are similarly available from regional sources. The following discussion describes the potential sources of pollution from commercial facilities, parking lots, and landscaping as well as further discussion on the pollutants associated with the Home Depot garden center, possible restaurants and other buildings, and material storage.

3.1.1 Commercial Land Use

Commercial land use is a typical land use for which literature value EMCs are available. Commercial facilities typically have pollutants associated with trash and debris, and oil and grease (O&G). Additional pollutant categories such as sediment, nutrients, organic compounds, oxygen-demanding substances, and pesticides are also possible based on activities. The Home Depot development involves the mentioned categories. The influence of a partly outdoor garden center, possible outdoor storage of stock and materials, and landscaping present potential pollutant sources. These and other sources present a wide range of pollutant sources within the commercial operation. Table 3-1 provides EMCs from studies in the San Diego area, Los Angeles area, and other national sources.

3.1.2 Parking Lots

Pollutant categories commonly associated with parking lots include heavy metals, trash and debris, and O&G (County of Los Angeles Department of Public Works, 2002). Water quality constituents associated with parking lot runoff are usually derived from releases from vehicles. Hydrocarbons, O&G, metals, and other chemicals can be released via leaks, wearing of parts (e.g., tires and brakes), and general transport. Some published EMCs and average concentrations for parking lot runoff are provided in Table 3-2, Average Concentrations of Parking Lot Runoff Constituents. Some of these values are associated with a study from a test site in Long Beach, California. The other EMCs listed in Table 3-2 are associated with several nationwide studies.

Of the approximately 13.4 acres of parking lot, approximately 650 square feet will consist of vegetated swales. The parking surfaces will be paved and will typically involve parking of vehicles for customers during hours of operation. Parking lot EMCs are expected to be similar to values shown in Table 3-2.

3.1.3 Industrial Land Use

Industrial land uses typically have pollutants associated with metals, organic compounds, trash and debris, and O&G. Industrial activity can vary considerably, and the storage tank and associated equipment that will remain may have potentially elevated sources of O&G and organic compounds

associated with contained fluids and pumps. However, the remaining existing area is relatively small with limited activity, and the site features will be improved (i.e. berm improvements). Table 3-3provides EMCs associated with Industrial land use in the Los Angeles area.

Table 3-1
Average Concentrations of Commercial Land Use Runoff Constituents

Constituent	San Diego Area[1] EMCs	Los Angeles Area[2] EMCs	Other Sources[3] EMCs
TSS (mg/L)	111	67	100
TDS (mg/L)	NA	108	NA
COD (mg/L)	NA	NA	90
Oil & Grease (mg/L)	NA	6.0	8.5
Total Coliform (MPN/100mL)	NA	150,000	NA
Dissolved P (mg/L)	0.3	0.3	0.1
Total P (mg/L)	0.41	0.52	0.45
TKN (mg/L)	3.37	2.11	2.40
NO_3 (mg/L)	0.58	1.05	0.96
Cd (mg/L)	0.008	0.007	0.008
Cu (mg/L)	0.027	0.035	0.050
Pb (mg/L)	0.016	0.012	0.030
Zn (mg/L)	0.254	0.239	0.140

1. City of San Diego, 1999
2. Los Angeles County, 1999
3. Claytor, et al., 1996

NA – Not Available

Table 3-2
Average Concentrations of Parking Lot Runoff Constituents

Constituent	City of Long Beach Paved Parking Lots[1]	Other Literature Sources[1] EMCs
Cd (mg/L)	0.001	0.008
Cu (mg/L)	0.028	0.051
Pb (mg/L)	0.045	0.028
Zn (mg/L)	0.293	0.139
TSS (mg/L)	36	100
Oil & Grease (mg/L)	NA	8.5

1. Tiefenthaler et al., 2001
2. Claytor, et al., 1996

NA – Not available

Table 3-3
Average Concentrations of Industrial Land Use Runoff Constituents

Constituent	Los Angeles Area[2] EMCs
TSS (mg/L)	152
TDS (mg/L)	111
COD (mg/L)	68
Oil & Grease (mg/L)	1.6
Total Coliform (MPN/100mL)	450,000
Dissolved P (mg/L)	0.23
Total P (mg/L)	0.26
TKN (mg/L)	3.21
NO_3 (mg/L)	0.70
Cd (mg/L)	NA
Cu (mg/L)	0.022
Pb (mg/L)	0.007
Zn (mg/L)	0.347

1 – Los Angeles County, 1999

NA – Not Available

3.1.4 Landscaping

Landscaping will be included at the Home Depot site within planters and adjacent to the parking lot. The pollutant categories associated with landscape runoff are pesticides, sediments, nutrients, and oxygen-demanding substances. Landscaping can offer benefits of reducing impervious area and treating runoff, provided that the areas are effectively managed for irrigation, fertilizer, and pesticide application, as well as using appropriate vegetation and landscaping design.

Landscaping features will be a critical part of the proposed BMPs, as vegetated swales will be implemented at each of the drainage inlets. Soil and vegetation type for these swales will be specified and refined prior to construction. Construction of these BMPs will also be designed to minimize release of pollutants such a nutrients from the BMP.

3.1.5 Other Potential Pollutant Sources

Certain activities at the Home Depot site are potential runoff pollutant sources atypical of other commercial facilities. These activities or pollutant sources include the garden center and outdoor material storage. Additionally, the other buildings proposed to the west of the site may be a restaurant and other shops.

The garden center will be partly outdoors and may be exposed to rainfall. The garden center may have potted plants, bagged fertilizers, soil products, and other materials that could be of potential concern. Because potted plants require watering, and the general area may require cleaning by hosing down the surface, dry weather flows are of concern. Overall, the pollutant categories of concern may be similar to those under the landscaping category, but with the potential for much larger concentrations.

Many Home Depots include the temporary or day-to-day outdoor storage of materials and supplies. This may include lumber (e.g., treated lumber), soil amendments, rental equipment (washing of rental equipment), and refuse associated with supply packaging. The variety of materials that can be stored outdoors is quite diverse and presents a challenge in assessing stormwater runoff quality. Although some of these sources may have constituents associated with typical commercial EMCs, special emphasis will be needed to address material storage.

A restaurant in the other building may present trash and debris, O&G, and other food-related wastes. This may be similar to typical commercial land uses that include food services.

3.2 POLLUTANTS OF CONCERN

Pollutants of concern can be derived from an assessment of the potential pollutant sources from the Home Depot and other commercial operations and the sensitivity of receiving water bodies including 303(d) listed pollutants. Two receiving water bodies, San Gabriel River and Los Cerritos Channel, have to be addressed for impairment for the potential pollutant categories identified for the Home Depot site. The 2002 303(d) listed pollutants and other land use related pollutants will be addressed. The pollutants to be addressed are as follows:

- Sediment
- Dissolved Solids
- Nutrients
- Trash and Debris
- Oil and Grease
- Hydrocarbons
- Metals
- Pathogens
- Pesticides

The 2002 303(d) listing for abnormal fish histology may have various sources that are currently not identified, and is difficult to address via a pollutant constituent or category. The 303(d) listing for algae is addressed by nutrients being a pollutants of concern. Particular emphasis is placed on addressing trash and debris because of local use of cooling water. The Los Cerritos Wetland presents a challenge for protection. But, the wildlife protection needed at the wetland can be addressed through assessing the described pollutant categories.

SECTION 4 PROPOSED AND RECOMMENDED BMPS

The process of selecting BMPs should consider structural and nonstructural BMPs. In many cases, nonstructural and preventive BMPs are more effective than structural (treatment) BMPs because they address pollutants at the source and preclude their contact with stormwater runoff. Types of post-construction BMPs are typically identified as site design, source control, and treatment control BMPs.

Source and treatment control BMPs are currently proposed for the Home Depot site based on current design drawings and discussions with Madison Engineering (Madison Engineering, 2004b) These proposed BMPs, along with recommendations for improving BMPs to mitigate water quality impacts, are described below. These proposed BMPs with recommended improvements will be evaluated for reducing stormwater runoff impacts.

4.1 SITE DESIGN BMPS

Site design BMPs address aspects of the project design to reduce the impacts of stormwater runoff. Site design BMPs include practices that are typically nonstructural in nature and take advantage of innovative design approaches and practices to reduce stormwater impacts off-site. Some relevant site design BMPs at the Home Depot development are:

- Reducing impervious areas
- Reducing directly connected, impervious areas
- Providing runoff storage
- Landscape controls

Impervious surfaces result in increased runoff, including increased peak flow and volume of runoff. The Home Depot will require parking lots and areas that will be impervious surfaces. Vegetated bioswales, planters, and boundary landscaping are proposed to that will reduce the effects of impervious surfaces.

With an increase in impervious surfaces and a subsequent increase in peak flows, it is often desirable to store or retain runoff. The proposed vegetated bioswales allow for limited infiltration and retention of runoff based on the type and depth of subsurface material that provides the base for vegetation. Continuous deflective systems are proposed to treat runoff and allow for some runoff retention.

4.2 SOURCE CONTROL BMPS

Source control BMPs include structural and nonstructural BMPs that reduce or prevent pollutant runoff at the source. Source control BMPs currently proposed for the project are as follows:

- Parking lot sweeping or vacuuming will be performed regularly.
- Fertilizers and pesticides will be applied and scheduled to avoid over-application and avoid application prior to rain events.

- Alternative fertilizers and pesticides that do not result in runoff of toxic pesticides or bioavailable nutrients will be used.
- Landscape vegetation used will be drought tolerant and will require minimal irrigation and fertilizer application.
- Irrigation systems will be fitted with soil moisture sensors or precipitation detectors and designed to eliminate overspray onto impervious surfaces.
- Inspection and maintenance of drainage inlets and bioswales will be performed regularly to ensure the inlets do not have excess debris, swales are not eroding, and vegetation is adequately maintained.
- The area near the bioswales and drain inlets will be stenciled for public awareness to indicate release to surface waters.
- Stormwater runoff education programs will be implemented, and will include receiving water body information and relevant sensitive pollutant information.
- Trash and recycling materials will be stored to prevent runoff from storage areas (e.g., construction of a roof and berm around trash containers), and pick-up will be appropriately scheduled.
- Roof materials for the Home Depot will consist of metal sheet roofing with a durable painted surface that resists degradation. This type of roofing material will typically not increase metals in roof runoff, as would roofing materials constructed of galvanized metal or copper.
- The method of storing outdoor storage of materials will be specified. Materials that could result in contaminated stormwater runoff should not be stored outdoors. If suspect materials are stored outdoors, their removal and cleanup before storm events should be specified.
- Spilled fertilizers or other materials associated with the garden center will be cleaned up by dry sweeping; not by hosing off surfaces. Cleaning spilled materials in general by dry sweeping and not producing non-stormwater runoff (e.g. from cleaning surfaces) should be a part of the overall employee education associated with the Home Depot.
- Loading docks for the Home Depot and commercial buildings will be designed to prevent run-on from outside the loading dock area, and will be covered to prevent rainfall influence.

4.3 TREATMENT CONTROL BMPS

The following treatment control BMPs are proposed for the Home Depot development:

- Vegetated bioswales will be installed at every drainage inlet. The swales collect runoff from parking lots and will typically provide a flow path of five to ten feet before discharging to a drainage inlet. Maintained bioswales will reduce suspended solids concentrations and possibly reduce pollutants that will be removed in the soil/vegetation system. Maintained bioswales can contribute to infiltration and uptake sediments, nutrients, metals, and pathogens.

- Continuous deflective systems will be used to capture trash and debris, and reduce levels of sediment, O&G, and other hydrocarbons. The devices will house adsorbent materials to assist in collecting free oils and related pollutants.

The proposed treatment BMPs will be effective at addressing pollutants of concern. Adsorbent materials used in the continuous deflective systems can be effective measures for treating O&G and hydrocarbons. The vegetated bioswales will be an effective measure for reducing the pollutants from the impervious surfaces of the parking lot. The vegetated bioswales will have to be designed to collect and treat runoff from a design storm based on Los Angeles County SUSMP requirements.

SECTION 5 MODELING RESULTS AND BMP EFFECTIVENESS

PCSWMM 2002 was used to model stormwater runoff for pre- and post-construction conditions. Furthermore, post-construction conditions were modeled with and without the implementation of the proposed BMPs. Certain criteria were established for the modeling scenarios, which were based on PCSWMM modeling, BMP design, and regulatory requirements. Some of these criteria include a selected design storm, choice of constituents to model, pollutant buildup rates, and EMCs used for verifying model results. It should be noted that stormwater modeling is an inexact science, and the calculated results are useful for planning and making general decisions on BMP performance and resulting water quality.

5.1 DESIGN STORM

Modeling scenarios were run using a 0.2-inch-per-hour storm, which can be used to estimate a stormwater quality design flow for sizing BMPs under the Los Angeles County SUSMP (County of Los Angeles, 2003). For pollutant concentration modeling, however, this storm is not required, but a design storm associated with each land use scenario is required. Because the 0.2-inch-per-hour storm offers a comparable storm among various modeling scenarios and is relevant to storms associated with sizing BMPs, a 0.2-inch-per-hour storm is used for all the modeling.

5.2 CONSTITUENTS MODELED

Modeling or other stormwater runoff analyses were performed for the following 12 constituents:

- Total suspended solids (TSS)
- Total dissolved solids (TDS)
- Chemical oxygen demand (COD)
- Total coliform
- Oil and grease (O&G)
- Total phosphorus (total P)
- Dissolved phosphorus (dissolved P)
- Total Kjeldahl nitrogen (TKN)
- Nitrate (NO_3)
- Total copper (total Cu)
- Total lead (total Pb)
- Total zinc (total Zn)

These constituents were selected based on the pollutants of concern identified in Section 3. Most of these constituents relate well to the buildup and mass loading concepts associated with SWMM modeling. With the exception of total coliform and O&G, the listed water quality constituents were modeled and evaluated with buildup rates associated with data partly derived from land use studies in the San Diego and Los Angeles areas, and the parking lot study in the Long Beach area.

Because of the nature of pathogens, they are often difficult to model unless a strong understanding of the source is researched. Therefore, total coliform values were not modeled using PCSWMM. The San Diego and Los Angeles area studies offered local coliform data; however, a limited number of data points were available. Instead of modeling with buildup rates, EMCs for total coliform from similar land uses were assigned from literature on parking lot runoff (Claytor, et al., 1996) and other recent studies in the Huntington Beach area (URS, 2000).

Other pollutants of concern, including O&G, trash and debris, and hydrocarbons do not behave in the predictable manner associated with pollutant buildup and washoff. These constituents often float on the

surface of runoff or flow as heterogeneous mixtures. Regardless of the behavior, O&G was quantitatively analyzed in runoff and removal by BMPs based on data from relevant runoff studies. Because of the nature of the project site, proximity to open waters, and proposed BMPs, an additional quantitative assessment was performed to improve understanding. Trash and debris will be primarily addressed through source control BMPs and very effective treatment BMPs

Pesticides are a pollutant of concern based on the 303(d) status. Pesticides could be used around the buildings and landscaped area, but application should be controlled through the projects pest management program and use of "safer" alternatives. The Home Depot is a commercial supplier of pesticides. It is important that pesticides always be stored indoors. Reducing pesticides at the site will rely on design and source control BMPs. However some pesticides could be retained within the bioswales. Pesticides were not specifically modeled or analyzed to calculate quantitative results.

Biochemical oxygen demand (BOD) was not modeled or evaluated. Instead, COD was used as the primary indicator for oxygen-demanding substances. Because BOD is a subset of COD, BOD values will always be lower or equal to COD levels. TSS provide an indicator to eroded soil and a surrogate to many pollutants that may be even slightly associated with solids such as metals and nutrients. TDS depict dissolved constituents including levels of salinity or other constituents in dissolved form. TKN, NO_3, total P, and dissolved P all describe forms of nutrients. TKN and total P were chosen to depict overall levels of associated nutrients (nitrogen and phosphorus), while NO_3 and dissolved P usually depict a more bioavailable nutrient form. Although the source of nutrients in the proposed runoff is relatively small compared to other sources (i.e. POTWs), the 303(d) listing for algae warrants addressing nutrients.

Total metals of Cu, Pb, and Zn are associated with variable degrees and levels of toxicity and can be present in elevated levels in stormwater runoff. The total metal constituent depicts the overall metal present, which may include dissolved and other bioavailable fractions.

5.3 BUILDUP RATES AND COMPARABLE EMCs

The SWMM (or PCSWMM) model uses the concept of buildup and washoff to describe constituents accumulating between storms and then washing off with the storm event. Published buildup rates are available for some pollutants (James, 2000) but often require site-by-site verification. Published buildup rates were acquired for the modeled constituents and adjusted by calibrating to associated EMC values, such as those shown in Tables 1 and 2.

5.4 BMP EFFECTIVENESS

Assessing BMP effectiveness was performed by adjusting PCSWMM model input data or by adjusting the output values to reflect reliable removal efficiencies from the proposed source control or treatment BMPs. Treatment BMPs often have documented removal rates associated with particular pollutants. The treatment BMPs that were evaluated are:

- Vegetated Bioswales
- Continuous Deflective Systems (CDS™)

Table 5-1 provides removal efficiencies of the treatment BMPs for runoff constituents. These removal rates are based on documentation, communication with the manufacturer, other studies, and estimations based on a well-maintained treatment system.

Table 5-1
Removal Efficiency Factors for
Treatment BMPs Based on Concentration

Constituents	Bioswales[1]	CDS™ Units[2]
TSS	0.5	0.7
TDS	0.05	NA
COD	0.1	0.3
Total Coliform	1-2 log reduction	NA
O & G	0.5	0.8
Total P	0.4	0.3
Dissolved P	NA	0.1
TKN	0.31	0.2
NO_3	0.11	0.05
Total Cu	0.50	0.1
Total Pb	0.61	0.3
Total Zn	0.74	0.1

NA – Not applicable
1. Claytor, et al., 1996
2. CDS Technologies, 2003

Other adjustments were made by estimating the effects of some nonstructural and source control BMPs. Although improvements based on nonstructural BMPs are difficult to quantify, best professional judgments were made to offer quantitative conservative improvements. Consequently, approximate removal efficiencies of 5 or 10 percent were applied for applicable nonstructural BMPs such as:

- maintained irrigation systems
- appropriate landscaping and fertilizer application program
- regular maintenance of CDS™ units, swales and drainage inlets
- regularly scheduled sweeping prior to storms

To address pollutant reductions because of use of benign roofing material, buildup rates for the Home Depot building were reduced by 30%.

5.5 STORMWATER MODELING RESULTS

Table 5-2 presents the modeled runoff concentrations of the selected constituents before and after implementation of the proposed BMPs and recommended improvements described in Section 4. These estimated concentrations are associated with runoff from the two drainage areas for the Home Depot site discharging to the northern and southern water supply channels via proposed outfalls. Water quality standards or benchmarks are also shown in Table 5-2. Some of these standards and benchmarks may reflect concentrations of actual runoff (i.e., EPA benchmarks), while other values reflect concentrations to be attained in the receiving water bodies.

Table 5-2
Results of Water Quality Modeling

Constituent	Concentration in Stormwater Runoff						
	Pre-Construction		Post-Construction without BMPs		Post-Construction with BMPs[2]		Comparable Standard or Benchmark
	Outfall A	Outfall B	Outfall A	Outfall B	Outfall A	Outfall B	
TSS (mg/L)	88	89	56	53	10	10	100[3]
TDS (mg/L)	5	5	12	10	6	5	300[3]
COD (mg/L)	9	9	16	12	5	4	120[3]
Total Coliform[1] (MPN/100 mL)	12,000	12,000	137,000	137,000	1,200	1,200	1,000[4]
O & G[1] (mg/L)	6.6	6.6	6.0	6.0	<1	<1	Visible film or coating[4]
Total P (mg/L)	0.088	0.087	0.165	0.142	0.04	0.03	Avoid excess algal growth[4]
Dissolved P (mg/L)	0.019	0.019	0.130	0.120	0.02	0.01	Avoid excess algal growth[4]
TKN (mg/L)	0.66	0.67	0.99	0.82	0.21	0.20	Avoid excess algal growth[4]
NO_3 (mg/L)	0.77	0.78	0.415	0.382	0.16	0.17	0.7[3]
Total Cu (mg/L)	0.024	0.025	0.022	0.019	0.004	0.004	0.009[5]
Total Pb (mg/L)	0.026	0.026	0.018	0.016	0.002	0.002	0.025[5]
Total Zn (mg/L)	0.30	0.30	0.955	0.810	0.020	0.025	0.12[5]

1. Based on equivalent land use information rather than modeling.
2. Includes proposed BMPs and recommended improvements.
3. Based on EPA Benchmarks (USEPA, 2000b).
4. Based on relevant surface water standards or thresholds (RWQCB; 1995; Assembly Bill 411, 1999).
5. Based on California Toxics Rule for chronic criteria; hardness of 100 mg/L (USEPA, 2000a).

SECTION 6 MODELING AND BMP IMPLEMENTATION RESULTS

Calculated runoff concentrations for some pollutants were greater under post-construction conditions without BMPs than the existing conditions. Under the modeling scenario, the land use was converted from an industrial land use to a commercial land use, which also reflects a predominantly paved area.

Modeling results indicate that the implementation of proposed BMPs reduce pollutant levels below existing conditions and, with the exception of total coliform, are below the benchmark values. As a result of the combination of stormwater BMPs, pollutants of concern are calculated to be at acceptable levels.

Metals, which are a primary pollutant of concern, were reduced by the implementation of BMPs to below or equal to benchmark values listed in Table 5-2. The Los Cerritos Channel is 303(d) listed for metals. Although land uses associated with vehicles are typically associated with metals in runoff, the developed conditions with BMPs will reduce copper, lead, zinc and other similar heavy metal discharge concentrations. The bioswales in particular act to retain metals that are attached to soil or sediment. Benign roof materials are also critical for attaining acceptable metal runoff concentrations. Copper levels are calculated to be similar to the benchmark values while lead and zinc levels are calculated to be an order of magnitude lower than benchmark values.

O&G and hydrocarbons associated with vehicles and related equipment are reduced by the proposed BMPs, bioswales and continuous deflective systems. Regular replacement of the adsorbent media will be important to maintain pollutant removal efficiency. Likewise, the continuous deflective systems must be cleaned (e.g., with a vactor truck) on a regular schedule.

Nutrients in the form of total phosphorus, dissolved phosphorus, TKN, and nitrates are all reduced to acceptable levels. Nutrient issues were implied in the 303(d) listing for Algae. Nutrient releases from the Home Depot should not have an impact on excessive algal growth. Suspended solids are markedly reduced through control measures under the developed conditions. Oxygen-demanding substances (measured as COD and BOD) are likewise reduced and are not seen as a water quality problem. TSS, TDS, and COD are all reduced with BMP implementation. Other pollutants are often attached to particulate matter or solids. Therefore, removal of TSS prevents sediment transport downstream reducing discharge of other associated pollutants, such as metals and some nutrient components. The continuous deflective systems will capture particles in relation to the screen opening size. Bioswales can capture sediment if well designed and maintained. Bioswales will require regular inspection and maintenance to prevent eroding soil or degrading vegetation in the bioswale.

Trash and debris in runoff will be captured in the continuous deflective systems. Trash and debris are a primary concern in regard to cooling water use by the power plants. Although the power plants have an extensive system for screening trash and debris at intake points and within the channels, trash and debris will not be contributed from runoff from the Home Depot with properly designed continuous deflective systems.

Bacteria levels (total coliform) are estimated to be less than pre-construction conditions and are not expected to impact Los Cerritos Channel or the San Gabriel River. Maintenance of the bioswale to prevent soil and sediment in the bioswale from being washed away and released is critical in maintaining coliform removal efficiency.

It is important to note that implementation of nonstructural source control BMPs is of primary importance to prevent increased loading of many of the pollutants of concern. Parking lot sweeping/cleaning on a regular basis will be a necessary BMP. Cleaning of spilled fluids or materials is also critical. The continuous deflective systems require regularly scheduled cleaning to avoid buildup of trash, debris, and sediment. Bioswales and associated drainage inlets require regular maintenance. Proper scheduling and maintenance of these source control BMPs is necessary to maintain acceptable stormwater runoff quality and should be part of the stormwater management plan for the Home Depot facility.

SECTION 7 REFERENCES

California Regional Water Quality Control Board (RWQCB), Los Angeles Region 4, 2003. CWA Section 303(d) list, http://www.swrcb.ca.gov/tmdl/docs/2002reg4303dlist.pdf, July 2003.

California Regional Water Quality Control Board (RWQCB), Los Angeles Region 4, 2001. *Los Cerritos Channel and Alamitos Bay WMA*, http://www.swrcb.ca.gov/rwqcb4/html/programs/regional_program/ws_loscerritos.html. December 2001.

California Regional Water Quality Control Board (RWQCB), Los Angeles Region 4, 2000. *State of the Watershed – Report on the Surface Water Quality, The San Gabriel Watershed*, http://www.swrcb.ca.gov/rwqcb4/html/programs/regional_program/ws_sangabriel.html. June 2000.

California Regional Water Quality Control Board (RWQCB), Los Angeles Region 4, 1995. "Toxicity Study of the Santa Clara River, San Gabriel River, and Calleguas Creek", December 1996.

California Regional Water Quality Control Board (RWQCB), Los Angeles Region 4, 1995. Water Quality Control Plan for the Los Angeles Basin, February 1995.

California State Assembly Bill No. 411, 1999. An Act to Amend Sections 115880, 115885, and 115915 of the Health and Safety Code, Relating to Public Beaches.

CH2M Hill, 1997. Phase 1 Environmental Site Assessment Alamitos Generating Station, May 1997.

City of San Diego, Engineering and Development, 1999. City of San Diego and Co-Permittee NPDES Storm Water Monitoring Program Report, August 10. 1999.

Claytor, Richard A. and T.R. Scheuler, 1996. Design of Stormwater Filtering Systems, Center for Watershed Protection, December 1996.

County of Los Angeles, Department of Public Works, 2000. Los Angeles County 1994 – 2000 Integrated Receiving Water Impacts Report, July 31, 2000.

County of Los Angeles, 2002. Developing Planning for Storm Water Management; A Manual for the Standard Urban Storm Water Mitigation Plan (SUSMP), September 2002.

County of Los Angeles, 1991. Hydrology Manual. 1991

James, W, and R.C. James, 2000. SWMM Hydrology: Rain, Temperature and Runoff, June 2000.

Geotechnical Professionals Inc. (GPI), 2003. Draft Geotechnical Investigation Home Depot Oil Tank Farm See Loynes Drive and Studebaker Road Long Beach, California. September 29, 2003.

Madison Engineering, 2004a. Preliminary Hydrology Study Home Depot Site Id No. WC0398 at Studebaker Road & Loynes Drive Long Beach, CA, February, 2004.

Madison Engineering, 2004b. Home Depot at Studebaker Road & Loynes Drive Long Beach, CA, Design Drawings, 2004.

Partland, J.P., 2001. A Clean Sweep to Swipe Pollutants, Stormwater, May/June 2001.

San Diego Co-Permittees, 2002. Model Standard Urban Storm Water Mitigation Plan for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Tiefenthaler, Liesl L., K.C. Schiff, and S. Bay, 2001. Characteristics of Parking Lot Runoff Produced by Simulated Rainfall, Southern California Coastal Water Research Project (SCCWRP), July 2001.

URS Corporation, 2002. Engineering Services in Support of Investigating and Eliminating Bacteria in Urban Runoff Discharges to Huntington Beach, June 2002

U.S. Environmental Protection Agency (EPA), 2000a. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants in the State of California, Federal Register Vol. 65, No. 150, pp 31682-31719, May 18, 2000.

U.S. Environmental Protection Agency (EPA), 2000b. Final Reissuance of National Pollutant Discharge Elimination System (NPDES) Storm Water Multi-Sector General Permit; Notice. Federal Register Vol. 65, No. 210, pp. 64745-64794. October 20, 2000.

Woodward Clyde, 1998. Site Investigation Report for Soil and Groundwater Alamitos Generating Station, Long Beach, California, April 1998.

SOURCES: Census Bureau (TIGER roads 2000)
Airphoto USA (March 2002 aerial)

N

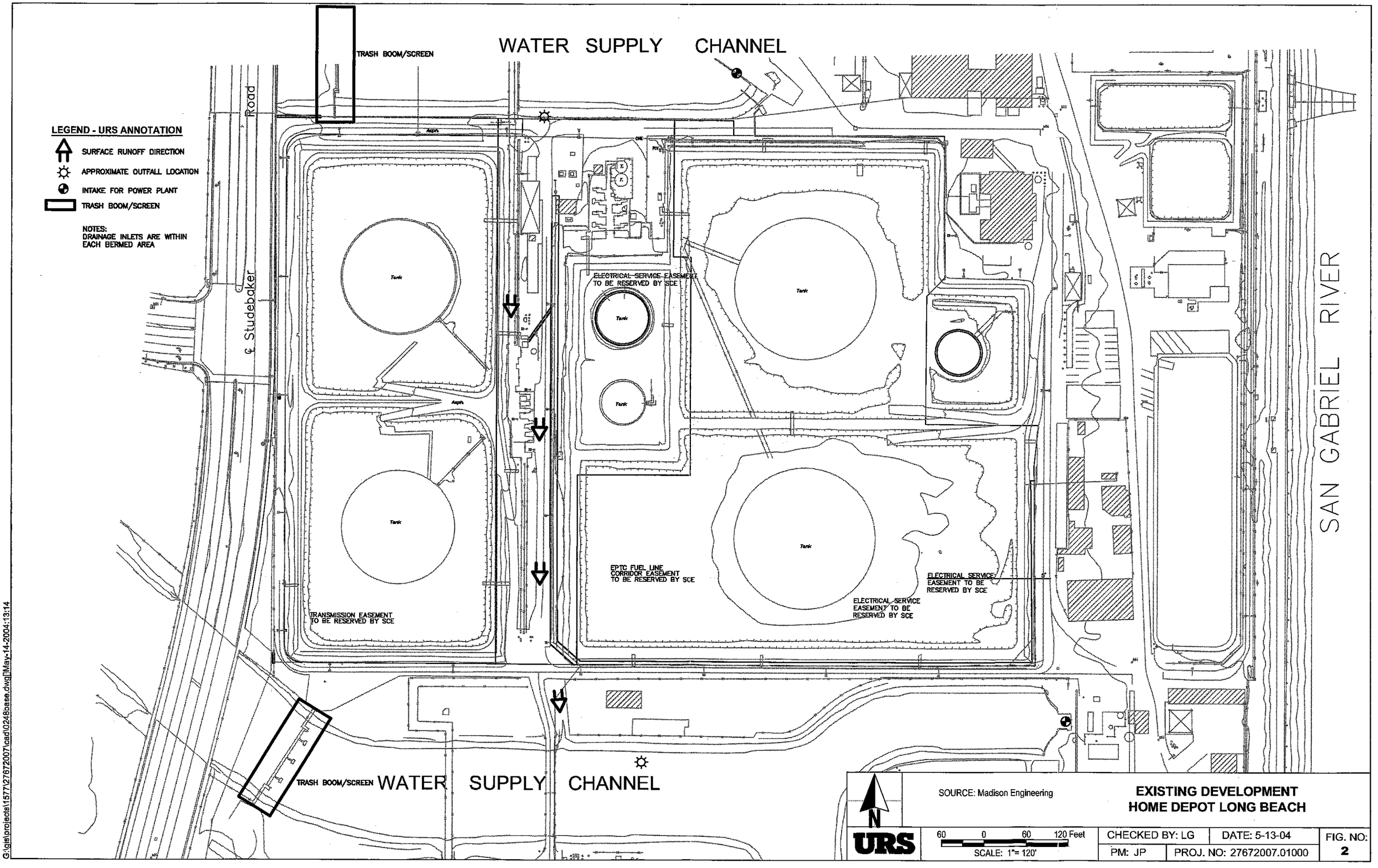
URS

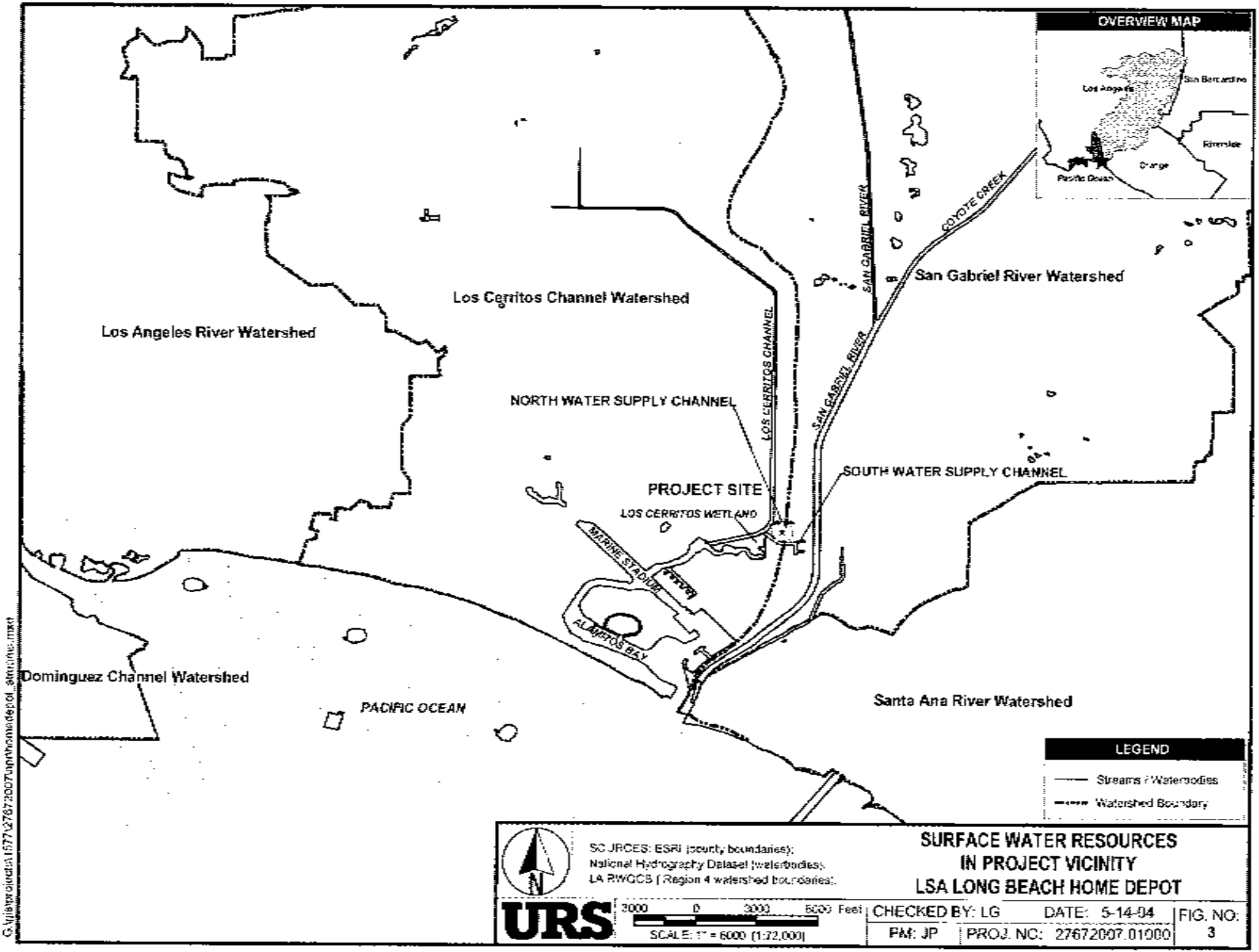
1000 0 1000 2000 Feet
SCALE: 1" = 2000' (1:24000)

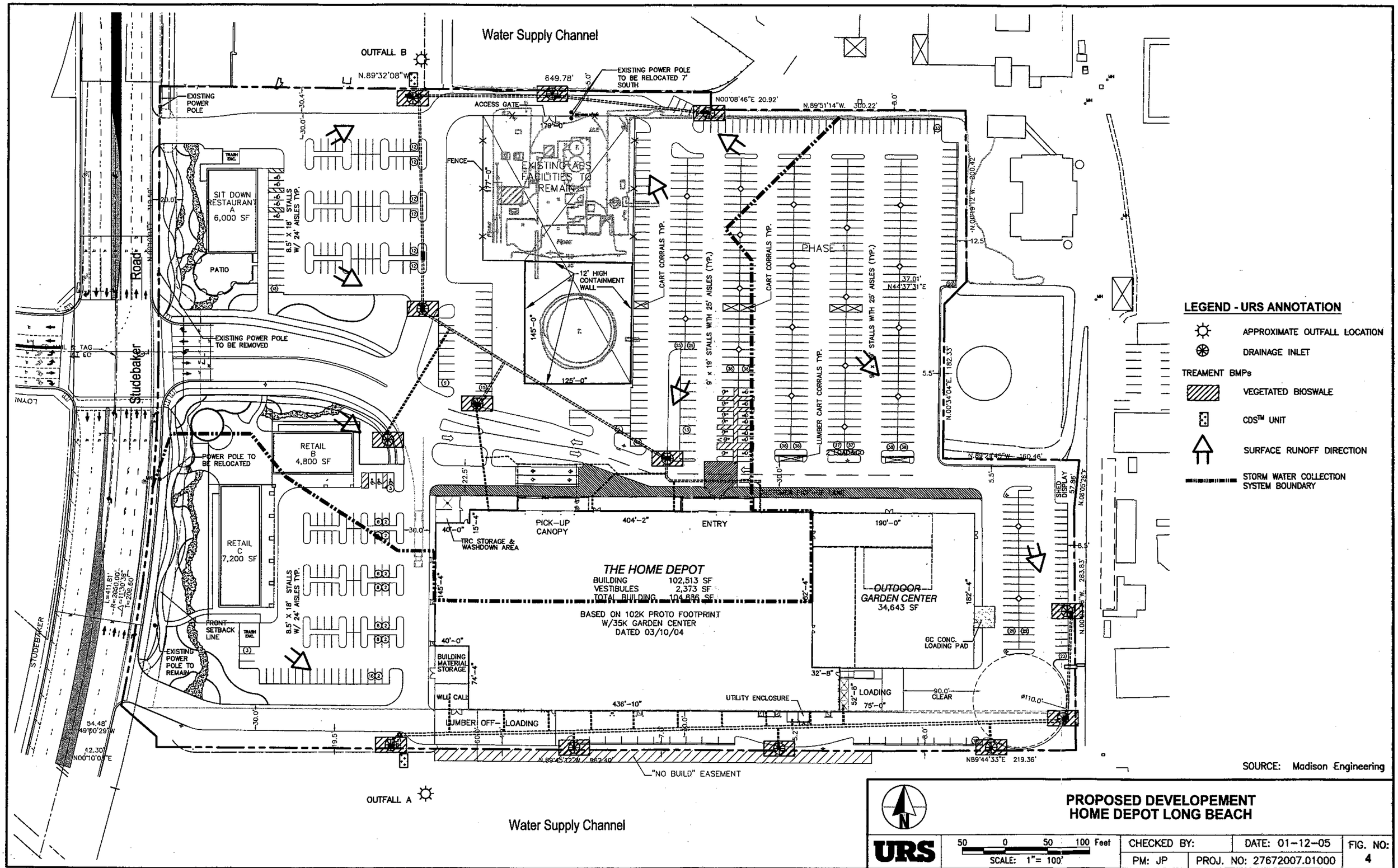
PROJECT VICINITY MAP
LSA LONG BEACH HOME DEPOT

CHECKED BY: LG	DATE: 5-11-04	FIG. NO. 1
PM: JP	PROJ. NO: 27672007.01000	

G:\projects\27672007\homedepot_vicinity.mxd


WATER SUPPLY CHANNEL
TRASH BOOM/SCREEN
LEGEND - URS ANNOTATION
SURFACE RUNOFF DIRECTION
APPROXIMATE OUTFALL LOCATION
INTAKE FOR POWER PLANT
TRASH BOOM/SCREEN
NOTES:
DRAINAGE INLETS ARE WITHIN EACH BERMED AREA
℄ Studebaker Road
Tank
ELECTRICAL SERVICE EASEMENT TO BE RESERVED BY SCE
EPTC FUEL LINE CORRIDOR EASEMENT TO BE RESERVED BY SCE
ELECTRICAL SERVICE EASEMENT TO BE RESERVED BY SCE
ELECTRICAL SERVICE EASEMENT TO BE RESERVED BY SCE
TRANSMISSION EASEMENT TO BE RESERVED BY SCE
SAN GABRIEL RIVER
TRASH BOOM/SCREEN
WATER SUPPLY CHANNEL
N
SOURCE: Madison Engineering
EXISTING DEVELOPMENT
HOME DEPOT LONG BEACH
URS
60 0 60 120 Feet
SCALE: 1"= 120'
CHECKED BY: LG
DATE: 5-13-04
PM: JP
PROJ. NO: 27672007.01000
FIG. NO: 2
G:\gis\projects\1577\27672007\cad\0248base.dwg[]May-14-2004:13:14


OVERVIEW MAP
Los Angeles
San Bernardino
Riverside
Orange
Pacific Ocean
Los Angeles River Watershed
Los Cerritos Channel Watershed
San Gabriel River Watershed
Dominguez Channel Watershed
Santa Ana River Watershed
PACIFIC OCEAN
NORTH WATER SUPPLY CHANNEL
SOUTH WATER SUPPLY CHANNEL
PROJECT SITE
LOS CERRITOS WETLAND
LOS CERRITOS CHANNEL
SAN GABRIEL RIVER
COYOTE CREEK
MARINE STADIUM
ALAMITOS BAY
LEGEND
Streams / Waterbodies
Watershed Boundary
SOURCES: ESRI (county boundaries);
National Hydrography Dataset (waterbodies);
LA RWQCB (Region 4 watershed boundaries).
URS
3000 0 3000 6000 Feet
SCALE: 1" = 6000 (1:72,000)
SURFACE WATER RESOURCES
IN PROJECT VICINITY
LSA LONG BEACH HOME DEPOT
CHECKED BY: LG
DATE: 5-14-04
FIG. NO: 3
PM: JP
PROJ. NO: 27672007.01000



X:\27672007\home depot site.dwg Jan 13, 2005 – 3:03pm

Photo A.

Roadway, Equipment, and Storage within Central Portion of Site

Photo B

Typical Inactive Tank within Bermed Area

Photo C.

Drainage Control Valve Operator at Top of Berm

Photo D.

Oil-based Emulsion on Berms

Photo E.

Stormwater Outfall North of Site at Water Supply Channel

Photo F.

Stormwater Outfall South of Site at the Water Supply Channel from Los Cerritos Channel

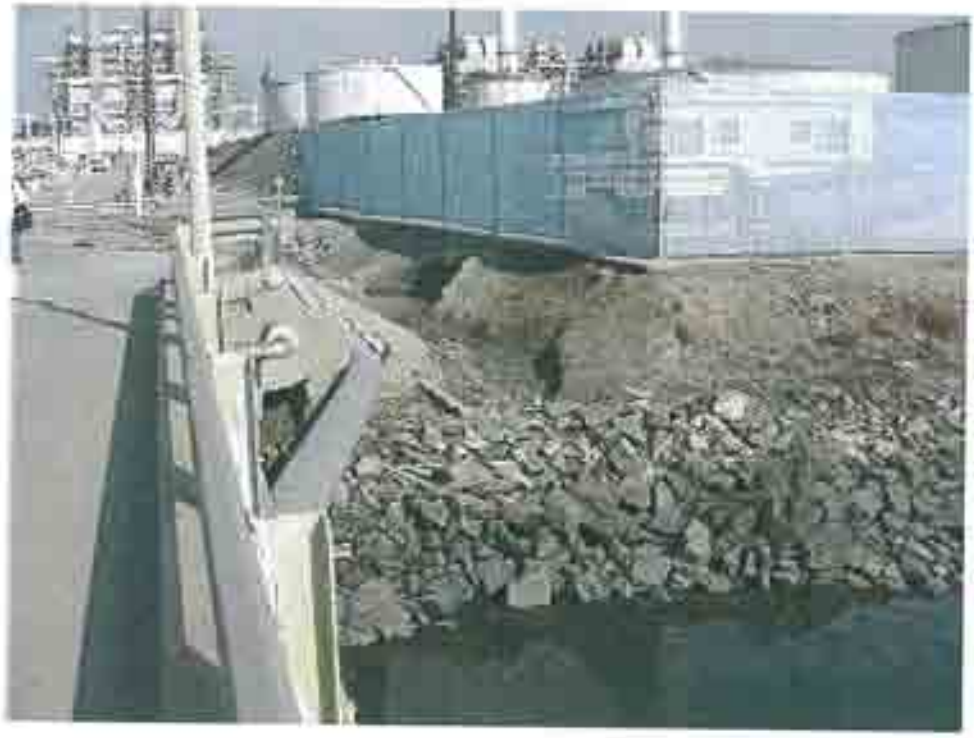


Photo G.

Gully that Conveys Surface Runoff Water Supply Channel South of Project Site

Photo H.

Water Supply Channel North of Project Site at Intake Point

Photo I.

View of Water Supply Channel South of Project Site

Photo J.

View of Water Supply Channel and Trash Boom North of Project Site

Photo K.

Trash Boom at Studebaker Avenue on Water Supply Channel South of Project Site

Photo L.

Facing West from Studebaker Road with Los Cerritos Channel in Background

Photo M.

San Gabriel River Facing North from Westmister Avenue, Power Plants near Project Site in Background