PAC AMP STAGE FLOOR

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January 17, 2008
Work Order 500643-A

Attention: Mr. Jason Jackson

Subject: **GEOTECHNICAL INVESTIGATION**
Proposed Pacific Amphitheatre Stage Buildings
Orange County Fairgrounds
100 Fair Drive
Costa Mesa, California

References: See Appendix

Gentlemen:

Pursuant to your request, Pacific Soils Engineering, Inc. (PSE), presents herein its geotechnical report for the subject buildings. The proposed buildings will be constructed on the stage of the Pacific Amphitheatre located on the Orange County Fairgrounds in the City of Costa Mesa, California. This report has utilized the information presented in the referenced reports and the architectural and structural plans, as well as additional data collected during the recently completed geotechnical investigation. The proposed development will consist of the construction of two buildings on the stage of the Pacific Amphitheater, a single-story Video Building and a two-story Office Production Building. Related improvements are also proposed.

The construction of the proposed improvements will surcharge the existing retaining walls at the site. The structural engineer should evaluate whether the existing retaining walls at the site can support the added surcharge. Our review and analysis indicate that the proposed development is feasible, from a geotechnical standpoint, provided that the recommendations presented in this report are incorporated in the design and construction of the development.

Actual site conditions will vary and modifications to the recommendations presented herein may be required based upon conditions exposed during grading. Addressing environmental issues is outside the scope of work performed by PSE.

We at Pacific Soils Engineering, Inc., appreciate the opportunity to be of service to you and your organization. Should you have any questions or require additional information, please do not hesitate to contact the undersigned at (951) 582-0170.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

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JJD: RAR: DAT: JAC: bjb-500643-A, January 17, 2008 (Prelim, Stage)

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1.0 INTRODUCTION

1.1 Background and Purpose

The subject site is located within the Pacific Amphitheatre located on the westerly side of the Orange County Fairgrounds in the City of Costa Mesa. The proposed development will consist of the construction of two buildings on the stage, a single-story Video Building and a two-story Office Production Building along with related improvements. The buildings will be constructed adjacent to the retaining walls that currently encompass rear stage area.

PSE conducted a previous geotechnical investigation at the site for the amphitheatre (PSE, 1981). The amphitheatre was constructed in 1983 and PSE provided geotechnical testing and observation during construction. PSE has recently completed a subsurface investigation at the site for the proposed development. PSE has prepared this report utilizing the geotechnical information gathered from the recent subsurface investigation and the referenced reports.

The purpose of this report is to provide geotechnical recommendations for the design and construction of the project as we understand it and as reflected on the architectural plans prepared by MAKE Architecture and preliminary structural plans prepared by Vincent Kevin Kelly and Associates. This report presents grading and preliminary design recommendations in support of the proposed site development.

1.2 Scope of Study

The scope of our study included the following tasks:

- Reviewing readily available geologic and geotechnical data pertinent to the site, including PSE's referenced report.
- Geotechnical logging and sampling of one hollow-stem auger boring drilled at the site. The boring was excavated with a hand auger to a depth of five feet prior to being drilled with the hollow-stem auger drill rig. No "in-situ" samples were obtained within the upper five feet. Three other borings were

advanced using a hand auger, but refusal was encountered at depths ranging from two to five feet.

- Conducting laboratory testing to establish general engineering properties of the on-site subsurface materials.
- Presenting site-grading recommendations, including remedial grading and utility trench backfill criteria.
- Providing preliminary recommendations relative to the design of foundations and concrete slabs-on-grade.
- Evaluating groundwater conditions and the potential effects on the proposed construction.
- Compiling a limited seismicity study.
- Preparing this report, which presents this firm's findings, conclusions, and recommendations to be used in the preliminary design of the proposed development.

1.3 Report Organization

This report has been organized to summarize geologic and geotechnical data and to present remedial grading recommendations relative to the proposed development as reflected on the architectural plans prepared by MAKE Architecture and structural plans prepared by Vincent Kevin Kelly and Associates. The locations of PSE's subsurface borings have been added to the architectural site plan. Subsurface exploration logs, laboratory test procedures and results, and data developed during this study have been utilized in our analyses and selected data is presented in this document.

The main text of this report is divided into the following sections: Introduction, Project Description, Field Investigation and Laboratory Testing, Geologic Conditions, Material Properties, Earthwork Conclusions and Recommendations, Earthwork Considerations, Design Recommendations, and Closure. Included in this report are the following appendices:

Appendix A - References

Appendix B - Subsurface Exploration

Appendix C - Laboratory Testing

Appendix D - Earthwork Specifications

1.4 Report Limitations

The conclusions and recommendations in this report are based on the data developed during this study and on the project as described in this report and reflected on the plans. Changes to the proposed development will necessitate further review and analyses.

This study focused on the evaluation and analysis of the geotechnical conditions of the subject site. Addressing environmental issues of the subject site is outside the scope of work of Pacific Soils Engineering, Inc.

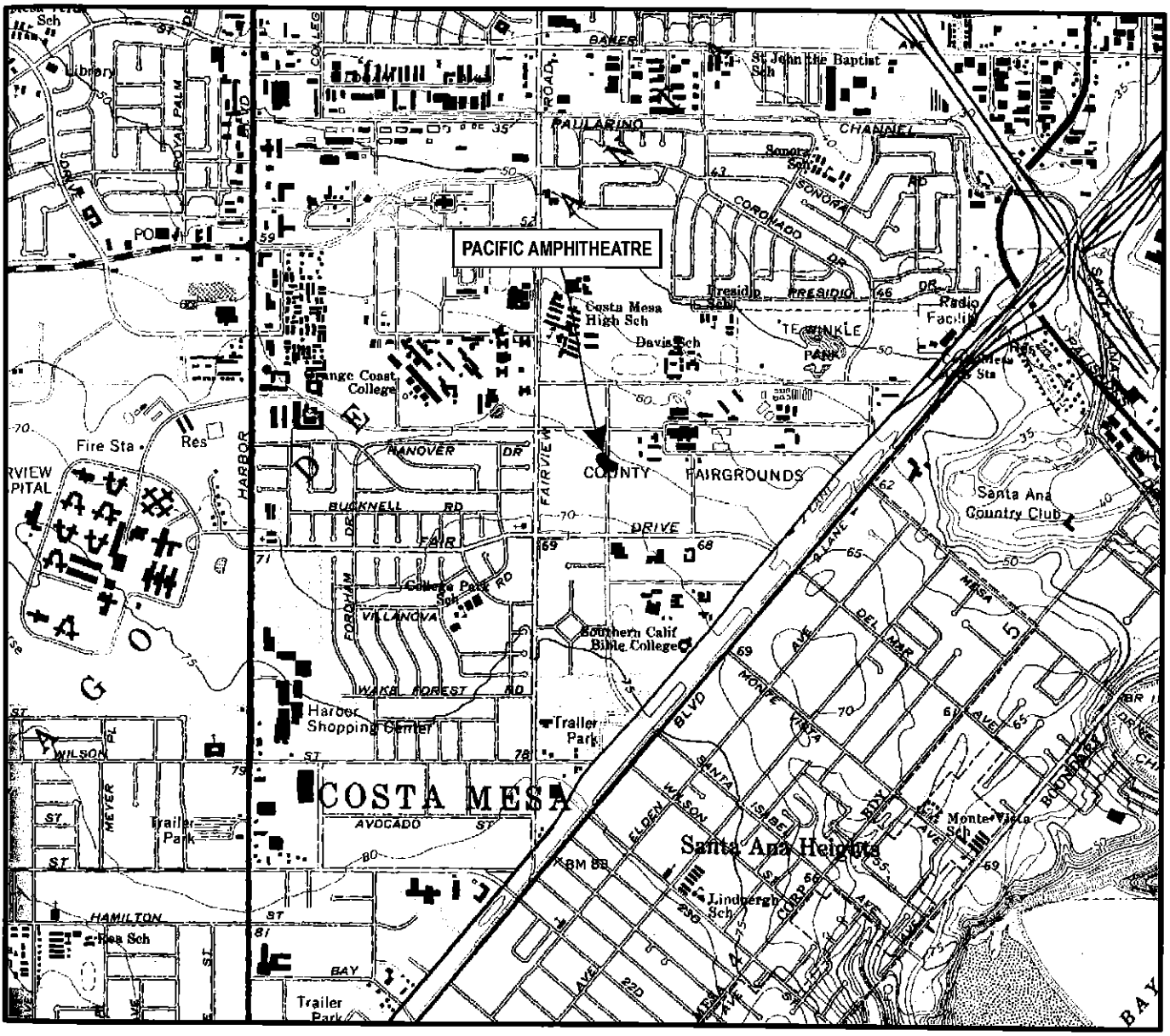
2.0 PROJECT DESCRIPTION

2.1 Location and Existing Conditions

The subject project is located near the westerly side of the Orange County Fairgrounds in the City of Costa Mesa (Figure 1, Site Location Map). More specifically, the proposed development is located on the stage of the Pacific Amphitheatre.

The amphitheatre was constructed circa 1983 and consists of a stage surrounded by concrete and grass seating. The stage is located approximately 26 feet below the original ground surface, and concrete anchored retaining walls surround three sides of the stage. A basement, roughly 10 feet in depth, is located below the center of the stage. A pile-supported steel structure is located at the center of the stage, roughly covering the same lateral extents as the basement. Access to the basement is provided by trap doors located near the center of the stage and a stairwell and tunnel located on the northerly side of the stage.

The stage is currently covered with concrete, with a reinforced concrete structural slab covering the basement and a reinforced slab-on-grade covering the remaining



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SITE LOCATION MAP
PACIFIC AMPHITHEATRE
COSTA MESA, CALIFORNIA

FIGURE 1

SOURCE MAP -
U.S.G.S. NEWPORT BEACH
7.5 MINUTE QUADRANGLE
SCALE 1:24,000

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outer portions of the stage. According to the original structural plans dated January 3, 1983, the 5-inch thick slab-on-grade is reinforced with Number 5 bars placed at 18 inches on center. The back and sides of the stage are largely bound by concrete retaining walls that are partially supported by deadman anchors. The proposed buildings are located immediately adjacent to these anchored walls. The heights of the wall located adjacent to the proposed Video Building range from roughly 14 feet to 24 feet. The heights of the wall located adjacent to the proposed Production Office Building range from roughly 20 feet to 23 feet.

2.2 Proposed Development

It is proposed to construct two buildings on the stage. A single-story Video Building is proposed on the northerly side of the stage and a two-story Office Production Building is proposed on the southerly side of the stage. Related improvements are also proposed including an elevator and a ramp connecting the elevator to the Office Production Building. The two buildings will be steel framed with a concrete slab-on-grade. It is proposed to support the Video Building on continuous footings and to support the Office Production Building on both spread and continuous footings.

According to the structural engineer, the Video Building will consist of three steel-framed walls with the existing retaining wall being utilized as the back wall of the building. The roof will be supported by the existing retaining wall and the three newly constructed walls. Continuous wall loads of roughly 3,400 pounds per lineal foot (1,600 pounds deal load plus 1,800 pounds live load) have been estimated for this building.

The proposed Office Production Building will be freestanding and one to two-stories in height. Continuous wall loads of roughly 3,400 pounds per lineal foot (1,600 pounds deal load plus 1,800 pounds live load) have been estimated for the single-story portion of this building. Column loads up to roughly 28.4 kips (14

kips dead load plus 12 kips live load plus 2.4 kips roof load) have been estimated for the two-story portion of this building. An elevator is proposed on the southeasterly corner of the stage. A steel access ramp will connect the elevator with the upper floor of the Office Production Building.

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

3.1 Current Field Investigation

One hollow-stem auger boring was drilled within the limits of the proposed Office Production Building to a depth of 26 feet below the existing ground surface as part of the current investigation. In addition, three other borings were advanced within the proposed Video Building site using a hand auger. These hand-auger borings were advanced to depths of up to 5 feet before refusal. A representative of this firm logged the borings and selected soil samples were collected. Logs of these borings are presented on Plates B-1 and B-2A through B-2C in Appendix B. The locations of these borings are shown on Plates 1 and 2, which uses site plans prepared by MAKE Architecture as bases.

3.2 Laboratory Testing

To assist in evaluating the geotechnical properties of the onsite materials, laboratory testing was performed on bulk and relatively "undisturbed" ring samples obtained during the field investigations. Laboratory testing results are presented in Appendix C.

4.0 GEOLOGIC CONDITIONS

4.1 Geologic and Geomorphic Setting

The subject site is located within the Newport Beach 7.5-minute Quadrangle, which includes the broad southern margin of the Los Angeles Basin that culminates abruptly with what is referred to as the Newport-Inglewood Zone of Deformation. This zone is characterized by broadly warped coastal mesas of late Miocene to early Pleistocene marine sediments and early to late Pleistocene

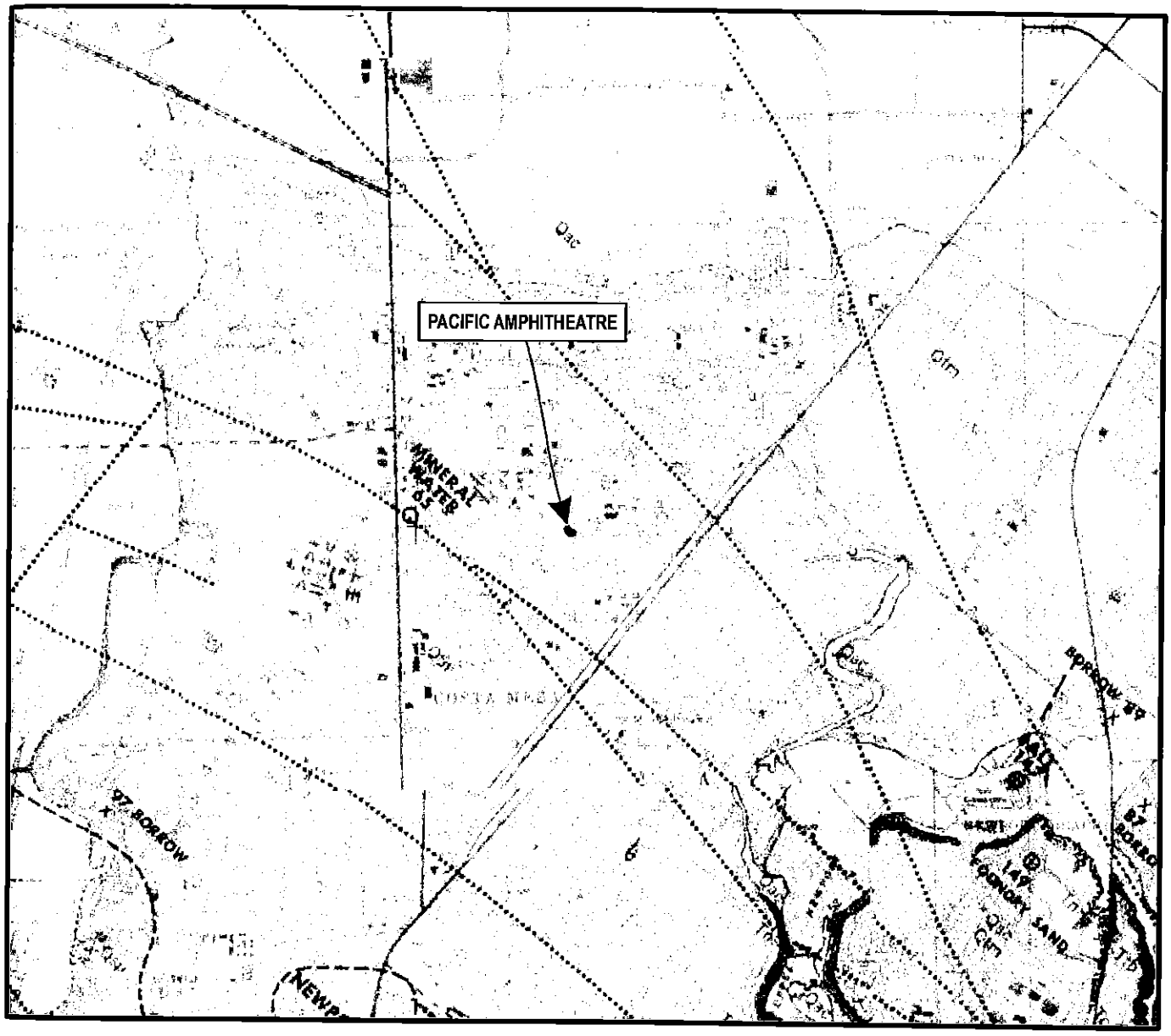
marine terrace deposits, which are deeply incised by the antecedent ancestral Santa Ana River system of late Pleistocene to early Holocene. The site rests on middle to early Pleistocene marine deposits that overlay bedrock, consisting of Miocene to Pliocene-age fine sandstone and siltstone (Figure 2, Regional Geologic Map). Samples obtained from the borings suggest that the marine deposits extend to at least 26 feet below the stage elevation.

4.2 Stratigraphy

The site is underlain by Marine Terrace Deposits (Qtm) and artificial fill (af). The artificial fill was placed during construction of the existing amphitheatre. Boring B-1 encountered 3 feet of artificial fill likely associated with the overexcavation beneath the stage concrete slab-on-grade. Borings B-2A through B-2C encountered artificial fill to their total depths, and this artificial fill may be associated with the backfill of the existing utility trenches. Deeper deposits of artificial fill associated with the backfill of the basement stairway and tunnel retaining wall may be present in the vicinity of Borings B-2A through B-2C. Marine Terrace Deposits underlie the artificial fill at the site. The Marine Terrace Deposits primarily consist of mottled orange to reddish brown silty sands to sandy silts that were generally observed to be moist and dense/very stiff.

4.3 Groundwater

Groundwater was not encountered during the subject exploratory investigation. Groundwater was previously encountered (PSE, 1981) at a depth of approximately 42 feet below the grade of the proposed improvements (68 feet below the original ground surface). Historic high groundwater levels have been reported to be greater than 30 feet in depth (CDMG, 1997b) below original grades. This depth is roughly four (4) feet below the grade of the proposed improvements. The existing basement is roughly 11 feet below the grade of the proposed improvements and has not experienced significant seepage or detrimental groundwater problems. It is PSE's opinion that groundwater is likely



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REGIONAL GEOLOGIC MAP
COSTA MESA, CALIFORNIA

LEGEND

Qtm - MARINE TERRACE DEPOSITS

SOURCE MAP -
P.K. MORTON & R.V. MILLER, GEOLOGIC MAP OF ORANGE COUNTY, CALIFORNIA, SHOWING MINES AND MINERAL DEPOSITS, 1981.
SCALE 1:48,000

FIGURE 2

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at a similar depth to that encountered previously (1981) and will likely not affect the proposed construction.

4.4 Geologic Structure

Complex faulting and folding dominate the geologic structure of the Los Angeles Basin and surrounding mountain ranges. There are several large active fault systems in the region surrounding the subject site (Figure 3). These fault systems have been studied extensively and in a large part control the geologic structure of Southern California. The prominent active regional fault systems affecting the site are the Newport-Inglewood, San Joaquin Hills Blind Thrust, Palos Verdes, Whittier/Elsinore and San Andreas Faults.

4.4.1 Prominent Regional Active Faults

Newport-Inglewood Fault Zone

The L.A. Basin branch of the Newport-Inglewood Fault system is located approximately 6 kilometers southwesterly of the subject site. This fault system, approximately 75 kilometers long, extends northwesterly from a point approximately 3.5 kilometers offshore of Laguna Beach to the Santa Monica Mountains. The Newport-Inglewood is a right-lateral fault system characterized by a series of en echelon (sub-parallel) faults which exhibit considerable offset at depth with little on no surface displacement. The slip rate for this fault is about 1.0 mm per year, with a maximum magnitude (Mw) of 6.7.

San Joaquin Hills Blind Thrust

This newly postulated fault system is based on Grant and others (2002) research findings, and current standard of practice suggests that this fault be considered a seismic source in regional hazard analysis. The fault system is thought to extend from San Clemente State Beach to the Santa Ana River. The model assumed in the analysis for this fault has a 23-degree southwest dip extending from 2 kilometers to 8 kilometers in

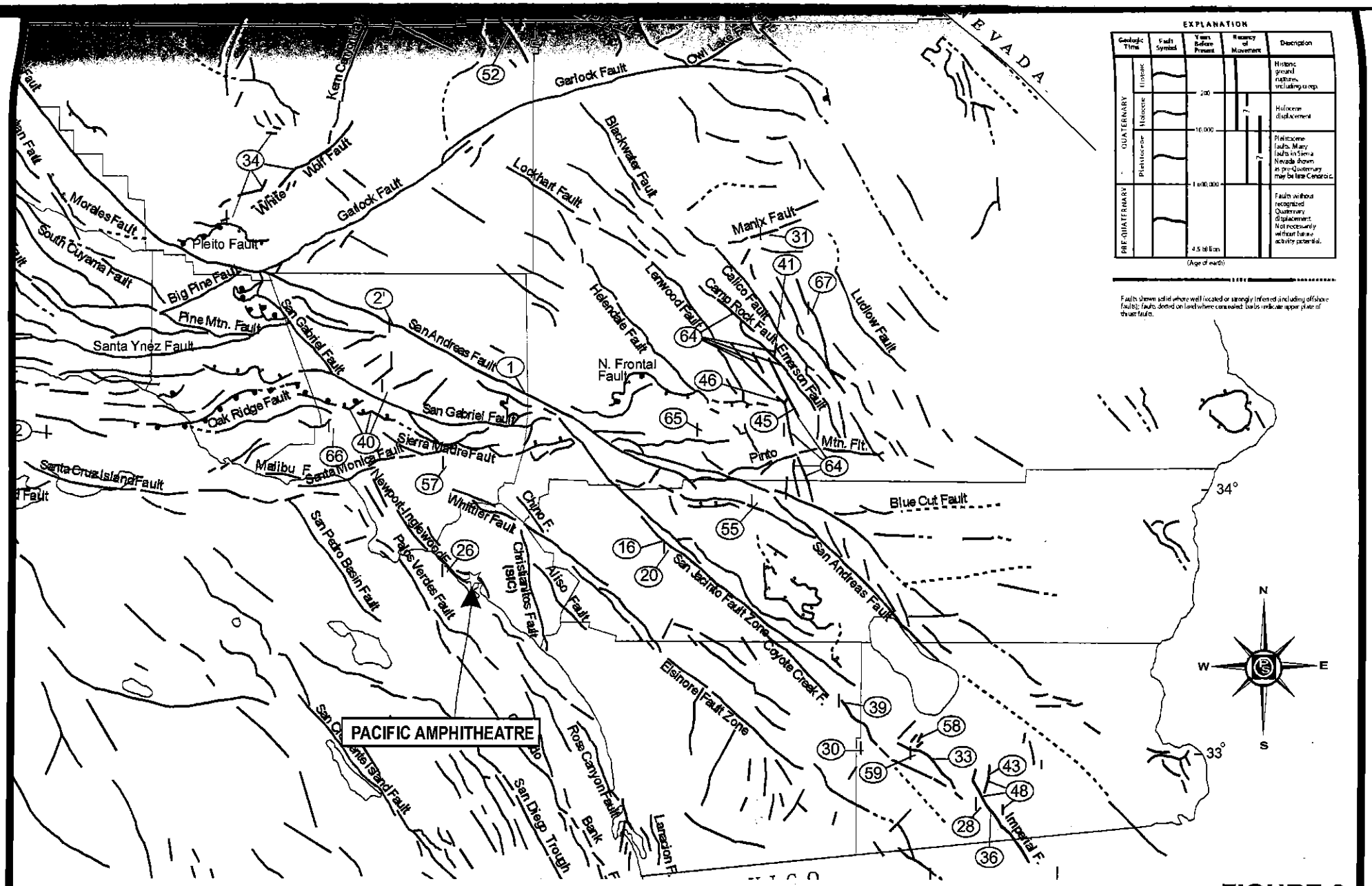

FIGURE 3

SIMPLIFIED FAULT ACTIVITY MAP OF CALIFORNIA

Compiled by Charles W. Jennings and George J. Saucedo
1999 (Revised 2002, Tousson Toppozada and David Branum)

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depth. The rupture bottom is approximately coincident with the location of the offshore Newport-Inglewood Fault Zone. The slip rate is 0.50 +/- 0.20 mm per year, and it is based on the average late Quaternary uplift rate of the San Joaquin Hills of 0.21 to 0.27 mm per year and inferred dip of 20 to 30 degrees. The maximum magnitude (Mw) is estimated at 6.6. Based on FRISKSP, the closest distance from the site to the location of the rupture plane, projected vertically to the surface, is approximately 3 kilometers.

Palos Verdes Fault Zone

The Palos Verdes fault system lies approximately 24 kilometers from the site. The Palos Verdes fault is approximately 80 kilometers in length, extending continuously from the Santa Monica Thrust southward across Santa Monica Bay, crossing the Palos Verdes Peninsula. It then continues southward into the Coronado Bank fault zone. It is generally considered to be a vertical, right-lateral strike-slip fault system that has generated uplift and folding of the Palos Verdes Peninsula. The slip rate for this fault ranges from 0.1 to 3.00 mm per year, with a maximum magnitude (Mw) of 7.1.

Whittier-Elsinore Fault Zone

The Elsinore/Whittier fault system lies approximately 29 kilometers from the site. The Elsinore fault runs north from Baja, California for approximately 180 kilometers where it splays near the Santa Ana River into two segments, the Whittier fault and the Chino fault. This fault system is a right-lateral strike-slip fault with some reverse-oblique slip on the Whittier fault, which may be partially responsible for the uplift of the Puente Hills. The slip rate for this fault ranges from 2.5 to 4 mm per year, with a maximum magnitude (Mw) of 6.8.

San Andreas Fault Zone

The San Andreas Fault zone lies approximately 79 kilometers northeasterly of the subject site. In California, the San Andreas extends northwesterly from the Mexican border to Point Arena where it continues offshore before turning to the west in the vicinity of Cape Mendocino. The San Andreas Fault is the major structural feature in California and defines a transform boundary between the Pacific and North American tectonic plates. Due to the length and complexity of this fault system, it has been divided into sections on the basis of general trend. The southern portion of the San Andreas, which extends from the Gulf of California to the Transverse Ranges, is closest to the subject site. Displacement along the San Andreas is right lateral strike-slip with a slip rate of about 25 to 35 mm per year and a maximum magnitude (Mw) of 7.2.

4.5 Earthquake Hazards

The subject site is located in southern California, which is a tectonically active area. The type and magnitude of seismic hazards affecting a site are dependent on the distance to the causative fault and the intensity and magnitude of the seismic event. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary such as liquefaction and/or ground lurching.

The State of California prohibits the location of most structures for human occupancy across the traces of active faults through the Alquist-Priolo (A-P) Earthquake Fault Zoning Act. The State Geologist assists local agencies by delineating Earthquake Fault Zones in California. In order to protect public safety from the effects of strong ground shaking, liquefaction, landslides or other ground failure, and other hazards caused by earthquakes, the State of California passed the Seismic Hazards Mapping Act in 1991. Seismic hazards relating to these two acts are discussed below.

4.5.1 Surface Rupture

Surface rupture is a break in the ground surface during or as a consequence of seismic activity. The site is not located within an A-P Fault Zone, nor are there any A-P Fault Zones near the site. No active faults have been identified in the reviewed literature or observed onsite during the referenced studies. The potential for surface rupture on this site is therefore considered low; however, as is the case with most of California, this potential cannot be completely eliminated as a possibility.

4.5.2 Seismically Induced Landsliding

The subject site is relatively level and the nearby slopes consist of engineered artificial fill; therefore, seismically induced landsliding is not expected to adversely affect the site.

4.5.3 Dynamic Settlement

Dynamic settlement is the settlement of the ground surface during a seismic event. Dynamic settlement includes liquefaction and dry-sand settlement.

4.5.3.1 Liquefaction

Liquefaction is the phenomenon where seismic agitation of loose, saturated sands and silty sands can result in a buildup of pore pressures and, if sufficient to overcome overburden stresses, can produce a temporary quick condition known as liquefaction. Once the excess pore water pressure dissipates, the liquefied zones/lenses consolidate causing settlement.

Groundwater was not encountered during the recent investigation and was encountered at depths of roughly 42 feet below the stage elevation during a previous investigation at the site (PSE, 1981). The site is generally underlain with artificial fill and Pleistocene-

aged Marine Terrace Deposits with consistencies that were observed to be medium dense to dense/very stiff. Based on the age and observed consistency of these materials, these materials are considered to have a low susceptibility to liquefaction.

4.5.3.2 Dry Sand Settlement

The granular materials that underlie the site consist of artificial fill and Pleistocene-aged Marine Terrace Deposits with consistencies that were observed to be medium dense to dense. These materials are considered resistant to dry sand settlement. Therefore, dry sand settlement is not anticipated to affect the subject development.

4.5.4 Seiches

A seiche is a free or standing-wave oscillation on the surface of water in an enclosed or semi-enclosed basin. The wave can be initiated by an earthquake and can vary in height from several centimeters to a few meters. Based on the distance to the site from reservoirs, the potential for a seiche impacting the property is considered to be non-existent.

4.5.5 Tsunami

A tsunami is a great sea wave produced by a submarine earthquake or volcanic eruption. It is characterized by great speed of propagation and low observable amplitude on the open sea but can attain heights of up to 100 feet upon encountering shallow water. Significant damage can occur along coastal areas subjected to such a wave. Due to the site's distance from the coastline (4 miles) and elevation (approximately 42 feet above sea level), a tsunami is not considered to pose a hazard.

5.0 MATERIAL PROPERTIES

Presented herein is a general discussion of the analytic methods utilized in this report and the geotechnical properties of the various soil types and earth materials encountered.

5.1 Excavation Characteristics

Based on the subsurface exploration data, it is our opinion that on-site materials can be excavated with conventional earth moving equipment.

5.2 Compressibility

The on-site materials that are highly compressible include the near surface materials that have been disturbed during the demolition of existing improvements at the site. Highly compressible materials will require removal from fill areas prior to placement of fill and where exposed at grade in cut areas within the building area. Recommended removal depths are presented in Section 6.1.

5.3 Hydro-Consolidation

The hydro-consolidation process is a singular response to the introduction of water into collapse-prone alluvial soils. Upon initial wetting, the soil structure and apparent strength are altered and a virtually immediate settlement response occurs. Test results performed on samples obtained from the recent field investigation did not show a hydro-collapse potential. Accordingly hydro-consolidation is not anticipated to affect the development.

5.4 Shear Strength

Shear strength tests were conducted a soil sample that was remolded to 90 percent of the maximum dry density as determined by ASTM Test Method D-1557-02. The shear strengths for the remolded specimen have been estimated based on the results of the test and are summarized in Table 5-1 below.

TABLE 5-1 SHEAR STRENGTH PARAMETERS		
Material	Ultimate Strength	
	Cohesion, C (psf)	Friction Angle, ϕ (degrees)
Remolded Fill	150	34

5.5 Expansion Potential

According to the results presented in Appendix C, a representative sample of the near surface soil is not considered expansive according to the criteria listed in Section 1802.3.2 of the 2007 CBC.

5.6 Earthwork Adjustments

The following average earthwork adjustment factors are presented in the following table:

TABLE 5-2 EARTHWORK ADJUSTMENTS	
Geologic Unit	Recommended Adjustment
Artificial Fill	Negligible Shrinkage

The value may be used in an effort to balance the earthwork quantities. As is the case with every project, contingencies should be made to adjust the earthwork balance when grading is in-progress and actual conditions are better defined.

5.7 Chemical Analyses

The on-site soils are classified as having a "negligible" soluble sulfate exposure level when classified in accordance with Table 4.3.1 of ACI 318-05. The resistivity of onsite soils indicates that these soils are "moderately" corrosive in nature with respect to ferrous metals. Consideration should be given to consulting with a Corrosion Engineer if a more extensive evaluation is required.

Upon completion of grading, samples should be collected and tested. Final recommendations should be based on the results of those tests.

6.0 EARTHWORK CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our geotechnical study, it is PSE's opinion that the subject site is suitable for the proposed development, provided the recommendations presented herein are incorporated into the design and construction of the proposed development.

6.1 Site Preparation and Removals

All grading shall be accomplished under the observation and testing of the project Geotechnical Engineer and Engineering Geologist in accordance with the recommendations contained herein, the current **Grading Code** of the City of Costa Mesa and this firm's **Earthwork Specifications** (Appendix D).

Soils that have been disturbed during site demolition activities should be removed from fill areas prior to placement of fill and should also be removed from shallow cut areas where exposed at finish grades or in footing excavations. Guidelines to determine the depth of removals are presented below; however, the exact extent of the removals must be determined in the field during grading, when observation and evaluation of the greater detail afforded by those exposures can be performed by the Geotechnical Engineer and/or Engineering Geologist.

The bottoms of all removal areas should be observed, mapped and approved by the Engineering Geologist or his/her representative and City representatives (as required) prior to fill placement.

6.1.1 Stripping

Vegetation, debris, and other deleterious materials are unsuitable as structural fill material and should be disposed of off-site prior to commencing removals and placement of compacted fills. All heavy concentrations of roots, if encountered, should be removed.

6.1.2 Disturbed Artificial Fill and Marine Terrace Deposits

Demolition of the existing improvements at the site may disturb some of the near-surface materials. Disturbed Marine Terrace Deposits and artificial fill will require removal. The bottoms of the proposed footing excavations may need to be scarified, moisture conditioned, and compacted to project standards. Final determination for these requirements should be made during grading by the Geotechnical Engineer or his/her representative.

In general, onsite soils are suitable to be re-used as structural fill when properly moisture conditioned and deleterious materials are removed. Some processing, such as mixing and moisture conditioning, should be anticipated.

6.1.3 Existing Utilities and Utility Trench Backfill

It is proposed to leave some of the exiting utilities at the site in place. Some of these utilities are located within the limits of the proposed buildings. The exact depths and locations of these utility lines are unknown. During grading, the Geotechnical Engineer or his/her representative should evaluate the characteristics of the exposed backfill materials for these utilities. If the backfill materials are determined to be unsuitable for the support of the proposed buildings, the materials should be removed and replaced with clean sand, gravel, or cement slurry. Additional recommendations may be necessary if the utilities are located within one (1) foot of the bottom of the foundation elements. Possible recommendations may include rerouting the utility or deepening the foundation elements on either side of the utility in order to "bridge" over the utility.

7.0 EARTHWORK CONSIDERATIONS

7.1 Compaction Standards

All fill and processed natural ground should be compacted to a minimum relative compaction of 90 percent, as determined by ASTM Test Method: D-1557-02. Compaction shall be achieved at slightly above the optimum moisture content, and as generally discussed in the attached **"Earthwork Specifications"**.

Mixing and moisture conditions may be necessary in order to achieve the required moisture conditions.

7.2 Observation

All removal bottoms should be observed and approved by the Engineering Geologist and/or Geotechnical Engineer prior to fill placement.

7.3 Treatment of Removal Bottoms

At the completion of unsuitable soil removals, the exposed bottom should be scarified to a minimum depth of eight (8) inches, moisture-conditioned to above optimum conditions, and compacted in-place to the standards set forth in this report.

7.4 Fill Placement

After removals, scarification, and compaction of in-place materials are completed, additional fill may be placed. Fill should be placed in thin lifts (8-inch bulk), moisture conditioned to slightly above optimum, compacted and tested as grading progresses until final grades are attained.

7.5 Mixing

In order to prevent layering of different soil types and/or different moisture contents, mixing of materials may be necessary. The mixing should be accomplished prior to and as part of compaction of each fill lift. Discing may be required when either excessively dry or wet materials are encountered.

7.6 Benching

Where the existing slope is steeper than 5-horizontal to 1-vertical and where designated by the project Geotechnical Engineer or Engineering Geologist, engineered fill material shall be keyed and benched into competent natural soil.

7.7 Oversized Materials

Materials greater than 8-inches will be unsuitable for use in shallow (less than 10-feet) fills or within the depth of the deepest utility (whichever is greater). Oversized materials (material larger than 8-inches), may be crushed, or disposed of off-site.

7.8 Import Soils

Import soils, if required, should consist of clean, structural quality, compactible materials similar to the on-site soils and should be free of trash, debris or other objectionable materials.

PLANS AND SPECIFICATIONS SHOULD INDICATE THAT THE GRADING CONTRACTOR SHALL NOTIFY THE PROJECT GEOTECHNICAL ENGINEER NOT LESS THAN 72 HOURS IN ADVANCE OF THE LOCATION OF ANY SOILS PROPOSED FOR IMPORT. EACH PROPOSED IMPORT SOURCE SHALL BE SAMPLED, TESTED AND APPROVED PRIOR TO DELIVERY OF SOILS FOR USE ON THE SITE.

8.0 DESIGN RECOMMENDATIONS

8.1 Conventional Slab/Foundation Design Recommendations

According to the site plans, it is proposed to construct a one-story building and a two-story building at the site. Based upon testing of a representative sample of the near surface soils the onsite soils are considered to have a "Very Low" expansion potential in accordance to Section 1802.3.2 of the 2007 CBC. Preliminary foundation recommendations presented below are based upon this anticipated expansion potential of the near-surface materials.

- Allowable bearing: 2,000 psf, based on a minimum depth width and depth.

➢ Lateral Bearing:	200 psf/foot of depth to a maximum of 2,000 psf. These values assume a level condition at the toe.
➢ Sliding Coefficient:	0.35
➢ Minimum Embedment Depth:	12-inches from lowest adjacent grade.
➢ Minimum Footing Width:	18-inches for continuous footings and 24-inches for isolated spread footings
➢ Minimum Footing Reinforcement (Exterior and Interior)	All continuous; two (2) No. 4 bars, one (1) near the top, and one (1) near the bottom.
➢ Minimum Slab Reinforcement:	No. 3 bars, at 18 inches on center each way.
➢ Minimum Slab Thickness:	4-inches (actual)
➢ Slab Subgrade Moisture:	Minimum of 120% of optimum moisture to a depth of 12 inches immediately prior to placing concrete.

The above values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building Code and structural design considerations may govern depth and reinforcement requirements and should be evaluated.

8.2 Moisture and Vapor Retarding System

In accordance with Section 1807 of the 2007 CBC, a moisture and vapor retarding system should be placed below all slabs-on-grade in portions of the structures considered moisture sensitive. The retarder should be of suitable composition, thickness, strength and low permeability to effectively prevent the migration of water and reduce the transmission of water vapor to acceptable levels. Historically, a 10-mil plastic membrane, such as Visqueen placed between 2 to 4 inches of clean sand, has been used for this purpose. The use of this system or other systems, materials, or techniques can be considered, at the discretion of the designer, provided the system reduces the vapor transmission rates to acceptable levels.

8.3 Isolated Footings

Isolated exterior post/column footings should be tied into the main foundation system in at least two (2) orthogonal directions.

8.4 Additional Foundation Construction Considerations

- To reduce moisture penetration beneath the slab-on-grade areas, utility trenches should be backfilled with lean concrete or concrete slurry where they intercept the foundation perimeter. As an alternative, such excavations can be backfilled with native soils moisture-conditioned to over optimum and compacted to a minimum of 90 percent of the maximum dry density as determined in accordance with ASTM Test Method: D 1557-02.
- Soil materials from foundation excavations should not be spread on slab on grade areas unless it is compacted and tested.
- Foundation excavations should be observed by a representative of this firm prior to the placement of forms, reinforcement or concrete. The excavations should be free of all loose and sloughed materials, be neatly trimmed and moisture conditioned at the time of concrete placement.

8.5 Surcharge on Existing Retaining Walls

The proposed buildings and access ramp are expected to impose surcharge loads on the existing retaining walls and retaining wall foundations. The structural engineer should evaluate whether the added loading to the retaining walls and retaining wall foundations are within the tolerable structural limits of the existing walls and foundations. The structural engineer should also evaluate whether the added loading to the existing retaining wall foundations are within the limits of the allowable foundation bearing pressures of the existing retaining wall foundations. Design parameters provided in the referenced report indicate that the foundations may have been designed using an allowable bearing pressure of 2,000 pounds per square foot (PSE, 1981). However, the original structural calculations were not reviewed by this firm. According to the original structural plans for the amphitheatre, the retaining wall adjacent to the two proposed buildings is supported on a continuous footing that is roughly 7½ feet wide with the bottom of the foundation located 3 feet below the top of the stage.

The Video Building is expected to surcharge the existing retaining wall for the basement access stairwell and tunnel. Portions of the continuous footing for the Video Building are located within 2 feet horizontally from this wall. The surcharge on the retaining wall due to the footing (assuming a continuous footing load of roughly 3.4 kips per foot and assuming the bottom of the footing is located roughly 1 foot below existing grades at the site) has been estimated and is shown on Figure 4. Figure 4 shows added surcharge loads on the wall for portions of the wall located within roughly 2 feet from the footing; the surcharge loads on the wall decrease as the distance from the footing to the wall increase. The structural engineer should evaluate whether the existing retaining wall can tolerate this added surcharge.

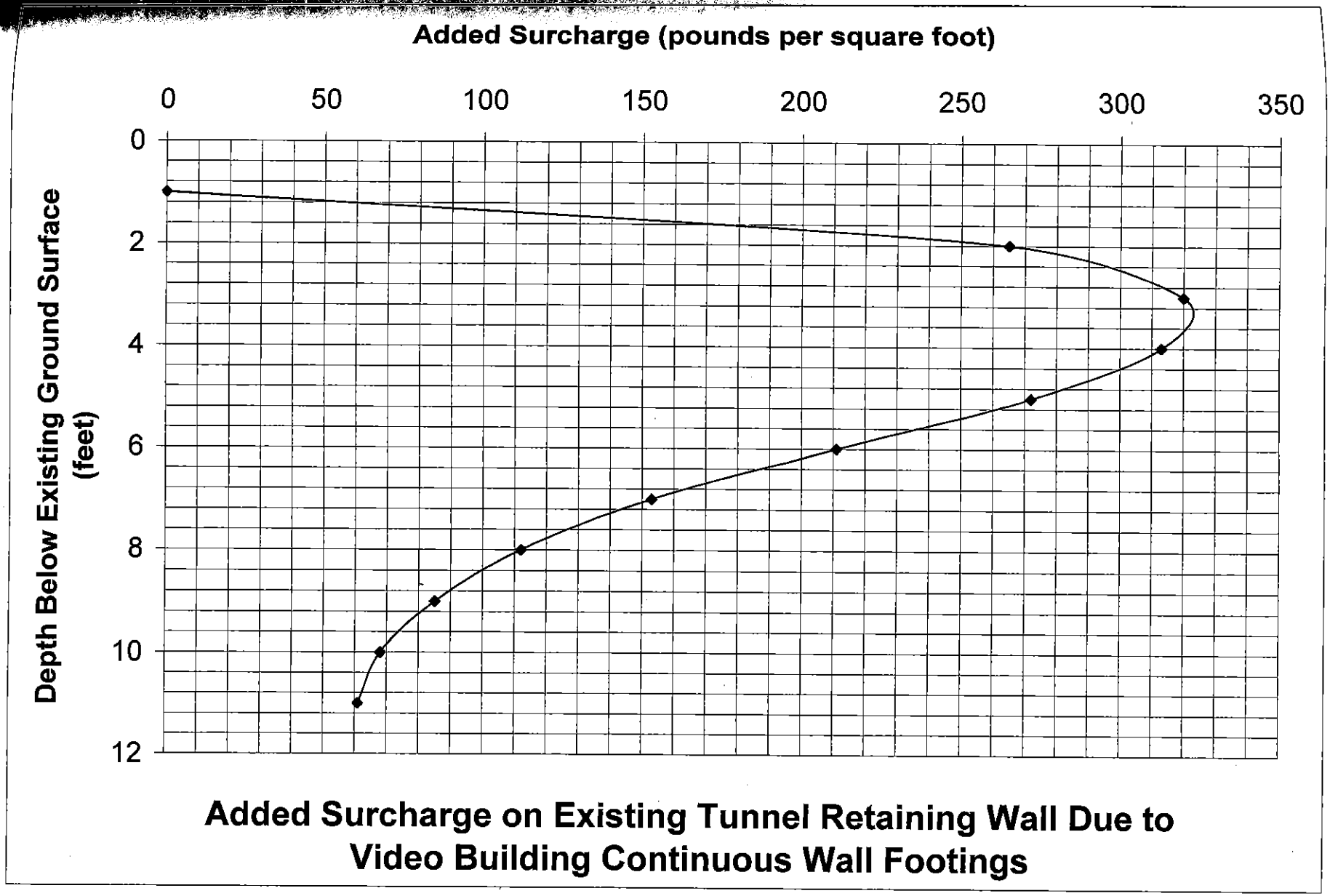
8.6 Settlement

For foundations designed based on the above values total settlements under structural loads should be less than 1-inch and differential settlements under structural loads should be less than ½-inch across 40 feet.

Settlement of the existing retaining wall footings due to the added loading of the proposed buildings is expected to be less than ¼ inch.

8.7 Seismic Design Parameters

The following seismic design parameters are presented to be code compliant to the California Building Code (2007). The subject site has been identified to be a "D" site class in accordance with Table 1613.5.3 (1) of the 2007 CBC. The site is located at Latitude 33° 39' 58.28" N and Longitude 117° 54' 17.33" W. Utilizing this information, the computer program USGS Earthquake Ground Motion Parameters Version 5.0.7, and ASCE 7 criterion, the seismic design category for 0.20 second (Ss) and 1.0 second (S1) period response accelerations can be determined (Section 1613.5.5.1, CBC, 2007) along with the design spectral response accelerations (Section 1613.5.4, CBC, 2007).



Added Surcharge on Existing Tunnel Retaining Wall Due to Video Building Continuous Wall Footings

8.8 Exterior Flatwork

The minimum thickness of all exterior concrete should be 4 inches (actual). Subgrade soils should contain at least 120 percent of the optimum moisture content to a depth of 12-inches immediately prior to placing concrete. The structural engineer should evaluate the need for reinforcement and doweling of exterior flatwork areas, raised porches and stairways. Control joints should be provided at a minimum spacing of 10± feet.

8.9 Utility Trench Excavation and Backfill

All utility trenches should be shored or laid back in accordance with applicable OSHA standards. Utility trench backfill should be compacted to at least 90 percent of maximum laboratory dry density as determined in accordance with ASTM Test Method: D 1557-02. On-site soils may not be suitable for use as bedding materials but will be suitable for use in backfill.

Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable. Under-slab trenches should also be compacted to project specifications. If native soils are used, mechanical compaction is recommended. The Geotechnical Engineer should be notified for observation and testing prior to placement of the membrane and slab reinforcement.

It is suggested that the utility trenches be backfilled with concrete slurry where they intercept the perimeter footings (under the footing) to reduce the potential for moisture migration below the slab area.

8.10 Concrete Mix Design

Testing of site soils during previous grading operations indicated "negligible" sulfate concentrations when classified in accordance with Table 4.3.1 of ACI 318-05. As such, sulfate resistant concrete is not required by ACI 318-05.

8.11 Site Drainage

Final site grading should assure positive drainage away from structures. The use of gutters and down spouts to carry roof drainage well away from structures is recommended.

9.0 CLOSURE

9.1 Geotechnical Review

As is the case in any grading project, multiple working hypotheses are established utilizing the available data and the most probable model is used for the analysis. Information collected during the grading operations is intended to evaluate the hypothesis and some of the assumptions summarized herein may need to be changed as more information becomes available. Some modification of the grading recommendations may become necessary, should the conditions encountered in the field differ significantly than those hypothesized to exist.

Pacific Soils Engineering, Inc. should review the pertinent plans and sections of the project specifications, to evaluate conformance with the intent of the recommendations contained in this report.

If the project description or final design varies from that described in this report, Pacific Soils Engineering, Inc., must be consulted regarding the applicability of, and the necessity for, any revisions to the recommendations presented herein. Pacific Soils Engineering, Inc., accepts no liability for any use of its recommendations if the project description or final design varies and Pacific Soils Engineering, Inc., is not consulted regarding the changes.

9.2 Limitations

This report is based on the project as indicated on the architectural plans prepared by MAKE Architecture and on the structural plans prepared by Vincent Kevin Kelly and Associates, on the information communicated by the structural engineer, and on the information obtained from the borings at the approximate

locations indicated on the plans. The findings are based on the results of the field, laboratory, and office investigations combined with an interpolation and extrapolation or conditions between and beyond the boring locations. The results reflect an interpretation of the direct evidence obtained. Services performed by Pacific Soils Engineering, Inc., have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by Geotechnical Engineers and Engineering Geologists who are familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report. Pacific Soils Engineering, Inc., should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations of this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of Pacific Soils Engineering, Inc.

Pacific Soils Engineering, Inc., has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the

CONTRACTOR, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

APPENDIX A

REFERENCES

APPENDIX A

References

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APPENDIX B

SUBSURFACE INVESTIGATION

APPENDIX B

Subsurface Investigation

A limited access hollowstem auger drill rig was utilized to excavate one boring within the subject site to a depth of 26 feet below existing grades. Three additional borings were advanced using a hand-auger to depths of up to 5 feet. The approximate locations of the exploratory borings are shown on the accompanying Plates 1 and 2 and the Geotechnical Boring Logs are attached.

Representative bulk soil samples were obtained at various depths. Ring samples were obtained by driving a Modified California Sampler into the material a total of 18-inches or until refusal. Blow counts required to drive the sampler the final 12 inches are indicated on the Geotechnical Boring Logs. The Modified California Sampler is a spoon-type sampler, which has an inside diameter of 2.42-inches and a tapered cutting tip at the lower end. The barrel is lined with thin brass rings, each 1-inch in length. Material is retained within the brass rings during the driving of the sampler.

The ring samples and bulk samples were transported to PSE's laboratory for testing. Laboratory testing procedures and test results are presented in Appendix C of this report.

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		grf	ltr	Description
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravel and Gravelly Soils More than 50% of coarse fraction retained on No. 4 sieve		GW	Well-graded gravels or gravel sand mixtures, little or no fines
			GP	Poorly-graded gravels or gravel sand mixture, little or no fines
			GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and Sandy Soils More than 50% of coarse fraction passes No. 4 sieve		SW	Well-graded sands or gravelly sands, little or no fines
			SP	Poorly-graded sands or gravelly sands, little or no fines
			SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, and-clay mixtures

Major Divisions		grf	ltr	Description
Fine Grained Soils More than 50% passes No. 200 sieve	Silts And Clays LL < 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silt-clays of low plasticity
	Silts And Clays LL ≥ 50		MH	Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat and other highly organic soils

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

U.S. STANDARD SERIES SIEVE: 200 | 40 | 10 | 4 — CLEAR SQUARE SIEVE OPENINGS: 3/4" | 3" | 12"

Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

RELATIVE DENSITY

Sands and Gravels	Blows/Foot (SPT)
Very Loose	< 4
Loose	4 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

CONSISTENCY CLASSIFICATION

Silts and Clays	Criteria
Very Soft	Thumb penetrates soil >1 in.
Soft	Thumb penetrates soil 1 in.
Firm	Thumb penetrates soil 1/4 in.
Stiff	Readily indented with thumbnail
Very Stiff	Thumbnail will not indent soil

HARDNESS

Bedrock
Soft
Moderately Hard
Hard
Very Hard

LABORATORY TESTS

Symbol	Test
DS	Direct Shear
DSR	Direct Shear (Remolded)
CON	Consolidation
SA	Sieve Analysis
MAX	Maximum Density
RV	Resistance (R) Value
EI	Expansion Index
SE	Sand Equivalent
AL	Atterberg Limits
CHEM	Chemical Analysis
HY	Hydrometer Analysis

SOIL MOISTURE

Increasing Visual Moisture Content

Dry - Dry to touch

Moist - Damp, but no visible free water

Wet - Visible free water

SIZE PROPORTIONS

Trace - < 5 %

Few - 5 to 10 %

Some - 15 to 25 %

KEY TO EXPLORATORY BORING LOGS

PACIFIC SOILS ENGINEERING, INC.

PLATE B

GEOTECHNICAL BORING LOG

PROJECT NO.	500643-A	PROJECT NAME	Pacific Amphitheatre	BORING DESIG.	B-1
DATE STARTED	12/21/07	GROUND ELEV.	43	LOGGED BY	SJD
DATE FINISHED	12/21/07	GW DEPTH (FT)		DRIVE WT.	140 lbs.
DRILLER	Jet	DROP	30 in.		
TYPE OF DRILL RIG	8" HSA				

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						Concrete, 5"				
		B			SM	**ARTIFICIAL FILL (af):** Silty Sand, fine-grained, some clay intermixed, mottled, orangish brown, brown, and light yellowish brown, moist, medium dense				DSR MAX EI HY CHEM
	40				SM	**MARINE TERRACE DEPOSITS (Qtm):** Silty Sand, fine-grained, slighty mottled, greyish brown, dense				
5		R	70			@ 5 ft. - some clay, mottled, greyish brown and yellowish brown, moist, dense	13.4	111	72	CON HY
	35	R	75			@ 7.5 ft. - finer-grained, slightly mottled, yellowish brown, moist, medium dense	14.1	111	77	
10		R	89/10"		ML	@ 10 ft. - SANDY SILT, sand is fine-grained, slightly mottled, olive grey and olive brown with some orangish brown staining, moist, very stiff	13.7	108	69	CON HY
	30									
15		R	75/11"		SM	@ 15 ft. - SILTY SAND, fine-grained, slightly mottled, grey with orangish brown staining, moist, dense	7.0	95	25	
	25									
20		R	80/10"		SM	@ 20 ft. - very fine-grained, slightly mottled, greyish brown and olive brown with orangish brown staining, moist, dense	8.9	102	38	
	20									
25		R	86/11"		SM	@ 25 ft. - less silt, fine to coarse-grained, ornagish brown, moist, dense to very dense	6.7	101	28	HY
						TOTAL DEPTH 26 FEET NO GROUNDWATER ENCOUNTERED				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE B-1

GEOTECHNICAL BORING LOG

PROJECT NO.	500643-A	PROJECT NAME	Pacific Amphitheatre		
DATE STARTED	12/21/07	GROUND ELEV.	43	BORING DESIG.	B-2A
DATE FINISHED	12/21/07	GW DEPTH (FT)		LOGGED BY	SJD
DRILLER	Jet	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	Hand Auger	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SP-SM	Concrete, 5"				
						ARTIFICIAL FILL (af): Silty Sand and Sand, yellowish brown, moist				
	40					TOTAL DEPTH 2'4"				
5						REFUSAL ON PLASTIC CONDUITS (ELECTRICAL?)				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

PACIFIC SOILS ENGINEERING, INC.

PLATEB-2A

GEOTECHNICAL BORING LOG

PROJECT NO.	500643-A	PROJECT NAME	Pacific Amphitheatre	BORING DESIG.	B-2B
DATE STARTED	12/21/07	GROUND ELEV.	43	LOGGED BY	SJD
DATE FINISHED	12/21/07	GW DEPTH (FT)		DRIVE WT.	
DRILLER	Jet	DROP			
TYPE OF DRILL RIG	Hand Auger				

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SP-SM	Concrete, 5"				
	40					**ARTIFICIAL FILL (af):** Silty Sand and Sand, several large pieces of concrete debris (wash?), yellowish brown, moist				
5						TOTAL DEPTH 2' REFUSAL ON CONCRETE (FOOTING OR ENCASED CONDUITS)				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE B-2B

GEOTECHNICAL BORING LOG

PROJECT NO. 500643-A
DATE STARTED 12/21/07
DATE FINISHED 12/21/07
DRILLER Jet
TYPE OF DRILL RIG Hand Auger

PROJECT NAME Pacific Amphitheatre
GROUND ELEV. 43
GW DEPTH (FT)
DROP

BORING DESIG. B-2C
LOGGED BY SJD
DRIVE WT.

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SP-SM	Concrete, 5"				
	40					**ARTIFICIAL FILL (af):** Silty Sand and Sand, several large pieces of concrete debris (wash?), yellowish brown, moist				
5						@ 5ft. - piece of concrete (conduit?)				
						TOTAL DEPTH 5' REFUSAL DUE TO ELECTRICAL LINE (CONCRETE ENCASED ELECTRICAL CONDUIT?)				

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE B-2C

APPENDIX C

LABORATORY DATA

APPENDIX C

Laboratory Data

The results of laboratory testing performed during this study are enclosed within this Appendix. Table C-1 presents a summary of laboratory test results.

The following laboratory tests were performed on representative samples in accordance with the applicable latest standards or methods from the ASTM, Uniform Building Code (UBC) and California Department of Transportation.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM D-2487 and D-2488.

Consolidation Tests

Consolidation tests were performed on two relatively undisturbed soil samples in accordance with procedures outlined in ASTM D-2435. Samples were placed in a consolidometer and loads were applied incrementally in geometric progression. The samples (2.42-inches in diameter and 1-inch in height) were permitted to consolidate under each load increment until the slope of the characteristic linear secondary compression portion of the thickness versus log of time plot was apparent.

The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Hydro-consolidation (collapse) and expansion characteristics were also evaluated by monitoring the change in volume with saturation while the specimen was confined under constant normal stress. The consolidation test results are shown on Plates C-1 and C-2.

Direct Shear Tests

A direct shear test was performed on one sample that was remolded to 90 percent of the maximum dry density as determined in accordance with ASTM Test Method: D 1557-02. Samples were saturated overnight in a confined condition prior to testing. The apparatus used is

in conformance with the requirements outlined in ASTM Test Method: D-3080. The test specimens (1-inch in height and 2.5-inches in diameter) were subjected to simple shear along a plane at mid-height.

The samples were sheared under various normal loads, a different specimen being used for each normal load. A strain of 0.050-inches per minute was used to evaluate shear strength values.

The specimens were sheared until the shear stress reached a constant value or until the sample deformation had reached approximately 10 percent of the original diameter.

The shear stress values obtained from the tests were plotted versus the applied normal pressures. An appropriate straight line was drawn through the plotted points to obtain the shear strength envelope. The cohesion and angle of internal friction of the soil materials were evaluated from the shear strength envelopes. The direct shear test results are shown on Plate C-3.

Maximum Density/Optimum Moisture

The maximum dry densities and optimum moisture contents of one representative bulk sample were evaluated in accordance with ASTM D-1557/Method A. The results of these tests are summarized in Table C-1.

Particle Size Analysis

Modified hydrometer portions of ASTM D 2442-72 were conducted to aid in classification of the soils. The results of the particle size analysis are presented in Table C-1.

Expansion Index Tests

Expansion Index testing was performed to evaluate the expansion potential of typical on-site soils. Testing was carried out according to UBC Method 18-2. The results are presented in Table C-1.

Chemical Analyses

Resistivity and pH testing was performed by PSE to evaluate the corrosivity characteristics of on-site materials in accordance with ASTM Test Method G57. The sulfate and chloride contents

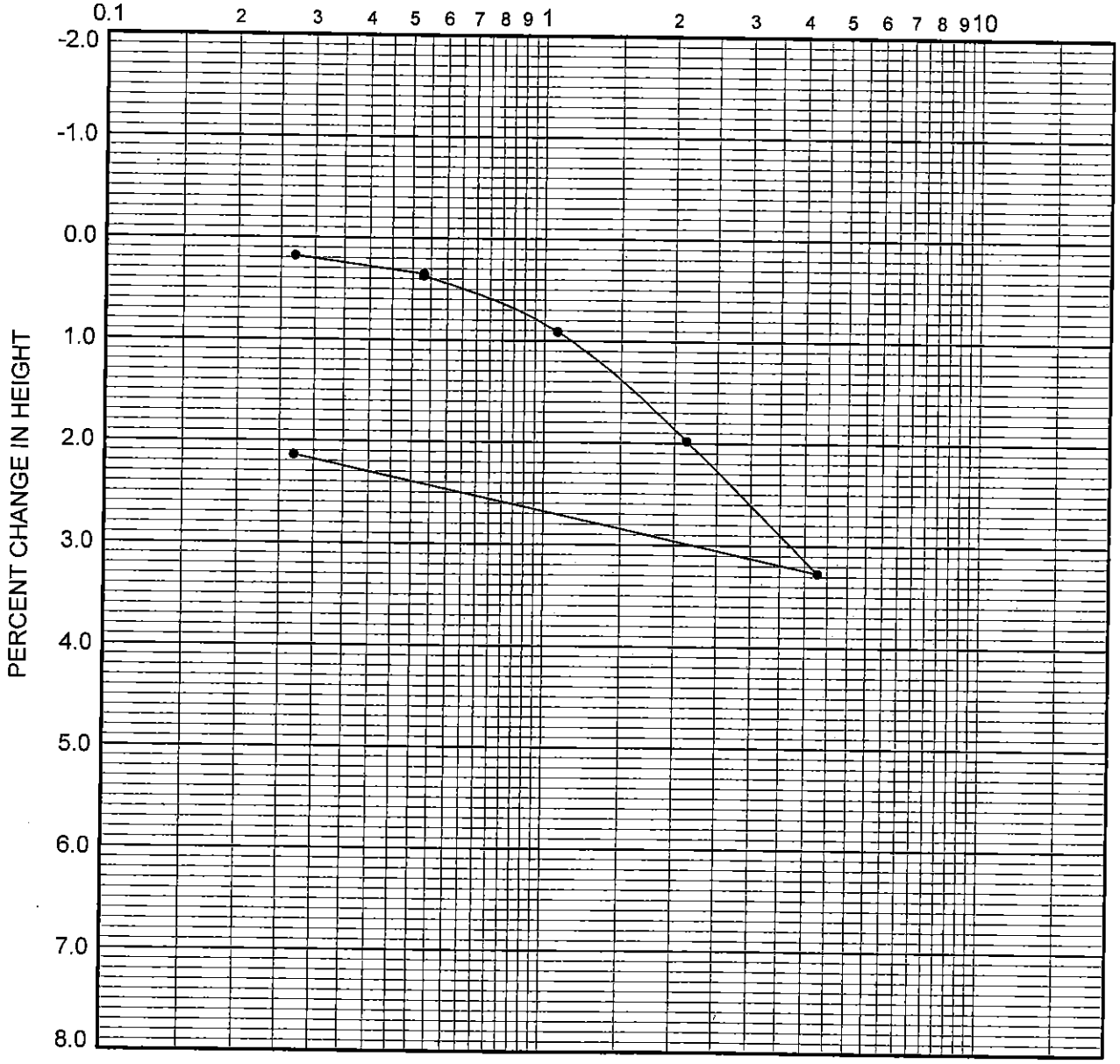
of a selected sample were evaluated by KYH Co., Analytical Laboratory. The results of these tests are included in the following table.

CHEMICAL TEST RESULTS				
Sample	**Sulfate Content (% wt.)***	**Chloride Content (% wt.)***	**pH**	**Resistivity (ohm-cm)**
B-1 @ ½-3 feet	0.010	0.004	7.7	1,800
*Sulfate and Chloride Content tests provided by KYH Co. Analytical Laboratory, Santa Ana, California				

TABLE C-1
SUMMARY OF LABORATORY TEST DATA
W.O. 500643-A

BORING	DEPTH (FEET)	SOIL DESCRIPTION	GROUP SYMBOL	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DIRECT SHEAR	PLUS NO.4 SEIVE (plus 4.76mm) (%)	SAND (4.76mm-0.075mm) (%)	SILT (0.075mm-0.005mm) (%)	CLAY (minus 0.005mm) (%)	EXPANSION INDEX UBC 18-2	OTHER TESTS REMARKS
B-1	0.5	Artificial Fill (af): Silty Sand	SM	115.8	13.5	SEE PLATE C-3	0	75	13	12	4	Chemical
B-1	5	Marine Terrace Deposits (Qtm): Silty Sand	SM				0	78	10	12		Consol- See Plate 1
B-1	10	Marine Terrace Deposits (Qtm): Sandy Silt	ML				0	38	45	17		Consol- See Plate 2
B-1	25	Marine Terrace Deposits (Qtm): Silty Sand	SM				1	79	15	5		

COMPRESSIVE STRESS IN TSF



boring	depth (ft.)	dry density (pcf)	in situ moist. (%)	in situ satur. (%)	-200 sieve (%)	group symbol	typical names
B-1	5.0	111	13.4	72	22	SM	Marine Terrace Deposits (Qtm): Silty Sand

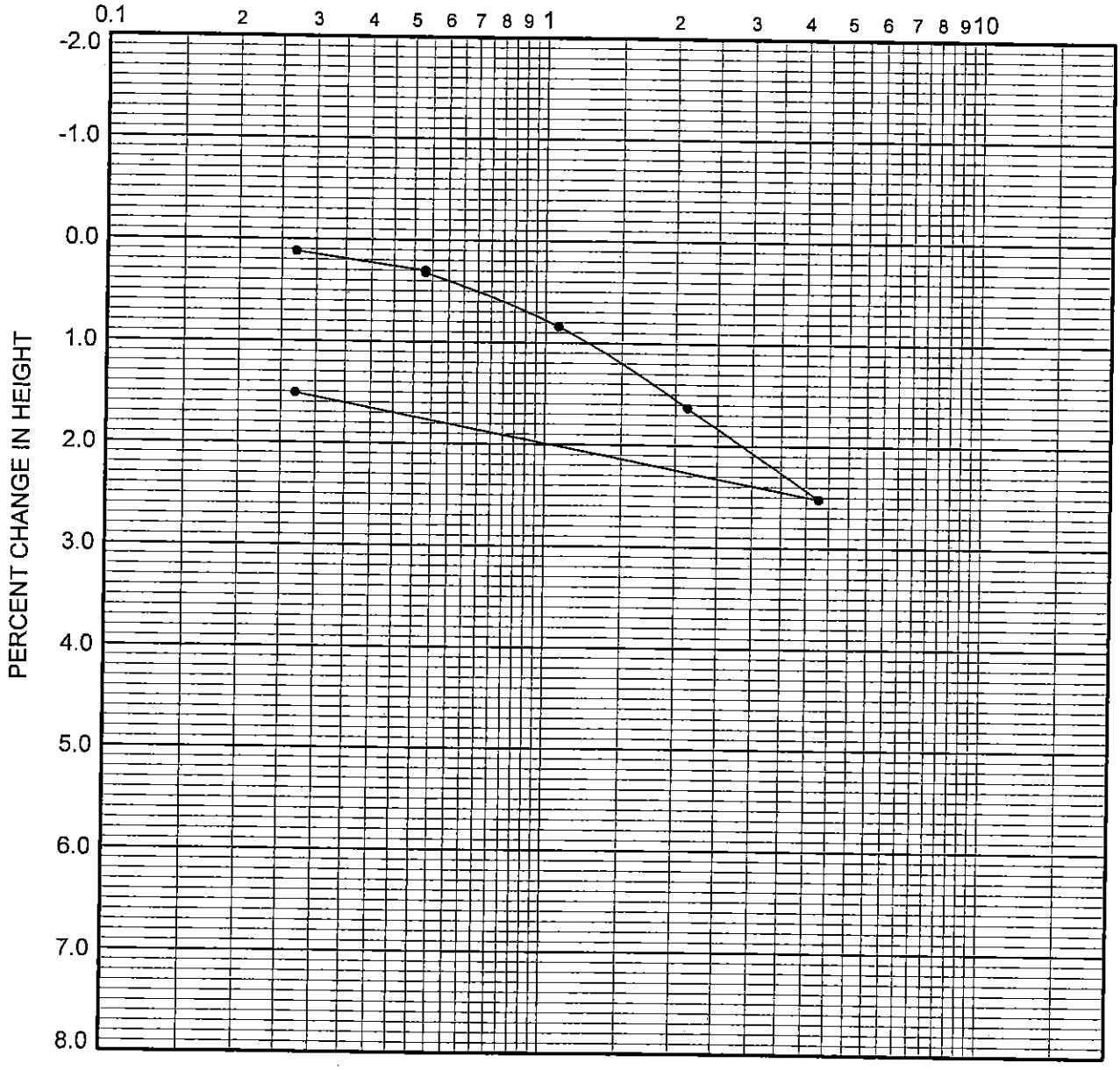
REMARKS: WATER ADDED AT 0.53 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

W.O. 500643-A PLATE C-1

COMPRESSIVE STRESS IN TSF



boring	depth (ft.)	dry density (pcf)	in situ moist. (%)	in situ satur. (%)	-200 sieve (%)	group symbol	typical names
B-1	10.0	108	13.7	69	62	ML	Marine Terrace Deposits (Qtm): Sandy Silt

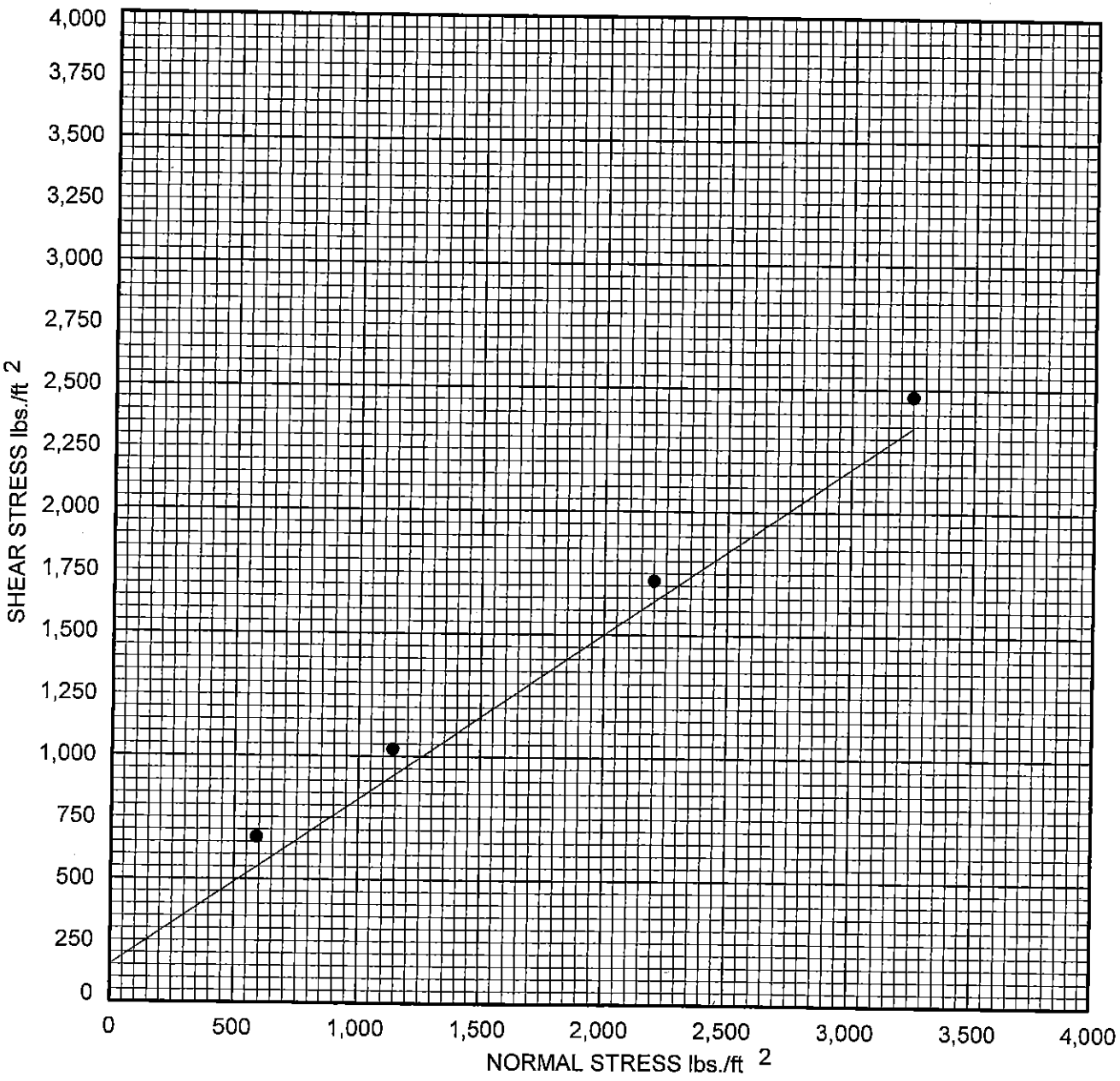
REMARKS: WATER ADDED AT 0.53 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

W.O. 500643-A PLATE C-2

DIRECT SHEAR TEST
Remolded at 90% Relative Compaction - Residual Strength



boring	depth (ft.)	dry density (pcf)	in situ moist. (%)	-200 sieve (%)	group symbol	typical names
B-1	0.5			25	SM	Artificial Fill (af): Silty Sand

COHESION	150	psf.
FRICTION ANGLE	34.0	degrees

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.

W.O. 500643-A PLATE C-3

APPENDIX D

EARTHWORK SPECIFICATIONS

PACIFIC SOILS ENGINEERING, INC.
EARTHWORK SPECIFICATIONS

These specifications present generally accepted standards and minimum earthwork requirements for the development of the project. These specifications shall be the project guidelines for earthwork except where specifically superceded in preliminary geology and soils reports, grading plan review reports or by prevailing grading codes or ordinances of the controlling agency.

I. GENERAL

A. The contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.

B. The project Soil Engineer and Engineering Geologist or their representatives shall provide testing services, and Geotechnical consultation during the duration of the project.

C. All clearing, grubbing, stripping and site preparation for the project shall be accomplished by the Contractor to the satisfaction of the Soil Engineer.

D. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soil Engineer and to place, spread, mix and compact the fill in accordance with the job specifications and as required by the Soil Engineer. The Contractor shall also remove all material considered by the Soil Engineer to be unsuitable for use in the construction of compacted fill.

E. The Contractor shall have suitable and sufficient equipment in operation to handle the amount of fill being placed. When necessary, equipment will be shut down temporarily in order to permit proper compaction of fills.

II. SITE PREPARATION

A. Excessive vegetation and all deleterious material should be disposed of offsite as required by the Soil Engineer. Existing fill, soil, alluvium or rock materials determined by the Soil Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Where applicable, the Contractor may obtain the approval of the Soil Engineer and the controlling authorities for the project to dispose of the above described materials, or a portion thereof, in designated areas onsite.

After removals as described above have been accomplished, earth materials deemed unsuitable in their natural, in-place condition, shall be removed as recommended by the Soil Engineer/Engineering Geologist.

B. After the removals as delineated in Item II, A above, the exposed surfaces shall be disced or bladed by the Contractor to the satisfaction of the Soil Engineer. The prepared ground surfaces shall then be brought to the specified moisture condition, mixed as required, and compacted and tested as specified. In areas where it is necessary to obtain the approval of the controlling agency, prior to placing fill, it will be the contractor's responsibility to notify the proper authorities.

C. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or others not located prior to grading are to be removed or treated in a manner prescribed by the Soil Engineer and/or the controlling agency for the project.

III. COMPACTED FILLS

A. Any materials imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soil Engineer. Deleterious material not disposed of during clearing or demolition shall be removed from the fill as directed by the Soil Engineer.

B. Rock or rock fragments less than eight inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets and the distribution of the rocks is approved by the Soil Engineer.

C. Rocks greater than eight inches in the largest dimension shall be taken offsite, or placed in accordance with the recommendations of the Soil Engineer in areas designated as suitable for rock disposal.

D. All fills, including onsite and import materials to be used for fill, shall be tested in the laboratory by the Soil Engineer. Proposed import materials shall be approved prior to importation.

E. The fill materials shall be placed by the Contractor in layers that when compacted shall not exceed six inches. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain a near uniform moisture condition and a uniform blend of materials.

All compaction shall be achieved at optimum moisture content, or above, as determined by the applicable laboratory standard. No upper limit on the moisture content is necessary; however, the Contractor must achieve the necessary compaction and will be alerted when the material is too wet and compaction cannot be attained.

F. Where the moisture content of the fill material is below the limit specified by the Soil Engineer, water shall be added and the materials shall be blended until a uniform moisture content, within specified limits, is achieved. Where the moisture content of the fill material is above the limits specified by the Soil Engineer, the fill materials shall be aerated by discing, blading or other satisfactory methods until the moisture content is within the limits specified.

G. Each fill layer shall be compacted to minimum project standards, in compliance with the testing methods specified by the controlling governmental agency and in accordance with recommendations of the Soil Engineer.

In the absence of specific recommendations by the Soil Engineer to the contrary, the compaction standard shall be ASTM:D 1557-91.

H. Where a slope receiving fill exceeds a ratio of five-horizontal to one-vertical, the fill shall be keyed and benched through all unsuitable topsoil, colluvium, alluvium, or creep material, into sound bedrock or firm material, in accordance with the recommendations and approval of the Soil Engineer.

I. Side hill fills shall have a minimum key width of 15 feet into bedrock of firm materials, unless otherwise specified in the soil report and approved by the Soil Engineer in the field.

J. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency and/or with the recommendations of the Soil Engineer and Engineering Geologist.

K. The contractor shall be required to maintain the specified minimum relative compaction out to the finish slope face of fill slopes, buttresses, and stabilization fills as directed by the Soil Engineer and/or the governing agency for the project. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of eh slope face with suitable equipment, or by any other procedure which produces the designated result.

L. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm material; and the transition shall be stripped of all soil or unsuitable materials prior to placing fill.

The cut portion should be made and evaluated by the Engineering Geologist prior to placement of fill above.

M. Pad areas in natural ground and cut shall be approved by the Soil Engineer. Finished surfaces of these pads may require scarification and recompaction.

IV. CUT SLOPES

A. The Engineering Geologist shall inspect all cut slopes and shall be notified by the Contractor when cut slopes are started.

B. If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the Engineering Geologist and Soil Engineer shall investigate, analyze and make recommendations to treat these problems.

C. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the prevailing drainage.

D. Unless otherwise specified in soil and geological reports, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

E. Drainage terraces shall be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the Soil Engineer or Engineering Geologist.

V. GRADING CONTROL

A. Fill placement shall be observed by the Soil Engineer and/or his representative during the progress of grading.

Field density tests shall be made by the Soil Engineer and/or his representative to evaluate the compaction and moisture compliance of each layer of fill. Density tests shall be performed at intervals not to exceed two feet of fill height. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density determinations shall be taken in the compacted material below the disturbed surface at a depth determined by the Soil Engineer or his representative.

B. Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction, or improper moisture is in evidence, the particular layer or portion shall be reworked until the required density and/or moisture content has been attained. No additional fill shall be placed over an area until the last placed lift of fill has been tested and found to meet the density and moisture requirements and that lift approved by the Soil Engineer.

C. Where the work is interrupted by heavy rains, fill operations shall not be resumed until field observations and tests by the Soil Engineer indicate the moisture content and density of the fill are within the limits previously specified.

D. During construction, the Contractor shall properly grade all surfaces to maintain good drainage and prevent ponding of water. The Contractor shall take remedial measures to control surface water and to prevent erosion of graded area until such time as permanent drainage and erosion measures have been installed.

E. Observation and testing by the Soil Engineer shall be conducted during the filling and compacting operations in order that he will be able to state in his opinion all cut and filled areas are graded in accordance with the approved specifications.

F. After completion of grading and after the Soil Engineer and Engineering Geologist have finished their observations of the work, final reports shall be submitted. No further excavation or filling shall be undertaken without prior notification of the Soil Engineer and/or Engineering Geologist.

VI. SLOPE

All finished cut and fill slopes shall be planted and/or protected from erosion in accordance with the project specifications and/or recommended by a landscape architect.

PAC AMP ORIGINAL

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Harbor City, Ca. 90710
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William Blurock & Partners
2300 Newport Boulevard
Newport Beach, California 92660

June 26, 1981
Work Order 100957

This report/plan reflects geotechnical conditions as of the original published date of _____ and the data, conclusions and recommendations presented may no longer be valid for the subject project/property. Issuance of this document on this date should not be construed as a re-certification or a representation of present site conditions.

Pacific Soils Engineering, Inc.
By:_____
Date:_____

Attention: Mr. William Blurock

Subject: Geotechnical Report for Proposed Pacific Amphitheatre for Nederlander West, Inc., Orange County Fair and Exposition Center, Costa Mesa, California

Gentlemen:

This report presents the results of the geotechnical investigation this firm has conducted at the site of the subject project. The purpose of the investigation is to evaluate existing site geotechnical conditions as they relate to proposed development. In evaluating these conditions, the following scope of work was undertaken:

- Subsurface exploration including logging and sampling of eight rotary bucket auger borings and two hollow stem auger borings to depths ranging from 26 to 100 feet.

- Laboratory testing to determine site soil characteristics within the depth of influence of the proposed development. These characteristics include in-place density, moisture, shear strength, swell and compressibility.

- Analyses of the proposed development in relation to soil characteristics.

- Summarization and presentation of our findings, conclusions and recommendations regarding earthwork and foundations for the project.

The findings, conclusions and recommendations presented herein are preliminary in nature and based upon the preliminary loading information and grading concepts presently developed. As the design process progresses, additional geotechnical recommendations may be required. Pacific Soils Engineering, Inc. will be available for consultation during this process.

PROPOSED DEVELOPMENT

The 11.4± acre parcel will be utilized for construction of an open air amphitheatre and support facilities. Concrete seating will be constructed within the lower one-half of the bowl while grass seating will be provided for the upper one-half. Cut/fill grading will be required in constructing the approximate 5-horizontal to 1-vertical slope ratios within the seating area. A 2-horizontal to 1-vertical slope ratio is proposed for the outside face of the embankment. This configuration is to be accomplished by excavating to depths on the order of 40± feet to stage foundation elevation and filling to maximum heights of 50± feet to top of berm. A typical section is presented on Plate II. The stage structure will extend to maximum heights of 100 ± feet from the lower-most building elevation.

Support facilities will be constructed at various levels within both natural soils and compacted embankments. The soils excavated in constructing the concrete seating and stage portions of the facility are to be reused in constructing the embankment. This quantity of material will have to be supplemented with import material of an unknown quantity.

Maximum column loads on the order of 245 kips and typical wall loads of 35 kips per foot have been estimated by the structural engineer for the stage structure. Loads on the order of 110 kips and 15 kips per foot have been estimated for the adjoining wings to the stage structures. Other support facilities are to be lightly loaded and structurally independent of the main structure. Some walls are to serve as retaining structures with maximum earth retaining heights of forty feet.

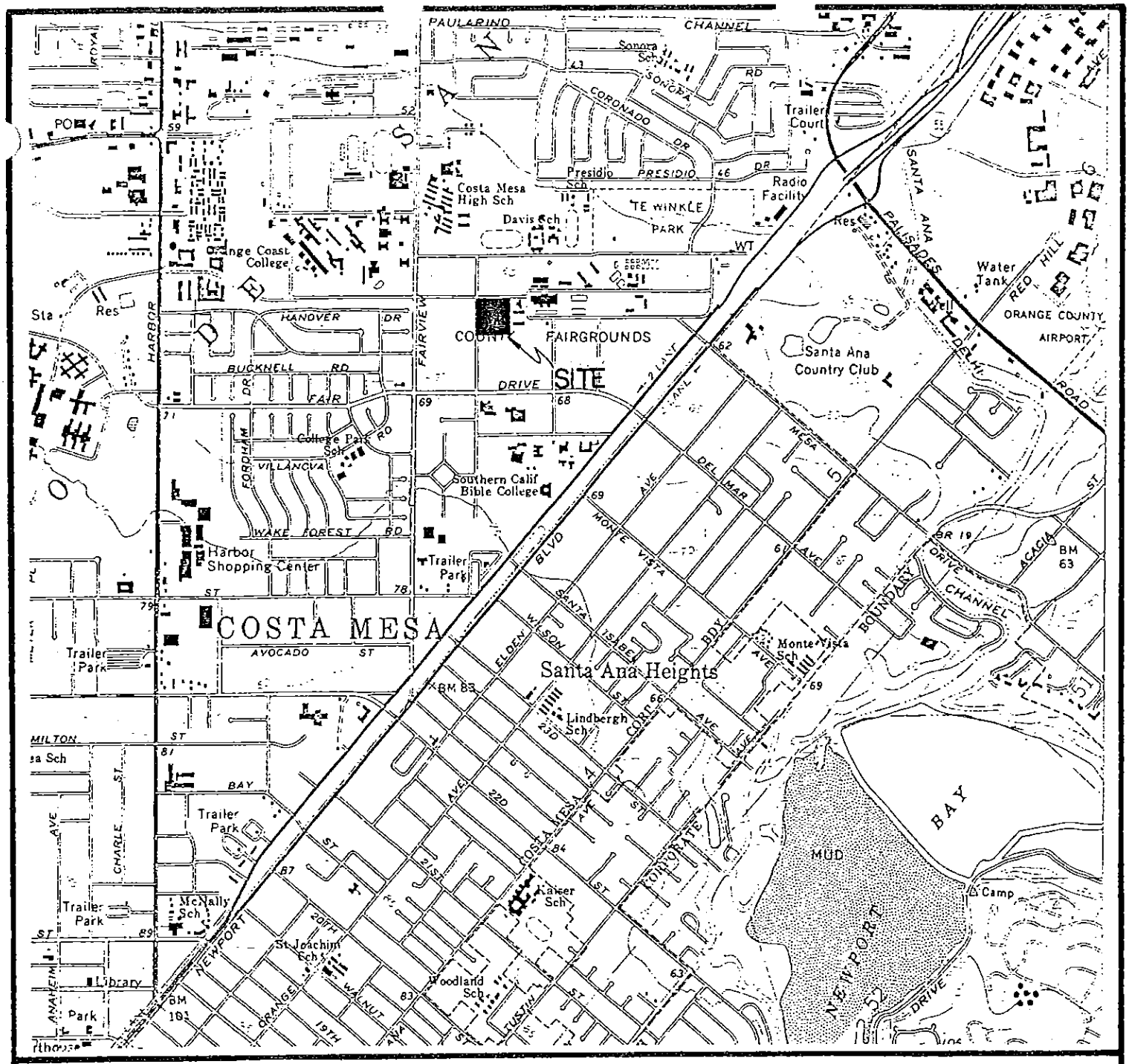
The development concept as presented herein is indicated on the enclosed Survey Plan (Plate I) and typical cross sections, including subsurface data are presented on Plate II.

SITE LOCATION AND DESCRIPTION - FIGURE 1

The site is located within the historic alluvial flood plain of the Santa Ana River within a well-developed portion of the City of Costa Mesa. Situated northerly of Fairview Road and Fair Drive, it exists within the southwesterly portions of the Orange County Fairgrounds. The enclosed Survey Plan (Plate I), prepared by William Blurock & Partners, indicates boundary lines and existing grades.

The site is virtually flat with a one percent ± (1%) gradient to the northeast. Past land use has apparently consisted of paved and unpaved parking in support of the fairground activities. No structures are known to have occupied the site except as indicated on Plate I.

Known underground utilities have apparently also been indicated on the enclosed plan.



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SITE LOCATION MAP

SCALE
1"=2000'

PACIFIC SOILS ENGINEERING, INC.
17909 FITCH · IRVINE, CA (714) 557-9450
W.O. 100957 DATE 6-26-81

FIG. 1

EXISTING SITE CONDITIONS

The borings revealed the existence of alluvial sands, silts and clays in varying proportions to the depths explored. Largely fine-grained deposits (silts and clays) exist in the upper 40 feet, with thin seams of sand interbedded. Below a depth of 40 feet the soils become largely granular in nature consisting of silty and clean sands with occasional silty clay seams.

The upper silty and lean clays are typically moist and stiff in-place although a moderate degree of porosity and localized dryness was exhibited in the upper ten feet. The sands existing below approximate elevation 30 feet are medium dense to dense becoming saturated below approximate elevation 0. Ground water was encountered in Borings 9 and 10 at a depth of 68 feet below present grade.

Generalized subsurface profiles are presented on Plate II and detailed descriptions of subsurface conditions are presented on the Log of Borings, Plates A-1 through A-10. All field and laboratory test results are presented on the Log of Borings and Table I, presented in the Appendix of this report. Also included in the Appendix are detailed descriptions of all field and laboratory test procedures and sample calculations. Approximate locations of borings are presented on Plate I.

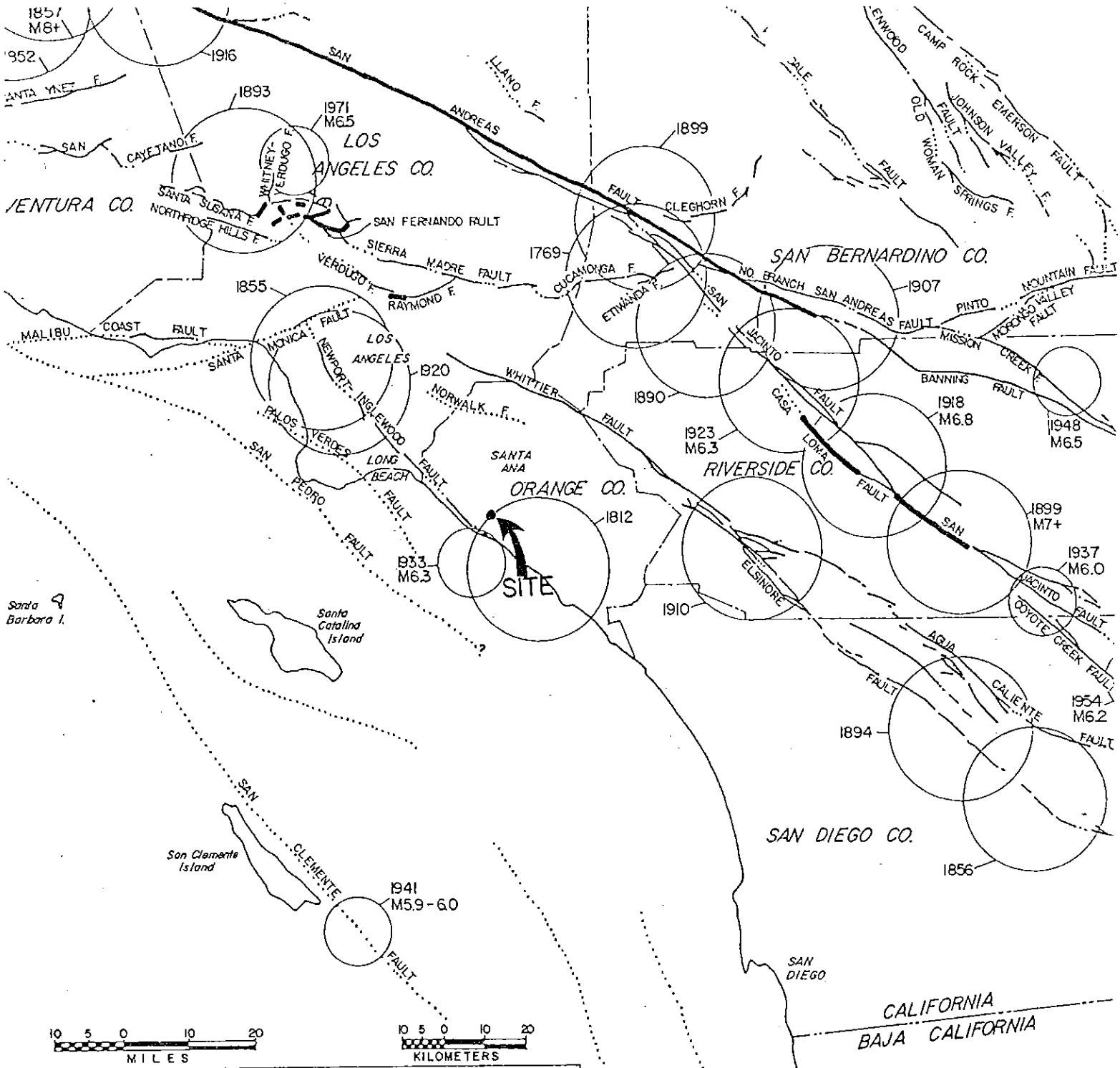
SEISMICITY

Active faults have not been mapped within or immediately adjacent to the site on published governmental maps. Alquist-Priolo special study zones are not designated for the property. Figure 2 shows the site in relation to known active faults and epicenters of Richter magnitude 6.0 or higher.

The nearest mapped active fault is the Newport-Inglewood fault zone located approximately two miles southwest of the site. Other active faults include the Whittier fault, Sierra Madre fault zone, San Jacinto and San Andreas fault zones located approximately 20, 60, 45 and 50 miles, respectively, northeasterly of the site.

The potential for ground accelerations at the site generated by these faults is considered probable during the life span of the project. A specific site response study was not preformed during this investigation. For structural design purposes seismic criteria set forth in the Uniform Building Code/Title 21, State of California, may be utilized in the absence of specific site response studies.

Liquefaction potential is considered low due to the stiff and cohesive nature of the upper thirty-five feet of surface soils and lack of shallow ground water conditions. The potential for ground cracking is present along the contact between materials exhibiting varying seismic velocities.



LEGEND

Total length of fault zone that breaks Holocene deposits or that has had seismic activity

Fault segment with surface rupture during an historic earthquake, or with aseismic fault creep

1899 M7.5

Approximate epicentral area of earthquakes that occurred 1769 - 1933

1952 M6.8

Earthquake epicenters since 1933

Figure 2

Ref.: AEG Special Publication October 1973 (compiled by Richard J. Proctor)

PACIFIC SOILS ENGINEERING, INC.

W.O.100957 DATE 6-22-81

CONCLUSIONS AND RECOMMENDATIONS

Based upon our field and laboratory testing and upon our review of the project grading and structural concepts, it is concluded that the site is suitable for the proposed development subject to the conclusions and recommendations presented herein.

A. GRADING

1. All vegetation, utilities, pavement, trees, slabs or other existing improvements should be removed from fill areas, natural areas or shallow cut areas. In general, the upper one (1) foot of site soils existing in proposed fill areas will require removal prior to fill placement.

   A minimum of three feet of compacted fill shall be provided for project perimeter support facilities (rest rooms, concessions, etc.) proposed to be constructed on existing grade. Where design cuts in excess of two feet are accomplished or where backfill of construction backcuts provides the required fill section, no special grading provisions are required.

   Existing utilities shall be removed in entirety or where approved by the soil engineer, may be abandoned in accordance with the provisions of the Governing Agency. Rubble from

demolition of existing structures should be removed from the site. The minor amounts of concrete and asphalt rubble that will be generated could be utilized within the central portions of the embankment provided that these materials are reduced to a workable size.

2. Processing Fill Areas

Upon completion of required removals, the exposed surface shall be scarified, moistened to near-optimum conditions and compacted in-place to project standards.

3. Compaction Standards

All fills and backfills shall be compacted minimally to 90% of maximum dry density as determined by ASTM:D 1557-78. Fills shall be compacted at or slightly above optimum moisture content as determined by ASTM:D 1557-78. All fills shall be placed under the observation and testing of the soil engineer.

4. Temporary Construction Cuts

No temporary construction cuts in excess of five feet should be cut steeper than 1 1/2 : 1 (horizontal to vertical) unless properly supported. It is understood that construction easements can be obtained in order that temporary cuts for construction of the stage facility may be laid back at the

recommended 1 1/2 : 1 ratio rather than be braced. Adequate room shall be provided at the toe of temporary cuts to provide access for construction of foundations and for compaction of backfill.

5. Embankment Construction

Fill slopes as proposed on the enclosed grading plan are considered stable to the heights and slope ratios indicated. The site soils excavated from design cuts for the seating area and stage structure will be suitable for reuse in construction of the earthen embankment. In general, the excavated soils will be cohesive and expansive in nature and best suited for use within the embankment. These materials should not be utilized for backfill of structures or placed in proximity to concrete seating areas.

6. Import Soils

Import soils shall be granular in nature and shall be approved by the soil engineer at the source prior to importation. Overexcavation of expansive soils in seating area cuts will be required as discussed below. Replacement materials shall be non-expansive import materials. Backfill for retaining walls and building walls shall be granular, free-draining import materials.

7. Permanent Construction Cuts

Permanent cut slopes as indicated on the enclosed grading plan are considered stable to the heights and slope ratios programmed. Due to the expansive nature of the majority of cut soils, it is recommended that the entire fixed seating areas be undercut a minimum of five (5) feet in depth and be replaced with non-expansive import soils. Plate G-1 details the recommended overexcavation/recompaction procedures.

8. Settlements

Based upon our analyses of laboratory data and experience with similar soil types, it is concluded that settlement will be induced within the alluvial materials below the embankment. These settlements may be anticipated to vary from minor near the toes of the embankment to as much as 10± inches under the crest of the embankment. The majority of settlement will occur as grading progresses. However, it is estimated that post-grading settlement of several inches will be realized, occurring over a period of two to three months after grading completion.

Assuming that the entire embankment is constructed uniformly, post-grading settlement should be relatively uniform under similar fill depths reducing to negligible amounts near the fill toes. It is recommended that a post-grading delay period be provided before permanent structures are constructed. This delay period will be a minimum of one month and possibly as long as three months. The final release for construction will be based upon results of the settlement instrumentation data as discussed below.

9. Settlement Instrumentation

Settlement instrumentation as detailed on Plate G-2 (attached) is recommended for insallation at the locations indicated on Plate I. Those plates should be installed subsequent to removal operations and prior to initiation of fill placement. Level survey should be accomplished immediately prior to and after addition of each five-foot rod increment. Data from the instrumentation will be utilized as the basis for determinations that the settlement process is sufficiently complete to allow construction to proceed.

10. Fill Slope Construction

In order to minimize the potential of shallow surficial slumps on compacted fill slopes, and in consideration of settlement potential, the following grading procedures should be undertaken:

Fill slopes shall be overfilled to an extent determined by the contractor, but not less than two feet measured perpendicular to the slope face, so that when trimmed back to the compacted core, a minimum of 90% compaction is achieved. Compaction of each fill lift should extend out to the temporary slope face. Backrolling during mass filling at intervals not exceeding four feet in height is recommended unless more extensive overfill is undertaken. Final trimback should be delayed until the settlement process is substantially complete.

Proper seeding and planting of the slopes should follow as soon as practical, to inhibit erosion and deterioration of the slope surfaces. Proper moisture control will enhance the long term surficial stability of the finish slope surface.

11. Shrinkage and Subsidence

Site soils may be anticipated to undergo a shrinkage of approximately ten percent (10%) when excavated and reused as compacted fill.

Stripping and processing of fill areas may result in a loss/subsidence of 0.1 foot.

12. Drainage

It is strongly recommended that consideration be given to installation of some form of subsurface drainage system. Rainfall and irrigation of the planted seating areas will tend to filter through the embankment fill soils but are unlikely to percolate through the underlying native soils. Overexcavation of the seating area soils and replacement with non-expansive granular soils as recommended, will create a permeable medium for water flow and outlets for or diversion of this water is recommended. Pacific Soils Engineering, Inc. will be available for consultation during design of the possible drainage systems.

13. Earthwork Specifications

Earthwork Specifications and Grading Details are attached. Where applicable and where not directly superceded by the

text of this report, these specifications and details should be incorporated into the project plans and specifications.

B. DESIGN

The following design values and recommendations are based upon the loading information provided by the Structural Engineer. Vertical loads are preliminary estimates and lateral loads have not been analyzed to date. Alternative shallow and deep foundation systems are discussed below based upon the preliminary load estimates cited previously. Further analyses and refinement of design values will probably be required when loading conditions are more accurately defined. The selection of foundation systems may be based upon economic considerations provided that the recommendations presented herein are incorporated into the design and construction of the facility. Because the various structure types will produce highly varied loading conditions and will be supported by a variety of soil conditions, each is discussed separately below.

1. Stage Facilities

Maximum column loads of 245 kips and maximum wall loads of 35 kips per foot have been estimated for the main stage structure. In view of the high vertical loads and anticipated high lateral loads, the use of a pile foundation

system may be most feasible and economical. A shallow foundation system can be considered but must be embedded sufficiently to resist the lateral loads.

a. Deep Foundations

For preliminary estimating purposes, and in the discussion that follows, the use of an HP-10-42 pile has been assumed. Other pile types including precast concrete, concrete filled steel shells, and augercast-type cast-in-place piles can be considered. Design values will vary to some extent based upon the size and type of pile. More precise design values will be provided based upon actual pile types, if required.

1) Vertical Load Capacity

It is estimated that a working load of 50 tons can be safely supported in a pile driven to a depth of 40-feet below proposed grade. Estimated load/depths are presented below.

Depth, feet	Load, tons
20	15
30	30
35	37
40	45
45	52
50	60

A tension capacity of one-third the above values may be utilized for preliminary design purposes.

2) Lateral Load Capacity

The pile-soil system may be estimated to produce a lateral resistance of 5 tons/pile. This value could vary significantly depending upon the stiffness of the pile element. Deflections of 1/2-inch to 3/4-inch will occur in producing resistances of this magnitude.

3) Fixity

Fixity may be assumed to occur at a depth of 10 feet below pile cap for a restrained pile.

b. Shallow Foundations

1) Footings supporting those portions of the stage structure with finish floor elevation of 30± feet will bear in dense native sands and may be designed based upon the following values:

Allowable Bearing:	4000 lbs./sq.ft.
Lateral Bearing:	200 d lbs./sq.ft., where d = depth of embedment to a maximum of 3000 lbs./sq.ft.
Sliding Coefficient:	0.40

Estimated differential settlements under estimated loading conditions may be estimated at 3/4 inch.

2) Footings supporting those portions of the stage wings with finish floor elevation of 40± will bear in native clays (or compacted fill) and may be designed based upon the following values:

Allowable Bearing:	2000 lbs./sq.ft.
Lateral Bearing:	200 d lbs./sq.ft., where d = depth of embedment to a maximum of 3000 lbs./sq.ft.
Sliding Coefficient:	0.33

Reinforcement: Continuous footings shall be designed based upon the requirements of the structural engineer. Provision of a minimum of two (2) No. 5 bars in the upper half of continuous footings is recommended in consideration of the expansive nature of these soils and potential for rebound from overburden removals.

3) Slabs

Trap Room Area: Excavations in this area will likely encounter the silty and clean sands existing at elevation 30±. Non-expansive conditions can be anticipated and slabs-on-grade may be designed strictly in accordance with the requirements of the structural engineer. Should the excavation not expose sands throughout this level, overexcavation of the expansive materials is recommended.

Stage Wing Area: Overexcavation of exposed site soils to a depth of one (1) foot below slab subgrade is recommended. These materials shall be replaced with select non-expansive granular soils. Floor slabs may then be designed strictly in accordance with the requirements of the structural engineer.

2. Other Support Structures

Restrooms, ticket offices, concessions and other lightly loaded support structures may be founded on a shallow foundation system designed in accordance with the following values:

Allowable Bearing:	2000 lbs./sq.ft.
Lateral Bearing:	200 d lbs./sq.ft. where d = embedment depth to a maximum of 2000 lbs/sq.ft.
Sliding Coefficient:	0.33

A minimum of three feet of select non-expansive compacted fill shall be provided below subgrade elevation. Footings shall be embedded a minimum of 18 inches and be reinforced with a minimum of four No. 4 bars, two near the top and two near the bottom. Slabs-on-grade shall minimally contain reinforcement equivalent to 6-inch by 6-inch, No. 6 by No. 6 welded wire mesh.

3. Retaining Walls

Numerous free standing walls and building exterior walls serving as earth retaining structures are proposed. The design of these facilities may be accomplished in accordance with the following recommendations depending upon the applicable conditions.

a. Wall Design

1) Free Standing - (horizontal backfill,vertical wall)

Ka = 0.33

kp = 1.5 for small strains

Kp = 3.0 ultimate (large strains)

2) Fixed (horizontal backfill, vertical wall)

Ka = 0.5

Kp = 1.5 for small strains

Kp = 3.0 ultimate (large strains)

3) Foundations

Foundations may be designed based upon the following values:

Allowable Bearing:	2000 lbs./sq.ft.
Lateral Bearing:	200xd lbs./sq.ft., where d = embedment depth to a maximum of 2000lbs./sq.ft.
Sliding Coefficient:	0.3

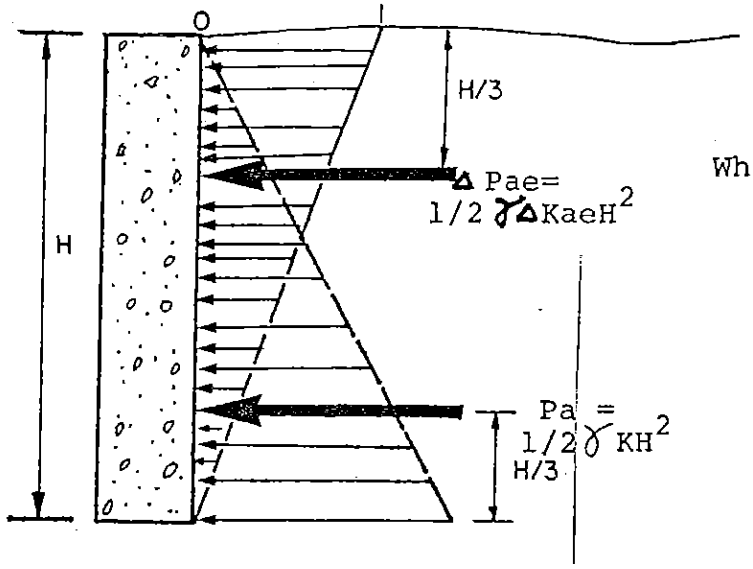
4) Seismic Design

Retaining walls may be designed for the applicable static earth pressure coefficient (active or at-rest) as discussed above. In addition, a dynamic increment of active earth pressure shall be applied as discussed

below. Assignment of a design site acceleration is beyond the scope of this investigation. However, in view of the proximity of the site to the Newport-Inglewood fault zone (two miles±), peak horizontal ground acceleration of 0.5g or more may be realized during the life of the facility. Table A below presents recommended dynamic increments for various site accelerations. The static and dynamic earth pressure increments should be evaluated as detailed below:

TABLE A

Peak Acceleration / g = Kh	0.1	0.2	0.3	0.4	0.5
Δ Kae	.07	.15	0.22	0.3	0.37



Where: Pa = Static Thrust
Δ Pae = Dynamic Lateral Force Component
γ = 120 lbs./cu.ft.
K = K_a or K_o, Static Lateral earth pressure coefficien active or at rest as previously discussed
Δ Kae = Dynamic Lateral Coefficient as Tabulated Above

5) Drainage and Backfill

Backfill of walls shall consist of granular, free-draining sand and be compacted to a minimum of 90% of maximum density as determined by ASTM:D 1557-78. Drainage shall be provided.

6) Other Considerations

The effects of any other permanent, temporary or transient surcharges should be evaluated. If walls are to provide support to inclined backfill, or be battered from vertical further evaluation will be required.

4. Light Standards

Values for the design of large lighting standards will be provided when locations and loads are finalized.

5. Concrete Seating

Provided that a minimum section of non-expansive compacted fill is provided within the seating area as recommended in the Grading Section of this report, no special reinforcement provisions for the concrete seating is required. These elements may be designed based upon the requirements of the structural engineer. Provisions should be made to prevent hydrostatic buildup behind the concrete seating as previously discussed.

6. Concrete Flatwork

Sidewalks, ramps and other similar concrete flatwork which may be placed on natural or graded areas containing expansive soils shall be a minimum of four inches thick, and be placed on a minimum of four inches of sand subgrade. Prior to placement of sand the underlying soils shall be presaturated to a minimum of optimum moisture content plus five percent (5%) (by dry weight) to a depth of 12 inches.

7. The onsite soils may possess sufficiently high sulfate concentrations to be detrimental to concrete. Depending upon the final distribution of onsite soils and nature of import materials, the use of sulfate resistant concrete could be required. That determination should be made based upon as-graded conditions.

8. Utilities

All utility lines and backfill shall be compacted minimally to 90% of maximum density as determined by ASTM:D 1557-78.

The findings and recommendations contained in this report are based upon the specific excavations, observations and laboratory tests as noted. The materials immediately adjacent to or beneath those observed may have different characteristics and no representations are made as to the quality or extent of materials not observed.

Respectfully submitted,

PACIFIC SOILS ENGINEERING, INC.

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By: _____
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JBC:RPK:JAH:REL/vl

This report/plan reflects geotechnical conditions as of the original published date of_____and the data, conclusions and recommendations presented may no longer be valid, for the subject project/property. Issuance of this document on this date should not be construed as a re-certification or a representation of present site conditions.

Pacific Soils Engineering, Inc.

By:_____

Date:_____

APPENDIX

A. Field Exploration

A total of ten (10) borings were made to depths ranging from 26 to 100 feet using truck mounted auger bucket and hollow stem drill rigs. Undisturbed samples for detailed testing in our laboratory were obtained by driving a sampling spoon into the material. Split-barrel type sampling spoons were used, having inside diameters of 2.4 and 2.5-inches, with tapered cutting tips at the lower end and a ball valve at the upper end. The barrel is lined with thin brass rings, each one (1) inch in length. The spoon penetrated into the soil below the depth of boring approximately 12 inches. The central portion of this sample was retained for testing. Standard penetration blow counts were obtained at 70 feet and below in Boring No. 10. Bulk samples of the soils which will be involved in grading were also obtained for testing and analyses. All samples in the natural field condition were sealed in air-tight containers and transported to the laboratory.

Blow counts to obtain the undisturbed samples were recorded (see Plates A-1 through A-10) and are used as an indication of in-place density. Driving weights of 2650 lbs., 1600 lbs. and 800 lbs., were used to depths of 25 feet, 47 feet and 60 feet, respectively, using a hammer drop of 12 inches for Borings 1 through 8. A 140 pound hammer and an 18-inch drop was used for all driven samples for Borings 9 and 10.

The materials encountered were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System as shown on Plate A. Logs of Borings are presented on Plates A-1 through A-10. Test data are presented on Plates A-1 through A-10, Plates B-1, B-2, C-1 through C-10, and in Table I. Approximate boring locations are shown on the enclosed plan.

B. Laboratory Tests

Moisture content and unit weight determinations were made on specimens from undisturbed samples, providing information on the relative densities and moisture retention properties, and also serving as a further index of classification. The results are presented on Plates A-1 through A-10.

Appendix Cont.

Shear tests were performed on bulk and undisturbed samples with a direct shear test machine of the strain control type in which the rate of strain is 0.05-inch per minute. The machine is so designed that tests may be performed without removing the specimens from the rings in which they were obtained or remolded, insuring a minimum of disturbance from the initial condition. Specimens were inundated for a period of 24 hours prior to testing and subjected to shear under various normal loads. The results are presented on Table I and on Plates B-1 and B-2.

Consolidation tests were performed on specimens of the representative soils. The consolidometers, like the direct shear machine, are designed to receive the specimens from the rings in the field condition. Porous stones placed at the top and bottom of each specimen, permit the free flow of water from the specimen during the test.

Water was introduced at various surcharge loadings. Progressive and final settlements under increasing load increments were recorded to an accuracy of 0.0001-inch. The final settlements so obtained are plotted to determine the curve shown on Plates C-1 through C-10.

Laboratory maximum densities were determined on samples of various soil strata to provide data on relative compaction of the native soils. Hydrometer analyses were conducted to aid in classification of the soils. Expansion potential was determined in accordance with UBC Standard 29-2.

The preceding laboratory test results are presented in Table I.

Unified Soil Classification
(Including Identification and Descri, n)

Major Divisions			Group Symbols	Typical Names	Field Identification Procedures (Excluding particles larger than 3 inches and basing fractions on estimated weights)		
1	2		3	4	5		
Coarse-grained Soils: More than half of material is larger than No. 200 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.	Gravels: More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the ¼-in. size may be used as equivalent to the No. 4 sieve size)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.		
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.	Nonplastic fines or fines with low plasticity. (for identification procedures see ML below)		
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification procedures see CL below).		
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size.	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.		
			SP	Poorly-graded sands, gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity. (for identification procedures see ML below)		
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).		
Fine-grained Soils: More than half of material is smaller than No. 200 sieve size.	Silts and Clays: Liquid limit less than 50				Identification Procedures on Fraction Smaller than No. 40 Sieve Size		
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL.)
			ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight
	Silts and Clays: Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.		

(1) Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder. (2) All sieve sizes on this chart are U.S. standard.

CONSISTENCY		CLASSIFICATION	
Granular Soil		Cohesive Soil	Bedrock
Very Loose		Very Soft	
Loose		Soft	
Moderately Dense		Firm	Soft
Medium Dense		Stiff	Moderately Hard
Dense		Very Stiff	Hard
Very Dense		Hard	Very Hard

Moisture Variation

- Dry
- Slightly Moist
- Moist
- Wet
- Saturated

- R – Undisturbed Sample
- B – Bulk Sample
- ▽ – Groundwater Table
- ◇ – Groundwater Seepage

PACIFIC SOILS ENGINEERING, INC.

Plate A

PACIFIC SOILS ENGINEERING, INC.

BORING LOG

Logged by CC

BORING NO. 1

DATE 5/26/81

W.O. 100957 (bucket auger)

SURFACE EL. 69 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0	R	2	CL	ALLUVIUM (Qal): Lean to medium clay, dark gray, moist, very firm to stiff; @ 1.0 ft. dark green/brown color	107.5	18.3
5	R	2	CL	Lean clay; light gray brown, moist, stiff, partially cemented	108.3	16.1
10	R	4	SM	Silty fine sand, light brown, moist, dense	96.6	4.8
			CL	Lean clay light gray brown, moist, stiff to hard;		
15	R	2		@ 17 ft. slightymore moist, less porous	99.4	18.9
20	R	4	SM	Silty fine to medium sand, orange brown, moist, dense	94.7	18.8
			ML	Clayey silt, damp to moist, firm, gray brown, with calcareous nodules, rust stained, occasional thin sand seams		
25	R	3			88.1	5.0

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PLATE A-1

PACIFIC SOILS ENGINEERING, INC

BORING LOG

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BORING NO. 1 con't

DATE 5/26/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25				(ML cont. from 21.0 ft.)		
			CL	Lean clay, mottled gray & brown, moist, stiff, highly rust stained, blocky		
30	R	4/2			92.8	28.5
			SC	Clean fine sand, olive brown, moist, dense		
35	R	5/2	CL	Lean Clay, mottled gray & brown, moist, stiff	106.5	17.2
			SM	Silty fine to medium sand, gray brown, moist, dense @ 38 ft. light gray color		
40	R	11/2	SP	Clean fine to medium sand, light gray & light brown, moist, dense	114.5	1.4
			SM	Silty fine sand, light gray & orange brown, moist, dense		
45				@ 45 ft. olive brown color		
			SP	Clean medium to coarse sand with scattered gravel & sea shells, light brown, medium dense		
50						

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PLATE A-1

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 1 cont.

DATE 5/26/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
50				(SP cont. from 48.0 ft.)		
			SW	Clean well graded sand with an abundance of sea shells, light gray, moist, dense. Unable to retain cuttings in bucket below 59 ft.		
55						
60				TOTAL DEPTH 60 ft. No water Some caving below 53 ft.		

PACIF[illegible] SOILS ENGINEERING, IN[illegible]

BORING LOG

Logged by CC

BORING NO. 3 (bucket auger)

DATE 5/26/81

W.O. 100957

SURFACE EL. 67.7 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0	R	2	CL	ALLUV (Qal): Lean to medium clay, dark gray brown, moist, stiff	100.7	17.8
5	R	2		@ 5.0 ft. lean clay, light gray and brown, moist, stiff, partially cemented.	95.7	19.5
10	R	7			111.9	12.9
			ML	Clayey silt, light gray, moist, cemented, hard		
			CL	Lean clay, mottled light gray and brown, moist, stiff		
15			ML	Fine sandy silt, mottled light gray and light brown, moist, dense		
			SC	Clayey sand, light gray/brown, moist, dense		
20	R	6			106.2	5.5
			SM	Silty fine to medium sand, light gray and orange-brown, moist, dense		
			SM	Sandy silt, light gray and orange/brown, moist, dense		
25						

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PLATE A-3

PACIFIC SOILS ENGINEERING, INC

BORING LOG

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BORING NO. 3 (bucket auger)

DATE 5/26/81

W.O. 100957

SURFACE EL. 67.7 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0	R	2	CL	ALLUV (Qal): Lean to medium clay, dark gray brown, moist, stiff	100.7	17.8
5	R	2		@ 5.0 ft. lean clay, light gray and brown, moist, stiff, partially cemented.	95.7	19.5
10	R	7			111.9	12.9
			ML	Clayey silt, light gray, moist, cemented, hard		
			CL	Lean clay, mottled light gray and brown, moist, stiff		
15			ML	Fine sandy silt, mottled light gray and light brown, moist, dense		
			SC	Clayey sand, light gray/brown, moist, dense		
20	R	6			106.2	5.5
			SM	Silty fine to medium sand, light gray and orange-brown, moist, dense		
			SM	Sandy silt, light gray and orange/brown, moist, dense		
25						

continued on next page

PLATE A-3

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 2 (bucket auger)

DATE 5/26/81

W.O. 100957

SURFACE EL. 68.5 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0			CL	ALLUV (Qal): Lean to medium clay, dark gray, moist, firm, jointed; stiff @ 1.5 ft.		
	1 push				95.3	18.7
5	R	3			96.4	13.3
	Bulk		CL	Lean clay, light gray and brown, damp to moist, stiff; @ 8.0 ft. moist and partially cemented;		
10	R	5			112.8	13.9
15	R	2		@ 15.5 ft. cementation absent, mottled gray and brown	95.2	24.7
			SC	Clayey sand, mottled gray and orange-brown, moist, dense		
20			SM	Silty fine to medium sand, mottled gray and orange-brown, moist, dense		
			CL	Lean clay, gray, moist, stiff, partially cemented		
			ML	Clayey silt, mottled gray-brown, moist,		
	R	2		stiff	92.0	27.0
25						

TOTAL DEPTH 26.0 ft. No Water, No Caving

PLATE A-2

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 3cont

DATE 5/26/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25				(SM cont. from 24.0 ft.)		
			ML	Clayey silt, light gray and light brown, moist, dense		
			CL	Lean clay, light gray and light brown, moist, stiff, considerable iron-oxide staining between 28-29 ft.		
30	R	4			89.5	31.2
			SM	Silty fine to medium sand, mottled light gray and orange-brown, moist, dense;		
35				unable to retain cuttings in bucket below 39.0 ft.		
40				TOTAL DEPTH 40.0 ft.		
				No Water, Minor Caving below 34.0 ft.		

PLATE A-3 cont.

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 4 (bucket auger)

DATE 5/26/81

W.O. 100957

SURFACE EL. 67 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0			CL	ALLUV (Qal): Lean to medium clay, dark gray-brown, damp, soft to firm; moist and hard at 1.0 ft.		
	R	3			103.4	14.4
			CL	Lean clay, light gray and brown, damp to moist, stiff, partially cemented		
5	R	5			107.3	15.5
10			SC	Clayey fine sand, light gray-brown, moist, dense		
			CL	Lean clay, light gray and brown, moist, stiff		
15	B					
	R	1			99.8	23.0
			ML	Clayey silt, mottled light gray and light brown, moist, stiff		
			SC	Clayey sand, light gray and orange-brown, moist, dense		
20						
			SM	Silty fine to medium sand, gray/brown, moist, dense		
			ML	Sandy silt, mottled light gray and orange-brown, moist, dense		
25						

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PLATE

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 4 cont.

DATE 5/26/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25	R	2	CL	Lean clay, reddish-brown, very moist, stiff	88.6	17.7
			SM	Silty fine sand, light gray, moist, dense		
			CL	Lean clay, light gray-brown, moist, stiff		
			ML	Clayey silt, gray-brown, very moist, stiff		
			CL	Lean clay, gray, moist, stiff to hard		
30						
			SM	Silty fine sand, olive-brown, moist, dense;		
35	R	7/2			107.8	12.4
40				@ 40.0 ft. mottled light gray & orange brown		
			SM	Silty fine to medium sand, abundance of sea shells, light gray/brown, moist, dense		
45	R	15/2			106.7	3.3
50						

TOTAL DEPTH 50.0 ft. No Water, Minor Caving below 44.0 ft.

PLATE A-4

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 5 (bucket auger)

DATE 5/27/81

W.O. 100957

SURFACE EL. 65.4 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0				FILL: Gravelly clean sand, light gray, dry, medium dense		
	R	3	CL	ALLUV(Qal)Lean to medium clay, dark gray-brown, moist, stiff	96.5	14.2
5			CL	Lean clay, light gray and brown, damp, firm to stiff, partially cemented; @ 6.0 ft. moist and stiff		
10	R	1			105.3	20.3
			ML	Clayeysilt, light gray-brown, moist, stiff		
			CL	Lean clay, mottled light gray and brown, moist, stiff		
15			ML	Clayey silt, mottled gray and brown, moist, stiff		
			CL	Lean clay, mottled gray and brown, moist and stiff		
			ML	Clayey silt, mottled gray and brown, moist, stiff		
20	R	3	SM	Sandy silt, light gray, orange,brown, moist, dense	100.6	14.8
			SM	Silty fine sand, light gray and orange/ brown, moist, dense		
25						

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PLATE A-5

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

DATE 5/27/81

BORING NO. 5 cont.

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25			ML	(SM cont. from 23.5 ft.) Clayey silt, gray and reddish brown, moist to very moist, stiff, considerable red oxide staining between 26-27.5 ft.		
			CL	Lean clay, light gray and brown, moist, stiff to hard		
30	R	3/2			94.3	28.1
			CL	Lean to medium clay, light gray, moist, hard		
35			SM	Silty fine to medium sand, mottled light gray and light brown, moist, dense;		
40	R	14/2		Unable to retain cuttings in bucket	96.9	4.9
				TOTAL DEPTH 43.0 ft. No Water, Some caving below 35.5 ft.		

PLATE A-5

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 6 (bucket auger)

DATE 5/27/81

W.O. 100957

SURFACE EL. 66.3 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0	R	4	CL	ALLUV (QAL): Lean to medium clay, dark gray brown, moist, stiff;	108.8	13.7
				@ 3.0 ft. dark brown		
			CL	Lean clay, light gray and brown, damp, firm to stiff;		
5	R	3		@ 5.0 ft. partially cemented & stiff	101.0	17.2
10	R	5	SM	Silty fine sand, light brown, moist, dense	100.5	7.5
			CL	Lean clay, gray and brown, moist, stiff		
15	Bulk					
			SM	Silty fine sand, light gray and light brown, moist, dense;		
				@ 18.0 ft. reddish-brown, fine to medium grained;		
20	R	6			104.5	2.6
				@ 23.0 ft. light gray, very fine grained		
25						

continued on next page

PLATE A-6

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 6 cont.

DATE 5/27/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25			CL	Lean clay, light gray and brown, moist, hard		
			SM	Sandy silt, light gray and orange-brown, moist, dense		
			CL	Lean clay, light gray and brown, moist, hard		
			ML	Clayey silt, light gray and light brown, moist, dense		
30	R	4/2	CL	Lean clay, gray and brown, moist, hard	95.4	26.2
	Bulk					
35			SM	Silty fine sand, light gray and orange-brown, moist, dense		
40	14/2				97.3	1.6
				TOTAL DEPTH 41.0 ft.		
				No Water, No Caving		

PLATE A-6

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 7 (bucket auger)

DATE 5/27/81

W.O. 100957

SURFACE EL. 66.6 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0	R	3	CL	ALLUV (Qal): Lean to medium clay, dark gray brown, damp, soft to firm; @ 1.0 ft. moist and stiff;	99.7	13.6
				@ 4.0 ft. brown		
5	R	3	CL	Lean clay, light gray and brown, damp, stiff	101.1	14.5
10	R	7	ML	Clayey silt, light gray and light brown, moist, hard	106.0	13.1
15			CL	Lean clay, light gray and brown, moist, hard		
			ML	Clayey silt, light gray and orange-brown moist, hard		
			SM	Silty fine to medium sand, light gray and reddish brown, moist, dense		
20	R	6	SW	Well-graded sand, light gray and light brown, moist, dense	104.4	3.3
			ML	Sandy silt, olive brown, moist, dense		
25						

continued on next page

PLATE A-7

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 7 cont.

DATE 5/27/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25			SM	Silty fine sand, light gray and orange-brown, moist, dense		
			CL	Lean clay, gray and brown, moist, hard		
			SM	Silty fine sand, light gray and light brown, moist, dense		
			CL	Lean clay, gray and brown, moist, hard, considerable iron staining between 28.5 and 29.5		
30	R	3			101.8	22.0
				TOTAL DEPTH 31.0 ft.		
				No Water, No Caving		

PLATE A-7

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 8 (bucket auger)

DATE 5/27/81

W.O. 100957

SURFACE EL. 65.4 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0				FILL: Mixture clayey sand and lean clay with scattered gravel and asphalt fragments, light brown, dry, loose		
	R	1	CL	ALLUV (Qal): Lean to medium clay, dark gray-brown, moist, stiff	106.5	19.3
5	R	3			107.2	16.6
			CL	Lean clay, light gray and brown, moist, stiff, partially cemented		
10	R	3			109.0	16.0
			ML	Clayey silt, light gray and brown, moist, stiff; partially cemented between 13.0 and 14.5 ft.		
15	Bulk					
			SM	Silty fine to medium sand, light gray and orange-brown, moist, dense		
20	R	12			120.0	5.5
			SM	Sandy silt, light gray and orange-brown, moist, dense		
25						

continued on next page

PLATE A-8

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 8 cont.

DATE 5/27/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25			SM	(SM cont. from 23.0 ft.) Silty fine sand, light gray and orange-brown, moist to very moist, dense		
30	R	3/2	CL	Lean clay, gray, very moist, stiff; @ 32.0 ft. moist and mottled gray/brown	100.2	24.4
35	Bulk					
40	R	9/2			97.7	8.4
45						
			SW	Well-graded sand, light brown, moist, dense		
50	R	14/3			92.4	5.0

TOTAL DEPTH 51.0 ft. No Water, Minor Caving below 45 ft.

PLATE A-8

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 9 (hollow stem flight auger)

DATE 6/1/81

W.O. 100957

SURFACE EL. 68.5 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0			CL	ALLUV (Qal): Lean to medium clay, dark gray-brown, moist, stiff		
5	R	38	CL	Lean clay, light gray and brown, moist, stiff, partially cemented	87.4	18.6
10	R	62			94.7	6.8
15	R	51	ML	Clayey silt, mottled light gray and light brown, damp, stiff	95.8	13.6
			SC	Clayey sand, orange-brown, moist, medium dense to dense		
20	R	68	CL	Lean clay, light gray and light brown, moist, stiff	106.4	4.2
			SM	Silty fine sand, light gray-brown, moist, dense		
25						

continued on next page

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 9 cont.

DATE 6/1/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25	R	36	CL	Lean clay, gray and brown, moist, hard,	84.7	30.4
30	R	32		@ 30.0 ft. zone of considerable red iron oxide staining	83.0	32.0
35	R	135	SM	Silty fine sand, mottled light gray and light brown, moist, dense;	105.0	4.0
40	R	106			88.1	2.9
				@ 43.0 ft. becomes fine to medium grained, contains sea shells		
45	R	165			98.1	2.7
50						

continued on next page

PLATE A-9

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

DATE 6/1/81

SURFACE EL.

BORING NO. 9 cont.

W.O. 100957

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
50	R			(SM cont. from 35.0 ft.)	No Recovery	
55	R	37	CL	Lean clay, mottled blue-gray and brown, moist, hard	82.7	42.7
			SP	Clean fine to medium sand, light gray-brown, moist, dense;		
60	R	100/5"			91.7	3.1
65	R	100/5"			89.2	4.0
				@ 68.0 ft. saturated;		
				@ 69.0 ft. water table;		
70	R	100/5½"			94.1	22.5
75						

continued on next page

PLATE A-9

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

DATE 6/1/81

BORING NO. 9 cont.

W.O. 100957

SURFACE EL. _____

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
75	R	156/9"		(SP cont. from 59.0 ft.)	103.9	20.8
80	R	100/5"		@ 80.0 ft.blue-gray color; below 80.0 ft. contains occasional thin interbeds of silty fine sand	91.4	24.6
85	R	45			99.6	21.7
90	R	55			104.0	21.9
95				TOTAL DEPTH 95.0 ft. No Caving Water Table at 68.5 ft.		

PLATE A-9

PACIFIC SOILS ENGINEERING, INC

BORING LOG

BORING NO. 10 (hollow stem flight auger)

W.O. 100957

Logged by CC

DATE 6/2/81

SURFACE EL. 68 (per topo)

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
0			CL	ALLUV(Qal): Lean to medium clay, dark gray brown, moist, stiff		
5	R	40	CL	Lean clay, light gray and brown, moist, stiff, partially cemented	94.2	14.3
10	R	59			103.9	13.7
			ML	Clayey silt, gray-brown, moist, stiff		
15	R	36	CL	Lean clay, mottled gray and brown, moist, hard	100.5	22.9
			SM	Silty fine to medium sand, light gray and light brown, moist, dense		
20	R	62			103.2	2.7
			SM	Sandy silt, mottled light gray and orange-brown, moist, dense		
25						

continued on next page

PLATE A-10

PACIF'^ SOILS ENGINEERING, IN^

BORING LOG

Logged by CC

DATE 6/2/81

SURFACE EL.

BORING NO. 10 cont.

W.O. 100957

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
25	R	32	CL	Lean clay, gray-brown, moist, hard, considerable red oxide staining	85.3	33.0
			ML	Clayey silt, light gray and light brown, moist, stiff		
30	R	28	CL	Lean clay, mottled gray and brown, moist, hard	91.6	29.4
35	R	46			100.3	21.2
			SC	Clayey fine sand, mottled light gray and light brown, moist, dense		
40	R	68			90.6	7.2
45	R	144	SM	Silty well-graded sand, light brown, moist dense	103.7	5.2
50						

continued on next page

PLATE A-10

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 10 cont.

DATE 6/2/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
50	R	73	SW	Clean well-graded sand with an abundance of sea shells, light brown, moist, dense	94.9	6.9
			SM	Silty fine sand, light gray, moist, dense		
55	R	160			97.5	7.5
			SP	Clean fine to medium grained sand, light gray-brown, moist, dense;		
60	R	100			91.4	3.4
65	R	190/3"			84.5	4.6
				@ 68.0 ft. becomes medium to coarse grained, saturated; water table at 68.0 ft.		
70	SPT	18/18 50 for 5"				
75						

continued on next page

PLATE A-10

PACIFIC SOILS ENGINEERING, INC

BORING LOG

Logged by CC

BORING NO. 10 cont.

DATE 6/2/81

W.O. 100957

SURFACE EL.

Depth ft.	SAMPLE	BLOWS/ft.	GROUP SYB.	DESCRIPTION and REMARKS	Unit Dry Wt. (lbs/cu.ft.)	% Moisture
75	SPT 24/5"	50/	SM	Silty fine to medium sand, blue-gray, very moist, dense		
			SP	Clean sand with occasional interbeds of silty fine sand, light gray and light brown, wet, dense;		
80	SPT 100/5"					
85	SPT 40/5 for 5½"			@ 85.0 ft. clean sand with occasional interbeds of silty fine sand, light gray, light brown;		
90	SPT 100/5"			@ 90.0 ft. clean sand with interbeds of silty fine sand, light gray and light brown		
95	SPT 50/5½"			@ 95.0 ft. clean blue-gray sand with interbeds of silty fine sand, light gray and light brown		
100	SPT 50/5½"			TOTAL DEPTH 100.0 ft. No Caving, Water Table @ 68.0 ft.		

PLATE A-10

TABLE I
SUMMARY OF LABORATORY TEST DATA

Boring No.	Depth (ft.)	Soil Description	MAXIMUM DENSITY ASTM: D 1557-78		HYDROMETER ANALYSIS			EXPAN. INDEX	DIRECT SHEAR:			OTHER TESTS
			Max. Dens. (lb./cu.ft.)	Opt. Moist. (%)	Percentage of sand	silt	clay	UBC 29-2	Cohesion (psf)	ø degrees	Test* condition	
1	35	Lean Clay CL			61	9	30					CONSO
	40	Clean Sand SP			97	1	2		100	34	U/S	
	Surf	Lean Clay CL	114.2	14.7	21	36	43	94				
2	6	Lean Clay CL	117.2	12.6	22	31	47	105	250	36	R/S	
3	10	Clayey Sand SC			50	22	28					CONSO
	30	Fat Clay CH			12	9	79					CONSO
4	5	Lean Clay CL			27	25	48		500	28	U/S	
	25	Clayey Silt ML			34	44	18		100	30	U/S	
	15	Lean Clay CL	115.0	15.5	22	36	42	109				
5	10	Lean Clay CL			30	28	42					CONSO
	20	Clayey Sand SC			52	37	11					CONSO
6	14	Lean Clay CL			17	34	49	93				
	34	Fat Clay CH			9	4	87	366				
7	10	Lean Clay CL			39	25	36		300	37	U/S	
8	5	Medium Clay CH-CL			21	26	53					CONSO
	30	Clayey Silt ML			27	45	28					CONSO
9	30	See Boring Logs										CONSO
	40											CONSO
	45								0	42	U/S	
	55											CONSO
	60								100	37	U/S	
	70								200	38	U/S	

* TEST CONDITIONS: R - Remolded, U - Undisturbed

TABLE I (cont)
SUMMARY OF LABORATORY TEST DATA

Boring No.	Depth (ft.)	Soil Description	MAXIMUM DENSITY ASTM: D 1557-78 Max. Dens. (lb./cu.ft.)	Opt. Moist. (%)	HYDROMETER ANALYSIS Percentage of sand	silt	clay	EXPAN. INDEX UBC 29-2	DIRECT SHEAR: Cohesion (psf)	Ø degrees	Test* condition	OTHER TESTS
9	85	See Boring Logs							300	33	U/S	
10	40	↓ ↓ ↓							200	35	U/S	
	45								50	42	U/S	
	65								50	33	U/S	

* TEST CONDITIONS: R - Remolded, U - Undisturbed

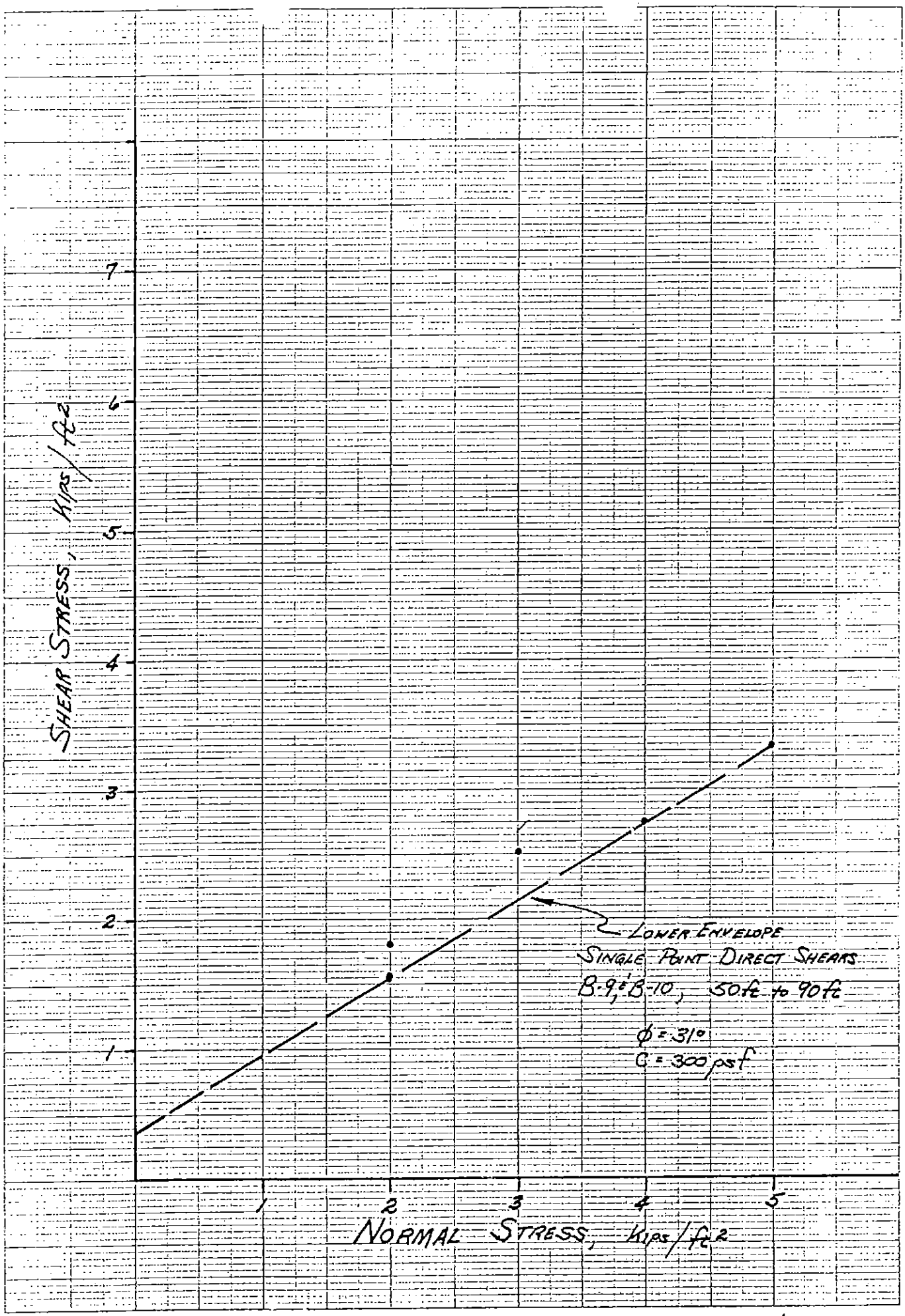


Plate B-1

46 1242

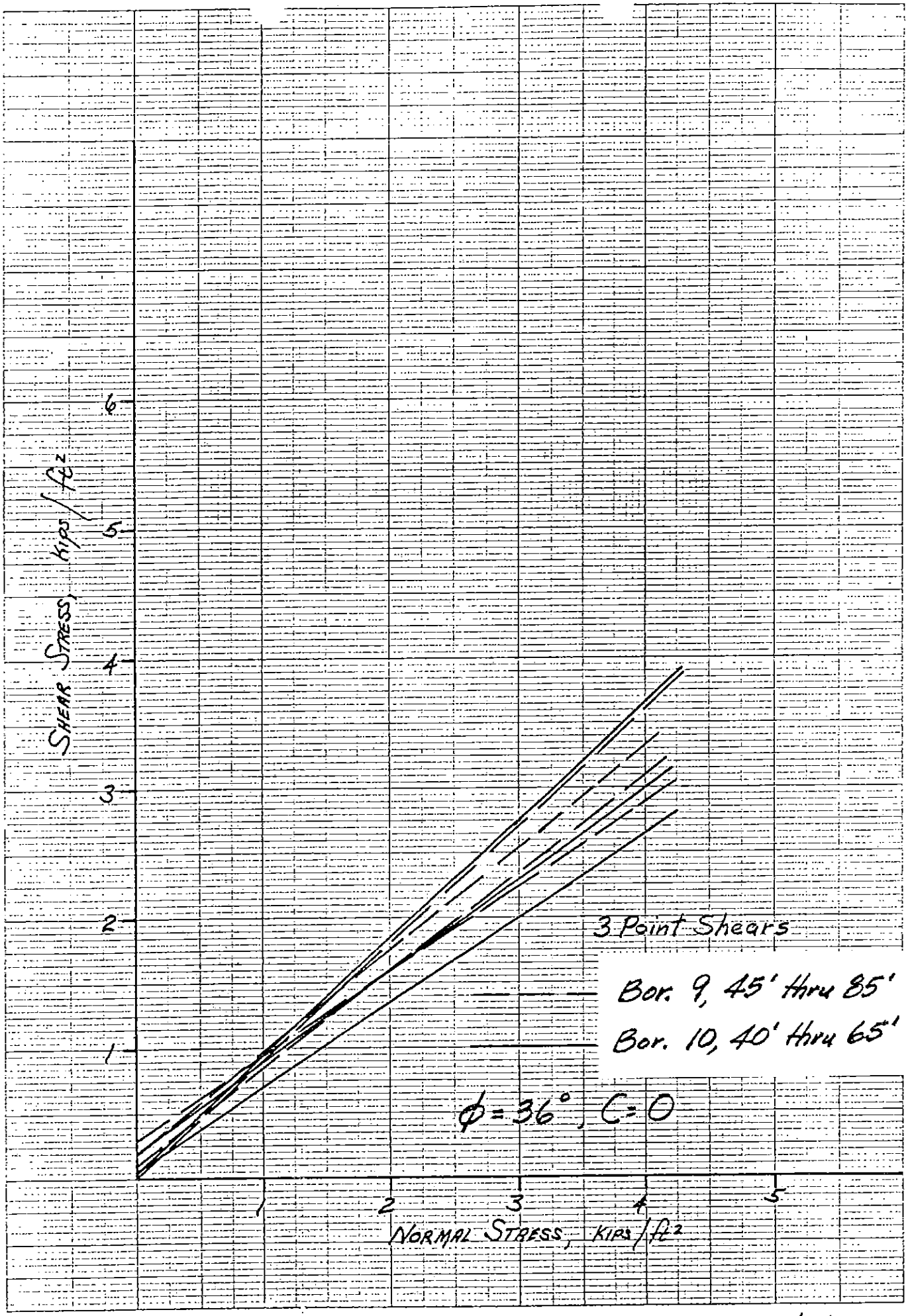
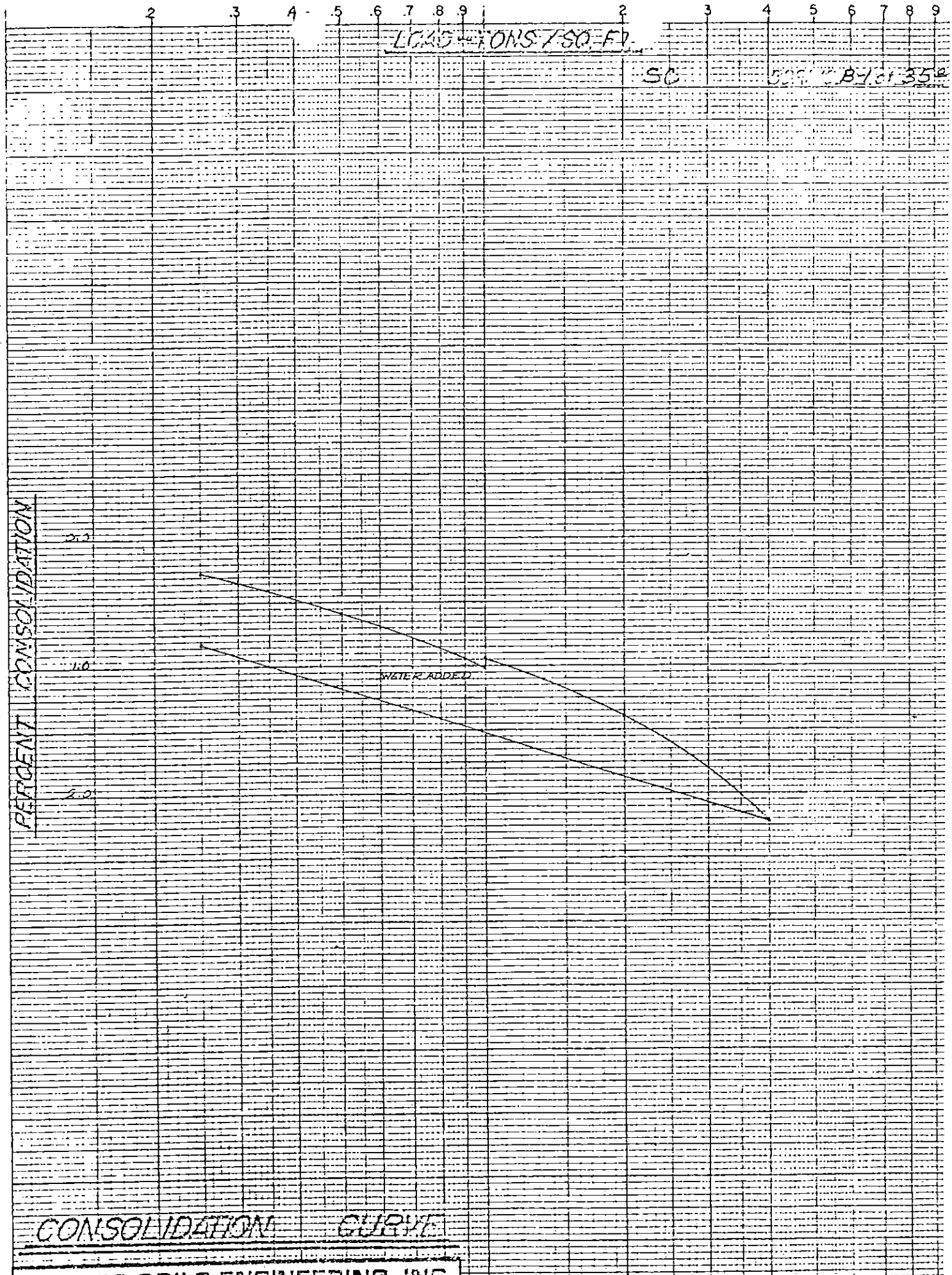


Plate B-2

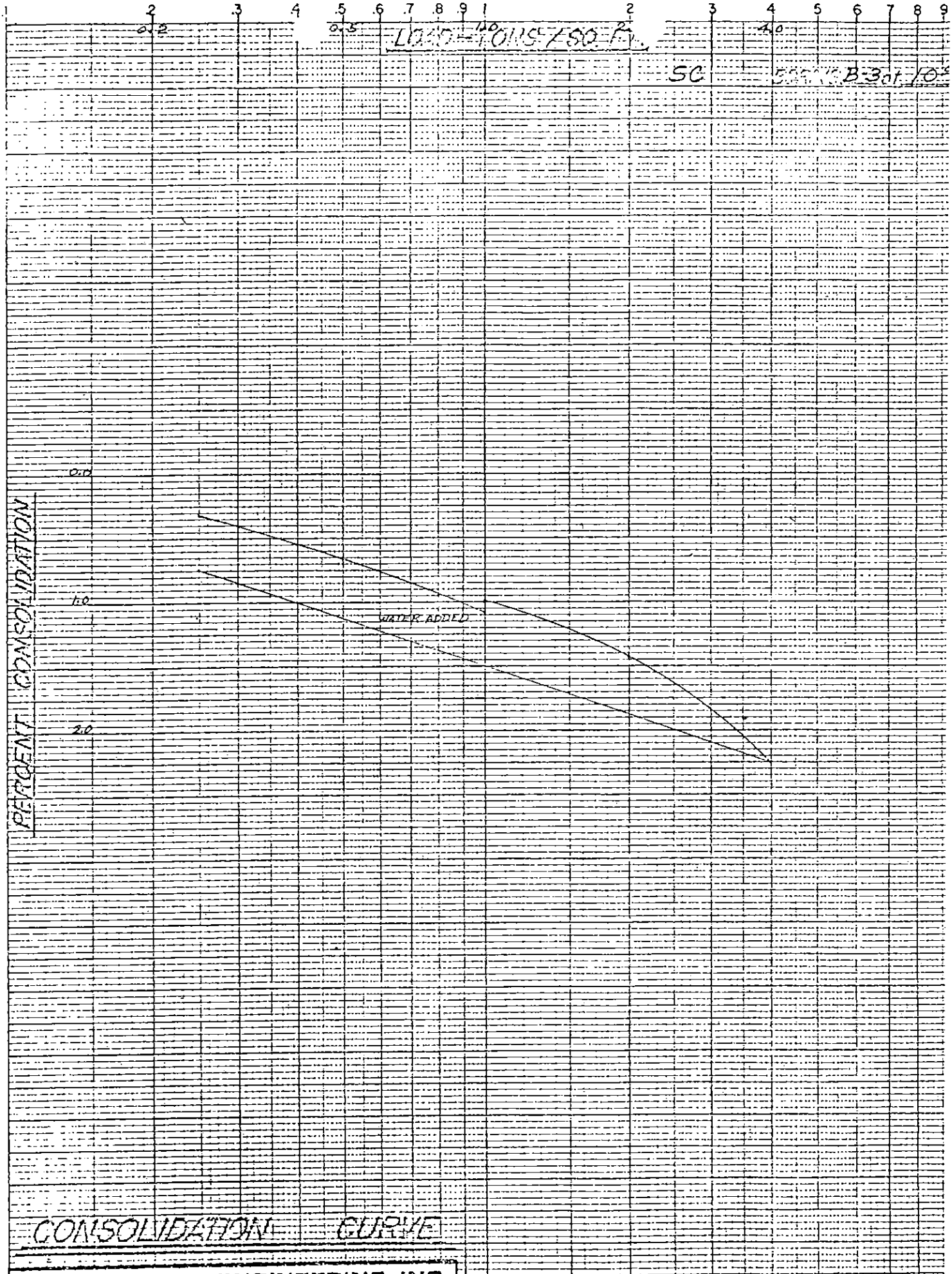
46 1242
K&E 20 X 20 TO THE INCH • 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.



CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
W.O. 100957 DATE 6-5-81

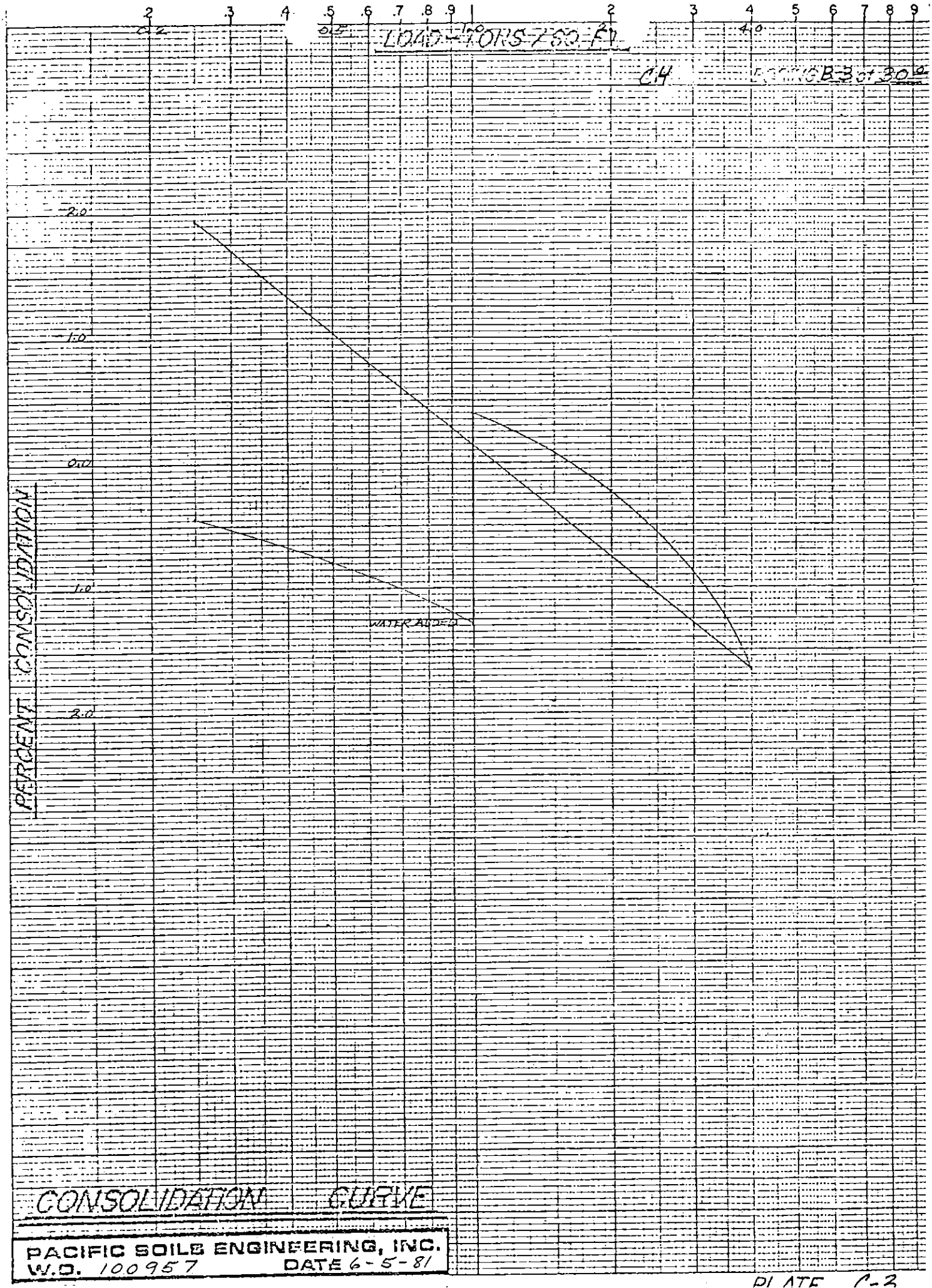
PLATE C-1



CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
W.O. 100957 DATE 6-5-81

PLATE A-3



CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
W.O. 100957 DATE 6-5-81

PLATE C-3

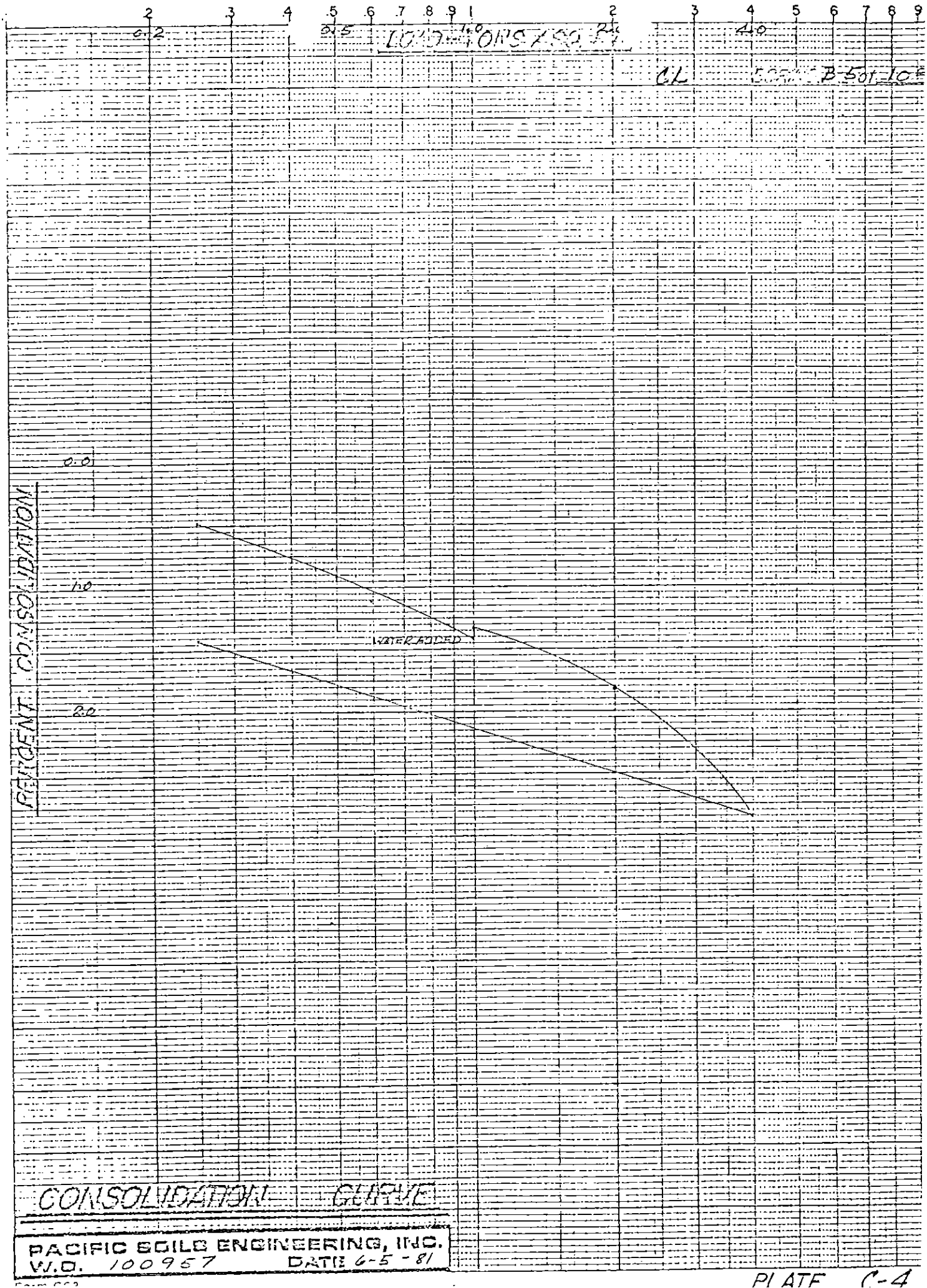
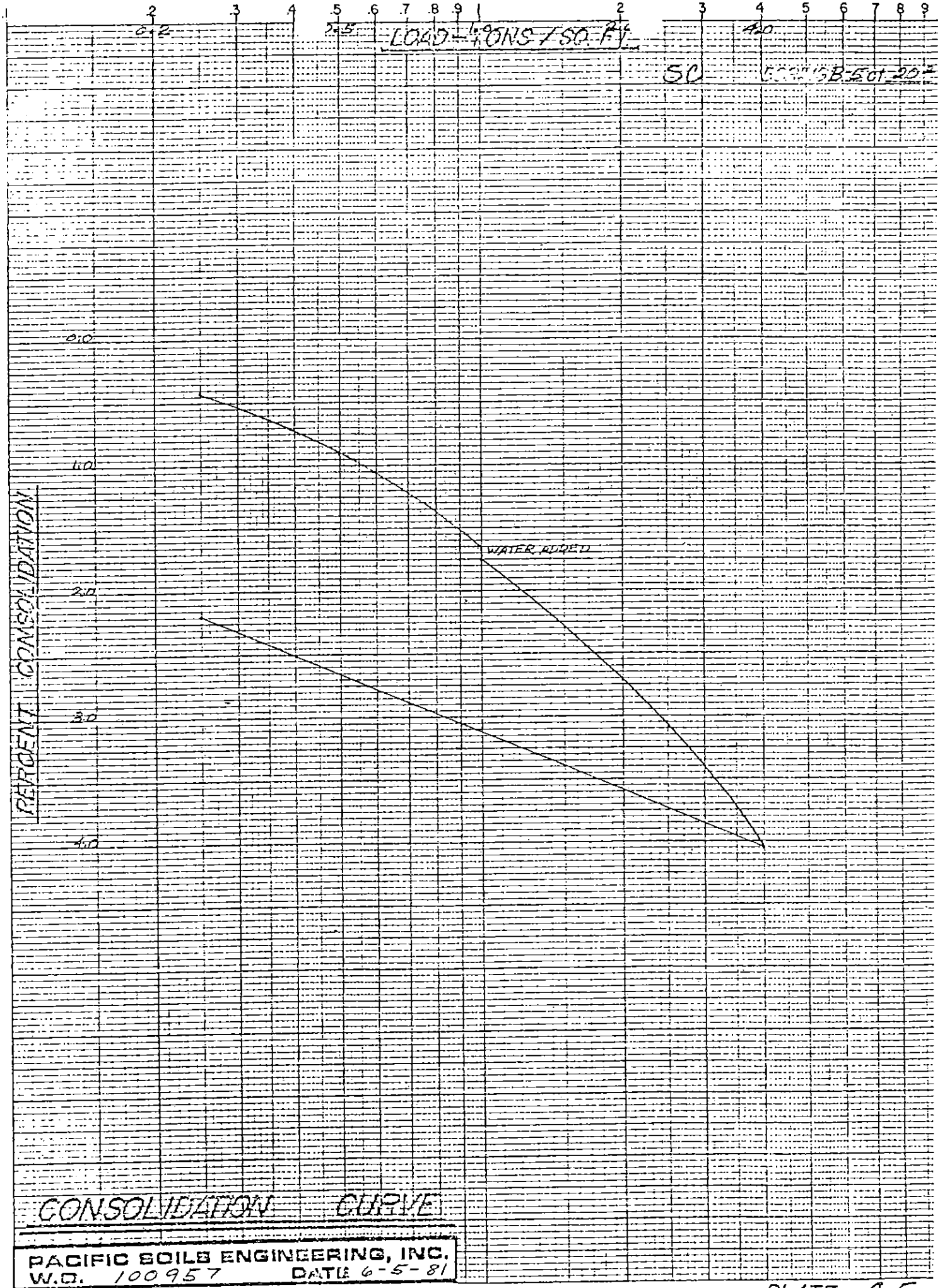

2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9
0.2
0.5
1.0
2.0
4.0
CL
B-501
0.01
1.0
2.0
WATER ADDED
PERCENT CONSOLIDATION
CONSOLIDATION CURVE
PACIFIC SOILS ENGINEERING, INC.
W.O. 100957
DATE 6-5-81

PLATE C-4

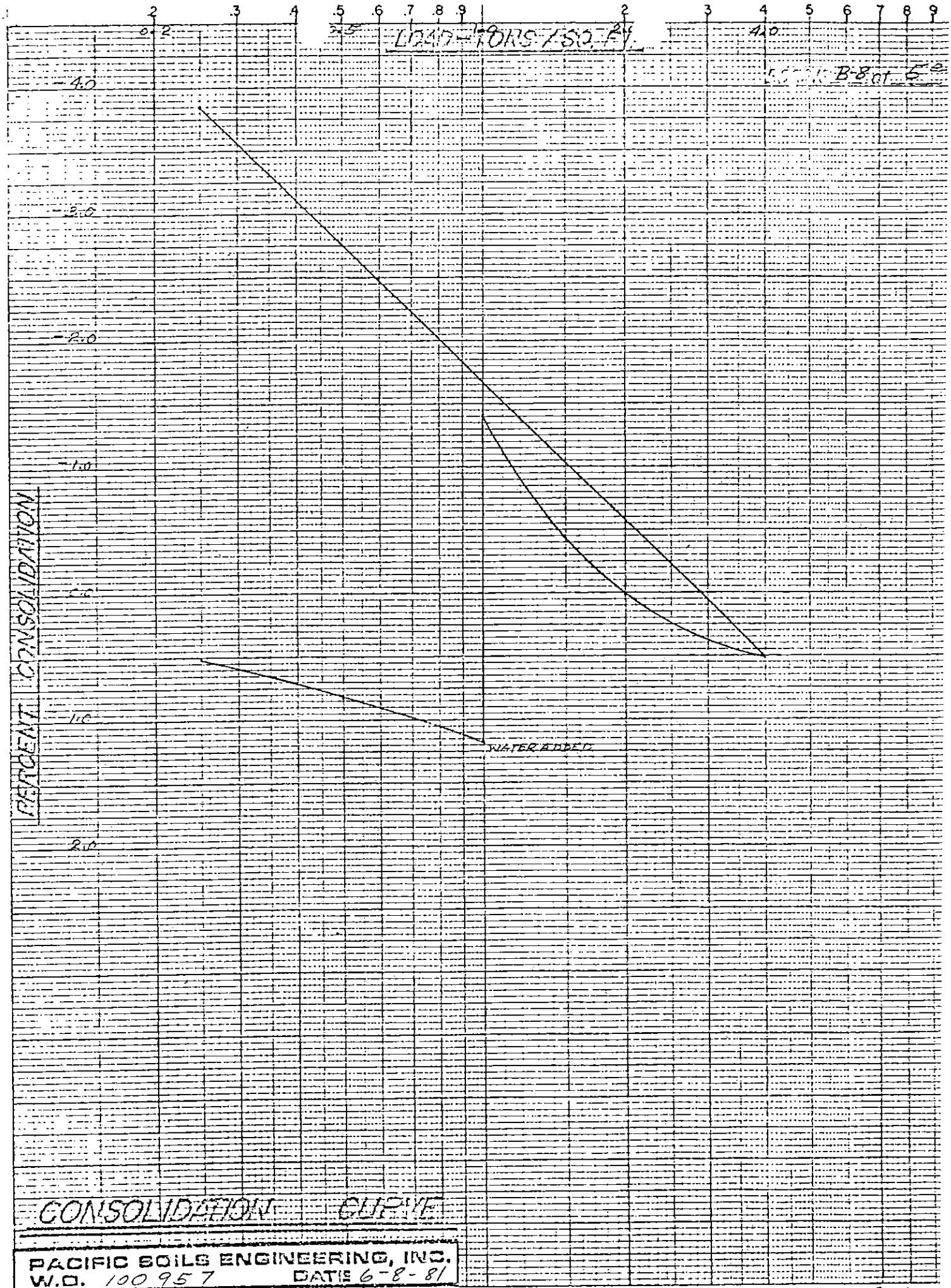


CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
W.O. 100957 DATE 6-5-81

PLATE C-5

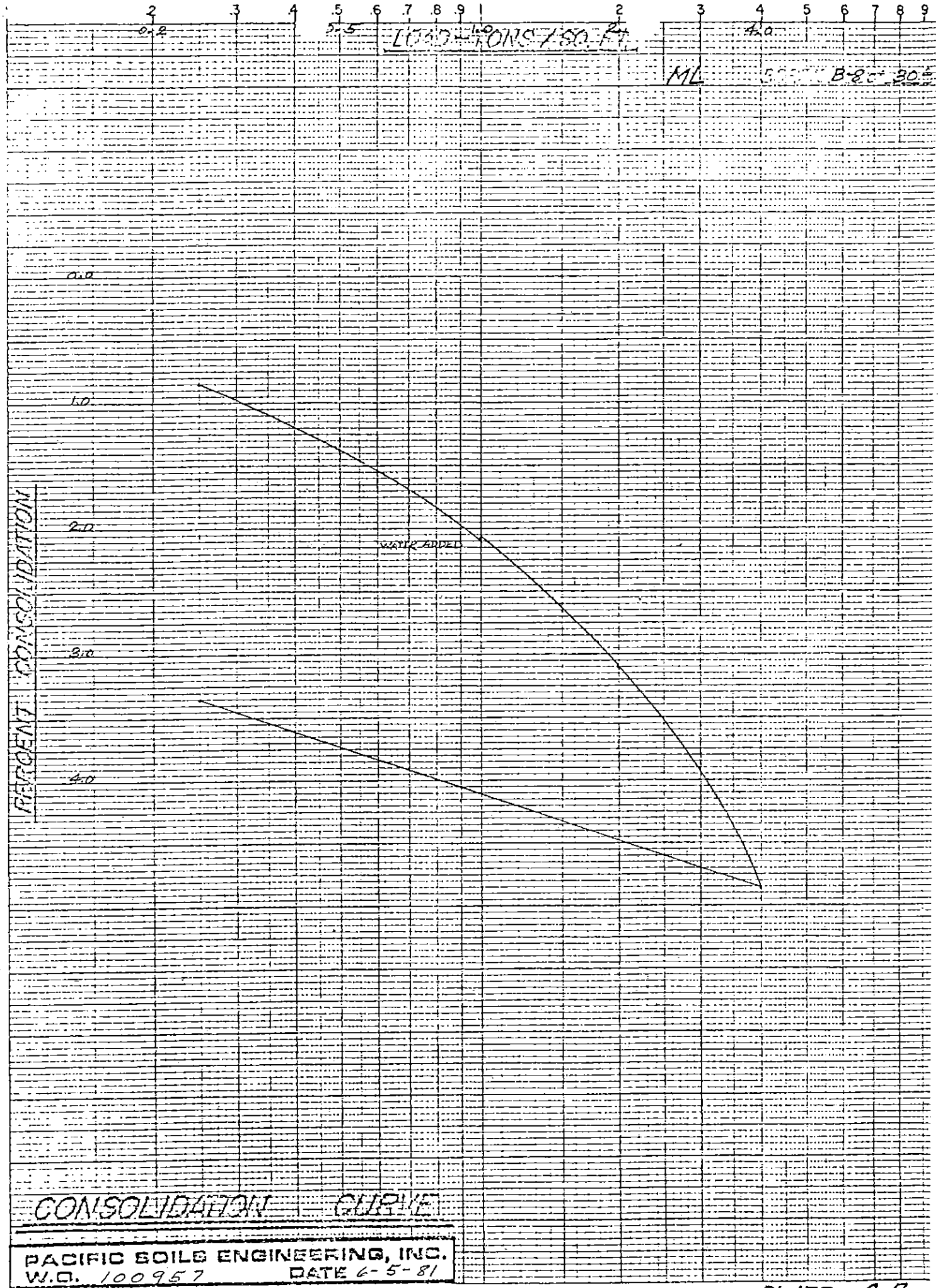
Form CC2



PACIFIC SOILS ENGINEERING, INC.
W.O. 100957 DATE 6-8-81

Form CC2

PLATE C-6



CONSOLIDATION CURVE

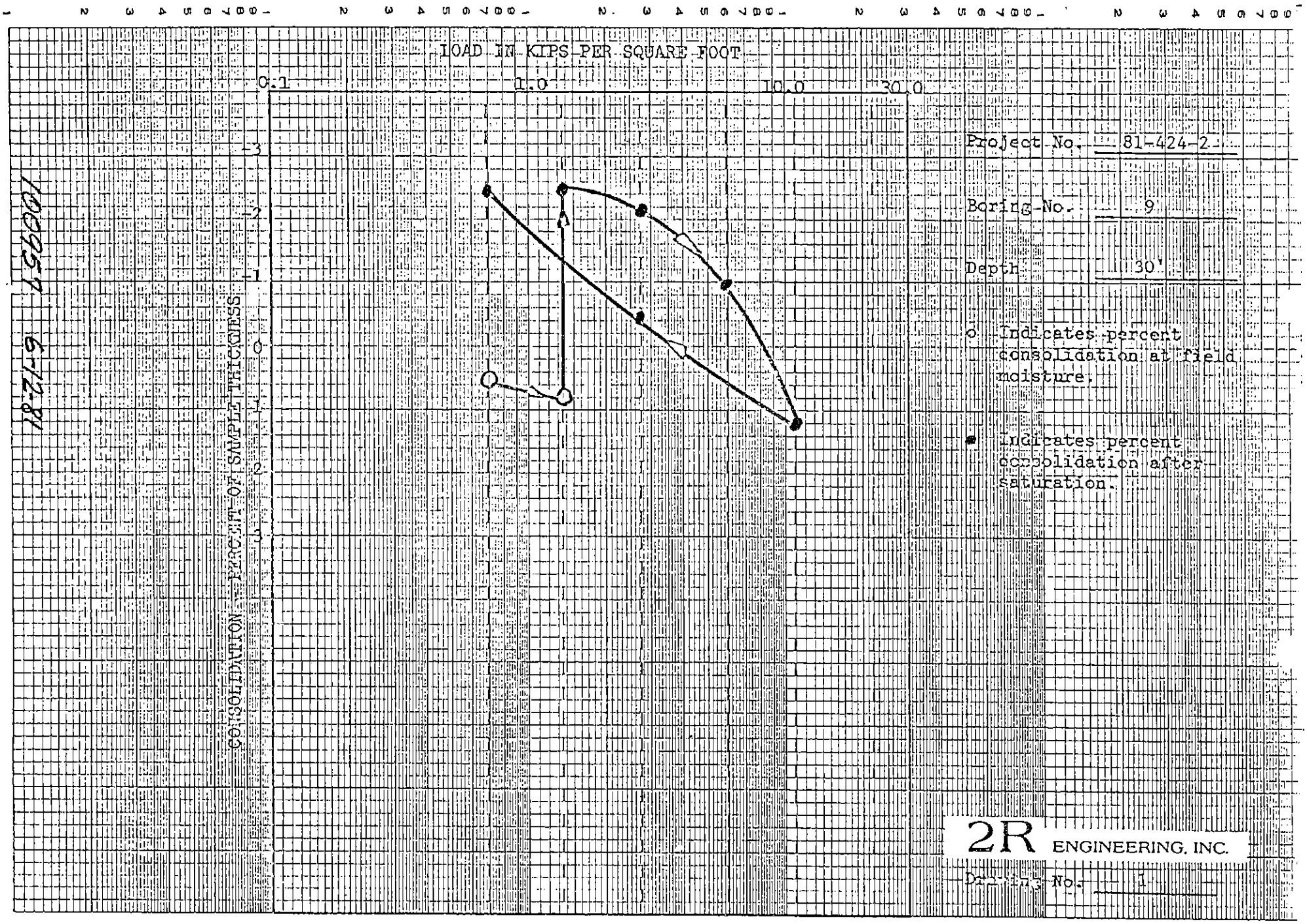
PACIFIC SOILS ENGINEERING, INC.
W.O. 100957 DATE 6-5-81

Form CC2

PLATE C-7

NO. 4-5C-10 SEMCO-GRAPH PAPER SEMI-LOGARITHMIC
5-2 INCH CYCLES X 10 DIV. PER INCH (70 DIV.)

SPAULDING-MOSS COMPANY
BOSTON 10, MASS.
MADE IN U.S.A.



100957 6-12-81

Plate C-8

NO. 4-5C-10 SEMCO-GRAPH PAPER SEMI-LOGARITHMIC
5-2 INCH CYCLES X 10 DIV. PER INCH (70 DIV.)

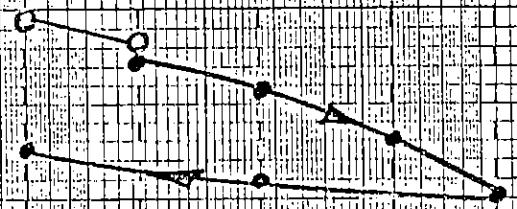
SPAULDING-MOSS COMPANY
BOSTON 10, MASS.
MADE IN U.S.A.

LOAD IN KIPS PER SQUARE FOOT

0.1 1.0 10.0 30.0

CONSOLIDATION - PERCENT OF SAMPLE THICKNESS

0 1 2 3



Project No. 81-424-2

Boring No. 9

Depth 40

○ Indicates percent consolidation at field moisture.

● Indicates percent consolidation after saturation.

2R ENGINEERING, INC.

Drawing No. 2

Page C-9

NO. 4-5C-10 SEMCO-GRAPH PAPER SEMI-LOGARITHMIC
5-2 INCH CYCLES X 10 DIV. PER INCH (70 DIV.)

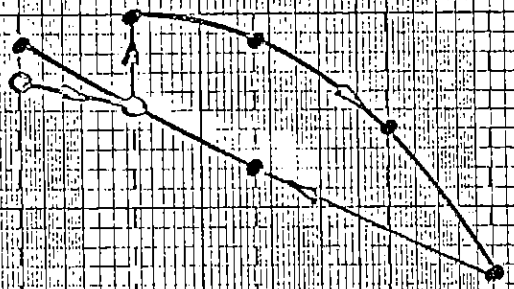
SPAULDING-MOSS COMPANY
BOSTON 10, MASS.
MADE IN U.S.A.

LOAD IN KIPS PER SQUARE FOOT

0.1 1.0 10.0 30.0

CONSOLIDATION - PERCENT OF SAMPLE THICKNESS

0 1 2 3



Project No. 81-424-2

Boring No. 9

Depth 55'

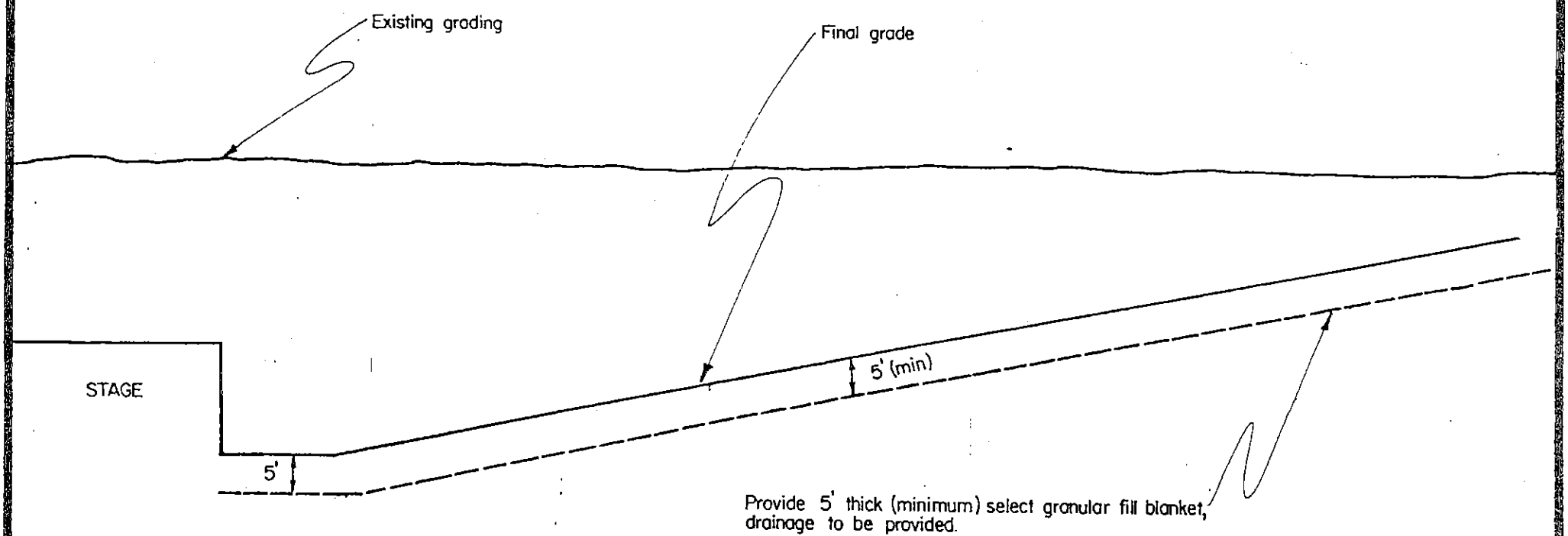
o Indicates percent consolidation at field moisture.

● Indicates percent consolidation after saturation.

2R ENGINEERING, INC.

Figure No. 3

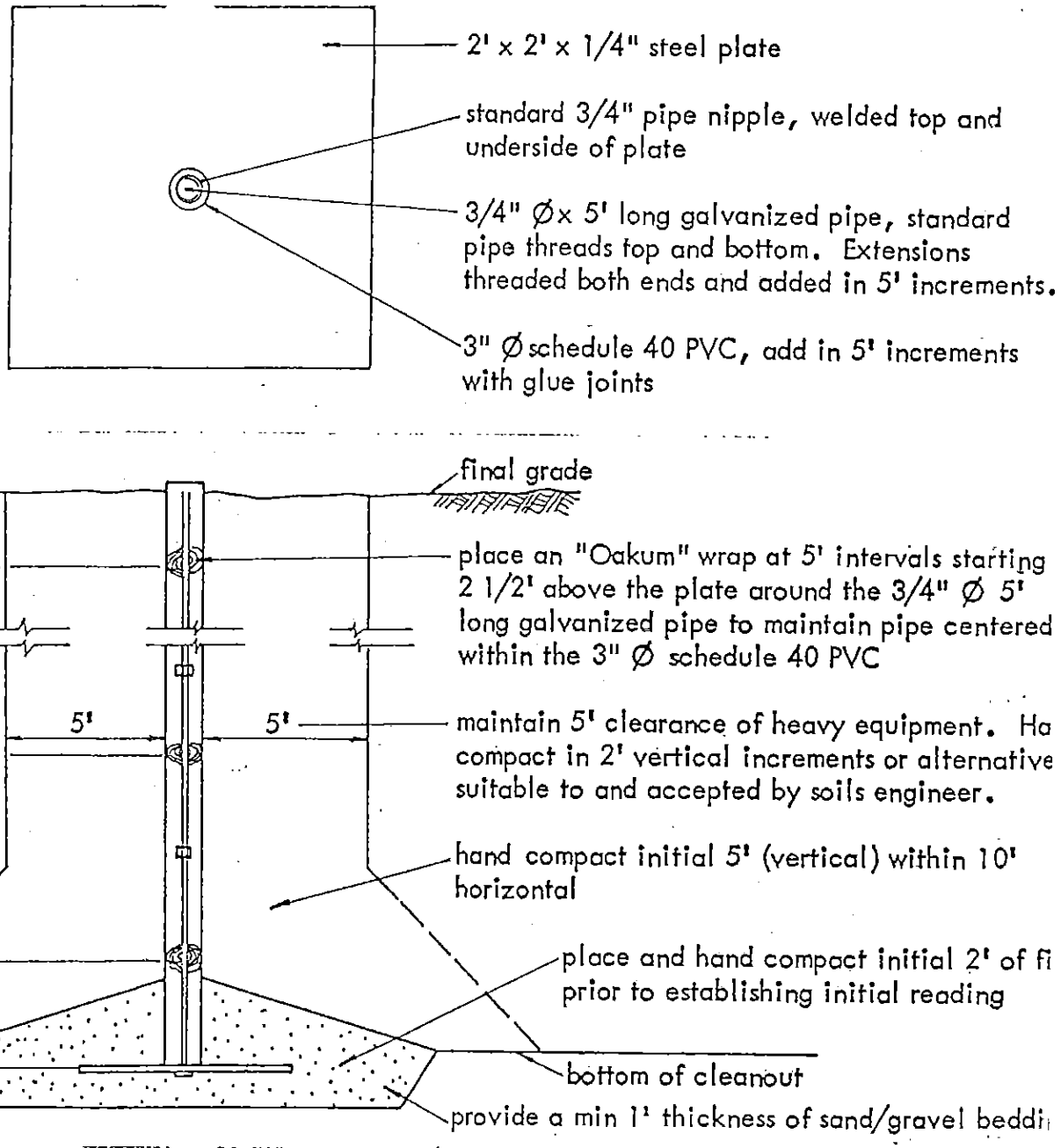
Plate C-10



SCALE: 1"=20' HORIZONTAL & VERTICAL

PACIFIC SOILS ENGINEERING, INC.
17809 FITCH IRVINE, CA (714) 557-9450

W.O. 100957 DATE 6-26-81



NOTE:

1. Locations of settlement plates shall be clearly marked and readily visible (red flagged) Equipment Operators.

2. Contractor shall maintain 10' horizontal clearance for heavy equipment within 5' (vertical) of plate base. Fill within clearance area shall be hand compacted to project specifications or compacted by alternative approved soils engineer.

3. After 5' (vertical) of fill is in place, contractor shall maintain 5' horizontal equipment clearance. Fill in clearance area shall be hand compacted (or approved alternative) ir vertical increments not to exceed 2 feet.

4. In the event of damage to settlement plate or extension resulting from equipment operating within prescribed clearance area, contractor shall immediately notify soils engineer and shall be responsible for restoring the settlement plates to working order.

PACIFIC SOILS ENGINEERING, INC
17909 FITCH IRVINE, CA (714) 557-94
100957 6-26-81

PLATE C- 2

DAC AMP BERM

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVENUE, SUITE 514, TUSTIN, CALIFORNIA 92780
TELEPHONE: (714) 730-2122, FAX: (714) 730-5191

CALIFORNIA CONSTRUCTION AUTHORITY
88 Fair Drive
Costa Mesa, California 92626

June 27, 2002
Work Order 500588

Attention: Jess Cummings

Subject: **GEOTECHNICAL STUDY**
Pacific Amphitheater Berm
Orange County Fairgrounds
Costa Mesa, California

Mr. Cummings:

Pursuant to your request, Pacific Soils Engineering, Inc. (PSE), has conducted a preliminary geotechnical study of the soils comprising the berm at the Pacific Amphitheatre in the Orange County Fairgrounds in general conformance with our proposal dated March 18, 2002. The Fairgrounds are located on the northeast corner of Fair Drive and Fairview Road, and the subject berm separates the amphitheater from other improvements such as the farm and operations buildings.

1.0 INTRODUCTION

1.1 Background and Purpose

The berm was constructed circa 1983 of onsite and import materials. PSE understands the berm is to be removed and the materials exported offsite. The purpose of this report is to provide information regarding the soils comprising the berm that California Construction Authority intends to provide to potential importers of the soil.

1.2 Scope of Study

A geotechnical field investigation and study was to provide a basis for compiling the presented geotechnical design parameters. The scope of PSE's study included the following tasks:

- Reviewing readily available geotechnical data pertinent to the site.
- Excavating, logging, and sampling of four bucket auger borings to depths of about 50 feet below the existing ground surface.
- Performing laboratory testing to evaluate relevant engineering properties of the on-site subsurface materials.
- Evaluate the data collected.
- Prepare and submit six (6) copies of a geotechnical report containing this firm's findings, conclusions and recommendations.

It should be noted that this study focused on the evaluation and analysis of the geotechnical conditions of the subject site. Investigation or assessment of the potential presence of toxic or hazardous substances is beyond the scope of our services.

1.3 Report Structure

The main text of this report is divided into the following sections: Introduction, Project Description, Subsurface Conditions, Engineering Analyses, Conclusions and Recommendations. Included with this report are the following appendices:

Appendix A - Field Investigation including Boring Logs

Appendix B - Laboratory Testing including data

Accompanying this report is a facsimile copy of a site plan with approximate boring locations added by PSE.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Existing Conditions

The berm is part of the Pacific Amphitheatre at the Orange County Fairgrounds. The Fairgrounds are located on the northeast corner of Fair Drive and Fairview Road, and the berm separates the amphitheater from other improvements such as the farm and operations buildings. The top of the berm is paved with approximately two to three inches of asphalt. Two structures, formerly used as

concession stands are present at either end of the berm. Concrete steps provide pedestrian access to near the top of the berm. Access for the drill rig was via a road comprised of paving stones. The side of the berm facing the amphitheatre is planted with grass, the side facing the farm has mature trees and ground cover.

2.2 Proposed Construction

The proposed construction consists of removal and export of the earthen berm.

3.0 SUBSURFACE CONDITIONS

Presented herein is a description of the materials encountered in our borings.

3.1 Fill

Fill materials were encountered to depths of about 46 feet in all the borings. The fill consisted of sandy and silty clays, clayey silts and sands and some poorly graded sands. The fill materials were generally dry at the surface and damp to moist below. Below the upper disturbed and weathered soils the fill soils were firm to stiff and medium dense. It should be noted that the berm was constructed of fill generated onsite as well as import soils.

3.2 Native Soils

Native soils were encountered at depths varying from 45 to 46½ feet and consist of damp to moist and stiff silty clays and clayey silts.

3.3 Groundwater

Groundwater was not encountered to the maximum depth explored of 50 feet.

4.0 ENGINEERING ANALYSIS

4.1 Materials Properties

4.1.1 Excavation Characteristics

The fill materials are considered to be easily removed and recompacted using conventional grading equipment.

4.1.2 Expansion Potential

The expansion potential of the berm materials, varied from "very low" to "high" when tested in accordance with Standard 18-2 of the 1997 UBC and classified in accordance with Table 18-I-B of the 1997 UBC. Testing for expansion potential should be performed during and at the completion of grading.

4.1.3 Soluble Sulfate Test Results

Results of soluble sulfate tests performed on representative samples of the site soils are presented on Table B-1 in Appendix B. The majority of the on-site soils are classified as having a "negligible" soluble sulfate effect on concrete when classified in accordance with Table 19-A-4 of the 1997 UBC. One sample had a soluble sulfate content 0.102 percent. Soils containing soluble sulfate of 0.10 to 0.20 percent are classified as having a "moderate" sulfate exposure.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The fill materials may be reused as fill. Specific recommendations regarding the placement of fill materials or recommended design should be provided by the geotechnical consultant of the project receiving the fill.

6.0 CLOSURE

6.1 Limitations

The conclusions and recommendations presented in this report are based on the data developed during the subject investigation. The materials immediately adjacent to or beneath those observed in the exploratory excavation may have different characteristics and no representations are made as to the quality or extent of materials not observed.

This report is based on the project as described and the information obtained from the boring at the approximate location indicated on the plans. The findings are

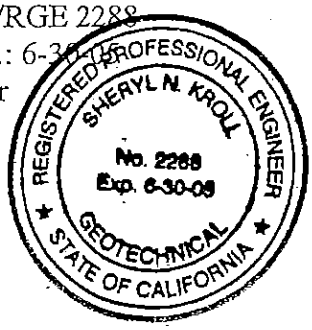
based on the results of the field, laboratory, and office investigations combined with an interpolation and extrapolation of conditions between and beyond the boring location. The results reflect an interpretation of the direct evidence obtained. Services performed by Pacific Soils Engineering, Inc., have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, either expresses or implied, and no warranty or guarantee is included or intended.

Pacific Soils Engineering, Inc., has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the CONTRACTOR, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

We wish to thank you for providing Pacific Soils Engineering, Inc., the opportunity to be of service to you and your organization. Should you have any questions, please do not hesitate to contact us at (714) 730-2122.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

SHERYL N. KROLL/RGE 2288
RCE 44033/Reg. Exp.: 6-30-05
Geotechnical Engineer

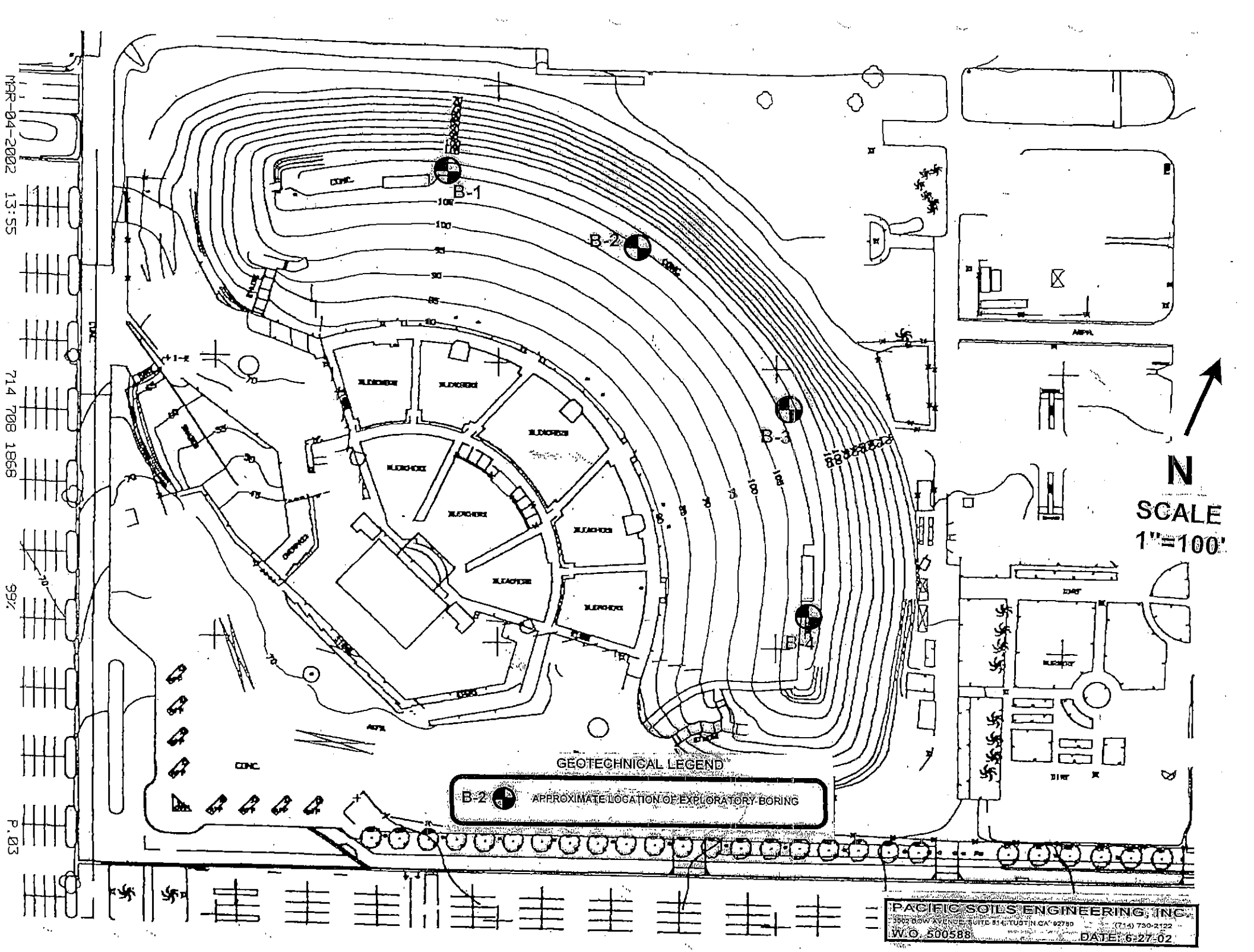


Reviewed by:

AZZAM J. ALWASH, Ph.D./RGE 2172
RCE 42518/Reg. Exp.: 3-31-04
Manager of Geotechnical Services

Distribution: (6) Addressee

SNK:AJA:RD/500588, June 28, 2002



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APPENDIX A

Field Investigation

APPENDIX A

Field Investigation

A truck mounted bucket auger drill rig was utilized to excavate four (4) borings within the subject project to depths of approximately 50 feet, below existing grades. The approximate locations of the exploratory borings are shown on the accompanying sketch and the Geotechnical Boring Logs are attached.

Representative bulk soil samples were obtained at significant lithologic changes. The samples were transported to PSE's laboratory for testing. Laboratory testing procedures and test results are presented in Appendix B of this report.

TERMS FOR THE DESCRIPTION OF SOIL

MAJOR DIVISIONS			GROUP SYMBOLS	GROUP NAMES
Coarse-grained Soils More than 50% retained on No. 200 sieve	GRAVELS More than 50 % of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines	GW	Well-graded gravel
			GP	Poorly graded gravel
		Gravels with more than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	SANDS 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	SW	Well-graded sand
			SP	Poorly graded sand
		Sands with more than 12% fines	SM	Silty sand
			SC	Clayey sand
Fine-grained Soils 50% or more passes the No. 200 sieve	SILTS and CLAYS Liquid Limit less than 50	inorganic	CL	Lean clay
			ML	Silt
		organic	OL	Organic clay or silt
	SILTS and CLAYS Liquid Limit 50 or more	inorganic	CH	Fat clay
			MH	Elastic silt
		organic	OH	Organic clay or silt
	Highly Organic Soils		PT	Peat

CONSISTENCY CLASSIFICATION

COARSE-GRAINED SOILS

	Blows/foot (SPT)
Very Loose	<4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	>50

FINE-GRAINED SOILS

	Criteria
Very Soft	Thumb penetrates soil > 1 in.
Soft	Thumb penetrates soil 1 in.
Firm	Thumb penetrates soil 1/4 in.
Stiff	Readily indented with thumbnail
Hard	Thumbnail will not indent soil

SOIL MOISTURE

Dry - dry to touch
Moist - damp, but no visible water
Wet - Visible free water

SIZE PROPORTIONS

Trace - < 5 %
Few - 5 to 10 %
Some - 15 to 25 %

LABORATORY TESTS

DS	Direct Shear
DSR	Direct Shear (Remolded)
CON	Consolidation
SA	Sieve Analysis
MAX	Maximum Density
RV	Resistance Value
EI	Expansion Index
SE	Sand Equivalent
AL	Atterberg Limits
CHEM	Chemical Analysis
HY	Hydrometer Analysis

PACIFIC SOILS ENGINEERING, INC.

PLATE A

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm	BORING DESIG.	B-1
DATE STARTED	5/30/02	GROUND ELEV.		LOGGED BY	snk
DATE FINISHED	5/30/02	GW DEPTH (FT)		NOTE	
DRILLER	Al Roy Drilling	DRIVE WT.			
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	SAMPLE TYPE	SAMPLE	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	OTHER TESTS
			CL	2" Asphalt **FILL:** fine to medium SANDY CLAY, light brown, dry, firm to stiff, with some coarse SAND and fine to coarse GRAVEL, trace rootlets	
5			CL	SILTY CLAY, olive brown and black brown, damp, medium stiff, trace white diatomaceous soil	
			CL	SANDY CLAY, dark brown, damp, medium stiff, with orange brown, SILTY SAND, some asphalt chunks	
10	B				MAX HY CHEM
15			ML	SANDY CLAYEY SILT, olive brown, damp, medium dense, trace roots	
			CL	SILTY CLAY, gray brown, damp to moist, firm to stiff	
20			CL	SILTY CLAY, gray brown, damp, firm to stiff, with some concrete	
			ML	SANDY CLAYEY SILT, some GRAVEL, light gray, moist, medium dense	
25			SM	SILTY SAND, orange brown, damp to moist, medium dense	
			SC	CLAYEY SAND, brown, moist, medium dense	
			CL	SANDY CLAY, olive brown, moist, firm to stiff, trace asphalt pieces	
30	B				MAX HY CHEM
			CL	SILTY CLAY, brown, moist, firm to stiff	
35			ML	CLAYEY SILT, gray brown, damp to moist, medium dense some black SILTY CLAY chunks	

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

- ▼ GROUNDWATER
- ► SEEPAGE
- B: BEDDING
- S: SHEAR
- J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-1
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy Drilling	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, light brown and dark brown, stiff				
						CL	SILTY CLAY, black brown, moist, stiff				
						CL	SILTY CLAY, black brown, moist, stiff, trace root hairs, organic smell				
45						CL	NATIVE:				
						CL	SILTY CLAY, brown, damp, stiff				
							SANDY CLAY, brown, damp, stiff, some pockets of tan silt				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm	BORING DESIG.	B-2
DATE STARTED	5/30/02	GROUND ELEV.		LOGGED BY	snk
DATE FINISHED	5/30/02	GW DEPTH (FT)		NOTE	
DRILLER	Al Roy Drilling	DRIVE WT.			
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	SAMPLE TYPE	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	OTHER TESTS
		CL	2" Asphalt SANDY CLAY, some fine to coarse GRAVEL, light brown, dry to damp, firm	
5			some white diatomaceous	
		CL	SILTY CLAY, brown, dry, stiff	
10		SP	fine to coarse SAND, orange brown, dry to damp, medium dense	
		CL	SILTY CLAY, dark gray, damp to moist, firm to stiff, some cobble size	
15		CL	SANDY CLAY, yellow gray, damp to moist, firm to stiff, some roots	
		CL	SILTY CLAY, black brown, moist, firm to stiff	
20	B	SC	CLAYEY SAND, orange brown, moist, medium dense, with some roots	MAX HY CHEM
			trace sea shells	
25		CL	SANDY CLAY, light olive brown, moist, firm to stiff, slightly plastic	
			some pieces of bark	
30		CL	SILTY CLAY, brown, moist, stiff, plastic	
		ML	CLAYEY SILT, gray brown, moist, stiff	
35		CL/ML	SILTY CLAY/CLAYEY SILT, black brown, moist, stiff	
	B	CL	SILTY CLAY, black, moist, stiff, organic smell	MAX

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE [T] TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm	BORING DESIG.	B-2
DATE STARTED	5/30/02	GROUND ELEV.		LOGGED BY	snk
DATE FINISHED	5/30/02	GW DEPTH (FT)		NOTE	
DRILLER	Al Roy Drilling	DRIVE WT.			
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, olive brown to brown, moist, stiff				HY CHEM
						CL	SILTY CLAY, black brown, moist, stiff, roots				
45						ML	**NATIVE:** CLAYEY SILT, light brown, some white powdery, damp to moist, stiff				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE [T] TUBE SAMPLE

- ▼ GROUNDWATER
- ► SEEPAGE
- B: BEDDING
- S: SHEAR
- J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm	BORING DESIG.	B-3
DATE STARTED	5/30/02	GROUND ELEV.		LOGGED BY	snk
DATE FINISHED	5/30/02	GW DEPTH (FT)		NOTE	
DRILLER	Al Roy Drilling	DRIVE WT.			
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						ML	2" Asphalt FILL: SANDY SILT, with some CLAY, light brown, dry, medium dense				
5		B									MAX HY CHEM
						SP	fine to coarse SAND, orange brown, damp to moist, medium dense, slightly micaceous, with some SANDY CLAY clods, dark brown, moist, stiff				
10						SP	fine to coarse SAND with CLAY, gray, damp to moist, medium dense, intermixed with black SILTY CLAY, moist, stiff				
						CL	SANDY SILTY CLAY, brown to gray brown, moist to stiff occasional asphalt chunks				
15						SP	fine to coarse SAND, orange brown, moist, medium dense				
20						ML	SANDY SILT, with clay clods, gray brown, moist, medium dense				
						CL	SANDY CLAY, light brown, moist, firm to stiff				
25						SC	CLAYEY SAND, gray brown, moist, medium dense, occasional sea shells				
30						CL	SANDY CLAY, orange brown, moist, stiff, slightly plastic, trace roots				
		B				ML	CLAYEY SILT, gray brown, moist, firm to stiff, slightly micaceous				MAX HY CHEM
35							becomes brown				
						CL	SILTY CLAY, dark gray brown, moist, stiff, trace mica				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

- ▼ GROUNDWATER
- ► SEEPAGE
- B: BEDDING
- S: SHEAR
- J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO. 500588
DATE STARTED 5/30/02
DATE FINISHED 5/30/02
DRILLER Al Roy Drilling
TYPE OF DRILL RIG 18" bucket

PROJECT NAME OC Fair Berm
GROUND ELEV.
GW DEPTH (FT)
DRIVE WT.
DROP

BORING DESIG. B-3
LOGGED BY snk
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, trace SAND, black brown, moist, stiff, plastic				
						CL	SILTY CLAY, black, moist, firm to stiff, organic smell, roots, plastic				
45						CL	SILTY CLAY, brown, moist, firm to stiff				
						ML	NATIVE CLAYEY SILT, light brown, damp, stiff				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO. 500588
DATE STARTED 5/30/02
DATE FINISHED 5/30/02
DRILLER Al Roy
TYPE OF DRILL RIG 18" bucket

PROJECT NAME OC Fair Berm
GROUND ELEV.
GW DEPTH (FT)
DRIVE WT.
DROP

BORING DESIG. B-4
LOGGED BY snk
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						SC/CL	3" Asphalt CLAYEY SAND/SANDY CLAY, light brown, dry, loose to medium dense/firm, roots				
						CL	SILTY CLAY, brown, damp, firm, with asphalt pieces				
5											
10		B				CL	SANDY CLAY, dark gray, damp to moist, firm to stiff, occasional roots				MAX HY CHEM
						CL	SILTY CLAY, trace SAND, black, damp to moist, firm to stiff, trace asphalt pieces				
15						CL	SILTY CLAY, gray brown, damp, stiff				
						SC	CLAYEY SAND, light gray brown, damp to moist, medium dense				
20						SP	SAND with CLAY clods, brown, damp, medium dense				
25						CL	SANDY CLAY with SILT, gray brown, damp to moist, firm to stiff, slight mica				
30						CL	SILTY CLAY, brown, moist, firm to stiff, slightly micaceous				
						ML/CL	CLAYEY SILT/SILTY CLAY, gray brown, moist, firm to stiff, slightly plastic				
35		B				CL	SILTY CLAY, gray, moist, firm to stiff, micaceous				MAX HY CHEM
						CL	SILTY CLAY, black brown, moist, firm to stiff, plastic				

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO. 500588
DATE STARTED 5/30/02
DATE FINISHED 5/30/02
DRILLER Al Roy
TYPE OF DRILL RIG 18" bucket

PROJECT NAME OC Fair Berm
GROUND ELEV.
GW DEPTH (FT)
DRIVE WT.
DROP

BORING DESIG. B-4
LOGGED BY snk
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, black, damp, slight organic smell, rootlets				
45						CL	**NATIVE:** SILTY CLAY, brown, damp, stiff, white staining				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

APPENDIX B

Laboratory Data

APPENDIX B

Laboratory Testing

The results of laboratory testing performed during this study are enclosed within this Appendix. Table B-1 presents a summary of laboratory test results.

The following laboratory tests were performed on representative samples in accordance with the applicable latest standards or methods from the ASTM, Uniform Building Code (UBC) and California Department of Transportation.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM D-2487 and D-2488.

Maximum Density/Optimum Moisture

The maximum dry density and optimum moisture content of a selected representative bulk samples were evaluated in accordance with ASTM D-1557-91/Method A. The results of these tests are summarized in Table B-1.

Particle Size Analysis

Modified hydrometer portion ASTM D 2442-72 were conducted to aid in classification of the soils. The results of the particle size analysis are presented in Table B-1.

Expansion Index Tests

An expansion index tests was performed to evaluate the expansion potential of typical on-site soils. Testing was carried out according to UBC Method 18-2. The results are presented in Table B-1.

Soluble Sulfate Content

Sulfate content of selected samples was evaluated by KYH Co., Analytical Laboratory. The results of their study are presented in Table B-1 and attached to this Appendix.

TABLE B-1

Summary of Laboratory Test Data

Boring/Pit No.	Depth	Soil Description	Group Symbol - Unified Soil Classification System	Maximum Dry Density		Grain Size Analysis				Expansion Index, UBC 18-2	Soluble Sulfate Content* (% wt)
				Maximum Density (pcf)	Optimum Moisture (%)	% + No. 4 Screen	% Sand	%Silt (0.074 to 0.005mm)	% Clay (-0.005 mm)		
B-1	12	Sandy Clay	CL	127	9.5	12	49	16	23	65	0.075
B-1	30	Sandy Clay	CL	122.5	11.5	1	40	28	31	82	0.074
B-2	21	Clayey Sand	SC	117	13.0	4	79	7	10	1	0.102
B-2	39	Silty Clay	CL	119	12.0	2	17	40	41	92	0.008
B-3	4	Sandy Silt	ML	125.5	10.0	0	39	33	28	68	0.002
B-3	33	Clayey Silt	ML	116	13.0	0	20	52	28	66	0.019
B-4	11	Sandy Clay	CL	126	10.0	4	42	23	31	56	0.007
B-4	36	Silty Clay	CL	117	14.0	0	26	31	43	96	0.063

* Sulfate Content tests by KYH Co. Analytical Laboratory, Santa Ana, California.

KYH Company Analytical Laboratory

3621 W. MacArthur Blvd., #118, Santa Ana, CA 92704 Tel: (714) 549-5824 Fax: (714) 549-8375

ANALYTICAL REPORT

Client Name:	Pacific Soils Engineering, Inc.	Report #:	223489R
Address:	10653 Progress Way Cypress, CA 90630	PSE W.O. No.	500588
Contact Person:	Mr. Keeney Van Horn	P.O. Number:	Verbal

Sample Analysis Report

Client ID	Lab ID	Requested Date	Analysis	Method	Result (% wt)	MDL (% wt)
B-1 (30')	15321	6-3-02	Sulfate Content	CalTrans 417	0.074	0.001
B-4 (11')	15322	6-3-02	Sulfate Content	CalTrans 417	0.007	0.001
B-3 (4')	15323	6-4-02	Sulfate Content	CalTrans 417	0.002	0.001

KYH Company Analytical Laboratory

3621 W. MacArthur Blvd., #118, Santa Ana, CA 92704 Tel: (714) 549-5824 Fax: (714) 549-8375

ANALYTICAL REPORT

Client Name:	Pacific Soils Engineering, Inc.	Report #:	223483R
Address:	10653 Progress Way Cypress, CA 90630	PSE W.O. No.	500588
Contact Person:	Mr. Keeney Van Horn	P.O. Number:	Verbal

Sample Analysis Report

Client ID	Lab ID	Requested Date	Analysis	Method	Result (% wt)	MDL (% wt)
B-4 (36')	15311	6-2-02	Sulfate Content	CalTrans 417	0.063	0.001
B-3 (33')	15312	6-2-02	Sulfate Content	CalTrans 417	0.019	0.001
B-2 (39')	15313	6-2-02	Sulfate Content	CalTrans 417	0.008	0.001
B-2 (21')	15314	6-2-02	Sulfate Content	CalTrans 417	0.102	0.001
B-1 (12-13')	15315	6-2-02	Sulfate Content	CalTrans 417	0.075	0.001

MALL / EAST FREEWAY HANGAR BLD.

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WAY, P.O. BOX 2248, CYPRESS, CALIFORNIA 90630
TELEPHONE: (714) 220-0770, FAX: (714) 220-9589
(Corporate Headquarters)

CALIFORNIA CONSTRUCTION AUTHORITY
1776 Tribute Road, Suite 200
Sacramento, Ca 95815

June 6, 2008
Work Order 102686

Attention: Mr. Tom Onishi

Subject: **GEOTECHNICAL COMMENTS**
Supplemental Geotechnical Design Parameters
Proposed Buildings Northerly and Easterly
Adjacent to the "Main Mall" Area
Orange County Fairgrounds
CITY OF COSTA MESA, CALIFORNIA

Reference: Preliminary Geotechnical Report, Proposed Buildings Northerly and Southerly Adjacent to the "Main Mall" Area, Orange County Fairgrounds, City of Costa Mesa, California; by Pacific Soils Engineering, Inc., dated May 27, 2008, (W.O. 102686).

Gentlemen:

Subsequent to the publication of the reference report, the structural engineer designing the foundation system for the new building proposed for east of the "Main Mall" area (between Building Nos. 14 and 16) requested clarification of some of the recommendations presented in the report as well as additional recommendations as discussed below.

Based upon recent information provided by the structural engineer, Pacific Soils Engineering, Inc., (PSE) recommends that the maximum allowable bearing capacity for use in design be 3,000 lbs. /sq. ft. This value may be increased as allowed by Code to resist seismic or wind loads.

In agreement with the report and due to the expansive soils onsite, grade beams are recommended along the east and west ends of the proposed building to tie the north and south continuous footings together. The grade beam should be a minimum 18 inches wide and embedded a minimum 24 inches below lowest adjacent grade within 5 horizontal feet (as measured from

bottom of grade beam) or, to allow for connection to deeper adjacent footings, as deep as the adjacent footings.

Depending upon the resultant configuration of the grade beam, the slab on the east and west sides of the building should have thickened edges that extend 24 inches below lowest adjacent grade within 5 horizontal feet. If the grade beam top is at slab subgrade, thickened edges will not be necessary, but the slab will need to be tied to the grade beam with No. 3 bars placed at a minimum spacing of 36 inches on center at alternating embedment depths of 24 and 36 inches into the slab.

It is our understanding that the structural engineer would like potential alternatives to tying back isolated exterior post/column footings back to the main foundation system in at least two (2) orthogonal directions, as recommended in the reference report. One alternative would be to deepen the isolated column footing an additional 2 feet to a total depth of 48 inches below lowest adjacent grade within 5 horizontal feet (as measured from the bottom of the footing). Another alternative would be to support the isolated columns on caissons. If caissons are used, they should incorporate the recommendations presented in the report (Section 7.1.2).

For clarification of the discussion about vapor retarders presented in the report, the following is provided:

A moisture and vapor retarding system should be placed below all slab-on-grade in areas of the structures considered to be moisture sensitive. The retarder should be of suitable composition, thickness, strength, and low permeance to reduce water vapor transmission through the slab to acceptable levels. Historically, a 10-mil plastic membrane, such as "Visqueen" placed between 2 inches of clean sand (1-inch above and 1-inch below) to as much as 4 inches of clean sand (2-inches above and 2-inches below), has been used for this purpose. The use of this system or other systems, materials, or techniques can be considered, at the discretion of the designer, provided the system reduced the vapor transmission rates to acceptable levels.

Unless requested, or additional geotechnical issues arise requiring comment by PSE, no additional recommendations beyond those included in this letter and the reference report are anticipated to be published during design of the foundation system for the structure proposed between Building Nos. 14 and 16.

All other recommendations presented in the reference report, except where superseded herein, are considered still valid for use in design.

This report is subject to review by the controlling authorities for the subject project. If you have any questions or require additional information, please contact the undersigned at (714) 220-0770.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

By: _____
DON OBERT/RCE 66411
Reg. Exp.: 6-30-09
Registered Civil Engineer

Reviewed by: _____
PAUL J. ERNST/RGE 2317
RCE 46394/Reg. Exp.: 3-31-09
Manager of Geotechnical Services

Distr.: (1) Addressee
(7) ATI Architects & Engineers, Attn: Bill Bigatti

DO:PJE:rb/do-26860002

PRELIMINARY GEOTECHNICAL REPORT
Proposed Buildings
Northerly and Easterly Adjacent to the "Main Mall" Area
Orange County Fairgrounds
CITY OF COSTA MESA, CALIFORNIA

Work Order 102686

Dated May 27, 2008

Prepared for:

CALIFORNIA CONSTRUCTION AUTHORITY
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Sacramento, CA 95815

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Attention: Mr. Tom Onishi

Subject: **PRELIMINARY GEOTECHNICAL REPORT**
Proposed Buildings
Northerly and Easterly Adjacent to the "Main Mall" Area
Orange County Fairgrounds
CITY OF COSTA MESA, CALIFORNIA

Gentlemen:

Pursuant to your request, presented herein is this firm's Preliminary Geotechnical Investigation for the two proposed buildings to be located near the "Main Mall" in the north central portion of the Orange County Fairgrounds in the City of Costa Mesa, California. The major geotechnical/geologic issues identified within this document include:

- Unsuitable soil removals
- Engineering and excavation characteristics of onsite earth materials
- Preliminary foundation design parameters

Pacific Soils Engineering, Inc., (PSE) appreciates the opportunity to provide you with geotechnical consulting services. If you have any questions or should you require any additional information, please contact the undersigned at (714) 220-0770.

Respectfully submitted,
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1.0 INTRODUCTION

1.1 Purpose and Scope of Study

The purpose of this report is to review and evaluate the existing geologic and soils engineering conditions and present geotechnical recommendations for the design and construction of the subject structures.

Specific items discussed as part of this report include unsuitable soil removals, engineering and excavation characteristics of onsite earth materials, and preliminary foundation recommendations.

The scope of this study include the following tasks:

1) *Excavation, logging and sampling of four (4) exploratory bucket auger borings on the subject property.*
2) *Laboratory testing of representative material samples collected from the exploratory excavations.*
3) *Plotting of geologic and geotechnical information on a 40-scale Topographic Survey Map prepared by Stantec Consulting, Inc., dated January 30, 2008, which serves as a Geotechnical Map (in pocket) for this report.*
4) *Formulation of conclusions and recommendations based on results of the field, office and laboratory studies.*
5) *Preparation of this report.*

1.2 Report Limitations

The conclusions and recommendations contained in this report are based on the data developed during this investigation. The materials immediately adjacent to or beneath those observed may have different characteristics than those observed. No representation is made as to the characteristics of materials not observed.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Description

The proposed buildings will be located within the north central portion of the Orange County Fairgrounds in the City of Costa Mesa, in the vicinity of existing Building Nos. 14, 16, and 17 (see Figures 1A and 1B).

The proposed site for one of the buildings is between existing Building Nos. 14 and 16 east of the "Main Mall". This approximately ½-acre flat area is primarily covered with asphalt paving, and has a 15± foot wide landscaped area, supporting grass and trees, which runs down the center portion of the area and extends its entire length.

The proposed site of the second building is the current site of Building No. 17, north of the "Main Mall". This steel-framed metal-clad building, which is scheduled for demolition, is surrounded by flat, asphalt-paved land.

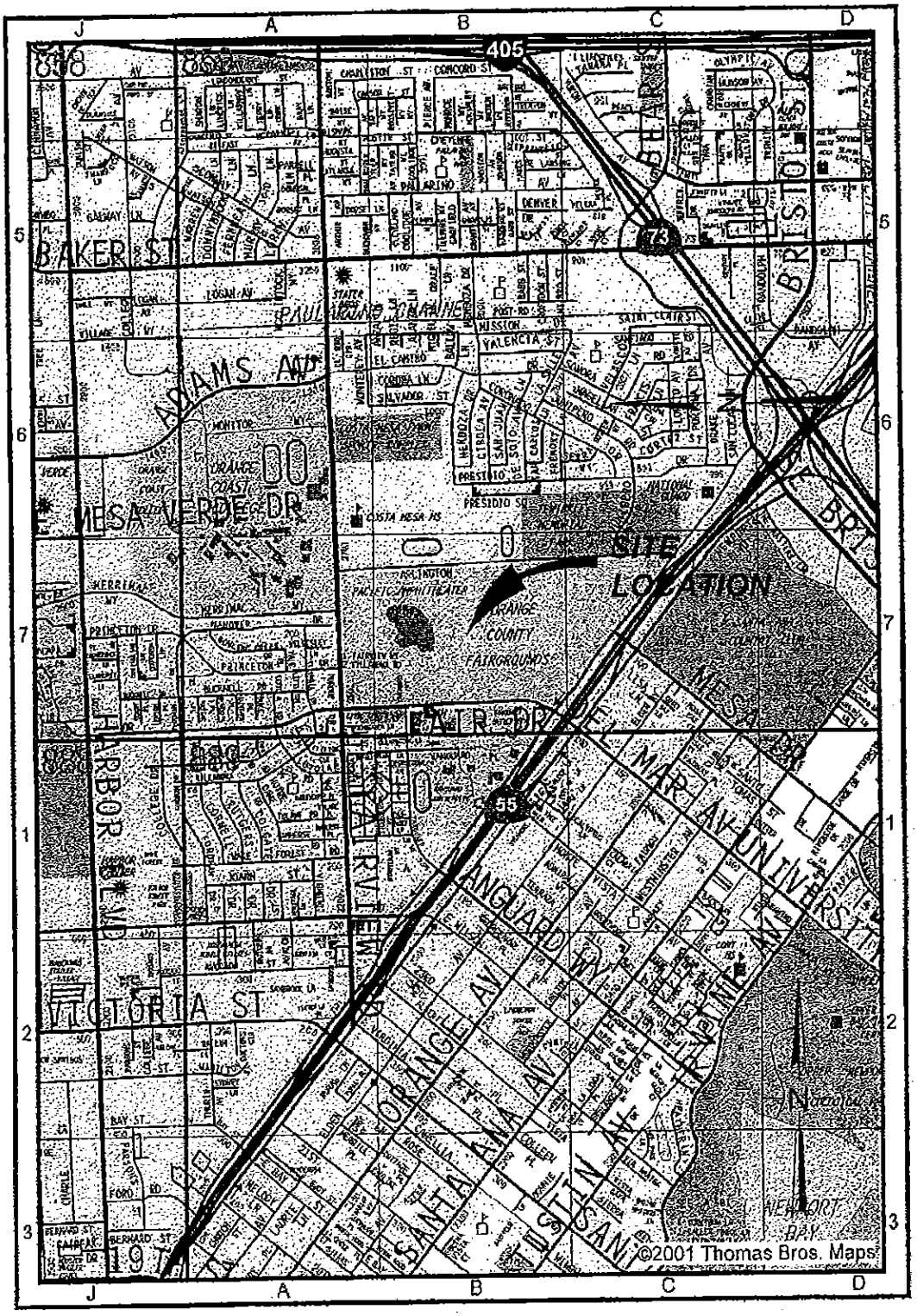
2.2 Proposed Development

As communicated to this firm, these new buildings are to be "Butler-Type" buildings (pre-fabricated steel buildings). The proposed building between existing Building Nos. 14 and 16 will also include 18-foot high masonry firewalls on the north and south sides.

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

3.1 Field Investigation

The subsurface exploration program completed as part of this investigation was directed towards evaluating the engineering characteristics of the site earth materials. A truck-mounted bucket auger drill rig was used to advance four (4) exploratory borings ranging in depth from 31 to 51± feet. The exploratory excavations were logged and selectively sampled by a member of this firm's geologic staff. The borings were sited as generally directed by the architect. Two borings were excavated outside the proposed building footprint of the replacement structure for Building No. 17, and the other two borings were excavated within the approximate footprint of the structure proposed for the area between Building Nos. 14 and 16. The approximate locations of the exploratory excavations are shown on the accompanying Geotechnical Map. Logs of the Borings are presented on Plates A-1 through A-4 of the Appendix.



SITE LOCATION MAP FIGURE 1A

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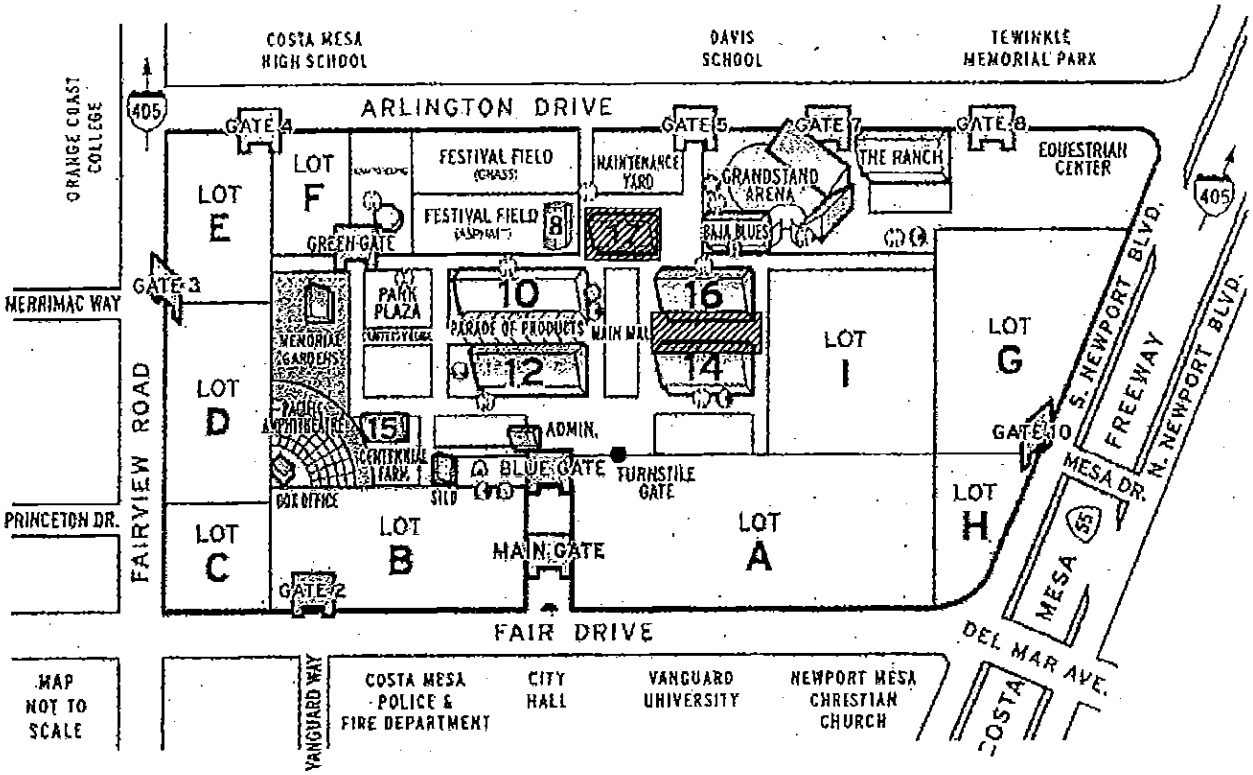
W.O.102686 DATE: 5-27-08



APPROXIMATE LOCATION
OF PROPOSED STRUCTURES

FIGURE 1B

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3.2 Laboratory Testing

To assist in evaluating the geotechnical properties of the site, laboratory testing was performed on bulk and relatively "undisturbed" ring samples obtained during the field investigation. A summary of the Laboratory Test Results (Table I) along with a brief description of the tests performed are presented in the Appendix.

4.0 GEOLOGIC CONDITIONS

4.1 Site Soil Conditions

Based upon observations made during the excavations, native materials generally underlie the site. The first 3 to 5 feet of material consists of alluvium. The alluvium, consisting of silty clay and silty sand was observed to be moist, brown, and firm/loose to medium dense. To the depths explored (51± feet), the alluvium is underlain by older paralic (near marine border deposits) material which is generally comprised of silts and clays with occasional silty to coarse-grained sand interbeds and lenses. These materials are moist, with the silts and clays ranging from firm to very stiff and the sands noted as medium dense to dense.

4.2 Groundwater

Groundwater was not encountered in any of the four exploratory excavations. Based upon data provided by the California Geological Survey, historically high groundwater is at a depth of approximately 30± feet below ground surface at the site.

4.3 Seismic Hazards

Earthquakes have occurred in the southern California region and will, undoubtedly, occur in the future. This site is (as is the entire City of Costa Mesa) in a seismically active region. The site is not within an earthquake fault zone as defined by the Alquist-Priolo Earthquake Fault Zoning Act, 1972, but it is approximately 1½ miles from the San Joaquin Hills fault and 3½ miles from the Newport-Inglewood fault. As such, design and construction of the improvements should be in accordance with

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content and as generally discussed in the attached **"Earthwork Specifications"**. Should a majority of the fill materials exhibit "very high" expansion potential, these compaction requirements may have to be modified subject to the approval of the Building Official.

When necessary, earthmoving equipment may be used for compaction or temporarily shut down in order to permit proper compaction of fills. Mixing and moisture-conditioning will be necessary to achieve the required moisture contents.

6.2.2 **Observation of Excavations**

All removal bottoms shall be observed and approved by the engineering geologist and/or soil engineer or their authorized representative prior to fill placement.

6.2.3 **Treatment of Removal Bottoms**

At completion of unsuitable soil removals, the exposed bottom shall be scarified and moisture-conditioned to above optimum conditions to a minimum depth of eight (8) inches, and compacted to the standards set forth in this report.

6.2.4 **Suitability of Onsite Soils**

Materials excavated during unsuitable soil removals may be used for compacted fill, provided they are free from trash, vegetation and other deleterious materials.

6.2.5 **Fill Placement**

After removals, moisture conditioning, and compaction of exposed materials are completed, additional fill may be placed. Fills shall be placed in thin lifts (maximum 8 inches in bulk thickness), properly moisture-conditioned, and compacted as grading progresses until final grades are attained.

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1. Given the proximity of the existing structures to the proposed improvements, consideration should be given to using cast-in-place

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CBC, Section 1613.5.6) along with the design response spectral accelerations (2007 CBC, Section 1613.5.4).

7.1.4 Chemical Analyses

Preliminary sulfate testing of the on-site soil samples indicate that these materials contain "negligible" amounts of soluble sulfates when classified in accordance with Table 4.3.1 of ACI 318-05.

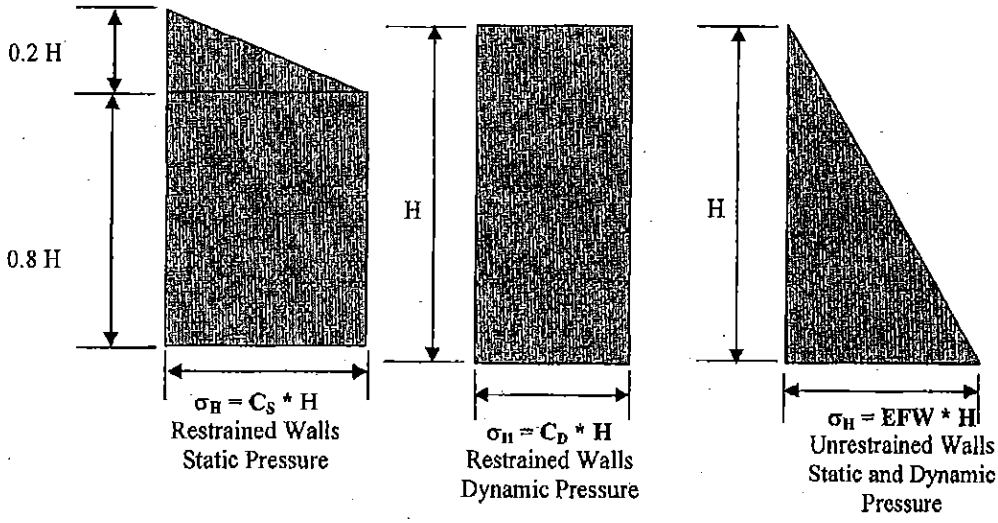
Testing of selected material samples from the exploratory excavations indicate the on-site materials are anticipated to be "severely corrosive" toward on-site ferrous improvements. *Consideration should be given to consulting a corrosion engineer for a more detailed evaluation.*

Additional testing of pH, sulfates, and resistivity is recommended during grading to provide a more comprehensive evaluation of the as-graded condition.

Upon the completion of rough grading, finish grade samples should be collected and tested so as to provide specific recommendations as they relate to foundation design. These test results and corresponding design recommendations will be presented in a Final Soils Engineering Report. Final foundation design recommendations should be made based upon specific structure-sitings, loading conditions, and as-graded soil conditions.

7.2 Retaining Walls

Retaining walls and other structures or facilities constructed to retain level, drained, structural quality backfill may be designed to resist lateral pressures developed by an equivalent fluid weight for soil as presented below. The pressures indicated are in pounds per square foot per foot of wall length. Dynamic pressures were derived using a peak ground acceleration having a probability of exceedence of 10 percent in 50 years (see Section 4.3.1.2).



Lateral Pressure Distribution Diagrams

Figure 2

Lateral Pressure Parameters (To be used in conjunction with Figure 2)							
Restrained Retaining Walls				Unrestrained Retaining Walls			
Select Backfill		Native Backfill		Select Backfill		Native Backfill	
Static	Dynamic	Static	Dynamic	Static	Dynamic	Static	Dynamic
$C_S = 23$	$C_D = 39$	$C_S = 90$	$C_D = 39$	EFW = 36	EFW = 32	EFW = 70	EFW= 32

"Select" backfill is free draining material that is the "very low" range of potential expansion per ASTM D 4829 (Expansion Index (EI) value of 20 or less) and has a Sand Equivalent (S.E.) of 30 or greater. If possible, onsite materials should not be used as backfill. For "select" backfill, retaining wall backcuts should extend a distance behind the wall not less than one half the wall height.

The calculated static and dynamic forces should be applied at approximately 1/3H and 0.63H, respectively. These forces should be combined to arrive at the total seismic force.

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sible for maintenance and cleaning of all drainage devices that have been installed to reduce ground saturation, and to promote structure stability.

7.3.2 Concrete Flatwork and Lot Improvements

At a minimum, the following recommendations should be incorporated into design and construction of proposed flatwork improvements.

a. Lightly loaded exterior concrete hardscape improvements should be a minimum of four (4) inches in thickness. Slabs and walkways should be reinforced with a minimum 6 inch x 6 inch No. 6 x No. 6 welded wire mesh or by No. 3 bars spaced at 24 inches on center, each way. Reinforcement should be placed in the middle third of the slab thickness.

b. A reinforced thickened perimeter edge extending a minimum of 8 inches below slab bottom, and having a minimum width of 6 inches should be incorporated into hardscape improvement design/construction.

c. In an effort to minimize shrinkage cracking, concrete flatwork should be constructed of uniformly cured, low slump concrete and should contain sufficient control/contraction joints (typically spaced at 8± feet, maximum).

d. Curbings that enclose planters or planting areas should extend a minimum of one foot below pavement subgrade.

e. Prior to concrete placement, subgrade soils should be thoroughly moisture conditioned to at least 140 percent of optimum moisture to a depth of 12 inches below finished subgrade. After achieving the above moisture conditions at depth, the exposed subgrade soils should be scarified and "flooded" overnight, prior to concrete placement.

f. Of primary importance in expansive soils conditions is minimizing the moisture variation below the improvements. Differential uplift of slabs, caused by non-uniform wetting expansion of soils, can cause

uplift at corners, edges or centers of slabs. Provisions for minimizing moisture variation include:

i. Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios and other hardscape improvements.

ii. Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drainage way from the improvements via subdrains into approved disposal areas.

iii. Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.

Additional provisions need to be incorporated into the design and construction of all improvements exterior to the proposed structures (walls, patios, walkways, and planters) to account for potential expansive soil and sulfate conditions. Design considerations on any given pad may need to include provisions for perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure and differential settlement/ heave, among others.

7.3.3 Zones of Special Foundation Consideration

Where the proposed removal of near-surface, low-density soils is impeded and/or restricted by property line or other physical constraints, such as existing structures or perimeter walls, zones of special foundation consideration may be established to account for future potential settlement. The width and locations of such zones will be dictated by exposed field conditions, removal configurations achieved, and finished pad elevations. Encroachment into such zones by perimeter wall or structural footings would require deepening of foundations, stiffening of foundations, increased pad drainage gradients, and/or additional reinforcing steel and additional expansion/control joints in hardscape and wall improvements. Approximation of the geometry of this zone will be a function of removal

configuration data recorded by the project civil engineer (surveyors). Evaluation of the future performance of the improvements constructed in this zone should consider the geotechnical conditions discussed here.

7.3.4 Utility Trench Excavation

All utility trenches should be shored or laid back in accordance with applicable OSHA standards.

7.3.5 Utility Trench Backfill

Mainline and lateral utility trench backfill should be compacted to at least 90 percent or maximum dry density as determined by ASTM Test Method: D-1557. Bedding materials should have an Expansion Index value of 20 or less and a sand equivalent value of 30 or greater. Onsite soils will be suitable for trench backfill. Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable.

Under-slab trenches should also be compacted to project specifications. If native soils are used, mechanical compaction is recommended. If select granular backfill (SE > 30 by laboratory testing) is utilized, densification by jetting will be acceptable, although backfill with granular material is not recommended as it may act as an undesirable reservoir for water. As such in lieu of native materials, under-slab trench may be backfilled with a lean slurry. The soil engineer should be notified for observation prior to placement of the membrane and slab reinforcement.

7.3.6 Temporary Excavation Considerations

Temporary excavations should be sloped or braced in accordance with CAL-OSHA/FED-OSHA regulations.

Excavations for the proposed foundations adjacent the existing structures should be performed in slots to reduce the potential for undermining these structures.

- Soils may be removed in slots no greater than 20 feet in width and 5 feet in depth. Adjacent open slots should be located a minimum of 40 feet (horizontal) from each other (i.e., "A,B,C" slot cuts, where all "A" slot foundation elements are constructed before excavating adjacent "B" slots, and all "B" slot foundation elements are constructed before excavating adjacent "C" slots).

  As an alternative, slots can be opened one at a time and the 20-foot foundation element constructed before excavating an adjacent slot.

- Foundation elements should be constructed as expeditiously as possible after excavating the slots.

No surcharge loads are permitted above unshored or unretained excavations. This includes, but is not limited to, earth spoil piles, lumber, concrete trucks or other vehicles, concrete blocks, or other construction materials or construction equipment. Drainage above excavations should be directed away from banks. Care should be taken to prevent saturation of the soils.

8.0 SITE MAINTENANCE

Design fine grade elevations should be maintained through the life of the structure. As expansive soils have been identified as underlying the site, it is of primary importance to reduce the moisture variation below all site improvements. Measures for maintaining conditions around the structures may include:

- Employing contractors for owner improvements who design and build in recognition of local building code and specific site soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other hardscape improvements.
- Avoiding the construction of raised planters adjacent to structural improvements. Alternatively, planter sides/bottoms may be sealed and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.

- Utilizing landscaping schemes with vegetation that requires minimal watering. Watering should be done in a uniform manner as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures or providing roof gutters on all structures with downspouts installed to carry roof runoff directly into area drains or discharged well away from the structures.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree. Alternate placement of trees (closer to the structures) may be performed based on recommendations from a qualified landscape contractor.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively constant moisture conditions.

The property manager/owner should be made aware of the potential problems that may develop when drainage is altered through construction of retaining walls, paved walk-ways and patios. Ponded water, leaking irrigation systems, overwatering or other conditions that could lead to ground saturation must be avoided.

9.0 FUTURE PLAN REVIEWS

This report represents a preliminary outline of the geotechnical issues pertaining to development of the site as presently proposed. As the project design progresses, site specific geotechnical issues may need to be incorporated into design and construction of the project. Consequently, future plan reviews may be necessary. These reviews may include reviews of:

- Demolition plans
- Grading plans
- Foundation plans
- Retaining wall plans

These plans should be forwarded to the project geotechnical engineer for evaluation and comment, as necessary.

10.0 CLOSURE

The findings and recommendations contained in this report are based upon the specific excavations, observations and laboratory testing as noted in this report. The material immediately adjacent to or beneath those observed may have different characteristics and no representations are made as to the quality or extent of materials not observed. This report is subject to review by the controlling authorities for the project.

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Earthwork Specifications

Retaining Wall Detail ..... Plate G-13

Geotechnical Map ..... (map pocket)

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Morton, P.K., Miller, R.V., and Fife, D.L., 1973, Geo-Environmental Maps of Orange County, California: California Division of Mines and Geology Preliminary Report 15, 4 Plates, scale 1:48,000.

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Department of Conservation, State of California, Division of Mines and Geology, 1997, Seismic Hazard Zone Report for the Anaheim and Newport 7.5-Minute Quadrangle, Orange County, California, SHZR 003.

_____ 1986, Special studies zones, Newport Beach Quadrangle, official map, effective July 1, 1986: Map Scale 1:24,000.

Department of Conservation, State of California, Division of Mines and Geology, Seismic Hazard Zones, Newport Beach Quadrangle, Office Map, Effective April 7, 1997.

May 27, 2008
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FIELD INVESTIGATION

AND

LABORATORY TEST DATA

APPENDIX

FIELD INVESTIGATION AND LABORATORY TESTING

The investigation upon which this report is based included a review of available published geotechnical reports and maps of the area, geologic reconnaissance of the site, and a subsurface field investigation program. The subsurface field investigation consisted of the excavation, logging and sampling of a total of 4 exploratory borings. The borings were excavated with a truck mounted bucket auger drill rig. Logs of the excavations appear herein.

In order to assess the physical properties of on-site earth materials, representative bulk and relatively "undisturbed" ring samples were obtained from the exploratory excavations and transported to our laboratory for testing. "Undisturbed" ring samples collected during this investigation were obtained by advancing a sampling spoon through the soil by repeated blows with the telescoping Kelly bars on the drill rig. The sampling spoon is lined with brass rings, each one, 1 inch in height by 2.50 inches inside diameter. Samples were retained in the rings, placed in relatively airtight containers and taken in our laboratory. Bulk samples collected during this investigation were placed in plastic buckets and also transported to our laboratory.

Laboratory tests consisted of in-situ moisture and density determinations, content, grain size, shear strength, consolidation, expansive soil characteristics, pH, resistivity, and sulfate analysis. Brief descriptions of the laboratory tests are presented below. Test results are summarized in Table I.

Moisture Density Determination

The in-situ unit dry weight and natural moisture content were determined for selected "undisturbed" ring samples. The results of these tests are included on Plates A-1 through A-4, of the Geotechnical Boring Logs.

Grain Size Determination

Grain size analyses were performed on representative ring and bulk samples. The tests were performed utilizing hydrometer test methods. The results of these tests were used as an aid in soil classification and are presented in Table I.

Shear Strength Determination

Shear tests were performed on selected remolded ring samples of the predominant soil types with a direct shear machine of the strain control type in which the rate of strain in 0.05 inches per minute. Specimens were inundated for approximately 24 hours in a confined conditioned and then subjected to shear under various normal loads. Results of these tests are summarized on Plate B.

Consolidation Tests

Consolidation tests were performed in accordance with procedures outlined in ASTM:D-2435. Testing was performed on five relatively "undisturbed" samples on onsite earth materials.

The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Hydroconsolidation (collapse) and expansion characteristics were also evaluated by monitoring the change in volume with saturation while the specimen was confined under a constant normal stress. Consolidation test results are shown on Plates C-1 and C-5.

Expansive Soils Characteristics

Expansion characteristics were evaluated on representative near surface samples in accordance with ASTM D 4829. The results of this testing is presented in Table I.

Corrosivity Analyses

Selected soil samples were analyzed for determination of pH and resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportioned in the flow of electrical current (DC) form the metal into the soil. The soil's resistivity decreases and, therefore, its corrosivity increase primarily as its moisture and chemical contents increase.

A commonly accepted correlation between electrical resistivity and corrosivity toward ferrous metals is:

Soil Resistivity in ohm-centimeters	Corrosivity Category
0 to 1,000	severely corrosive
1,000 to 2,000	corrosive
2,000 to 10,000	moderately corrosive
Over 10,000	mildly corrosive

The results of the corrosivity analysis are presented in Table I.

Chemical Testing

Testing for soluble sulfates and chlorides were performed (by others) on selected soil samples. The results of these tests are included in Table I.

GEOTECHNICAL BORING LOG

PROJECT NO.	102686	PROJECT NAME	OCF	BORING DESIG.	PSE-101
DATE STARTED	4/2/08	GROUND ELEV.	63	LOGGED BY	JH
DATE FINISHED	4/2/08	GW DEPTH (FT)		NOTE	0-24' 2150#; 24-44' 1350#; 44-64' 650#
DRILLER	Alroy	DRIVE WT.	See Note		
TYPE OF DRILL RIG	Bucket Auger	DROP	12 inches		

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 6" Asphalt				
						Alluvium (Qal): Silty Clay, brown, moist, firm, with some carbonate nodules.				
		B/R	2				22.5	99.9	88	
5	58	B/R	5			Old Paralic Deposits (Qopfsc): Sandy Silt, pale brown, moist, very stiff.	28.6	90.4	89	
						Moderate Cementation				
10	53	R	1			Silty Clay, pale brown to a light gray, moderate cementation, carbonate, mottled, moist, firm.	23.4	95.2	82	
15	48	R	1				29.0	92.8	96	
						Clayey Silt to Silty Clay, some stratification, light brown to brown, moist, firm.				
20	43	R	3				22.6	97.9	85	
		B				Fine Sand, yellowish brown, moist, medium dense, oxidized, reddish color.				
						Light gray, medium dense.				
25	38	R	5			Carbonaceous material in ring.	33.6	86.7	96	
						Silty Clay, reddish brown, moist, stiff.				
						Sandy Clay to Clayey Silt, brown, moist, very stiff.				
30	33	R	7				31.5	90.5	99	
						Total Depth 31 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

▼ Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	102686	PROJECT NAME	OCF		
DATE STARTED	4/2/08	GROUND ELEV.	63	BORING DESIG.	PSE-102
DATE FINISHED	4/2/08	GW DEPTH (FT)		LOGGED BY	JH
DRILLER	Alroy	DRIVE WT.	See Note	NOTE	0-24' 2150#; 24-44'
TYPE OF DRILL RIG	Bucket Auger	DROP	12 inches		1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 4" Asphalt				
						Alluvium (Qal): Silty Clay, brown, moist, firm.				
		B/R	2				27.1	96.6	98	
5	58	R	2			**Old Paralic Deposits (Qopfsc):** Silty Clay, pale brown, moist, firm.	25.5	92.5	84	
						Pale brown to grayish brown, mottled, abundant carbonate nodules.				
10	53	R	4			Stiff.	21.5	102.6	90	
15	48	R	3			Silty Clay, brown to olive, moist, stiff.	90.9	31.2	56	
		B								
20	43	R	3				24.7	100.0	97	
						Fine Sand to Silty Fine Sand, yellowish brown, moist, medium dense, moderate cementation, oxidation, stratification.				
25	38	R	6			Silty Clay, olive to reddish brown, moist, stiff, mottled.	36.8	83.5	98	
						Olive to yellowish brown.				
						Clayey to Silty Fine Sand, yellowish brown, moist, dense				
30	33	R	15				22.9	102.2	95	
						Sandy to Clayey Silt, pale brown to brown, moist, stiff.				
						Fine Sand, yellowish brown, moist, very dense.				
35	28	R	30				7.5	102.2	31	
						Clayey Sand to Sandy Clay, brown to dark yellowish brown,				

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO.	102686	PROJECT NAME	OCF		
DATE STARTED	4/2/08	GROUND ELEV.	63	BORING DESIG.	PSE-102
DATE FINISHED	4/2/08	GW DEPTH (FT)		LOGGED BY	JH
DRILLER	Alroy	DRIVE WT.	See Note	NOTE	0-24' 2150#; 24-44'
TYPE OF DRILL RIG	Bucket Auger	DROP	12 inches		1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R				moist, very dense to hard.	19.2	107.8	92	
		B				Fine- to medium-grained Sand, yellowish brown to grayish brown, very dense.				
45	18	R	50 for 10"			Medium- to coarse-grained Sand, yellowish brown, moist, very dense.	4.7	109.0	23	
						Clay lens, gray blue, moist, hard.				
50	13	R	50 for 5"				2.8	107.0	13	
						Total Depth 51 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

GEOTECHNICAL BORING LOG

PROJECT NO.	102686	PROJECT NAME	OCF		
DATE STARTED	4/2/08	GROUND ELEV.	62	BORING DESIG.	PSE-103
DATE FINISHED	4/2/08	GW DEPTH (FT)		LOGGED BY	JH
DRILLER	Alroy	DRIVE WT.	See Note	NOTE	0-24' 2150#; 24-44'
TYPE OF DRILL RIG	Bucket Auger	DROP	12 inches		1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 4" Asphalt				
						Alluvium (Qal): Silty Sand, brown, moist, loose to medium dense.				
		B/R	5			**Old Paralic Deposits (Qopfsc):** Silty Sand, pale brown, moist, medium dense, moderate cementation.	31.0	88.7	93	
5	57	B/R	2			Pale brown to grayish brown.	32.6	82.7	85	
10	52	R	4			Silty Clay to Clayey Silt, dark grayish brown to grayish brown, moist, stiff.	26.2	98.1	99	
15	47	R	5			Sandy Silt, pale brown, moist, very stiff, abundant carbonate, interbedded clay lenses.	27.7	95.8	99	
						Clay lens, olive, moist, stiff.				
20	42	R	4				24.9	100.0	98	
						Silty Fine Sand to Clayey Fine Sand, yellowish brown to grayish brown, moist, medium dense, oxidation, muscovite common.				
25	37	R	9				32.4	89.7	100	
						Silty Clay, grayish brown, moist, very stiff.				
30	32	R	7			Fine Sand, yellowish brown, moist, medium dense, abundant muscovite.	27.8	95.4	98	
						Total Depth 31 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

PACIFIC SOILS ENGINEERING, INC.

GEOTECHNICAL BORING LOG

PROJECT NO.	102686	PROJECT NAME	OCF		
DATE STARTED	4/2/08	GROUND ELEV.	62	BORING DESIG.	PSE-104
DATE FINISHED	4/2/08	GW DEPTH (FT)		LOGGED BY	JH
DRILLER	Alroy	DRIVE WT.	See Note	NOTE	0-24' 2150#; 24-44'
TYPE OF DRILL RIG	Bucket Auger	DROP	12 inches		1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 4" Asphalt				
						Alluvium (Qal): Silty Clay, brown, moist, firm.				
		R	2				23.5	100.0	93	
5	57	R	4			Old Paralic Deposits (Qopfsc): Clayey Silt to Silty Clay, pale brown, moist, stiff.	21.8	102.9	92	
						Pale brown to gray brown, increase in clay content, olive to gray brown.				
10	52	R	3			Silty Clay, gray brown, moist, stiff.	27.8	95.1	97	
						Moderate cementation.				
15	47	R	3			Fine Sand, stratification, thinly bedded, iron banded lenses.	32.7	88.9	99	
						Silty Clay, gray brown, moist, stiff.				
20	42	R	2			Silty Fine Sand, yellowish brown, moist, medium dense, abundant muscovite.	34.6	87.1	100	
						Silty Clay, reddish brown, moist, firm.				
		B				Fine Sand to Sandy Silt, yellowish brown, moist, medium dense/firm, oxidation, some stratification.				
25	37	R	6				33.0	88.8	99	
						Silty Clay, reddish brown, moist, stiff.				
30	32	R	7			Silty Fine Sand to Sandy Silt, yellowish brown, moist, medium dense/stiff, abundant oxidation.	30.7	90.3	96	
						Total Depth 31 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
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CONS - Consolidation

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

May 27, 2008
Work Order 102686

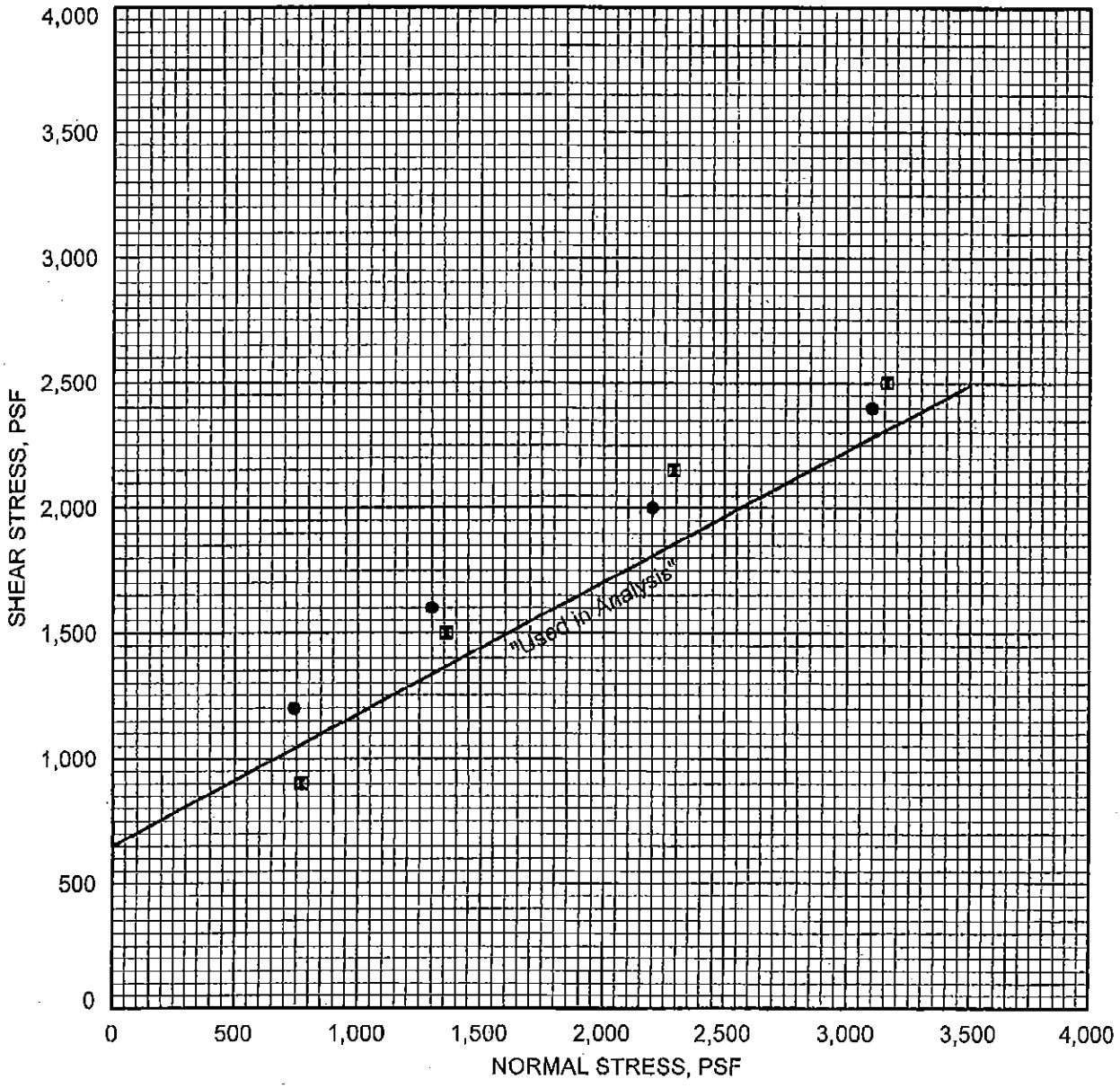
TABLE I
SUMMARY OF LABORATORY TEST DATA

			ASTM D-1557DIRECT SHEAR TESTS						Grain Size Analysis				Chemical Analyses				
Boring	Depth (ft.)	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Cohesion (psf)	Friction Angle ,ϕ, (degrees)	Test Conditions	Expansion Index (UBC 18-2)	% Gravel +#4	% Sand*	% Silt*	% Clay*	Sulfate (% by wt.)	Chloride (ppm)	pH	Resistivity (ohm-cm.)	Other Tests
B-101	2½	Brown Silty Clay							0	13	42	45					Consol.Plate C-1
B-101	2½	Brown Silty Clay	115.2	15.2	825	27	R/S	120	0	17	30	53	0.002	0.014	7.7	630	
B-101	10	Pale Brown Silty Clay							0	33	30	37					Consol. Plate C-2
B-102	7½	Brown Silty Clay							0	11	42	47					
B-102	5	Pale Brown Silty Clay							0	28	27	45					
B-103	2½	Brown Silty Sand							0	53	32	15					
B-103	5	Pale Brown Silty Clay							0	32	35	33					Consol. Plate C-3
B-103	5	Pale Brown Silty Sand	103.9	18.5	550	29	R/S	57	0	55	20	25	0.001	0.022	8.4	1530	
B-104	2½	Brown Silty Clay							0	17	35	48					Consol. Plate C-4
B-104	10	Pale to Grey Brown Silty Clay							0	21	32	47					Consol. Plate C-5

** Test performed by others.

Direct Shear Test Conditi R = Remolded; U = Undisturbed
S = Saturated; N = Natural Moisture

DIRECT SHEAR TEST
Remolded/Saturated



Engineered Fill - 90% R.C. (caf)	COHESION	650 psf.
	FRICTION ANGLE	27 degrees

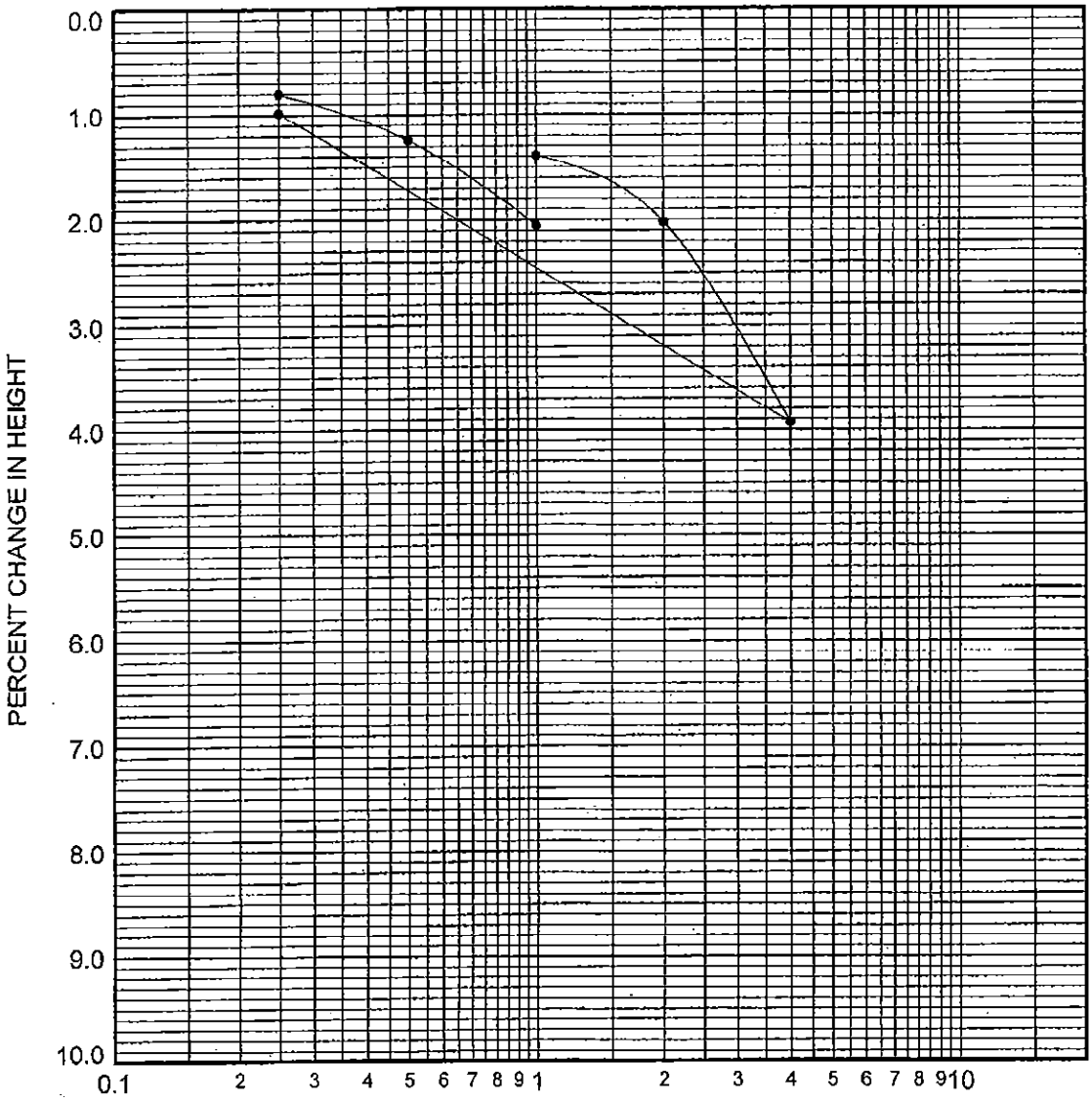
symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	PSE-101	2.5			
⊠	PSE-103	5.0			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 **PLATE B**

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-101	2.5

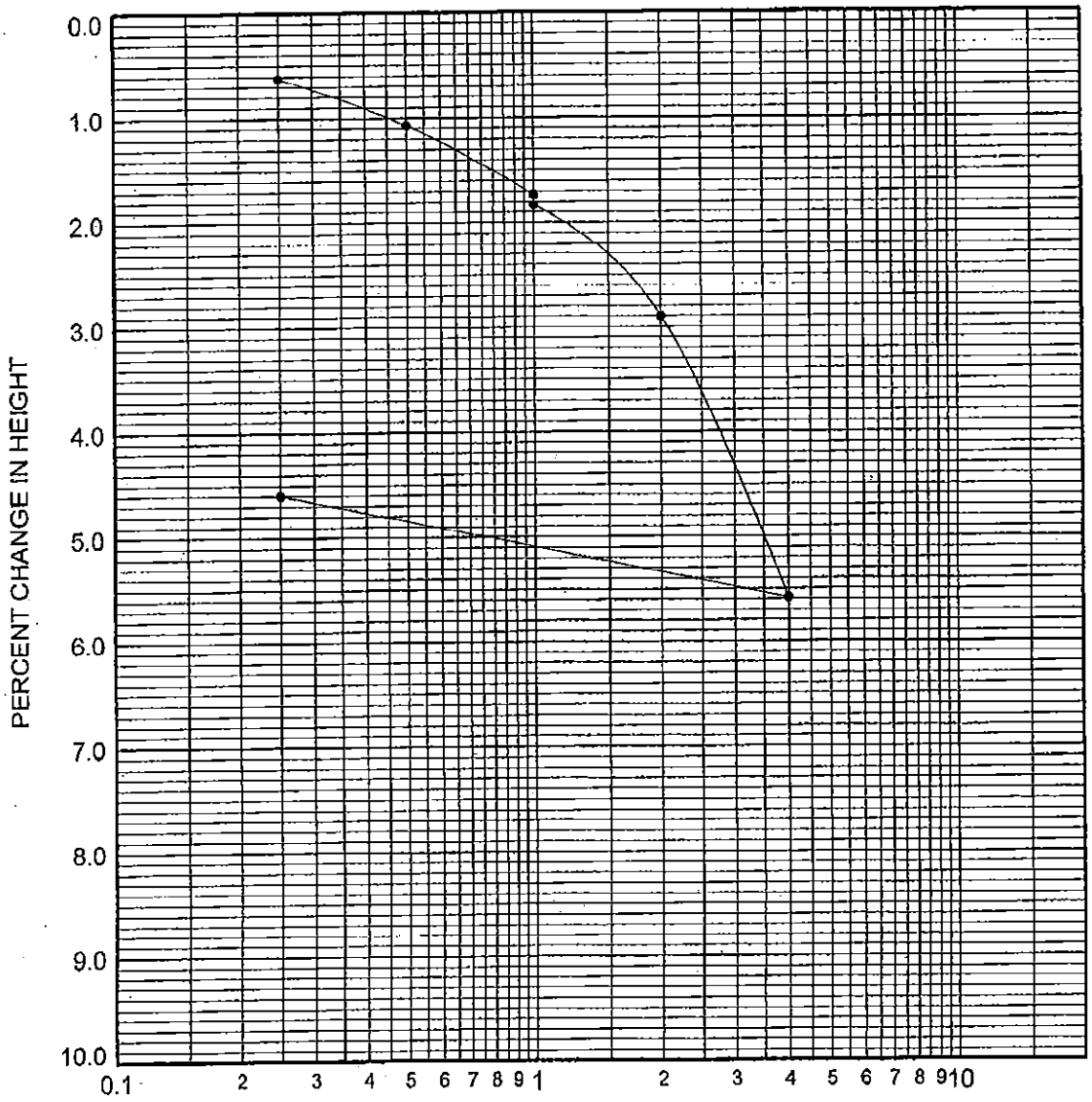
Water Added at 1.0 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-1

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-101	10.0

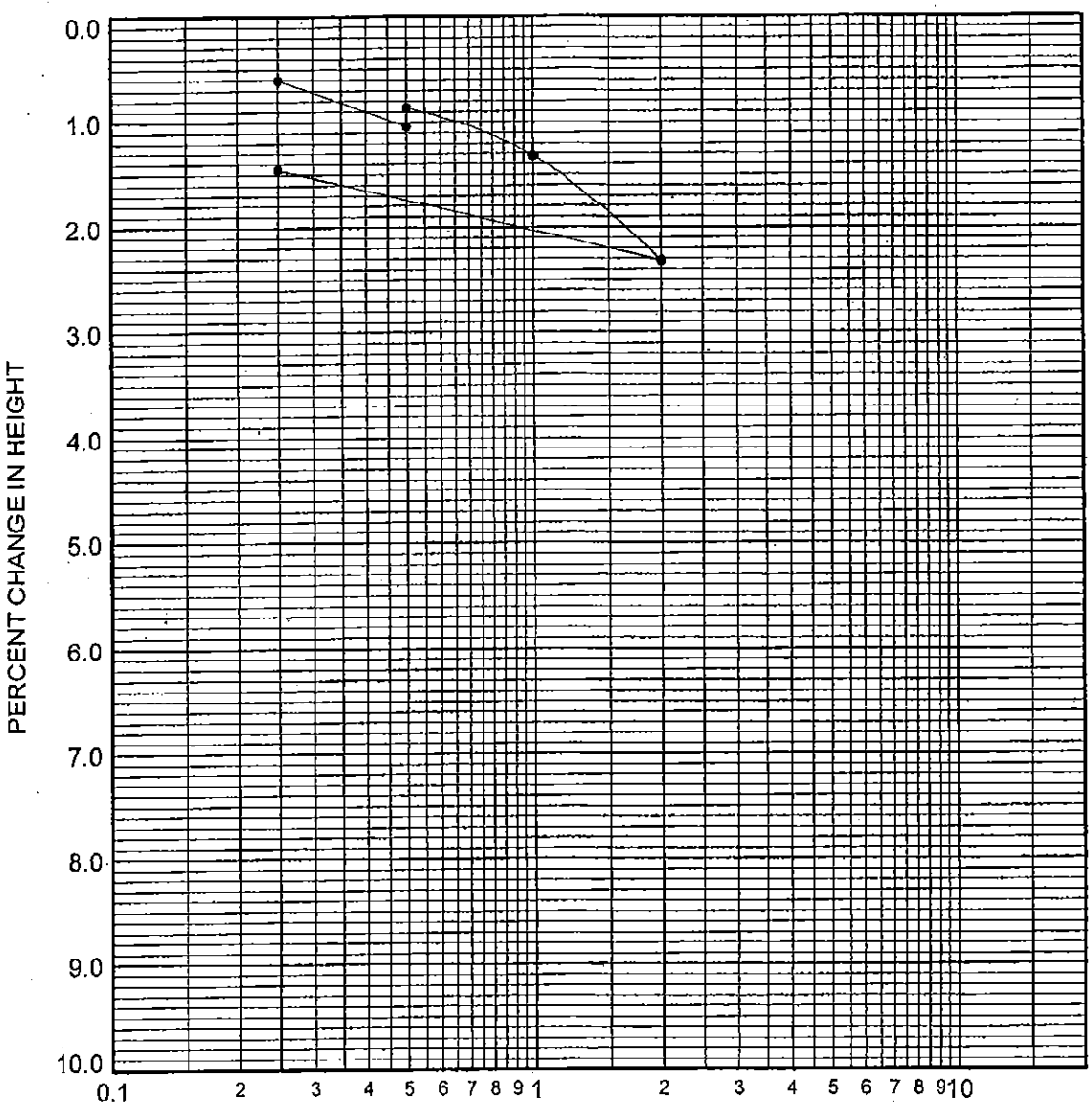
Water Added at 1.0 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-2

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-103	5.0

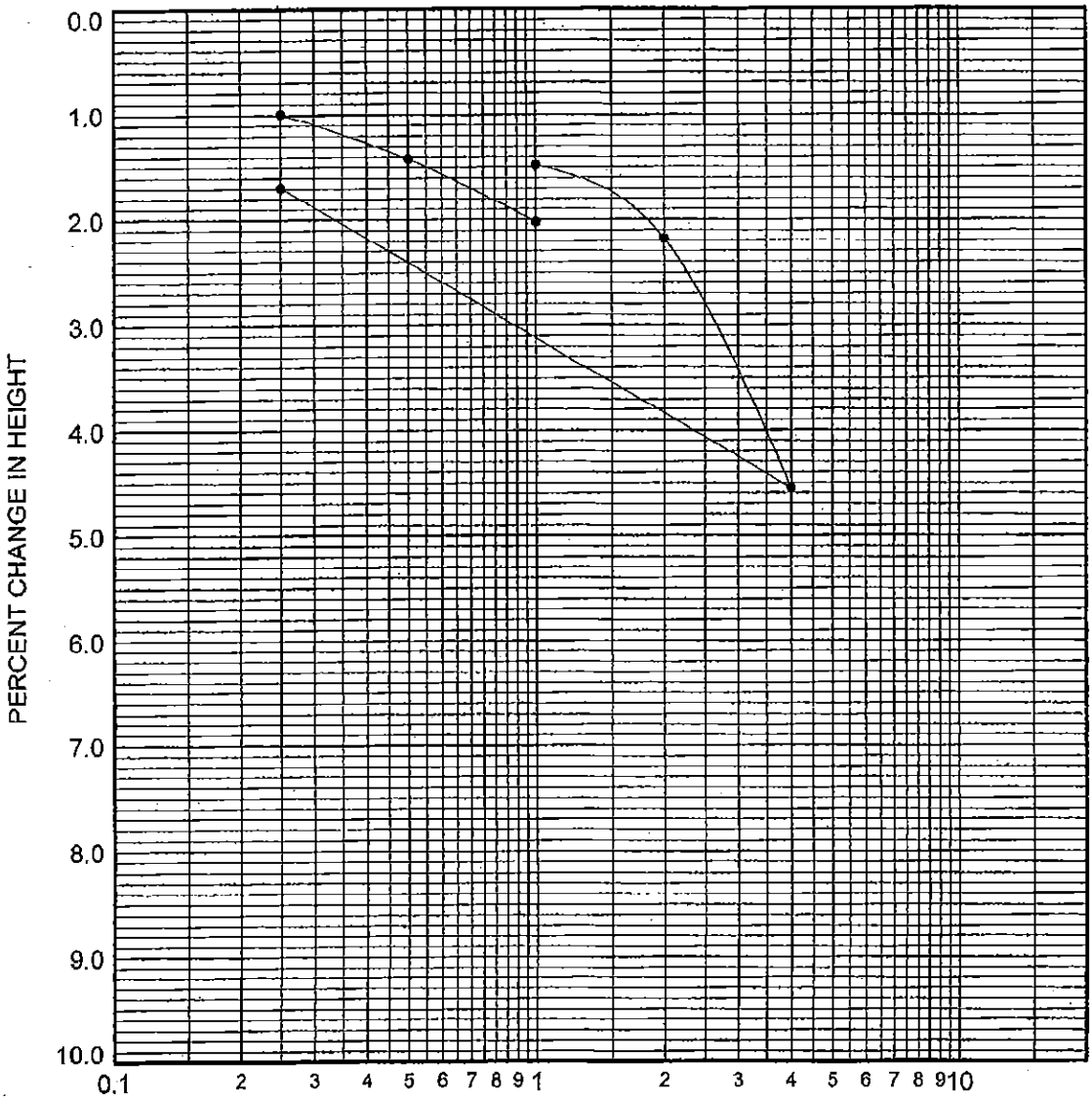
Water Added at 0.5 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-3

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-104	2.5

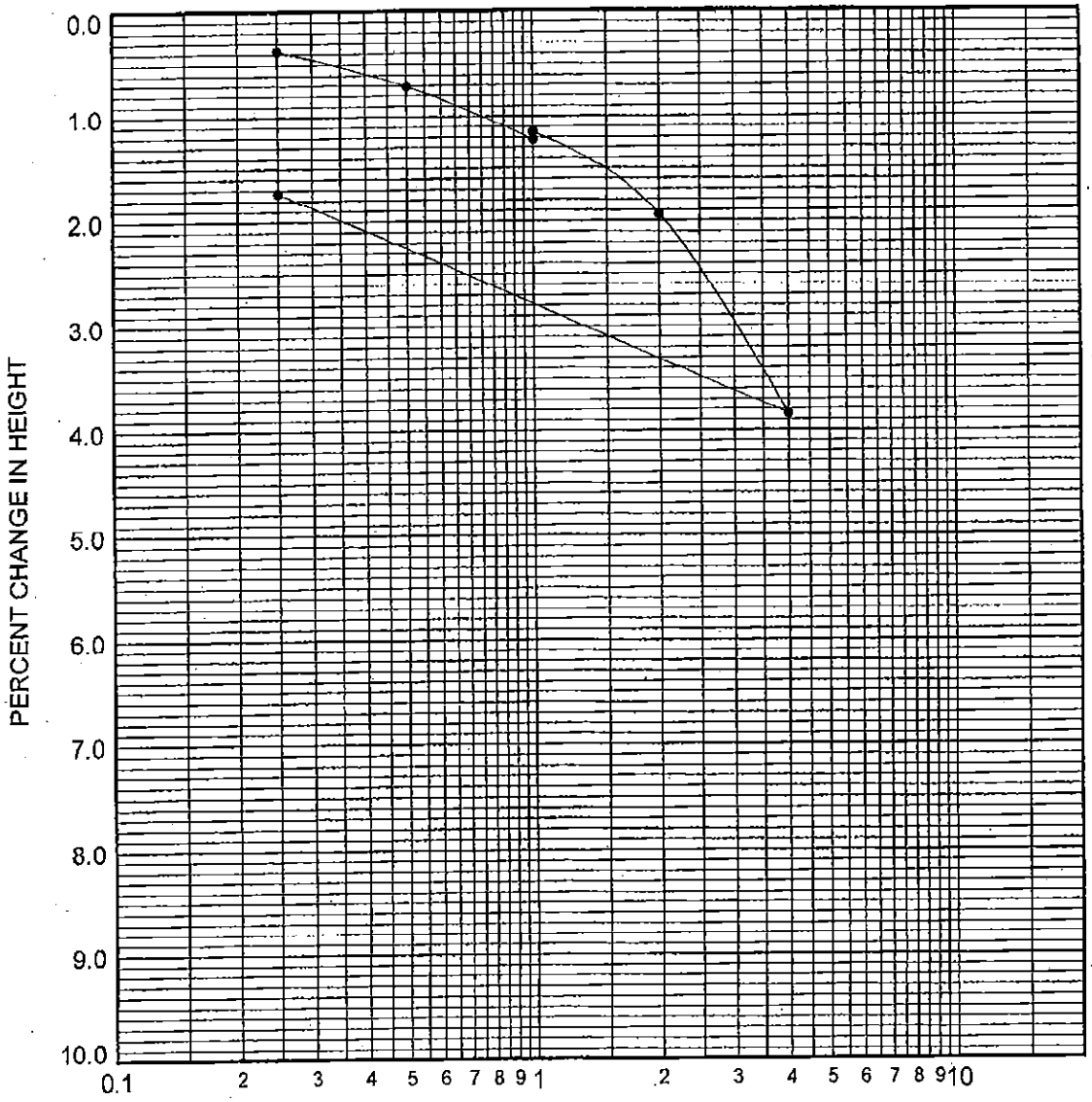
Water Added at 1.0 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-4

CONSOLIDATION CURVE



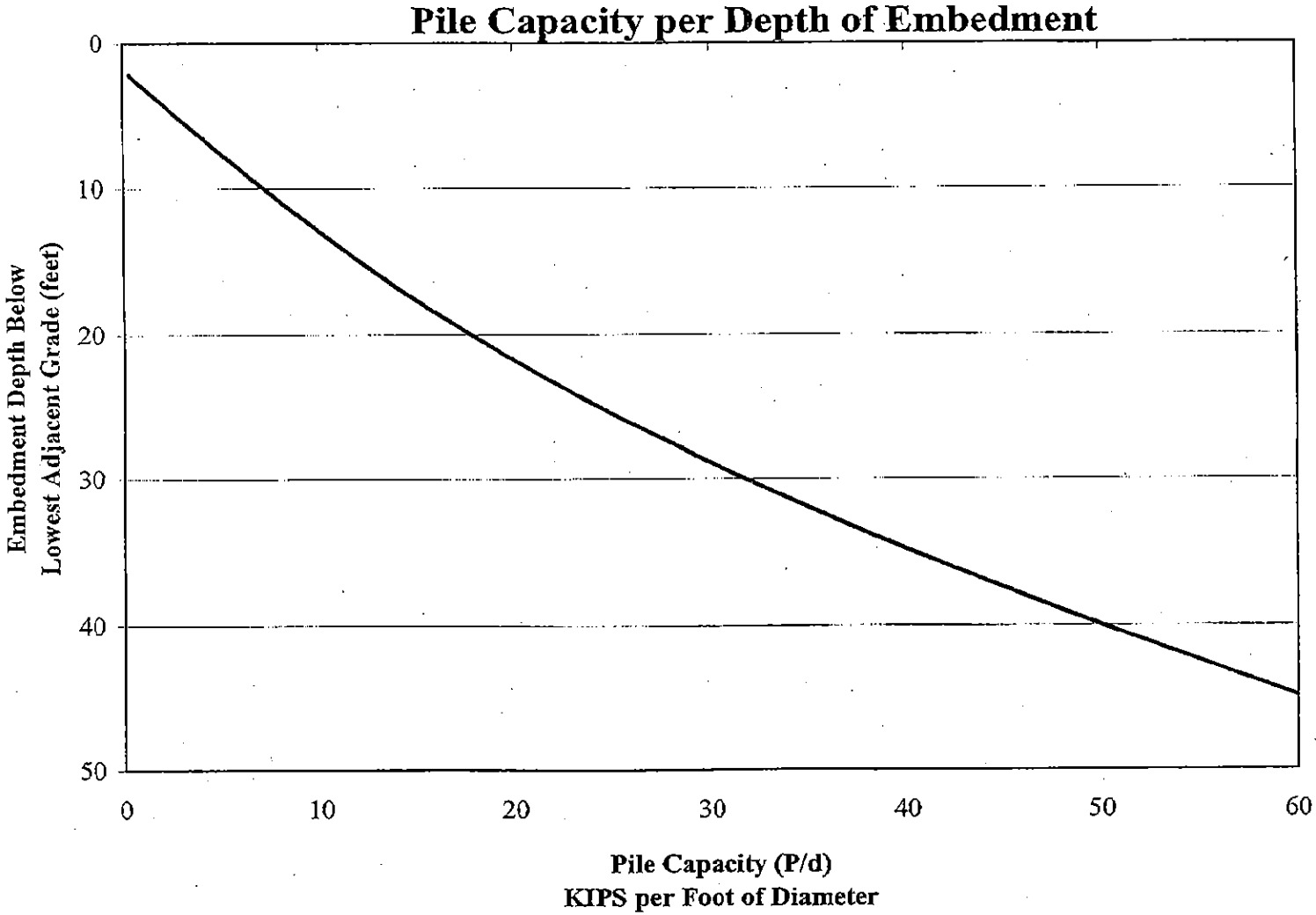
Boring	Depth (ft.)
PSE-104	10.0

Water Added at 1.0 TSF.

CONSOLIDATION CURVE

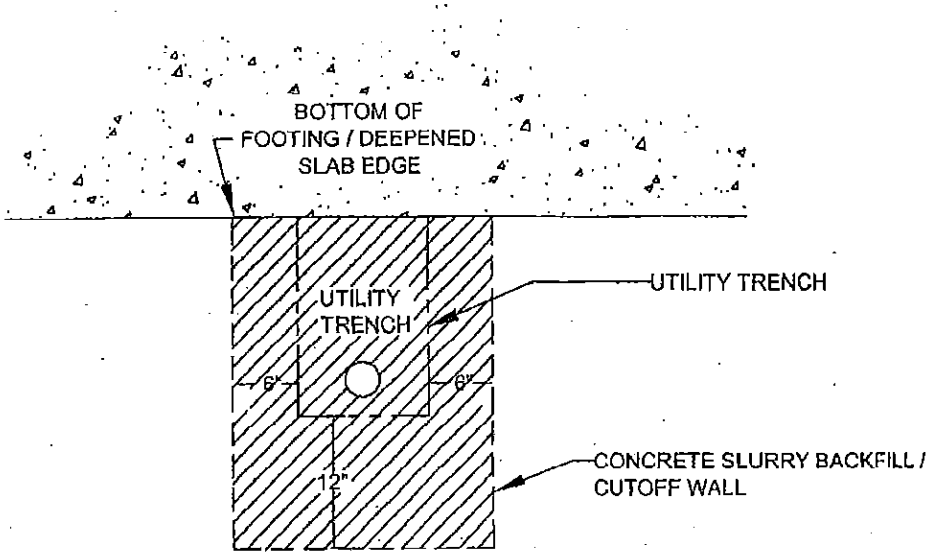
PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

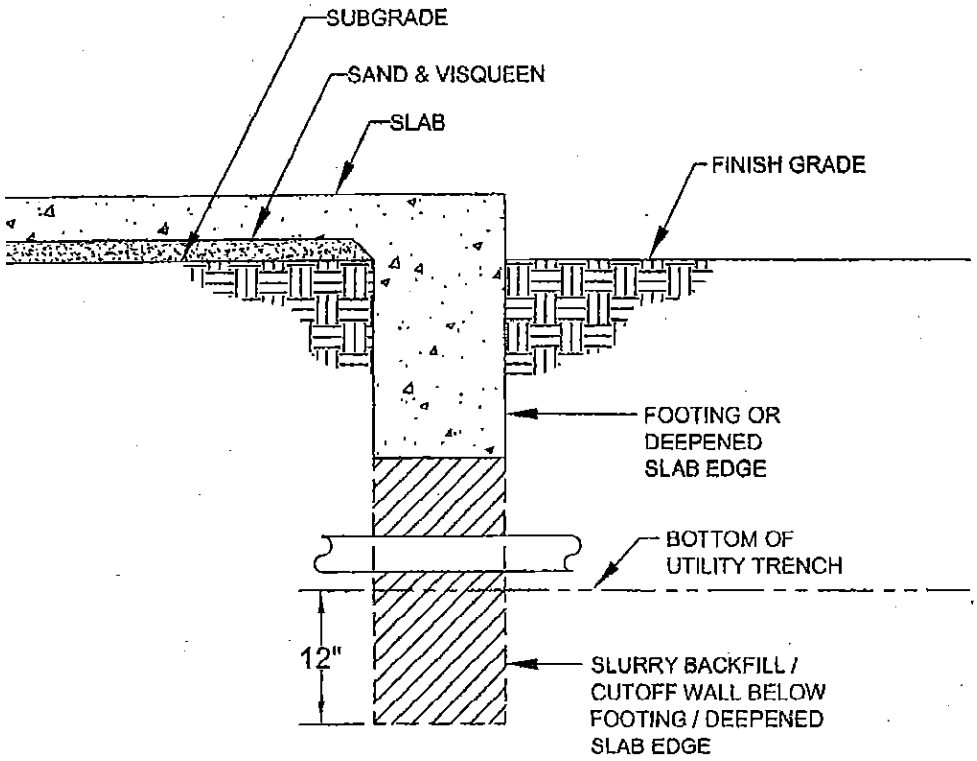
W.O. 102686 PLATE C-5



Work Order 102686

PLATE D





SCALE : 3/4" = 1'-0"

PLATE E

UTILITY TRENCH BACKFILL UNDER FOOTING / DEEPENED SLAB EDGE DETAIL

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WAY, CYPRESS, CA 90630
TELEPHONE: (714) 220-0770, FAX: (714) 220-9589
W.O. 102686 DATE: 5/27/08

PACIFIC SOILS ENGINEERING, INC.

EARTHWORK SPECIFICATIONS

These specifications present generally accepted standards and minimum earthwork requirements for the development of the project. These specifications shall be the project guidelines for earthwork except where specifically superceded in preliminary geology and soils reports, grading plan review reports or by prevailing grading codes or ordinances of the controlling agency.

I. GENERAL

A. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.

B. The project Soils Engineer and Engineering Geologist or their representatives shall provide testing services and geotechnical consultation during the duration of the project.

C. All clearing, grubbing, stripping and site preparation for the project shall be accomplished by the Contractor to the satisfaction of the Soils Engineer.

D. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soils Engineer and to place, spread, mix and compact the fill in accordance with the job specifications and as required by the Soils Engineer. The Contractor shall also remove all material considered by the Soils Engineer to be unsuitable for use in the construction of compacted fill.

E. The Contractor shall have suitable and sufficient equipment in operation to handle the amount of fill being placed. When necessary, equipment will be shut down temporarily in order to permit proper compaction of fills.

II. SITE PREPARATION

A. Excessive vegetation and all deleterious material shall be disposed of offsite as required by the Soils Engineer. Existing fill, soil, alluvium or rock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Where applicable, the Contractor may obtain the approval of the Soils Engineer and the controlling authorities for the project to dispose of the above described materials, or a portion thereof, in designated areas onsite.

After removals as described above have been accomplished, excavation of earth materials deemed unsuitable in their natural, in-place condition, shall be removed as recommended by the Soils Engineer/Engineering Geologist.

B. After the removals as delineated in Item II, A above, the exposed surfaces shall be disced or bladed by the Contractor to the satisfaction of the Soils Engineer. The prepared ground surfaces shall then be brought to the specified moisture condition, mixed as required, and compacted and tested as specified. In areas where it is necessary to obtain the approval of the controlling agency, prior to placing fill, it will be the Contractor's responsibility to notify the proper authorities.

C. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or others not located prior to grading are to be removed or treated in a manner prescribed by the Soils Engineer and/or the controlling agency for the project.

III. COMPACTED FILLS

A. Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soils Engineer. Deleterious material not disposed of during clearing or demolition shall be removed from the fill as directed by the Soils Engineer.

B. Rock or rock fragments less than eight inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets and the distribution of the rocks is approved by the Soils Engineer.

C. Rocks greater than eight inches in the largest dimension shall be taken offsite, or placed in accordance with the recommendations of the Soils Engineer in areas designated as suitable for rock disposal.

D. All fills, including onsite and import materials to be used for fill, shall be tested in the laboratory by the Soils Engineer. Proposed import materials shall be approved prior to importation.

E. The fill materials shall be placed by the Contractor in layers that when compacted shall not exceed six inches. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain a near uniform moisture condition and a uniform blend of materials.

All compaction shall be achieved at optimum moisture content or above, as determined by the applicable laboratory standard. No upper limit on the moisture content is necessary; however, the Contractor must achieve the necessary compaction and will be alerted when the material is too wet and compaction cannot be attained.

F. Where the moisture content of the fill material is below the limit specified by the Soils Engineer, water shall be added and the materials shall be blended until a uniform moisture content, within specified limits, is achieved. Where the moisture content of the fill material is above the limits specified by the Soils Engineer, the fill materials shall be aerated by discing, blading or other satisfactory methods until the moisture content is within the limits specified.

G. Each fill layer shall be compacted to minimum project standards, in compliance with the testing methods specified by the controlling governmental agency and in accordance with the recommendations of the Soils Engineer.

In the absence of specific recommendations by the Soils Engineer to the contrary, the compaction standard shall be ASTM:D 1557-91.

H. Where a slope receiving fill exceeds a ratio of five-horizontal to one-vertical, the fill shall be keyed and benched through all unsuitable topsoil, colluvium, alluvium, or creep material, into sound bedrock or firm material, in accordance with the recommendations and approval of the Soils Engineer.

I. Side hill fills shall have a minimum key width of 15 feet into bedrock or firm materials, unless otherwise specified in the soils report and approved by the Soils Engineer in the field.

J. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency and/or with the recommendations of the Soils Engineer and Engineering Geologist.

K. The Contractor shall be required to maintain the specified minimum relative compaction out to the finish slope face of the fill slopes, buttresses, and stabilization fills as directed by the Soils Engineer and/or the governing agency for the project. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the designated result.

L. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm material; and the transition shall be stripped of all soil or unsuitable materials prior to placing fill.

The cut portion should be made and evaluated by the Engineering Geologist prior to placement of fill above.

M. Pad areas in natural ground and cut shall be approved by the Soils Engineer. Finished surfaces of these pads may require scarification and recompaction.

IV. CUT SLOPES

A. The Engineering Geologist shall inspect all cut slopes and shall be notified by the Contractor when cut slopes are started.

B. If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the Engineering Geologist and Soils Engineer shall investigate, analyze and make recommendations to treat these problems.

C. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the prevailing drainage.

D. Unless other specified in the soils or geological reports, no cut slope shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agencies.

E. Drainage terraces shall be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the Soils Engineer or Engineering Geologist.

V. GRADING CONTROL

A. Fill placement shall be observed by the Soils Engineer and/or his representative during the progress of grading.

Field density tests shall be made by the Soils Engineer or his representative to evaluate the compaction and moisture compliance of each layer of fill. Density tests shall be performed at intervals not to exceed two feet of fill height. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density determinations shall be taken in the compacted material below the disturbed surface at a depth determined by the Soils Engineer or his representative.

B. Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction, or improper moisture is in evidence, the particular layer or portion shall be reworked until the required density and/or moisture content has been attained. No addi-

tional fill shall be placed over an area until the last placed lift of fill has been tested and found to meet the density and moisture requirements and that lift approved by the Soils Engineer.

C. Where the work is interrupted by heavy rains, fill operations shall not be resumed until field observations and tests by the Soils Engineer indicate the moisture content and density of the fill are within the limits previously specified.

D. During construction, the Contractor shall properly grade all surfaces to maintain good drainage and prevent ponding of water. The Contractor shall take remedial measures to control surface water and to prevent erosion of graded areas until such time as permanent drainage and erosion control measures have been installed.

E. Observation and testing by the Soils Engineer shall be conducted during the filling and compacting operations in order that he will be able to state in his opinion all cut and filled areas are graded in accordance with the approved specifications.

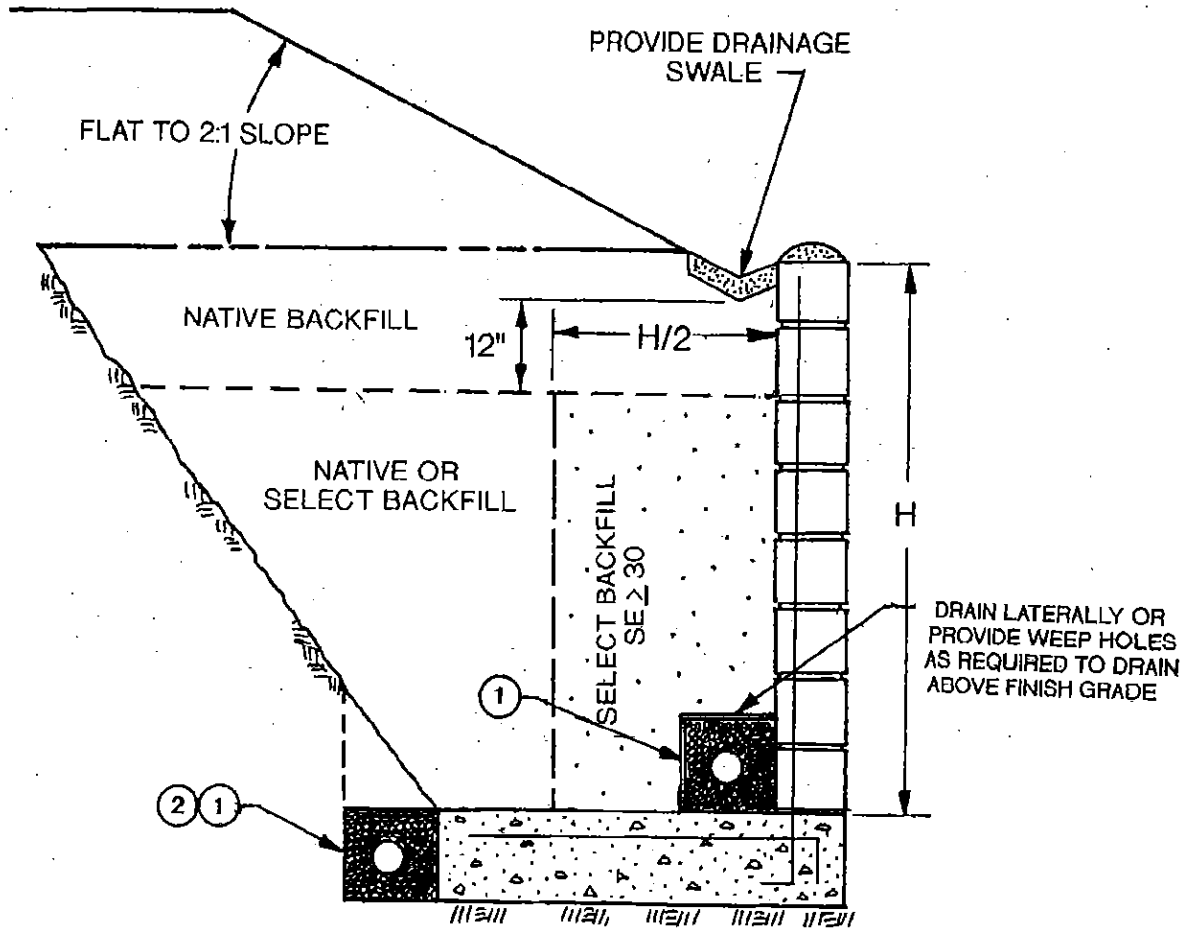
F. After completion of grading and after the Soils Engineer and Engineering Geologist have finished their observations of the work, final reports shall be submitted. No further excavation or filling shall be undertaken without prior notification of the Soils Engineer and/or Engineering Geologist.

VI. SLOPE PROTECTION

All finished cut and fill slopes shall be planted and/or protected from erosion in accordance with the project specifications and/or as recommended by a landscape architect.

TYPICAL

RETAINING WALL BACKFILL



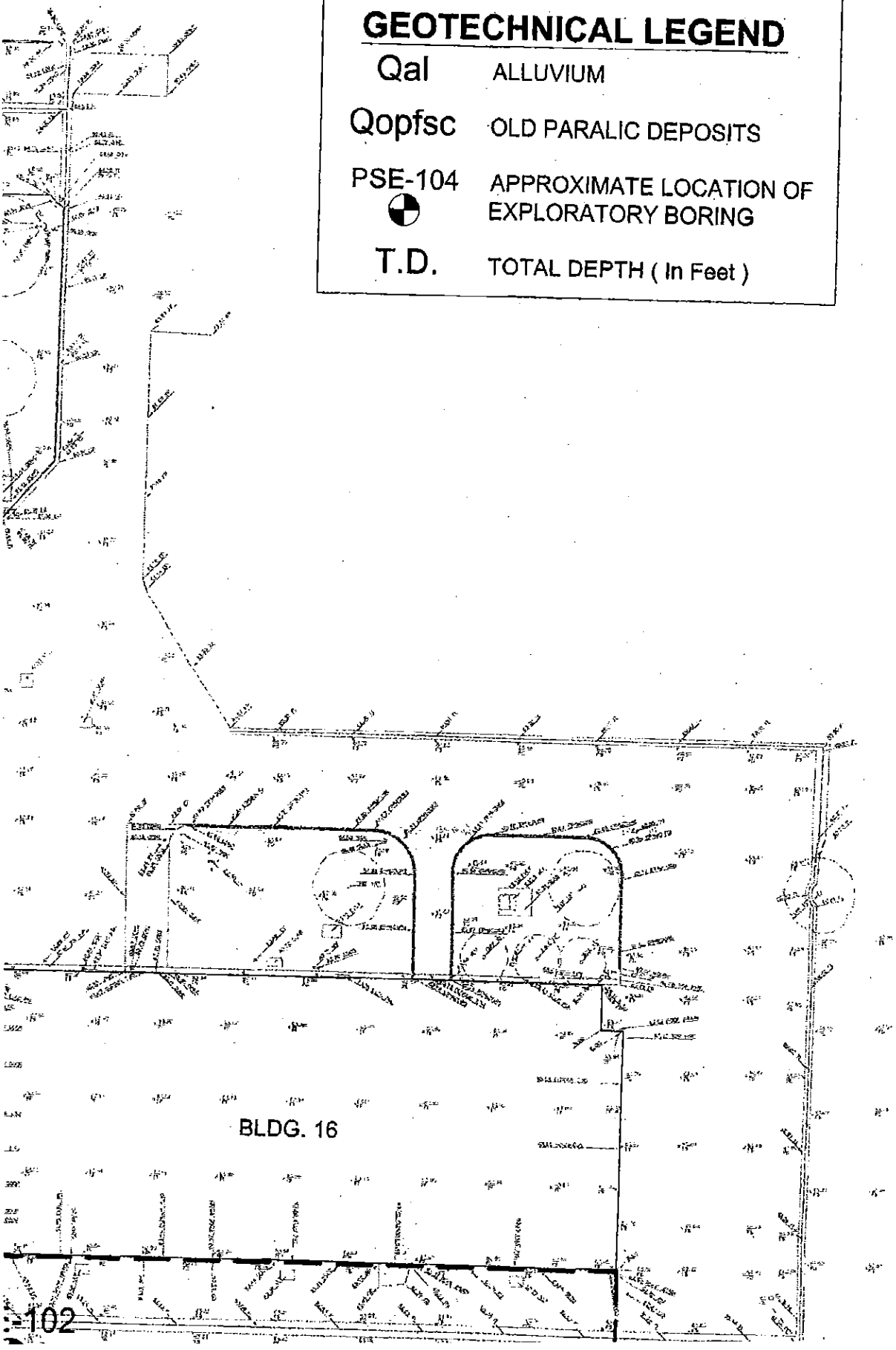
(1) 4-INCH PERFORATED PVC, SCHEDULE 40 OR APPROVED ALTERNATE. PLACE PERFORATION DOWN AND SURROUND WITH A MINIMUM OF 1 CUBIC FOOT PER LINEAL FOOT OF 3/4 INCH ROCK OR APPROVED ALTERNATE. ENCAPSULATE IN MIRAFI 140, OR EQUIVALENT

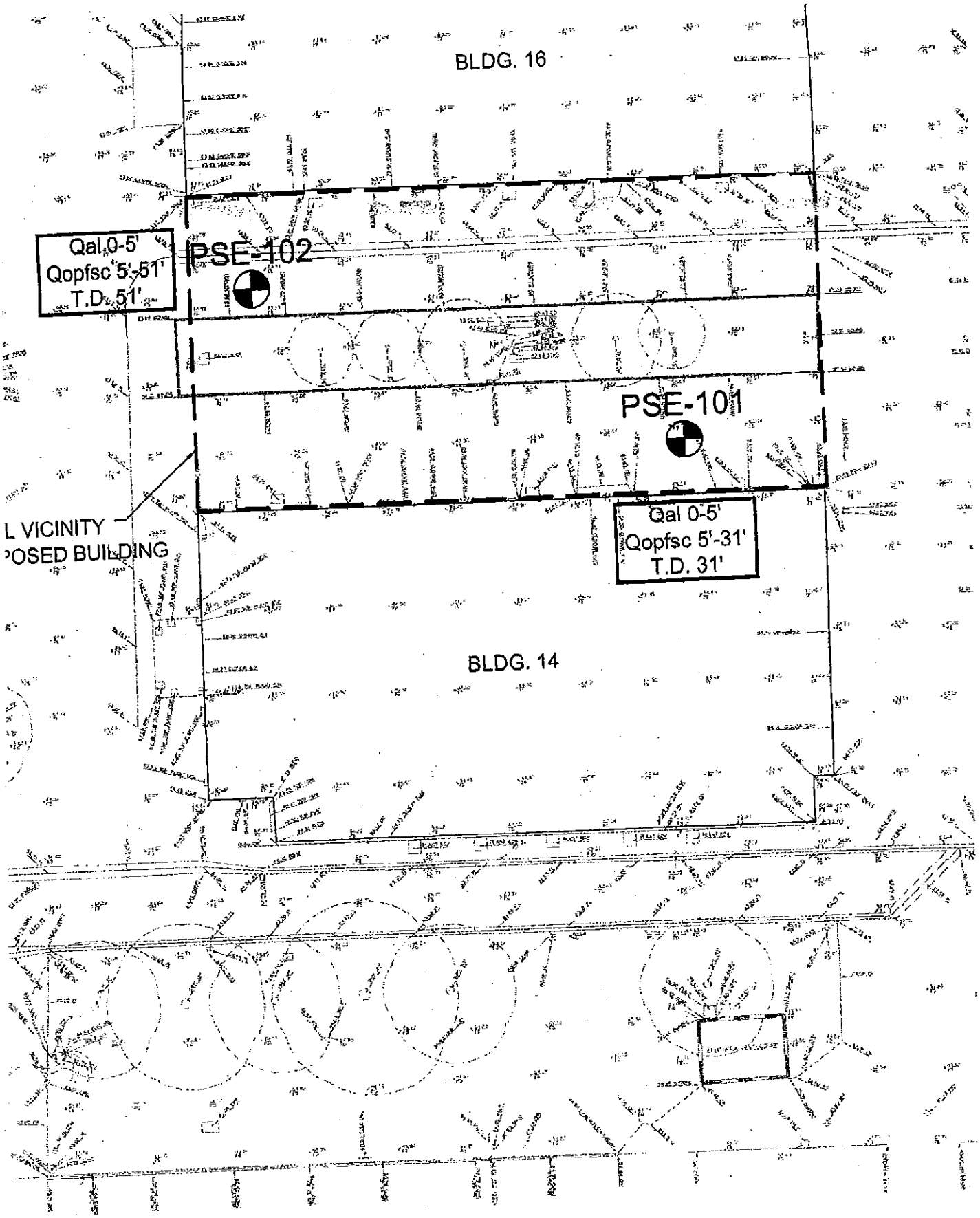
(2) PLACE DRAIN AS SHOWN WHERE PROVISIONS FOR DRAINAGE THROUGH THE WALL CANNOT BE ACCOMMODATED

PLATE G-13 NOT TO SCALE

PACIFIC SOILS ENGINEERING, INC.
10853 PROGRESS WAY CYPRESS, CALIFORNIA (714) 220-0770

W.O. **DATE**


GEOTECHNICAL LEGEND
Qal ALLUVIUM
Qopfsc OLD PARALIC DEPOSITS
PSE-104 APPROXIMATE LOCATION OF EXPLORATORY BORING
T.D. TOTAL DEPTH (In Feet)
BLDG. 16



E COUNTY FAIR
POSITION CENTER
OGRAPHIC SURVEY

ATI ARCHITECTS & ENGINEERS
1931-H NEWPORT BLVD.
COSTA MESA, CA 92627

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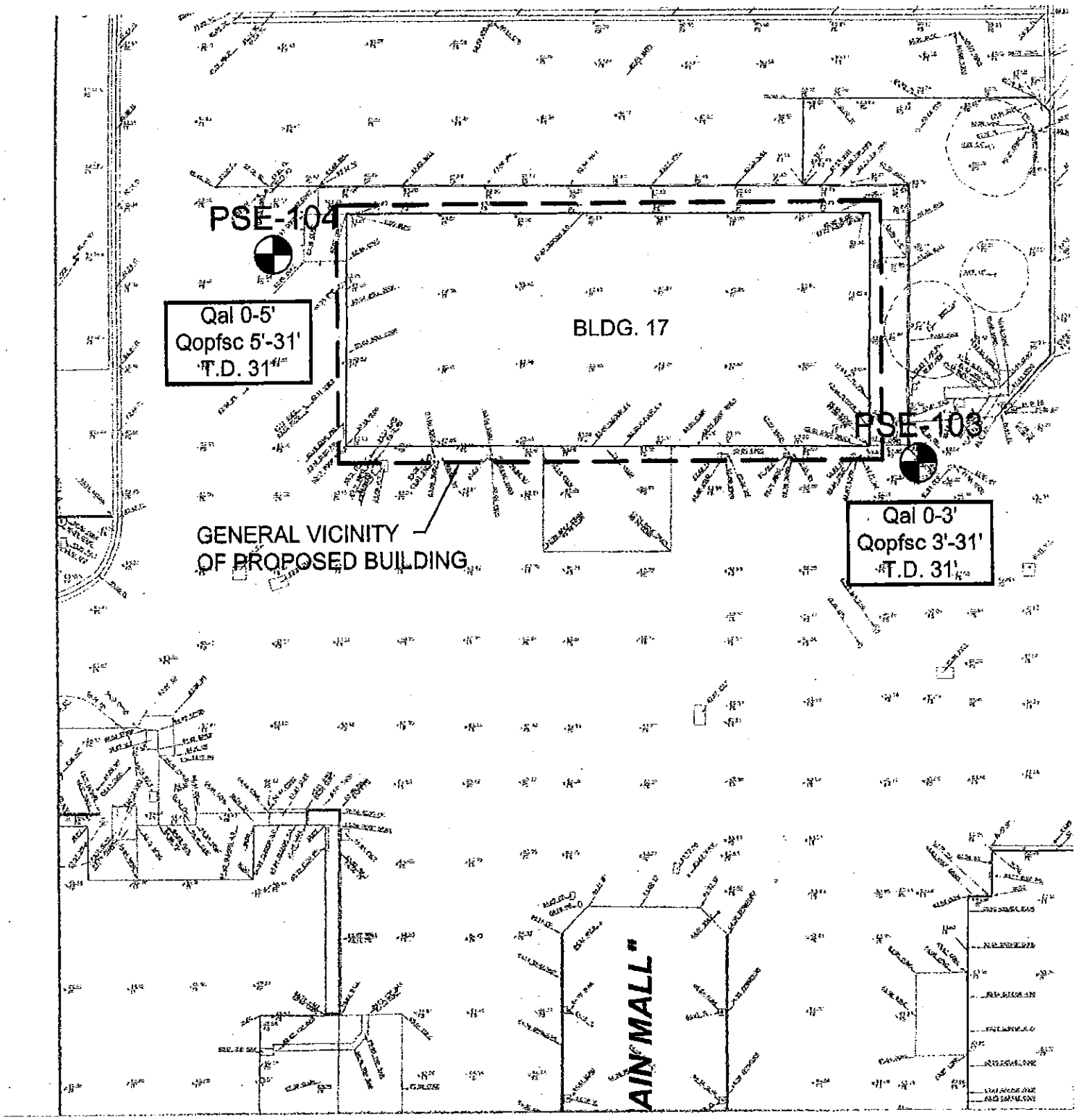
PSE-104
Qal 0-5'
Qopfsc 5'-31'
T.D. 31'
BLDG. 17
PSE-103
Qal 0-3'
Qopfsc 3'-31'
T.D. 31'
GENERAL VICINITY
OF PROPOSED BUILDING
MALL"

PRELIMINARY GEOTECHNICAL REPORT
Proposed Buildings HANGAR
Northerly and Easterly Adjacent to the "~~Main Mall~~" Area
Orange County Fairgrounds
CITY OF COSTA MESA, CALIFORNIA

Work Order 102686

Dated May 27, 2008

Prepared for:

CALIFORNIA CONSTRUCTION AUTHORITY
1776 Tribute Road, Suite 220
Sacramento, CA 95815

Prepared by:

PACIFIC SOILS ENGINEERING, INC.
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(Corporate Headquarters)

CALIFORNIA CONSTRUCTION AUTHORITY
1776 Tribute Road, Suite 200
Sacramento, Ca 95815

June 6, 2008
Work Order 102686

Attention: Mr. Tom Onishi

Subject: **GEOTECHNICAL COMMENTS**
Supplemental Geotechnical Design Parameters
Proposed Buildings Northerly and Easterly
Adjacent to the "Main Mall" Area
Orange County Fairgrounds
CITY OF COSTA MESA, CALIFORNIA

Reference: Preliminary Geotechnical Report, Proposed Buildings Northerly and Southerly Adjacent to the "Main Mall" Area, Orange County Fairgrounds, City of Costa Mesa, California; by Pacific Soils Engineering, Inc., dated May 27, 2008, (W.O. 102686).

Gentlemen:

Subsequent to the publication of the reference report, the structural engineer designing the foundation system for the new building proposed for east of the "Main Mall" area (between Building Nos. 14 and 16) requested clarification of some of the recommendations presented in the report as well as additional recommendations as discussed below.

Based upon recent information provided by the structural engineer, Pacific Soils Engineering, Inc., (PSE) recommends that the maximum allowable bearing capacity for use in design be 3,000 lbs. /sq. ft. This value may be increased as allowed by Code to resist seismic or wind loads.

In agreement with the report and due to the expansive soils onsite, grade beams are recommended along the east and west ends of the proposed building to tie the north and south continuous footings together. The grade beam should be a minimum 18 inches wide and embedded a minimum 24 inches below lowest adjacent grade within 5 horizontal feet (as measured from

bottom of grade beam) or, to allow for connection to deeper adjacent footings, as deep as the adjacent footings.

Depending upon the resultant configuration of the grade beam, the slab on the east and west sides of the building should have thickened edges that extend 24 inches below lowest adjacent grade within 5 horizontal feet. If the grade beam top is at slab subgrade, thickened edges will not be necessary, but the slab will need to be tied to the grade beam with No. 3 bars placed at a minimum spacing of 36 inches on center at alternating embedment depths of 24 and 36 inches into the slab.

It is our understanding that the structural engineer would like potential alternatives to tying back isolated exterior post/column footings back to the main foundation system in at least two (2) orthogonal directions, as recommended in the reference report. One alternative would be to deepen the isolated column footing an additional 2 feet to a total depth of 48 inches below lowest adjacent grade within 5 horizontal feet (as measured from the bottom of the footing). Another alternative would be to support the isolated columns on caissons. If caissons are used, they should incorporate the recommendations presented in the report (Section 7.1.2).

For clarification of the discussion about vapor retarders presented in the report, the following is provided:

A moisture and vapor retarding system should be placed below all slab-on-grade in areas of the structures considered to be moisture sensitive. The retarder should be of suitable composition, thickness, strength, and low permeance to reduce water vapor transmission through the slab to acceptable levels. Historically, a 10-mil plastic membrane, such as "Visqueen" placed between 2 inches of clean sand (1-inch above and 1-inch below) to as much as 4 inches of clean sand (2-inches above and 2-inches below), has been used for this purpose. The use of this system or other systems, materials, or techniques can be considered, at the discretion of the designer, provided the system reduced the vapor transmission rates to acceptable levels.

Unless requested, or additional geotechnical issues arise requiring comment by PSE, no additional recommendations beyond those included in this letter and the reference report are anticipated to be published during design of the foundation system for the structure proposed between Building Nos. 14 and 16.

All other recommendations presented in the reference report, except where superseded herein, are considered still valid for use in design.

This report is subject to review by the controlling authorities for the subject project. If you have any questions or require additional information, please contact the undersigned at (714) 220-0770.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

By: _____
DON OBERT/RCE 66411
Reg. Exp.: 6-30-08
Registered Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
DON OBERT
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Exp. 6/30/08
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Reviewed by:

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Manager of Geotechnical Services

REGISTERED PROFESSIONAL ENGINEER
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Distr.: (1) Addressee
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CALIFORNIA CONSTRUCTION AUTHORITY
1776 Tribute Road, Suite 220
Sacramento, CA 95815

May 27, 2008
Work Order 102686

Attention: Mr. Tom Onishi

Subject: **PRELIMINARY GEOTECHNICAL REPORT**
Proposed Buildings
Northerly and Easterly Adjacent to the "Main Mall" Area
Orange County Fairgrounds
CITY OF COSTA MESA, CALIFORNIA

Gentlemen:

Pursuant to your request, presented herein is this firm's Preliminary Geotechnical Investigation for the two proposed buildings to be located near the "Main Mall" in the north central portion of the Orange County Fairgrounds in the City of Costa Mesa, California. The major geotechnical/geologic issues identified within this document include:

- Unsuitable soil removals
- Engineering and excavation characteristics of onsite earth materials
- Preliminary foundation design parameters

Pacific Soils Engineering, Inc., (PSE) appreciates the opportunity to provide you with geotechnical consulting services. If you have any questions or should you require any additional information, please contact the undersigned at (714) 220-0770.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER — DON OBERT — No. C66411 Exp. 6/30/08 — CIVIL — STATE OF CALIFORNIA

By: _____
DON OBERT
RCE 66411/Reg. Exp.: 6-30-08
Registered Civil Engineer

By: _____
RICHARD H. SPINDLER
CEG 1802/Reg. Exp.: 4-30-10
Certified Engineering Geologist

Reviewed by:

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PAUL J. ERNST/RGE 2317
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Manager of Geotechnical Services

Distr.: (1) Addressee
(7) ATI Architects, Attn: Mr. Bill Bigatti
DO/RHS/PJE:rb-ml-26860001

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1.0 INTRODUCTION

1.1 Purpose and Scope of Study

The purpose of this report is to review and evaluate the existing geologic and soils engineering conditions and present geotechnical recommendations for the design and construction of the subject structures.

Specific items discussed as part of this report include unsuitable soil removals, engineering and excavation characteristics of onsite earth materials, and preliminary foundation recommendations.

The scope of this study include the following tasks:

1) *Excavation, logging and sampling of four (4) exploratory bucket auger borings on the subject property.*
2) *Laboratory testing of representative material samples collected from the exploratory excavations.*
3) *Plotting of geologic and geotechnical information on a 40-scale Topographic Survey Map prepared by Stantec Consulting, Inc., dated January 30, 2008, which serves as a Geotechnical Map (in pocket) for this report.*
4) *Formulation of conclusions and recommendations based on results of the field, office and laboratory studies.*
5) *Preparation of this report.*

1.2 Report Limitations

The conclusions and recommendations contained in this report are based on the data developed during this investigation. The materials immediately adjacent to or beneath those observed may have different characteristics than those observed. No representation is made as to the characteristics of materials not observed.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Description

The proposed buildings will be located within the north central portion of the Orange County Fairgrounds in the City of Costa Mesa, in the vicinity of existing Building Nos. 14, 16, and 17 (see Figures 1A and 1B).

The proposed site for one of the buildings is between existing Building Nos. 14 and 16 east of the "Main Mall". This approximately ½-acre flat area is primarily covered with asphalt paving, and has a 15± foot wide landscaped area, supporting grass and trees, which runs down the center portion of the area and extends its entire length.

The proposed site of the second building is the current site of Building No. 17, north of the "Main Mall". This steel-framed metal-clad building, which is scheduled for demolition, is surrounded by flat, asphalt-paved land.

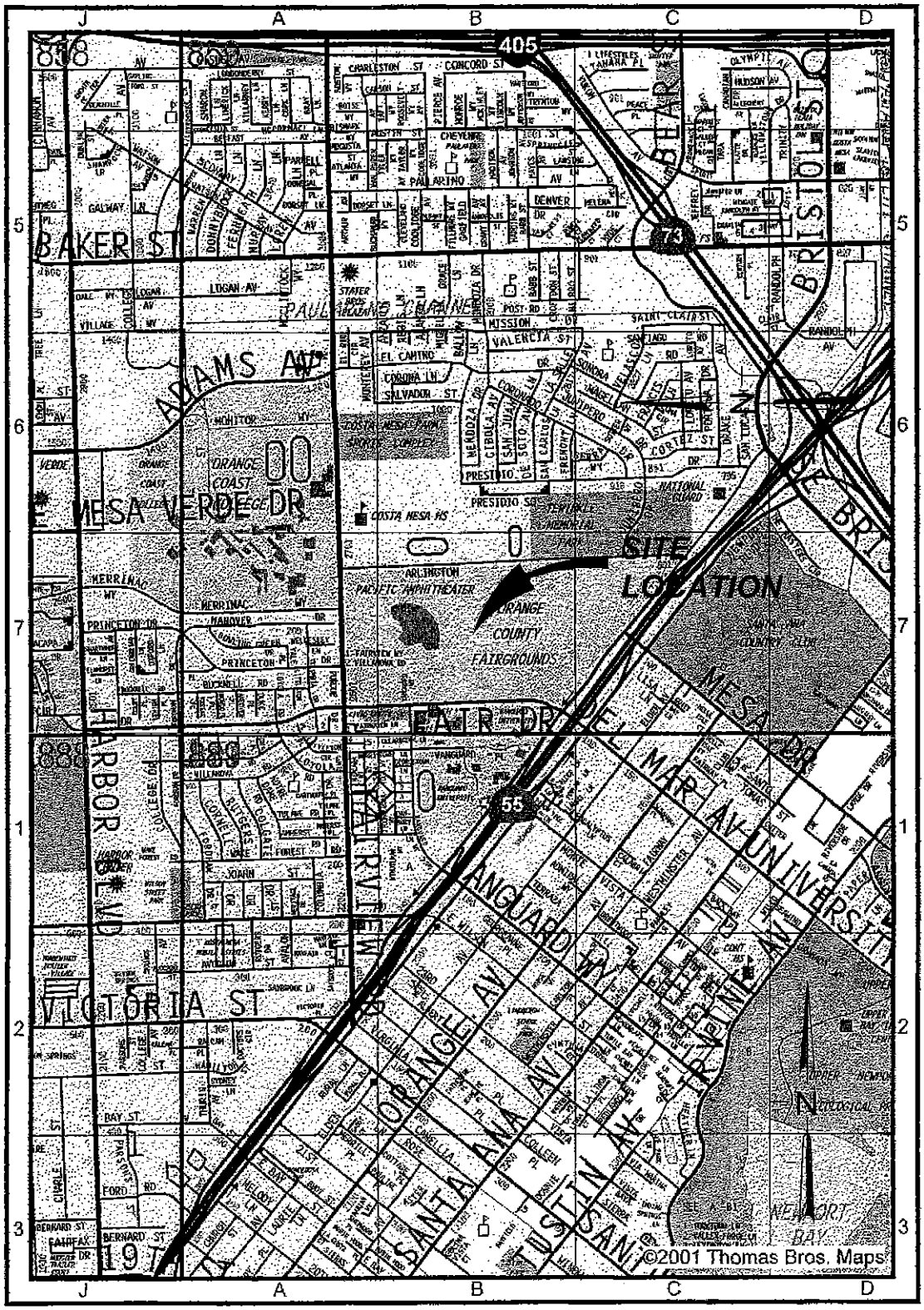
2.2 Proposed Development

As communicated to this firm, these new buildings are to be "Butler-Type" buildings (pre-fabricated steel buildings). The proposed building between existing Building Nos. 14 and 16 will also include 18-foot high masonry firewalls on the north and south sides.

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

3.1 Field Investigation

The subsurface exploration program completed as part of this investigation was directed towards evaluating the engineering characteristics of the site earth materials. A truck-mounted bucket auger drill rig was used to advance four (4) exploratory borings ranging in depth from 31 to 51± feet. The exploratory excavations were logged and selectively sampled by a member of this firm's geologic staff. The borings were sited as generally directed by the architect. Two borings were excavated outside the proposed building footprint of the replacement structure for Building No. 17, and the other two borings were excavated within the approximate footprint of the structure proposed for the area between Building Nos. 14 and 16. The approximate locations of the exploratory excavations are shown on the accompanying Geotechnical Map. Logs of the Borings are presented on Plates A-1 through A-4 of the Appendix.



SITE LOCATION MAP FIGURE 1A

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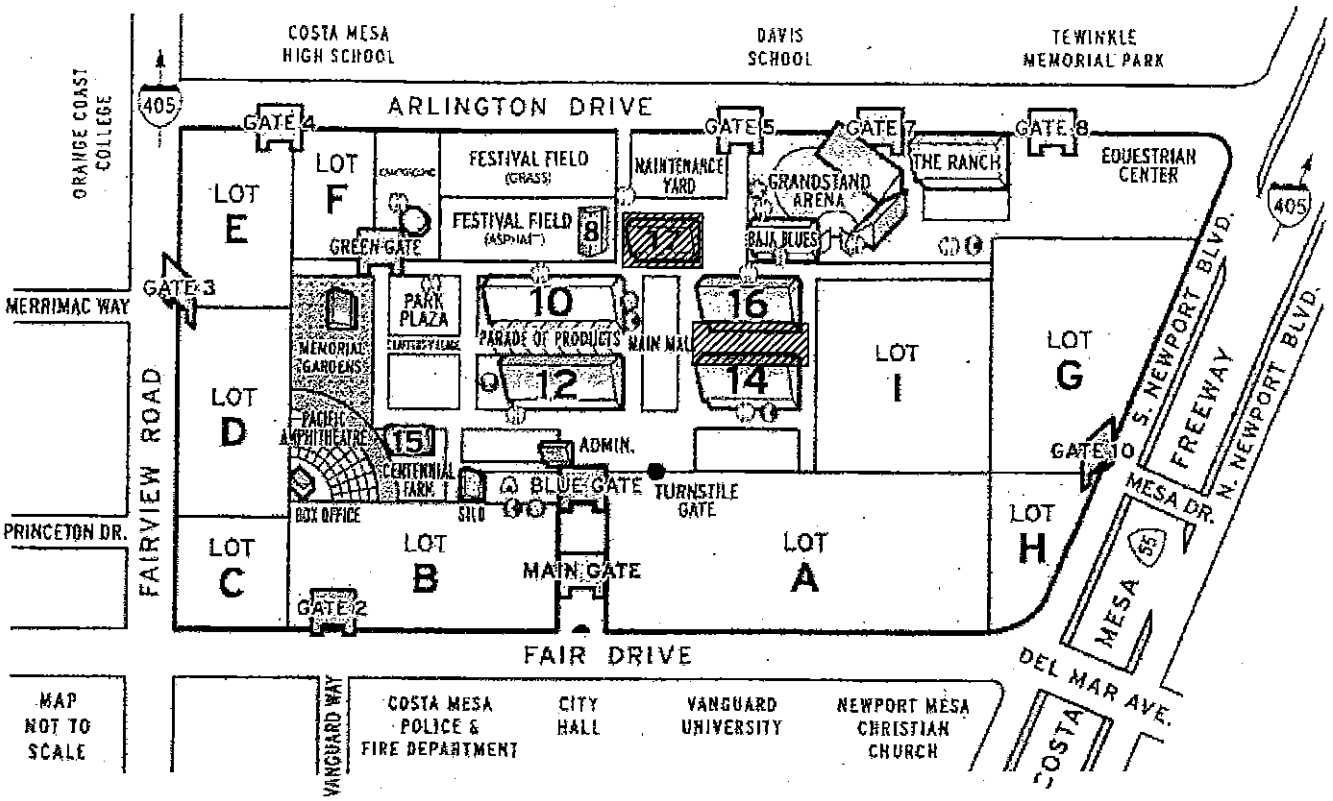
W.O.102686 DATE: 5-27-08



APPROXIMATE LOCATION
OF PROPOSED STRUCTURES

FIGURE 1B

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W.O.102686 DATE: 5-27-08

3.2 Laboratory Testing

To assist in evaluating the geotechnical properties of the site, laboratory testing was performed on bulk and relatively "undisturbed" ring samples obtained during the field investigation. A summary of the Laboratory Test Results (Table I) along with a brief description of the tests performed are presented in the Appendix.

4.0 GEOLOGIC CONDITIONS

4.1 Site Soil Conditions

Based upon observations made during the excavations, native materials generally underlie the site. The first 3 to 5 feet of material consists of alluvium. The alluvium, consisting of silty clay and silty sand was observed to be moist, brown, and firm/loose to medium dense. To the depths explored (51± feet), the alluvium is underlain by older paralic (near marine border deposits) material which is generally comprised of silts and clays with occasional silty to coarse-grained sand interbeds and lenses. These materials are moist, with the silts and clays ranging from firm to very stiff and the sands noted as medium dense to dense.

4.2 Groundwater

Groundwater was not encountered in any of the four exploratory excavations. Based upon data provided by the California Geological Survey, historically high groundwater is at a depth of approximately 30± feet below ground surface at the site.

4.3 Seismic Hazards

Earthquakes have occurred in the southern California region and will, undoubtedly, occur in the future. This site is (as is the entire City of Costa Mesa) in a seismically active region. The site is not within an earthquake fault zone as defined by the Alquist-Priolo Earthquake Fault Zoning Act, 1972, but it is approximately 1½ miles from the San Joaquin Hills fault and 3½ miles from the Newport-Inglewood fault. As such, design and construction of the improvements should be in accordance with

the applicable state and local codes pertaining to both primary and secondary seismic hazards.

Primary earthquake hazards include both surface rupture and ground motion (shaking). Secondary hazards resulting from major earthquakes include liquefaction, seismically induced flooding, and seismically induced landsliding.

4.3.1 Primary Hazards

4.3.1.1 Surface Rupture

Surface rupture is offset of the ground surface along the trace of the causative fault during seismic activity. No known active faults traverse the subject site. As such, the potential for surface rupture on this site is considered very low to nil.

4.3.1.2 Ground Motion (Shaking)

The site is not within an Alquist-Priolo Earthquake Fault Zone, and no faults have been mapped onsite. The study site is, however, in seismically active southern California, thus moderate to strong ground motions resulting from future regional earthquakes could occur during the life of the project. Current engineering standards, as well as the prevailing building codes and regulations, require that seismic considerations be incorporated into site designs and analyses. Accordingly, this firm has performed a FRISKSP (by T. Blake) probabilistic free-field ground acceleration (PGA) assessment of the site that may be useful for some engineering designs. The assessment yielded a PGA of .36g as that which has a 10 percent chance of exceedence in 50 years. This number is seemingly consistent with current practices in the study region, and with existing codes.

The calculated free-field PGA should not necessarily be used in empirical engineering formulas currently in use to determine

earthquake-resistant engineering design. Page and others (1972) noted that a single peak of intense motion (maximum or peak acceleration) might contribute less to cumulative damage potential than multiple cycles of less intense shaking. The California Division of Mines and Geology (1997) cautions that the seismic coefficient "k" is not equivalent to peak ground acceleration, and that peak ground acceleration should not be used in pseudostatic slope stability analyses.

Design of future improvements should be based on current design practices for similar works in the area. It is the purview of the engineer, based upon information presented herein, to select suitable seismic parameters. A discussion of 2007 CBC seismic design parameters is presented in Section 7.1.3.

4.3.2 Secondary Hazards

4.3.2.1 Liquefaction

Seismic agitation of loose, saturated sands and silty sands can result in a build-up of pore water pressures. If these pore water pressures are sufficient to overcome overburden stresses, a temporary quick condition known as liquefaction can result. As per the State of California, Seismic Hazard Zones Map, Newport Beach Quadrangle, dated April 7, 1997, the subject site does not lie within a zone determined by the State as requiring an investigation for liquefaction.

Based upon a historically high ground water level in the area of approximately 30 feet below ground surface (per the California Geological Survey), and due to the absence of groundwater encountered during our investigation as well as the material types encountered and in-situ densities of the "undisturbed" soil

samples collected, liquefaction potential within the developed portions of the subject property is considered low to nil.

Similarly, the potential for seismically induced post-liquefaction settlement of onsite materials is considered low to nil.

4.3.2.2 Seismically Induced Flooding

Seismically induced flooding normally includes flooding due to a tsunami (seismic sea wave), a seiche (wave generated in an enclosed body of water), or failure of a dam/reservoir retention structure upstream of the site.

Due to the site's elevation and location away from both the ocean and an enclosed body of water, the risk of seismically induced flooding due to a tsunami or seiche is considered low to nil.

5.0 ENGINEERING CHARACTERISTICS

5.1 Excavation Characteristics and Earthwork Adjustments

It is anticipated that the materials which will be encountered during site development will consist of alluvium and possibly older paralic deposits. These materials may be excavated with conventional earth moving equipment. Based upon limited in-situ moisture/density testing of selected samples collected during field investigation, the following earthwork factors are estimated:

Geologic Unit	Map Symbol	Adjustment Factor
Alluvium	Qal	0-10% Shrinkage

It is anticipated that after removal operations are completed, moisture conditioning and recompaction of the exposed soils will result in subsidence on the order of ½ an inch across the site.

5.2 Compressibility

The near-surface, low density alluvium is compressible in its existing state and will require removal from proposed structure areas. Specific removal recommendations are presented in Section 6.1.2 of this report. These materials, once suitably moisture conditioned, will be suitable for use as compacted fill.

5.3 Expansion Potential

The on-site soil materials, when tested in accordance with ASTM D 4829 indicate potential expansion in the "medium" to "high" range. Specific testing for expansion potential should be performed on the as-graded near-surface materials at the completion of grading.

5.4 Shear Strength Characteristics

Based on the results of laboratory testing and engineering analyses, the following residual strength parameters were estimated.

SHEAR STRENGTH PARAMETERS			
Materials	**Cohesion, C (psf)**	**Friction Angle, ϕ (degrees)**	**Plate**
Engineered Fill (90% R.C.)	650	27	B
(R.C. = Relative Compaction)			

5.5 Settlement

Per discussions with the project structural engineer, firewall pilaster loads for the building proposed for construction between Buildings 14 and 16 will require a minimum spread footing size of 9 x 8 feet. It is our understanding that this footing size was based upon a soil bearing capacity of 2000 lbs./sq.ft. Assuming a foundation bearing pressure of 2000 lbs./sq.ft., settlement on the order of ¾ inches is estimated. As such, differential settlement on the order of ½ inch in 30 horizontal feet may be realized.

Information provided to us by the project architect indicates that the steel superstructure will be supported by perimeter columns with loads on the order of 46

kips. It is our understanding that there may be a desire to support these loads separately from the pilaster loads and that due to space constraints, the steel columns may be founded on a deep foundation system. If cast-in-place concrete caissons are used, settlement on the order of ½ inch is expected.

If consideration is given to supporting the steel superstructure and firewall pilaster loads on a common foundation, then a continuous footing may be a viable option. Per discussions with the project structural engineer, an eight-foot 3-inch wide continuous footing imbedded approximately 3½ feet from adjacent grade may impose a bearing pressure of 3320 lbs./sq.ft. Given these parameters, a settlement on the order of 1 inch has been estimated with a differential settlement on the order of ½ inch in 30 horizontal feet.

A further discussion of these foundation systems is presented in Section 7.1.

5.6 Chemical Analyses

Preliminary sulfate testing of the on-site soil samples indicate that these materials contain "negligible" amounts of soluble sulfates when classified in accordance with Table 4.3.1 of ACI 318-05.

Testing of selected material samples from the exploratory excavations indicate the on-site materials are anticipated to be "severely corrosive" toward on-site ferrous improvements. *Consideration should be given to consulting a corrosion engineer for a more detailed evaluation.*

Additional testing of pH, sulfates, and resistivity is recommended during grading to provide a more comprehensive evaluation of the as-graded condition.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon data obtained from the exploratory excavations and laboratory test results, the construction of the two proposed buildings is considered feasible from a geotechnical viewpoint. Presented below are pertinent geotechnical considerations concerning development of the site.

6.1 Site Preparation and Removals

All grading shall be accomplished under the observation and testing of the project soil engineer and engineering geologist or his/her authorized representative in accordance with the **recommendations** contained herein, the current **Building Code** of the City of Costa Mesa and this firm's **"Earthwork Specifications"** (Appendix).

A representative of the project soils engineer should make periodic visits to the site during any demolition activities. Demolition of foundation elements and other subsurface improvements should be observed by a representative of the project soils engineer on a full-time basis.

6.1.1 Stripping and Deleterious Material Removal

Prior to grading, the areas within the subject site proposed for development should be stripped and cleared of all existing vegetation, trash, demolition debris and any other deleterious materials as directed by the soils engineer. The deleterious materials should be wasted from the site prior to commencing removal of unsuitable soils and replacement with compacted fill materials.

6.1.2 Removals/Overexcavations

After approval of site clearing and prior to fill placement, all existing artificial fill (if any) and materials disturbed during demolition operations should be removed across the site. In areas planned for structures, loose, soft compressible alluvium should be removed to suitable material as observed by the project geotechnical engineer. In general, the upper 3 feet of material (alluvium and paralic deposits) is considered unsuitable for support of structures. There may be areas not observed during our investigation of undocumented fill or unsuitable native materials that extend beyond a depth of 3 feet. The actual extent of removals can best be determined in the field during grading when observation and evaluation can be performed by the soils engineer or his authorized representative.

Where achievable, structural removals should extend a minimum distance of 5 horizontal feet beyond the building footprint and associated appurtenances (i.e. entrance canopies, etc.).

In order to minimize potential impacts on adjacent existing structures, slot-cutting techniques may be required along the edges of removal excavations. Preliminary widths and staging of slot cuts, are presented in Section 7.3.6.

Within any hardscape areas (non-structural areas), all existing fill (if any) should be removed. Additional overexcavation of alluvium in these areas may be required so that a minimum of 2 feet of compacted fill can be provided below hardscape subgrade.

It should be noted that the "unsuitable" soils generated from the removal operations are considered acceptable for re-use as compacted fill, provided they are free of trash, vegetation, debris, and deleterious materials.

6.1.3 Pipelines, Water Wells, Cesspools and Septic Tanks

Pipelines, if encountered, should be removed or be cut and plugged according to the applicable Code requirements as property line conditions dictate. Cesspools and septic tanks, if encountered, should be removed to a minimum of five (5) feet below existing grade or finished grade, which- ever is lower. The portion of cesspools not removed should be pumped of their contents and filled with washed concrete sand, thoroughly jetted into place or, if in the influence zone of structures, with a lean 3-sack slurry mix. The remaining cavities should be filled with compacted fill as specified herein.

6.2 Earthwork Considerations

6.2.1 Compaction Standards

All fill and processed natural ground should be compacted to a minimum relative compaction of 90 percent, as determined by ASTM Test Method: D-1557. Compaction shall be achieved slightly above optimum moisture

content and as generally discussed in the attached **"Earthwork Specifications"**. Should a majority of the fill materials exhibit "very high" expansion potential, these compaction requirements may have to be modified subject to the approval of the Building Official.

When necessary, earthmoving equipment may be used for compaction or temporarily shut down in order to permit proper compaction of fills. Mixing and moisture-conditioning will be necessary to achieve the required moisture contents.

6.2.2 Observation of Excavations

All removal bottoms shall be observed and approved by the engineering geologist and/or soil engineer or their authorized representative prior to fill placement.

6.2.3 Treatment of Removal Bottoms

At completion of unsuitable soil removals, the exposed bottom shall be scarified and moisture-conditioned to above optimum conditions to a minimum depth of eight (8) inches, and compacted to the standards set forth in this report.

6.2.4 Suitability of Onsite Soils

Materials excavated during unsuitable soil removals may be used for compacted fill, provided they are free from trash, vegetation and other deleterious materials.

6.2.5 Fill Placement

After removals, moisture conditioning, and compaction of exposed materials are completed, additional fill may be placed. Fills shall be placed in thin lifts (maximum 8 inches in bulk thickness), properly moisture-conditioned, and compacted as grading progresses until final grades are attained.

6.2.6 Mixing

In order to prevent layering of different soil types and/or different moisture contents, mixing of materials may be necessary. The mixing should be accomplished prior to and as part of compaction of each fill lift. Discing may be required when either excessively dry or wet materials are encountered.

6.2.7 Import Soils

Import soils, as required, should consist of clean, compactible materials having soils engineering properties similar to those onsite and should be free of trash, debris or other objectionable materials.

PLANS AND SPECIFICATIONS SHOULD INDICATE THAT THE GRADING CONTRACTOR SHALL NOTIFY THE PROJECT SOILS ENGINEER NOT LESS THAN 72 HOURS IN ADVANCE OF THE LOCATION OF ANY SOILS PROPOSED FOR IMPORT. EACH PROPOSED IMPORT SOURCE SHALL BE SAMPLED, TESTED AND APPROVED PRIOR TO DELIVERY OF SOILS FOR USE ON THE SITE.

6.2.8 Haul Roads

Haul roads traversing compacted fill areas should be coordinated and planned to avoid or minimize generation of loose spill fill thereon. When this condition is unavoidable, close coordination with the project soils engineer and his representative will be required to eliminate intermingling of engineered and non-engineered fill.

6.2.9 Final Reports

The results of the observations and testing of all earthwork should be presented in a final geotechnical report following the completion of earthwork and grading.

7.0 DESIGN RECOMMENDATIONS

7.1 Structural Design

Based upon preliminary design column and wall loads made available to this firm, the following comments are presented regarding both shallow and deep foundation systems.

7.1.1 Shallow Foundation Systems

It is anticipated that the majority of on-site soils will possess "medium" to "high" expansion potential when tested in accordance with ASTM D 4829. For preliminary design purposes, the following foundation design requirements, for conventional slab-on-grade foundation construction in soils possessing "high" expansion potential are presented. If a post-tensioned slab-on-grade foundation system is selected for construction, this firm can supply pertinent recommendations for that system.

For preliminary purposes, the design of continuous and spread footings should be based on 2,000 lbs./sq.ft., for both dead and live loads. These values can be increased 300 psf per foot of additional depth beyond the minimum embedment and 100 psf per foot of additional width to a maximum of 3500 lbs./sq.ft.

The minimum width for continuous footings should be 18 inches. The minimum dimension for spread footings should be 24 inches. The minimum embedment depth for both footings and exterior slab edges should be 24 inches, as measured from the lowest adjacent grade within 5 horizontal feet of the structure.

Lateral bearing of 150 lbs./sq.ft. per foot of depth to 2,000 lbs./sq.ft. and a coefficient of friction of 0.30 may be used in the design for resisting lateral forces. Friction and lateral bearing may be combined as allowed by Code. The above values may be increased as allowed by Code to resist seismic or wind loads.

Continuous footings should be reinforced with a minimum of four No. 4 bars, 2 each top and bottom. Slabs-on-grade should be reinforced with a minimum of No. 4 bars at 18 inches on center, each way. Minimum slab thickness should be 5 inches, net. The reinforcement should be located in the middle one-third of the slab thickness. Slabs should be doweled to the

footings with No. 3 bars, placed at a minimum spacing of 36 inches on center at alternating embedment depths of 24 and 36 inches into the slab.

The deepened, lightly loaded perimeters of the slab edges should be reinforced with a minimum of four No. 4 bars as indicated above.

A grade beam, 18 inches wide and 24 inches deep should be placed across large door openings and tied to the footings. The grade beams should be embedded as deep as the adjacent footings.

Isolated exterior post/column footings should be tied back to the main foundation system in at least two (2) orthogonal directions.

The foundation system should be designed to accommodate a differential settlement value of ½ inch over 30 horizontal feet.

A moisture and vapor retarding system should be placed below all slab-on-grade in living areas and other portions of the structures considered to be moisture sensitive. The retarder should be of suitable composition, thickness, strength and low permeance to water vapor to acceptable levels. Historically, a 10-mil plastic membrane, such as "Visqueen" placed between 2 to 4 inches of clean sand, has been used for this purpose. The use of this system or other systems, materials, or techniques can be considered, at the discretion of the designer, provided the system reduced the vapor transmission rates to acceptable levels.

It is essential to prevent damage to the "Visqueen" membrane. Care should be utilized when placing the membrane on subgrade to prevent damage. Sharp fragments should be removed from the subgrade surface and penetration of the membrane with screed guides should be avoided. The membrane should be properly lapped and sealed as well as sealed around all plumbing lines and other openings.

All foundation excavations should be observed by the project soils engineer prior to the placement of concrete. Forming of footing excavations may be required. Excavations should be free of slough and debris prior to pouring concrete.

Excavated material from footing trenches should not be placed in slab-on-grade areas unless properly compacted and tested.

Slab subgrade (including exterior concrete flatwork) should be premoistened to a minimum of 140 percent of optimum moisture to a depth of 12 inches prior to placing concrete.

To reduce the potential for moisture infiltration under slab-on-grade areas, **concrete slurry should be utilized to backfill utility trenches below perimeter foundations**. The slurry should be placed across the trench to create a cutoff wall as depicted on Plate E (Appendix). For this project, compacted fill should not be used for trench backfill beneath perimeter foundation and slab edges.

Final foundation design criteria should be made at the completion of grading, based on "as-graded" soil conditions.

The above foundation considerations are considered (preliminary) minimums. Additional reinforcing steel, deepening of foundation elements and/or additional stiffening elements may be required depending upon structural and/or Building Code considerations. Additional geotechnical design parameters can be provided depending upon the slab design methodology selected by the structural engineer.

7.1.2 Deep Foundations

Deep foundations may be employed with the following recommendations.

1. Given the proximity of the existing structures to the proposed improvements, consideration should be given to using cast-in-place

concrete caissons for support of the proposed structure. Caissons should have a minimum diameter of 2 feet.

2. Friction piles may be designed in accordance with Plate D (Appendix). Plate E is a load/diameter (P/d) vs. depth of embedment curve. This curve may be used to evaluate pile spacing, diameter, and depth of various foundation loading schemes.

3. A lateral bearing of 150 psf per foot of depth to a maximum of 3,000 psf may be used to design the piles.

4. The depth of fixity for the piles should be a minimum of 5 feet below the lowest adjacent grade.

5. Piles should be spaced a minimum of 3d center to center.

6. Recommendations concerning the installation of cast-in-place concrete caissons can be provided as the project design progresses.

7.1.3 Seismic Parameters

The following information is provided for use by the structural engineer in designing the structure to resist the effects of earthquake motions in accordance with ASCE 7. The Building No. 17 site is located at Latitude 33.6679 and Longitude -117.9009. The site between existing Buildings Nos. 14 and 16 is located at Latitude 33.6671 and Longitude -117.9002. Both sites have been classified as site class "D" in accordance with Table 1613.5.2 of the 2007 CBC. Utilizing this information and the computer program Seismic Hazard Curves and Uniform Hazard Response Spectra, Java Ground Motion Parameter Calculator – Version 5.0.8, provided by the United States Geological Survey http://earthquake.usgs.gov/research/hazmaps/design/), the seismic design category based upon 0.20 second (S_s) and 1.0 second (S_1) period mapped spectral response accelerations can be determined (2007

CBC, Section 1613.5.6) along with the design response spectral accelerations (2007 CBC, Section 1613.5.4).

7.1.4 Chemical Analyses

Preliminary sulfate testing of the on-site soil samples indicate that these materials contain "negligible" amounts of soluble sulfates when classified in accordance with Table 4.3.1 of ACI 318-05.

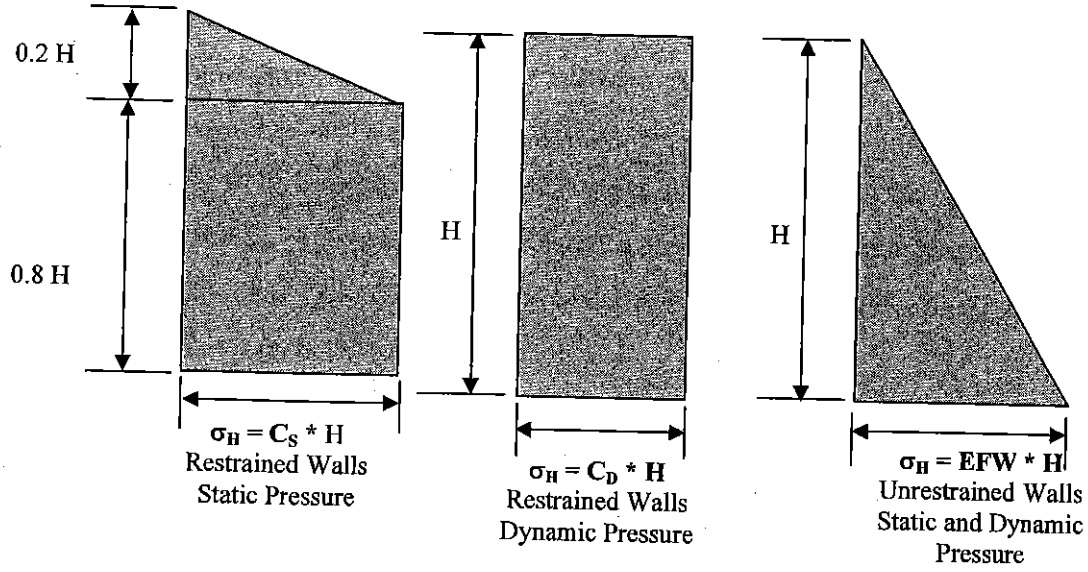
Testing of selected material samples from the exploratory excavations indicate the on-site materials are anticipated to be "severely corrosive" toward on-site ferrous improvements. *Consideration should be given to consulting a corrosion engineer for a more detailed evaluation.*

Additional testing of pH, sulfates, and resistivity is recommended during grading to provide a more comprehensive evaluation of the as-graded condition.

Upon the completion of rough grading, finish grade samples should be collected and tested so as to provide specific recommendations as they relate to foundation design. These test results and corresponding design recommendations will be presented in a Final Soils Engineering Report. Final foundation design recommendations should be made based upon specific structure-sitings, loading conditions, and as-graded soil conditions.

7.2 Retaining Walls

Retaining walls and other structures or facilities constructed to retain level, drained, structural quality backfill may be designed to resist lateral pressures developed by an equivalent fluid weight for soil as presented below. The pressures indicated are in pounds per square foot per foot of wall length. Dynamic pressures were derived using a peak ground acceleration having a probability of exceedence of 10 percent in 50 years (see Section 4.3.1.2).



Lateral Pressure Distribution Diagrams

Figure 2

Lateral Pressure Parameters (To be used in conjunction with Figure 2)							
Restrained Retaining Walls				**Unrestrained Retaining Walls**			
Select Backfill		**Native Backfill**		**Select Backfill**		**Native Backfill**	
Static	Dynamic	Static	Dynamic	Static	Dynamic	Static	Dynamic
$C_S = 23$	$C_D = 39$	$C_S = 90$	$C_D = 39$	EFW = 36	EFW = 32	EFW = 70	EFW= 32

"Select" backfill is free draining material that is the "very low" range of potential expansion per ASTM D 4829 (Expansion Index (EI) value of 20 or less) and has a Sand Equivalent (S.E.) of 30 or greater. If possible, onsite materials should not be used as backfill. For "select" backfill, retaining wall backcuts should extend a distance behind the wall not less than one half the wall height.

The calculated static and dynamic forces should be applied at approximately 1/3H and 0.63H, respectively. These forces should be combined to arrive at the total seismic force.

Wall design should include waterproofing (where appropriate), weep holes and subdrains or backdrains for relieving possible hydrostatic pressures. The backdrain should be comprised of a 4-inch perforated PVC pipe in a 1 ft. by 1 ft. ¾-inch gravel matrix, wrapped in Mirafi 140N (or equivalent) filter fabric. The backdrain should be installed with a minimum gradient of 2 percent and should be outletted to approved disposal areas utilizing solid pipe or weep holes (if appropriate).

Walls backfilled with "select" material should be backfilled to within 12 to 18 inches of finish grade. The remaining 12 to 18 inches of backfill in this zone should consist of on-site compacted fill. Retaining wall backfill should be compacted to a minimum of 90 percent of the applicable laboratory maximum dry density. A typical retaining wall backfill detail is shown on Plate G-13 (Appendix).

Walls designed to retain native soils should have a 1-foot wide section of ¾-inch gravel or free draining material with a Sand Equivalent of 30 or greater and an EI of 20 or less immediately behind the wall to within 12 to 18 inches of finished grade. The remaining 12 to 18 inches of backfill in this zone should consist of compacted fill derived from onsite sources.

Retaining wall footings may be designed with the same values presented in Section 7.1.1. Those values assume level conditions at the toe of the wall. Other conditions require specific evaluation. Continuous footings, where utilized, should contain minimum reinforcement consisting of four No. 4 bars, two top and two bottoms. Structural considerations could dictate additional reinforcement as being necessary.

7.3 Other Design and Construction Recommendations

7.3.1 Site Drainage

Positive drainage, away from structures should be provided and maintained. The property manager/owner should be made aware that they are respon-

sible for maintenance and cleaning of all drainage devices that have been installed to reduce ground saturation, and to promote structure stability.

7.3.2 Concrete Flatwork and Lot Improvements

At a minimum, the following recommendations should be incorporated into design and construction of proposed flatwork improvements.

a. Lightly loaded exterior concrete hardscape improvements should be a minimum of four (4) inches in thickness. Slabs and walkways should be reinforced with a minimum 6 inch x 6 inch No. 6 x No. 6 welded wire mesh or by No. 3 bars spaced at 24 inches on center, each way. Reinforcement should be placed in the middle third of the slab thickness.

b. A reinforced thickened perimeter edge extending a minimum of 8 inches below slab bottom, and having a minimum width of 6 inches should be incorporated into hardscape improvement design/construction.

c. In an effort to minimize shrinkage cracking, concrete flatwork should be constructed of uniformly cured, low slump concrete and should contain sufficient control/contraction joints (typically spaced at 8± feet, maximum).

d. Curbings that enclose planters or planting areas should extend a minimum of one foot below pavement subgrade.

e. Prior to concrete placement, subgrade soils should be thoroughly moisture conditioned to at least 140 percent of optimum moisture to a depth of 12 inches below finished subgrade. After achieving the above moisture conditions at depth, the exposed subgrade soils should be scarified and "flooded" overnight, prior to concrete placement.

f. Of primary importance in expansive soils conditions is minimizing the moisture variation below the improvements. Differential uplift of slabs, caused by non-uniform wetting expansion of soils, can cause

uplift at corners, edges or centers of slabs. Provisions for minimizing moisture variation include:

i. Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios and other hardscape improvements.

ii. Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drainage way from the improvements via subdrains into approved disposal areas.

iii. Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.

Additional provisions need to be incorporated into the design and construction of all improvements exterior to the proposed structures (walls, patios, walkways, and planters) to account for potential expansive soil and sulfate conditions. Design considerations on any given pad may need to include provisions for perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure and differential settlement/ heave, among others.

7.3.3 Zones of Special Foundation Consideration

Where the proposed removal of near-surface, low-density soils is impeded and/or restricted by property line or other physical constraints, such as existing structures or perimeter walls, zones of special foundation consideration may be established to account for future potential settlement. The width and locations of such zones will be dictated by exposed field conditions, removal configurations achieved, and finished pad elevations. Encroachment into such zones by perimeter wall or structural footings would require deepening of foundations, stiffening of foundations, increased pad drainage gradients, and/or additional reinforcing steel and additional expansion/control joints in hardscape and wall improvements. Approximation of the geometry of this zone will be a function of removal

configuration data recorded by the project civil engineer (surveyors). Evaluation of the future performance of the improvements constructed in this zone should consider the geotechnical conditions discussed here.

7.3.4 Utility Trench Excavation

All utility trenches should be shored or laid back in accordance with applicable OSHA standards.

7.3.5 Utility Trench Backfill

Mainline and lateral utility trench backfill should be compacted to at least 90 percent or maximum dry density as determined by ASTM Test Method: D-1557. Bedding materials should have an Expansion Index value of 20 or less and a sand equivalent value of 30 or greater. Onsite soils will be suitable for trench backfill. Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable.

Under-slab trenches should also be compacted to project specifications. If native soils are used, mechanical compaction is recommended. If select granular backfill (SE > 30 by laboratory testing) is utilized, densification by jetting will be acceptable, although backfill with granular material is not recommended as it may act as an undesirable reservoir for water. As such in lieu of native materials, under-slab trench may be backfilled with a lean slurry. The soil engineer should be notified for observation prior to placement of the membrane and slab reinforcement.

7.3.6 Temporary Excavation Considerations

Temporary excavations should be sloped or braced in accordance with CAL-OSHA/FED-OSHA regulations.

Excavations for the proposed foundations adjacent the existing structures should be performed in slots to reduce the potential for undermining these structures.

- Soils may be removed in slots no greater than 20 feet in width and 5 feet in depth. Adjacent open slots should be located a minimum of 40 feet (horizontal) from each other (i.e., "A,B,C" slot cuts, where all "A" slot foundation elements are constructed before excavating adjacent "B" slots, and all "B" slot foundation elements are constructed before excavating adjacent "C" slots).

  As an alternative, slots can be opened one at a time and the 20-foot foundation element constructed before excavating an adjacent slot.

- Foundation elements should be constructed as expeditiously as possible after excavating the slots.

No surcharge loads are permitted above unshored or unretained excavations. This includes, but is not limited to, earth spoil piles, lumber, concrete trucks or other vehicles, concrete blocks, or other construction materials or construction equipment. Drainage above excavations should be directed away from banks. Care should be taken to prevent saturation of the soils.

8.0 SITE MAINTENANCE

Design fine grade elevations should be maintained through the life of the structure. As expansive soils have been identified as underlying the site, it is of primary importance to reduce the moisture variation below all site improvements. Measures for maintaining conditions around the structures may include:

- Employing contractors for owner improvements who design and build in recognition of local building code and specific site soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other hardscape improvements.
- Avoiding the construction of raised planters adjacent to structural improvements. Alternatively, planter sides/bottoms may be sealed and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.

- Utilizing landscaping schemes with vegetation that requires minimal watering. Watering should be done in a uniform manner as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures or providing roof gutters on all structures with downspouts installed to carry roof runoff directly into area drains or discharged well away from the structures.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree. Alternate placement of trees (closer to the structures) may be performed based on recommendations from a qualified landscape contractor.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively constant moisture conditions.

The property manager/owner should be made aware of the potential problems that may develop when drainage is altered through construction of retaining walls, paved walk-ways and patios. Ponded water, leaking irrigation systems, overwatering or other conditions that could lead to ground saturation must be avoided.

9.0 FUTURE PLAN REVIEWS

This report represents a preliminary outline of the geotechnical issues pertaining to development of the site as presently proposed. As the project design progresses, site specific geotechnical issues may need to be incorporated into design and construction of the project. Consequently, future plan reviews may be necessary. These reviews may include reviews of:

- Demolition plans
- Grading plans
- Foundation plans
- Retaining wall plans

These plans should be forwarded to the project geotechnical engineer for evaluation and comment, as necessary.

10.0 CLOSURE

The findings and recommendations contained in this report are based upon the specific excavations, observations and laboratory testing as noted in this report. The material immediately adjacent to or beneath those observed may have different characteristics and no representations are made as to the quality or extent of materials not observed. This report is subject to review by the controlling authorities for the project.

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Geotechnical Map .....(map pocket)

SELECTED REFERENCES

Morton, P.K., Miller, R.V., and Fife, D.L., 1973, Geo-Environmental Maps of Orange County, California: California Division of Mines and Geology Preliminary Report 15, 4 Plates, scale 1:48,000.

Morton, D.M. 2004, Preliminary digital geologic map of the Santa Ana 30' x 60' quadrangle, southern California, version 2.0: U.S. Geological Survey Open-File Report 99-172, http://geopubs.wt.usgs.gov/open-file/of99-172/.

Department of Conservation, State of California, Division of Mines and Geology, 1997, Seismic Hazard Zone Report for the Anaheim and Newport 7.5-Minute Quadrangle, Orange County, California, SHZR 003.

_____ 1986, Special studies zones, Newport Beach Quadrangle, official map, effective July 1, 1986: Map Scale 1:24,000.

Department of Conservation, State of California, Division of Mines and Geology, Seismic Hazard Zones, Newport Beach Quadrangle, Office Map, Effective April 7, 1997.

May 27, 2008
Work Order 102686

FIELD INVESTIGATION

AND

LABORATORY TEST DATA

APPENDIX

FIELD INVESTIGATION AND LABORATORY TESTING

The investigation upon which this report is based included a review of available published geotechnical reports and maps of the area, geologic reconnaissance of the site, and a subsurface field investigation program. The subsurface field investigation consisted of the excavation, logging and sampling of a total of 4 exploratory borings. The borings were excavated with a truck mounted bucket auger drill rig. Logs of the excavations appear herein.

In order to assess the physical properties of on-site earth materials, representative bulk and relatively "undisturbed" ring samples were obtained from the exploratory excavations and transported to our laboratory for testing. "Undisturbed" ring samples collected during this investigation were obtained by advancing a sampling spoon through the soil by repeated blows with the telescoping Kelly bars on the drill rig. The sampling spoon is lined with brass rings, each one, 1 inch in height by 2.50 inches inside diameter. Samples were retained in the rings, placed in relatively airtight containers and taken in our laboratory. Bulk samples collected during this investigation were placed in plastic buckets and also transported to our laboratory.

Laboratory tests consisted of in-situ moisture and density determinations, content, grain size, shear strength, consolidation, expansive soil characteristics, pH, resistivity, and sulfate analysis. Brief descriptions of the laboratory tests are presented below. Test results are summarized in Table I.

Moisture Density Determination

The in-situ unit dry weight and natural moisture content were determined for selected "undisturbed" ring samples. The results of these tests are included on Plates A-1 through A-4, of the Geotechnical Boring Logs.

Grain Size Determination

Grain size analyses were performed on representative ring and bulk samples. The tests were performed utilizing hydrometer test methods. The results of these tests were used as an aid in soil classification and are presented in Table I.

Shear Strength Determination

Shear tests were performed on selected remolded ring samples of the predominant soil types with a direct shear machine of the strain control type in which the rate of strain in 0.05 inches per minute. Specimens were inundated for approximately 24 hours in a confined conditioned and then subjected to shear under various normal loads. Results of these tests are summarized on Plate B.

Consolidation Tests

Consolidation tests were performed in accordance with procedures outlined in ASTM:D-2435. Testing was performed on five relatively "undisturbed" samples on onsite earth materials.

The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Hydroconsolidation (collapse) and expansion characteristics were also evaluated by monitoring the change in volume with saturation while the specimen was confined under a constant normal stress. Consolidation test results are shown on Plates C-1 and C-5.

Expansive Soils Characteristics

Expansion characteristics were evaluated on representative near surface samples in accordance with ASTM D 4829. The results of this testing is presented in Table I.

Corrosivity Analyses

Selected soil samples were analyzed for determination of pH and resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportioned in the flow of electrical current (DC) form the metal into the soil. The soil's resistivity decreases and, therefore, its corrosivity increase primarily as its moisture and chemical contents increase.

A commonly accepted correlation between electrical resistivity and corrosivity toward ferrous metals is:

Soil Resistivity in ohm-centimeters	Corrosivity Category
0 to 1,000	severely corrosive
1,000 to 2,000	corrosive
2,000 to 10,000	moderately corrosive
Over 10,000	mildly corrosive

The results of the corrosivity analysis are presented in Table I.

Chemical Testing

Testing for soluble sulfates and chlorides were performed (by others) on selected soil samples. The results of these tests are included in Table I.

GEOTECHNICAL BORING LOG

PROJECT NO.	102686	PROJECT NAME	OCF		
DATE STARTED	4/2/08	GROUND ELEV.	63	BORING DESIG.	PSE-101
DATE FINISHED	4/2/08	GW DEPTH (FT)		LOGGED BY	JH
DRILLER	Alroy	DRIVE WT.	See Note	NOTE	0-24' 2150#; 24-44'
TYPE OF DRILL RIG	Bucket Auger	DROP	12 inches		1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 6" Asphalt				
						Alluvium (Qal): Silty Clay, brown, moist, firm, with some carbonate nodules.				
		B/R	2				22.5	99.9	88	
5	58	B/R	5			**Old Paralic Deposits (Qopfsc):** Sandy Silt, pale brown, moist, very stiff.	28.6	90.4	89	
						Moderate Cementation				
10	53	R	1			Silty Clay, pale brown to a light gray, moderate cementation, carbonate, mottled, moist, firm.	23.4	95.2	82	
15	48	R	1				29.0	92.8	96	
						Clayey Silt to Silty Clay, some stratification, light brown to brown, moist, firm.				
20	43	R	3				22.6	97.9	85	
		B				Fine Sand, yellowish brown, moist, medium dense, oxidized, reddish color.				
						Light gray, medium dense.				
25	38	R	5			Carbonaceous material in ring.	33.6	86.7	96	
						Silty Clay, reddish brown, moist, stiff.				
						Sandy Clay to Clayey Silt, brown, moist, very stiff.				
30	33	R	7				31.5	90.5	99	
						Total Depth 31 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	102686	PROJECT NAME	OCF	BORING DESIG.	PSE-102
DATE STARTED	4/2/08	GROUND ELEV.	63	LOGGED BY	JH
DATE FINISHED	4/2/08	GW DEPTH (FT)		NOTE	0-24' 2150#; 24-44' 1350#; 44-64' 650#
DRILLER	Alroy	DRIVE WT.	See Note		
TYPE OF DRILL RIG	Bucket Auger	DROP	12 inches		

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 4" Asphalt				
		B/R	2			**Alluvium (Qal):** Silty Clay, brown, moist, firm.	27.1	96.6	98	
5	58	R	2			**Old Paralic Deposits (Qopfsc):** Silty Clay, pale brown, moist, firm.	25.5	92.5	84	
						Pale brown to grayish brown, mottled, abundant carbonate nodules.				
10	53	R	4			Stiff.	21.5	102.6	90	
15	48	R	3			Silty Clay, brown to olive, moist, stiff.	90.9	31.2	56	
		B								
20	43	R	3				24.7	100.0	97	
						Fine Sand to Silty Fine Sand, yellowish brown, moist, medium dense, moderate cementation, oxidation, stratification.				
25	38	R	6			Silty Clay, olive to reddish brown, moist, stiff, mottled.	36.8	83.5	98	
						Olive to yellowish brown.				
30	33	R	15			Clayey to Silty Fine Sand, yellowish brown, moist, dense	22.9	102.2	95	
						Sandy to Clayey Silt, pale brown to brown, moist, stiff.				
35	28	R	30			Fine Sand, yellowish brown, moist, very dense.	7.5	102.2	31	
						Clayey Sand to Sandy Clay, brown to dark yellowish brown,				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO. 102686
DATE STARTED 4/2/08
DATE FINISHED 4/2/08
DRILLER Alroy
TYPE OF DRILL RIG Bucket Auger

PROJECT NAME OCF
GROUND ELEV. 63
GW DEPTH (FT)
DRIVE WT. See Note
DROP 12 inches

BORING DESIG. PSE-102
LOGGED BY JH
NOTE 0-24' 2150#; 24-44' 1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R				moist, very dense to hard.	19.2	107.8	92	
		B				Fine- to medium-grained Sand, yellowish brown to grayish brown, very dense.				
45	18	R	50 for 10"			Medium- to coarse-grained Sand, yellowish brown, moist, very dense.	4.7	109.0	23	
						Clay lens, gray blue, moist, hard.				
50	13	R	50 for 5"				2.8	107.0	13	
						Total Depth 51 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO. 102686
DATE STARTED 4/2/08
DATE FINISHED 4/2/08
DRILLER Alroy
TYPE OF DRILL RIG Bucket Auger

PROJECT NAME OCF
GROUND ELEV. 62
GW DEPTH (FT)
DRIVE WT. See Note
DROP 12 inches

BORING DESIG. PSE-103
LOGGED BY JH
NOTE 0-24' 2150#; 24-44' 1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 4" Asphalt				
		B/R	5			**Alluvium (Qal):** Silty Sand, brown, moist, loose to medium dense.				
5	57	B/R	2			**Old Paralic Deposits (Qopfsc):** Silty Sand, pale brown, moist, medium dense, moderate cementation.	31.0	88.7	93	
						Pale brown to grayish brown.	32.6	82.7	85	
10	52	R	4			Silty Clay to Clayey Silt, dark grayish brown to grayish brown, moist, stiff.	26.2	98.1	99	
15	47	R	5			Sandy Silt, pale brown, moist, very stiff, abundant carbonate, interbedded clay lenses.	27.7	95.8	99	
						Clay lens, olive, moist, stiff.				
20	42	R	4				24.9	100.0	98	
						Silty Fine Sand to Clayey Fine Sand, yellowish brown to grayish brown, moist, medium dense, oxidation, muscovite common.				
25	37	R	9				32.4	89.7	100	
						Silty Clay, grayish brown, moist, very stiff.				
30	32	R	7			Fine Sand, yellowish brown, moist, medium dense, abundant muscovite.	27.8	95.4	98	
						Total Depth 31 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

GEOTECHNICAL BORING LOG

PROJECT NO. 102686
DATE STARTED 4/2/08
DATE FINISHED 4/2/08
DRILLER Alroy
TYPE OF DRILL RIG Bucket Auger

PROJECT NAME OCF
GROUND ELEV. 62
GW DEPTH (FT)
DRIVE WT. See Note
DROP 12 inches

BORING DESIG. PSE-104
LOGGED BY JH
NOTE 0-24' 2150#; 24-44' 1350#; 44-64' 650#

DEPTH (feet)	ELEV.	SAMPLE TYPE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT. (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						0 - 4" Asphalt				
		R	2			**Alluvium (Qal):** Silty Clay, brown, moist, firm.	23.5	100.0	93	
5	57	R	4			**Old Paralic Deposits (Qopfsc):** Clayey Silt to Silty Clay, pale brown, moist, stiff.	21.8	102.9	92	
						Pale brown to gray brown, increase in clay content, olive to gray brown.				
10	52	R	3			Silty Clay, gray brown, moist, stiff.	27.8	95.1	97	
						Moderate cementation.				
15	47	R	3			Fine Sand, stratification, thinly bedded, iron banded lenses.	32.7	88.9	99	
						Silty Clay, gray brown, moist, stiff.				
20	42	R	2			Silty Fine Sand, yellowish brown, moist, medium dense, abundant muscovite.	34.6	87.1	100	
						Silty Clay, reddish brown, moist, firm.				
		B								
25	37	R	6			Fine Sand to Sandy Silt, yellowish brown, moist, medium dense/firm, oxidation, some stratification.	33.0	88.8	99	
						Silty Clay, reddish brown, moist, stiff.				
30	32	R	7			Silty Fine Sand to Sandy Silt, yellowish brown, moist, medium dense/stiff, abundant oxidation.	30.7	90.3	96	
						Total Depth 31 feet. No groundwater encountered/no caving observed. Backfilled and tamped with spoils. Capped with cold patch.				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ Ground Water Seepage
MAX - Max. Density/Opt. Moist.
DS - Direct Shear
HYDR - Hydrometer Analysis
ASCE - Expansion Index
CONS - Consolidation

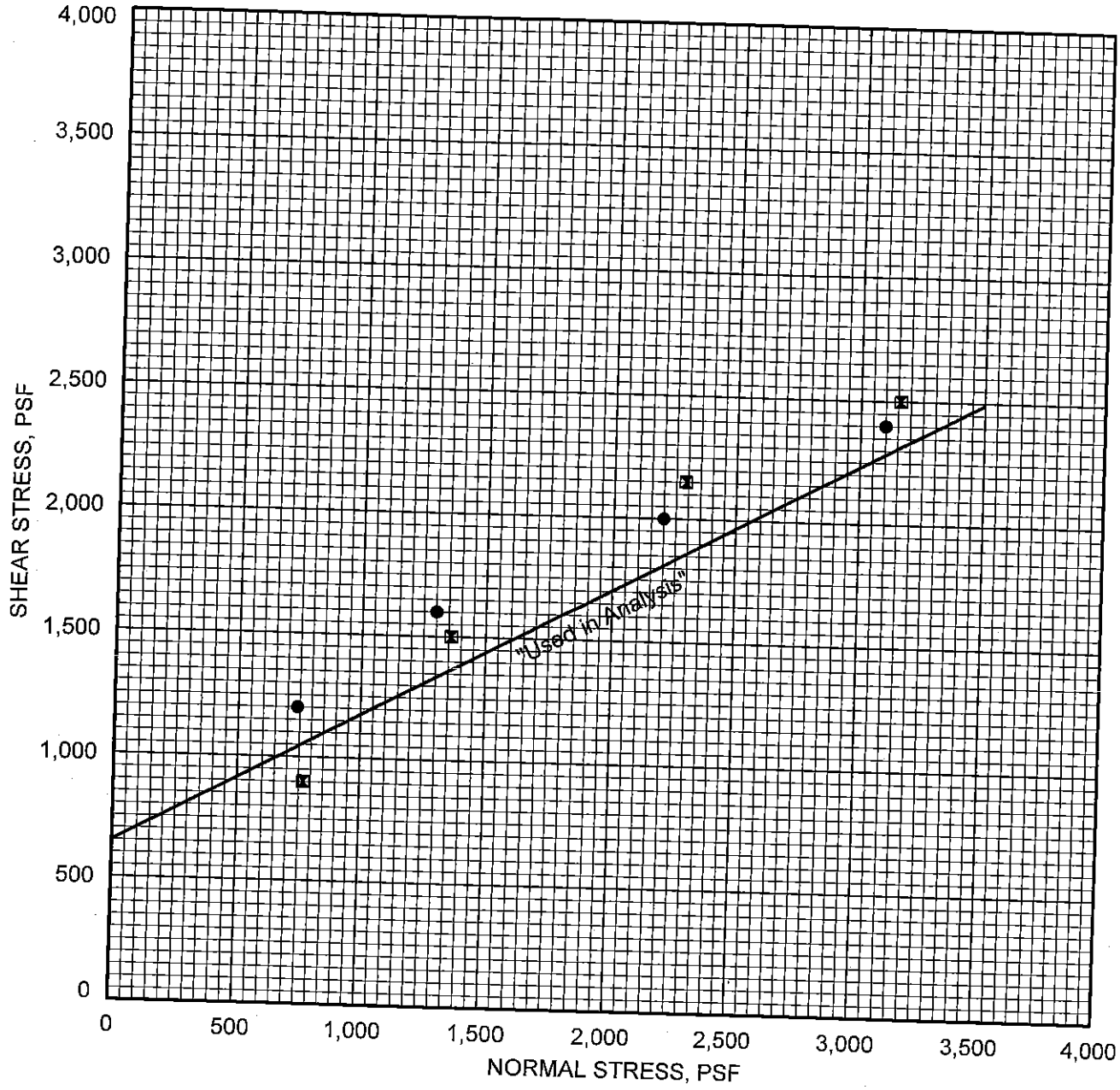
TABLE I
SUMMARY OF LABORATORY TEST DATA

Boring	Depth (ft.)	Description	ASTM D-1557DIRECT SHEAR TESTS						Grain Size Analysis				Chemical Analyses				
			Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Cohesion (psf)	Friction Angle ,ϕ, (degrees)	Test Conditions	Expansion Index (UBC 18-2)	% Gravel +#4	% Sand*	% Silt*	% Clay*	Sulfate (% by wt.)	Chloride (ppm)	pH	Resistivity (ohm-cm.)	Other Tests
B-101	2½	Brown Silty Clay							0	13	42	45					Consol.Plate C-1
B-101	2½	Brown Silty Clay	115.2	15.2	825	27	R/S	120	0	17	30	53	0.002	0.014	7.7	630	
B-101	10	Pale Brown Silty Clay							0	33	30	37					Consol. Plate C-2
B-102	7½	Brown Silty Clay							0	11	42	47					
B-102	5	Pale Brown Silty Clay							0	28	27	45					
B-103	2½	Brown Silty Sand							0	53	32	15					
B-103	5	Pale Brown Silty Clay							0	32	35	33					Consol. Plate C-3
B-103	5	Pale Brown Silty Sand	103.9	18.5	550	29	R/S	57	0	55	20	25	0.001	0.022	8.4	1530	
B-104	2½	Brown Silty Clay							0	17	35	48					Consol. Plate C-4
B-104	10	Pale to Grey Brown Silty Clay							0	21	32	47					Consol. Plate C-5

** Test performed by others.

Direct Shear Test Conditi(R = Remolded; U = Undisturbed
S = Saturated; N = Natural Moisture

DIRECT SHEAR TEST
Remolded/Saturated



Engineered Fill - 90% R.C. (caf)	COHESION	650 psf.
	FRICTION ANGLE	27 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	PSE-101	2.5			
⊠	PSE-103	5.0			

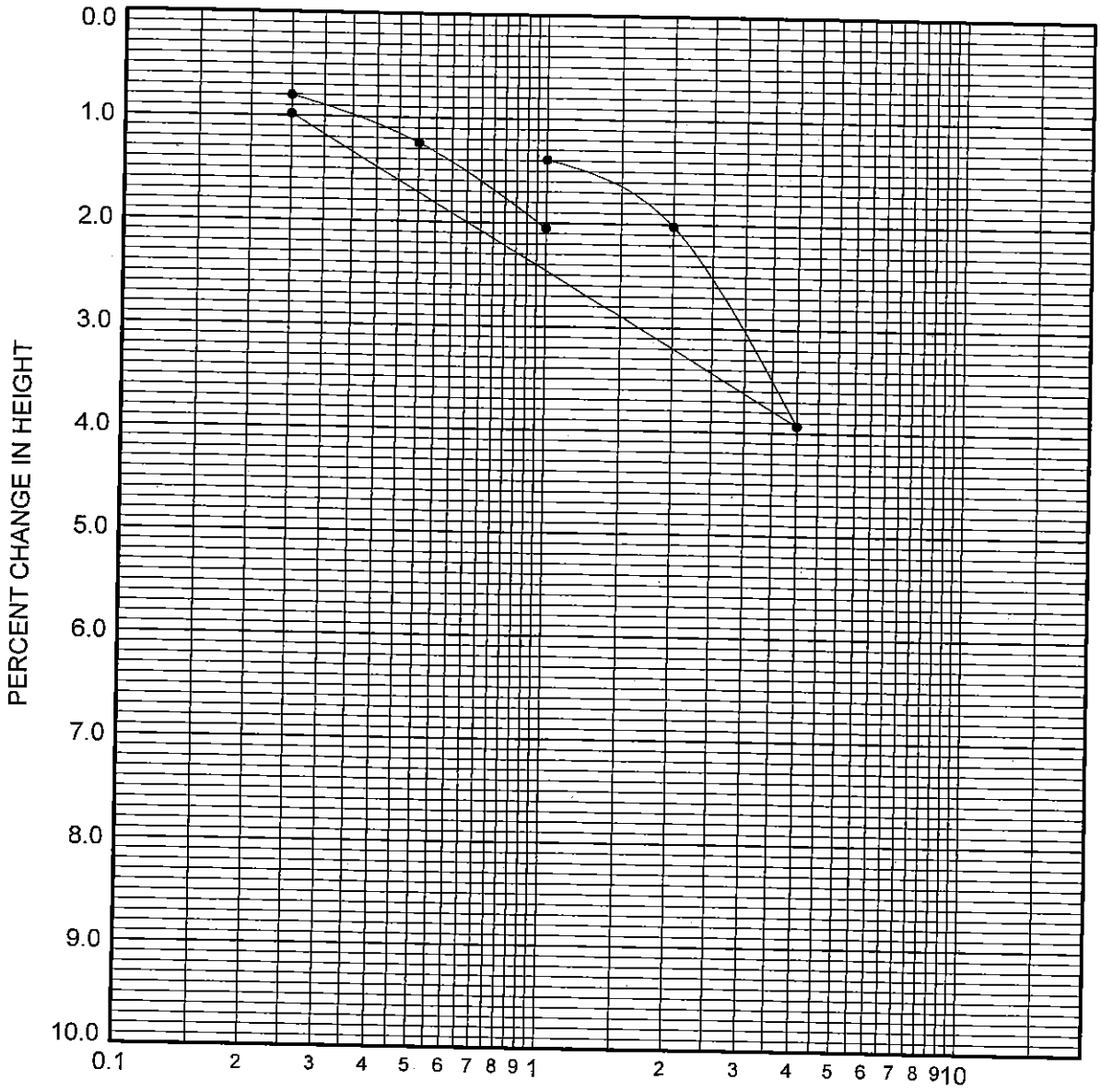
DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686

PLATE B

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-101	2.5

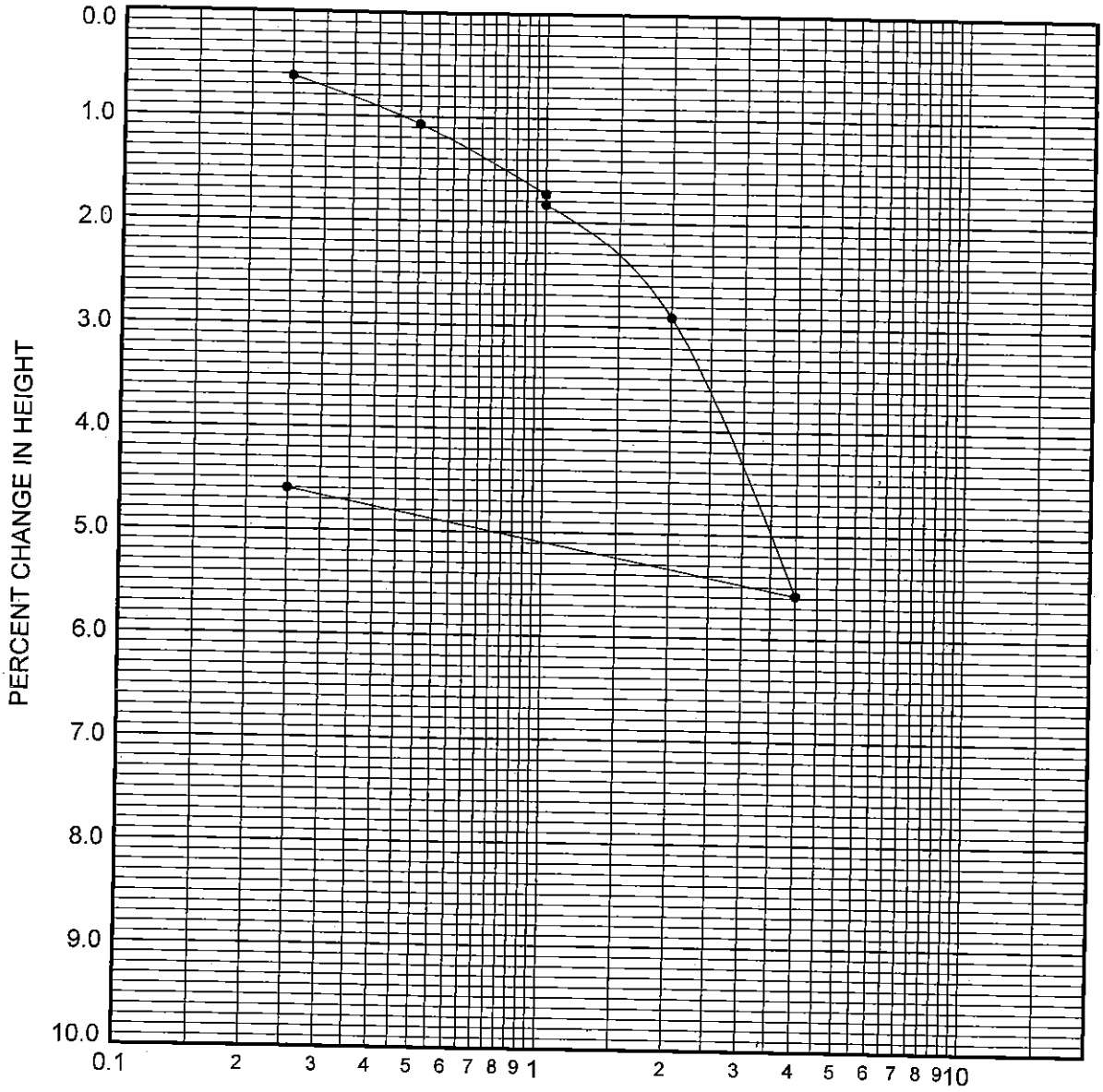
Water Added at 1.0 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-1

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-101	10.0

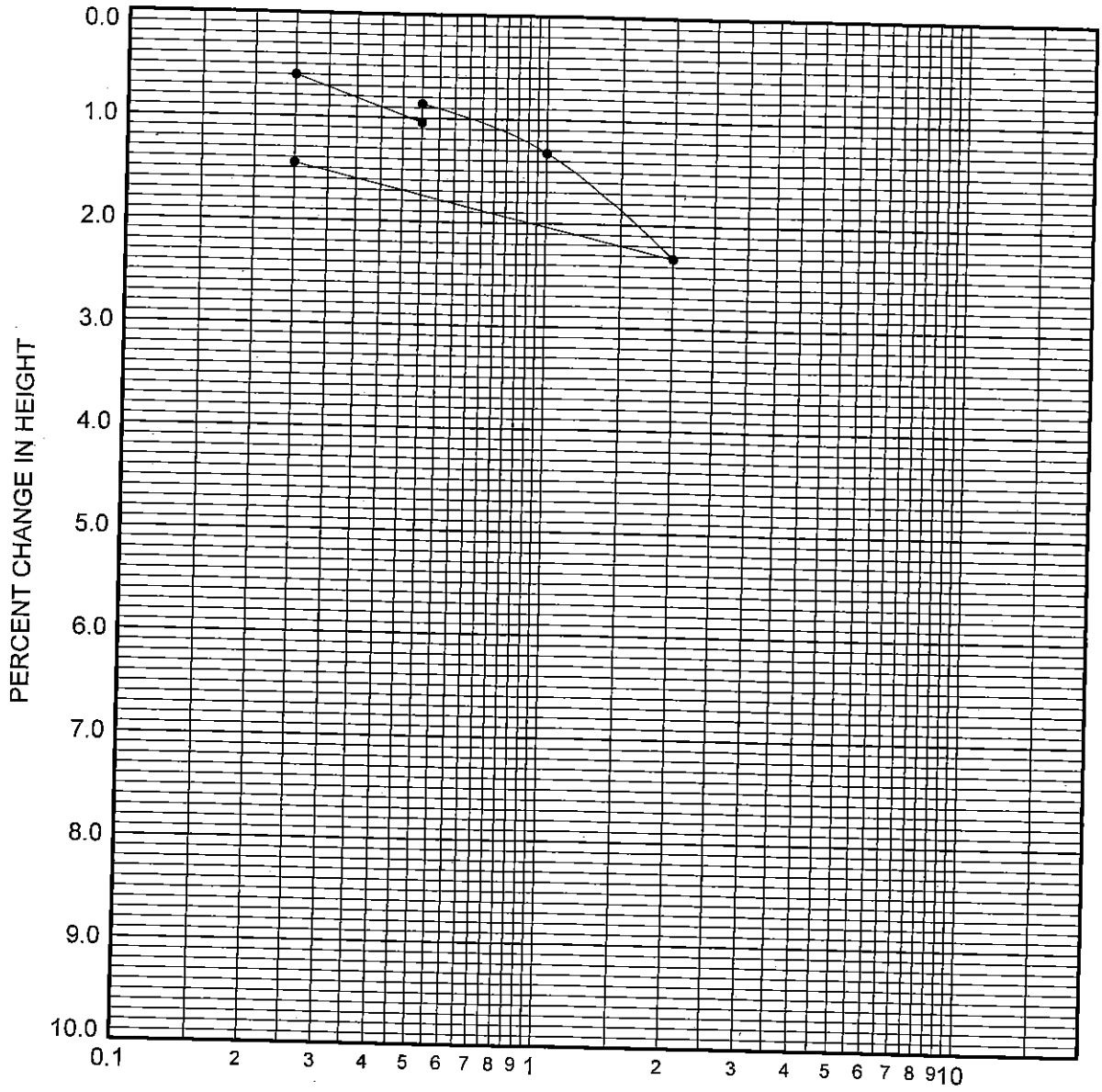
Water Added at 1.0 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-2

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-103	5.0

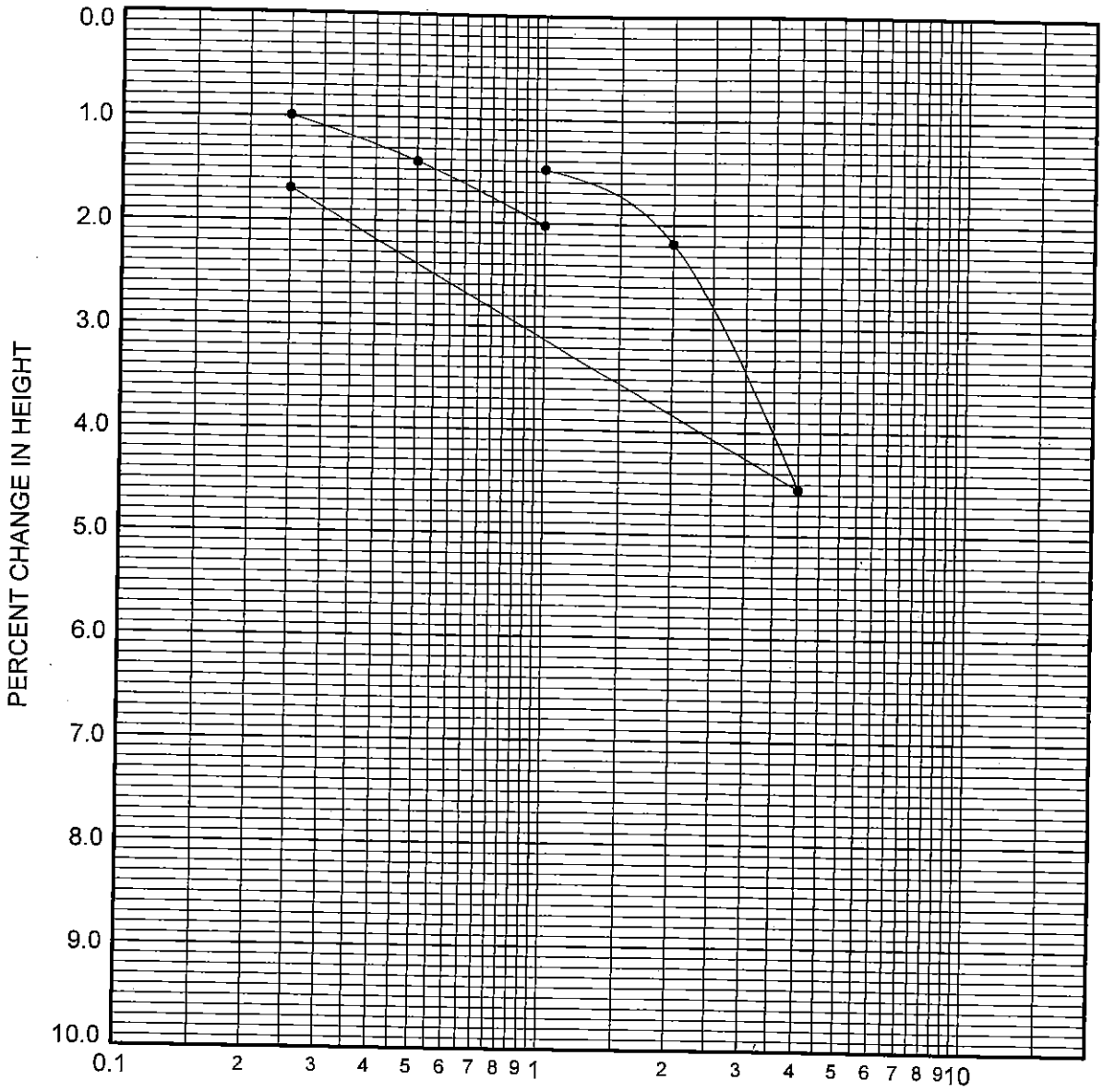
Water Added at 0.5 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-3

CONSOLIDATION CURVE



Boring	Depth (ft.)
PSE-104	2.5

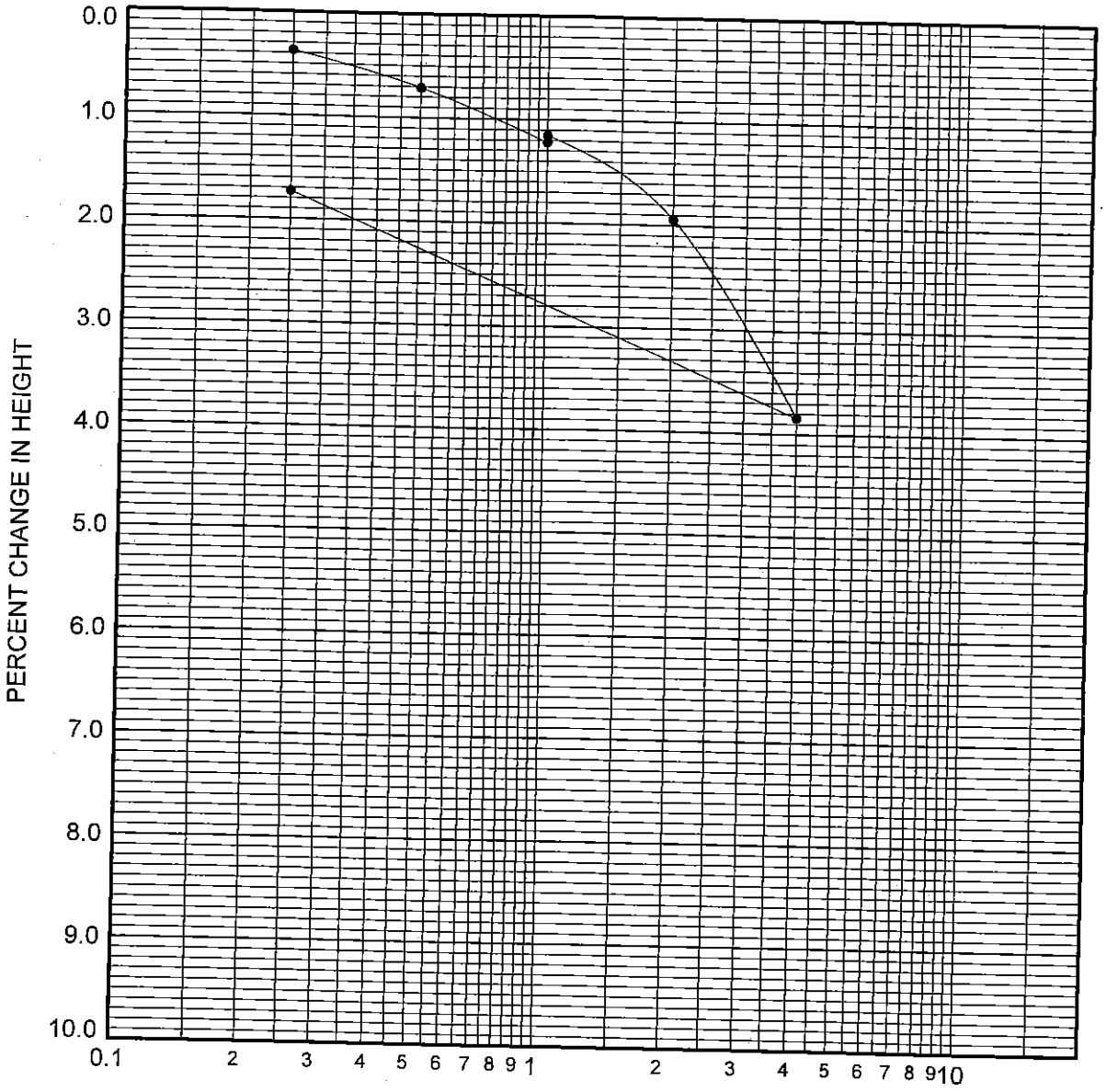
Water Added at 1.0 TSF.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

W.O. 102686 PLATE C-4

CONSOLIDATION CURVE



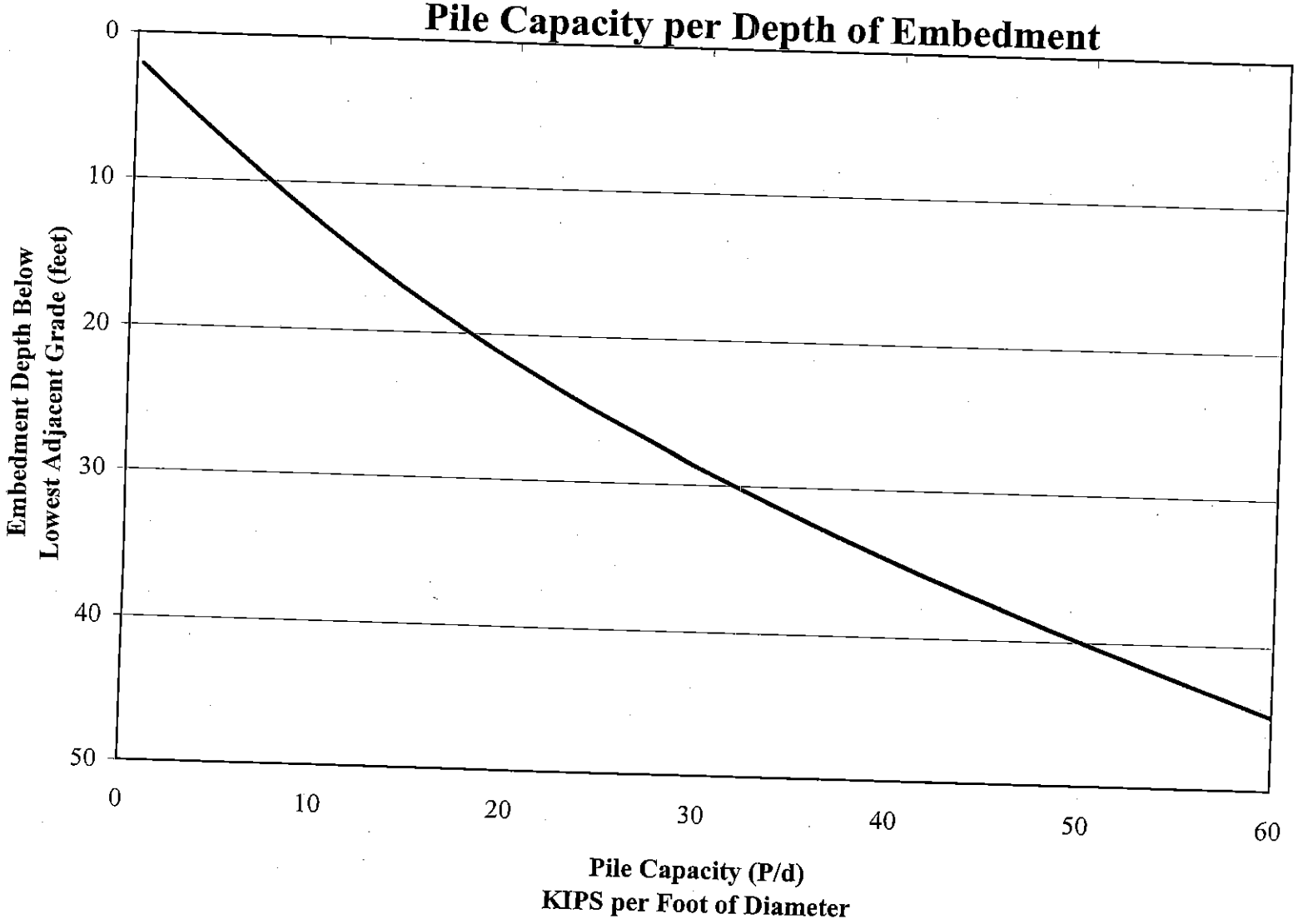
Boring	Depth (ft.)
PSE-104	10.0

Water Added at 1.0 TSF.

CONSOLIDATION CURVE

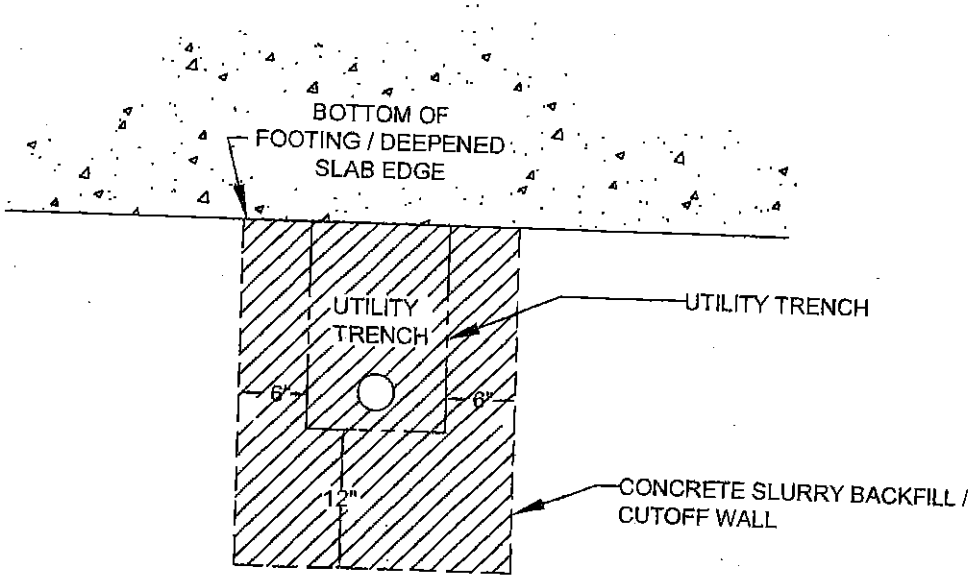
PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WY. CYPRESS, CA 90630 714-220-0770

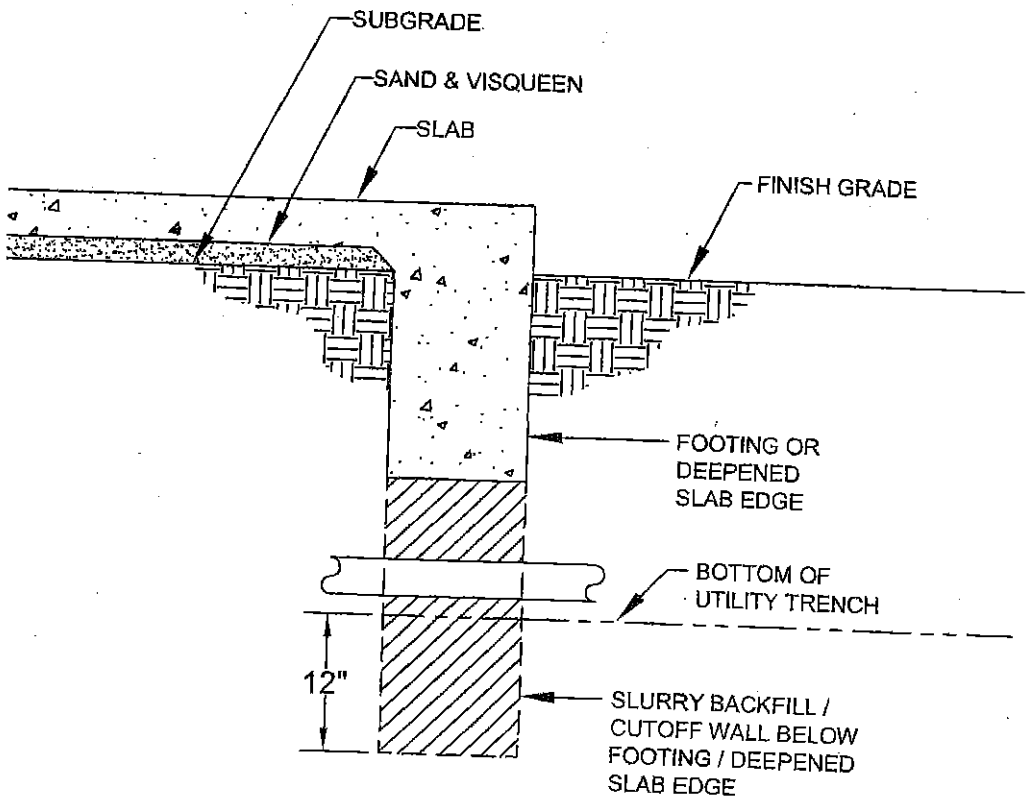
W.O. 102686 PLATE C-5



Work Order 102686

PLATE D





SCALE : 3/4" = 1'-0"

PLATE E

UTILITY TRENCH BACKFILL UNDER FOOTING / DEEPENED SLAB EDGE DETAIL

PACIFIC SOILS ENGINEERING, INC.
10653 PROGRESS WAY, CYPRESS, CA 90630
TELEPHONE: (714) 220-0770, FAX: (714) 220-9589
W.O. 102686
DATE: 5/27/08

PACIFIC SOILS ENGINEERING, INC.

EARTHWORK SPECIFICATIONS

These specifications present generally accepted standards and minimum earthwork requirements for the development of the project. These specifications shall be the project guidelines for earthwork except where specifically superceded in preliminary geology and soils reports, grading plan review reports or by prevailing grading codes or ordinances of the controlling agency.

I. GENERAL

A. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.

B. The project Soils Engineer and Engineering Geologist or their representatives shall provide testing services and geotechnical consultation during the duration of the project.

C. All clearing, grubbing, stripping and site preparation for the project shall be accomplished by the Contractor to the satisfaction of the Soils Engineer.

D. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soils Engineer and to place, spread, mix and compact the fill in accordance with the job specifications and as required by the Soils Engineer. The Contractor shall also remove all material considered by the Soils Engineer to be unsuitable for use in the construction of compacted fill.

E. The Contractor shall have suitable and sufficient equipment in operation to handle the amount of fill being placed. When necessary, equipment will be shut down temporarily in order to permit proper compaction of fills.

II. SITE PREPARATION

A. Excessive vegetation and all deleterious material shall be disposed of offsite as required by the Soils Engineer. Existing fill, soil, alluvium or rock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Where applicable, the Contractor may obtain the approval of the Soils Engineer and the controlling authorities for the project to dispose of the above described materials, or a portion thereof, in designated areas onsite.

After removals as described above have been accomplished, excavation of earth materials deemed unsuitable in their natural, in-place condition, shall be removed as recommended by the Soils Engineer/Engineering Geologist.

B. After the removals as delineated in Item II, A above, the exposed surfaces shall be disced or bladed by the Contractor to the satisfaction of the Soils Engineer. The prepared ground surfaces shall then be brought to the specified moisture condition, mixed as required, and compacted and tested as specified. In areas where it is necessary to obtain the approval of the controlling agency, prior to placing fill, it will be the Contractor's responsibility to notify the proper authorities.

C. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or others not located prior to grading are to be removed or treated in a manner prescribed by the Soils Engineer and/or the controlling agency for the project.

III. COMPACTED FILLS

A. Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soils Engineer. Deleterious material not disposed of during clearing or demolition shall be removed from the fill as directed by the Soils Engineer.

B. Rock or rock fragments less than eight inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets and the distribution of the rocks is approved by the Soils Engineer.

C. Rocks greater than eight inches in the largest dimension shall be taken offsite, or placed in accordance with the recommendations of the Soils Engineer in areas designated as suitable for rock disposal.

D. All fills, including onsite and import materials to be used for fill, shall be tested in the laboratory by the Soils Engineer. Proposed import materials shall be approved prior to importation.

E. The fill materials shall be placed by the Contractor in layers that when compacted shall not exceed six inches. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain a near uniform moisture condition and a uniform blend of materials.

All compaction shall be achieved at optimum moisture content or above, as determined by the applicable laboratory standard. No upper limit on the moisture content is necessary; however, the Contractor must achieve the necessary compaction and will be alerted when the material is too wet and compaction cannot be attained.

F. Where the moisture content of the fill material is below the limit specified by the Soils Engineer, water shall be added and the materials shall be blended until a uniform moisture content, within specified limits, is achieved. Where the moisture content of the fill material is above the limits specified by the Soils Engineer, the fill materials shall be aerated by discing, blading or other satisfactory methods until the moisture content is within the limits specified.

G. Each fill layer shall be compacted to minimum project standards, in compliance with the testing methods specified by the controlling governmental agency and in accordance with the recommendations of the Soils Engineer.

In the absence of specific recommendations by the Soils Engineer to the contrary, the compaction standard shall be ASTM:D 1557-91.

H. Where a slope receiving fill exceeds a ratio of five-horizontal to one-vertical, the fill shall be keyed and benched through all unsuitable topsoil, colluvium, alluvium, or creep material, into sound bedrock or firm material, in accordance with the recommendations and approval of the Soils Engineer.

I. Side hill fills shall have a <u>minimum key width</u> of 15 feet into bedrock or firm materials, unless otherwise specified in the soils report and approved by the Soils Engineer in the field.

J. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency and/or with the recommendations of the Soils Engineer and Engineering Geologist.

K. The Contractor shall be required to maintain the specified minimum relative compaction out to the finish slope face of the fill slopes, buttresses, and stabilization fills as directed by the Soils Engineer and/or the governing agency for the project. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the designated result.

L. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm material; and the transition shall be stripped of all soil or unsuitable materials prior to placing fill.

The cut portion should be made and evaluated by the Engineering Geologist prior to placement of fill above.

M. Pad areas in natural ground and cut shall be approved by the Soils Engineer. Finished surfaces of these pads may require scarification and recompaction.

IV. CUT SLOPES

A. The Engineering Geologist shall inspect all cut slopes and shall be notified by the Contractor when cut slopes are started.

B. If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the Engineering Geologist and Soils Engineer shall investigate, analyze and make recommendations to treat these problems.

C. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the prevailing drainage.

D. Unless other specified in the soils or geological reports, no cut slope shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agencies.

E. Drainage terraces shall be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the Soils Engineer or Engineering Geologist.

V. GRADING CONTROL

A. Fill placement shall be observed by the Soils Engineer and/or his representative during the progress of grading.

Field density tests shall be made by the Soils Engineer or his representative to evaluate the compaction and moisture compliance of each layer of fill. Density tests shall be performed at intervals not to exceed two feet of fill height. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density determinations shall be taken in the compacted material below the disturbed surface at a depth determined by the Soils Engineer or his representative.

B. Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction, or improper moisture is in evidence, the particular layer or portion shall be reworked until the required density and/or moisture content has been attained. No addi-

tional fill shall be placed over an area until the last placed lift of fill has been tested and found to meet the density and moisture requirements and that lift approved by the Soils Engineer.

C. Where the work is interrupted by heavy rains, fill operations shall not be resumed until field observations and tests by the Soils Engineer indicate the moisture content and density of the fill are within the limits previously specified.

D. During construction, the Contractor shall properly grade all surfaces to maintain good drainage and prevent ponding of water. The Contractor shall take remedial measures to control surface water and to prevent erosion of graded areas until such time as permanent drainage and erosion control measures have been installed.

E. Observation and testing by the Soils Engineer shall be conducted during the filling and compacting operations in order that he will be able to state in his opinion all cut and filled areas are graded in accordance with the approved specifications.

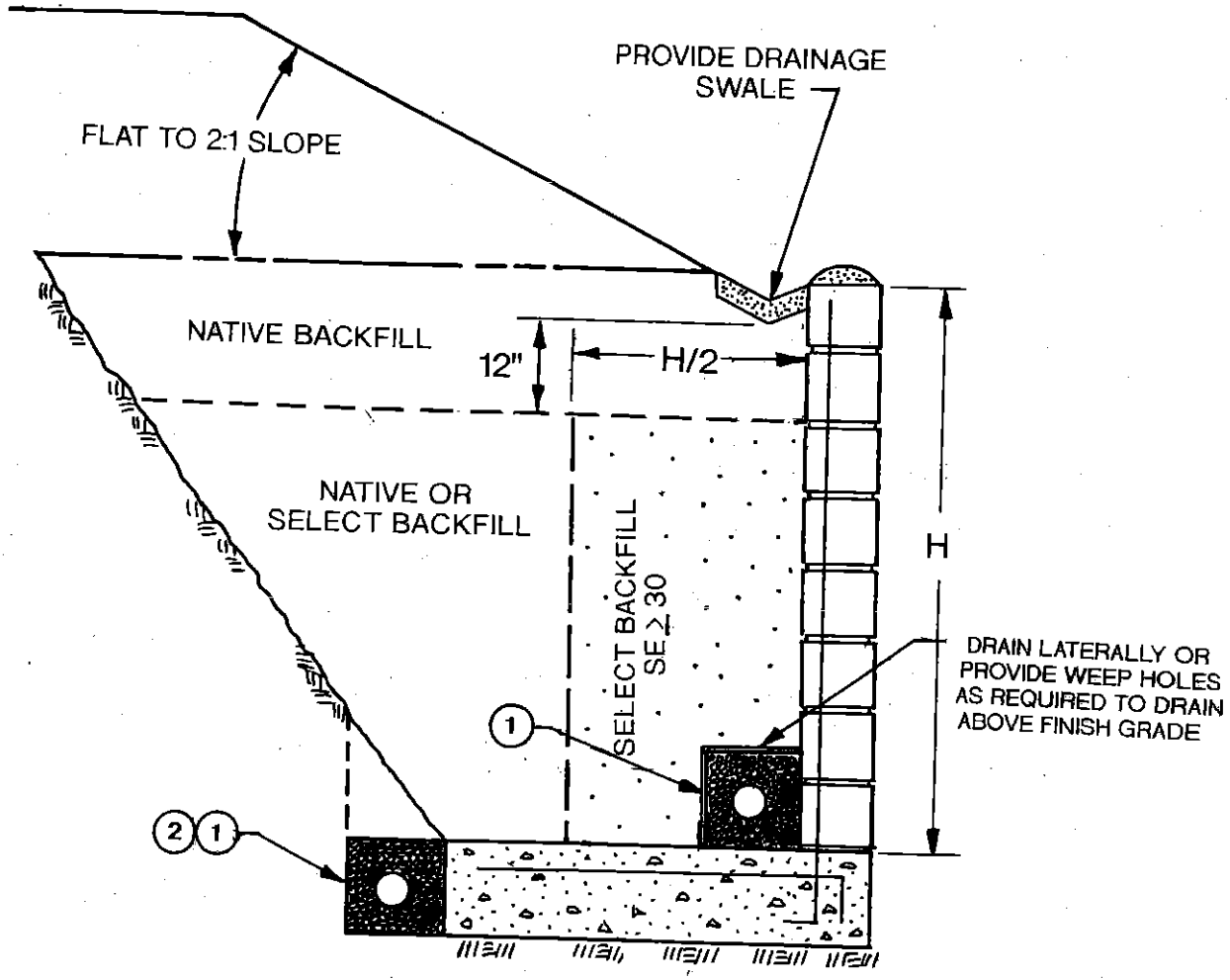
F. After completion of grading and after the Soils Engineer and Engineering Geologist have finished their observations of the work, final reports shall be submitted. No further excavation or filling shall be undertaken without prior notification of the Soils Engineer and/or Engineering Geologist.

VI. SLOPE PROTECTION

All finished cut and fill slopes shall be planted and/or protected from erosion in accordance with the project specifications and/or as recommended by a landscape architect.

TYPICAL

RETAINING WALL BACKFILL



(1) 4-INCH PERFORATED PVC, SCHEDULE 40 OR APPROVED ALTERNATE. PLACE PERFORATION DOWN AND SURROUND WITH A MINIMUM OF 1 CUBIC FOOT PER LINEAL FOOT OF 3/4 INCH ROCK OR APPROVED ALTERNATE. ENCAPSULATE IN MIRAFI 140, OR EQUIVALENT

(2) PLACE DRAIN AS SHOWN WHERE PROVISIONS FOR DRAINAGE THROUGH THE WALL CANNOT BE ACCOMMODATED

PLATE G-13 NOT TO SCALE

PACIFIC SOILS ENGINEERING, INC.
10853 PROGRESS WAY CYPRESS, CALIFORNIA (714) 220-0770

W.O. **DATE**

DEAN
1/9/2000
CENTENNIAL FARM
BUF. BARN (NOT BUILT
SILO BLD.

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVENUE, SUITE 514, TUSTIN, CALIFORNIA 92680
TELEPHONE: (714) 730-2122, FAX: (714) 730-5191

ORANGE COUNTY FAIR & EXPOSITION CENTER
32nd District Agricultural Association
88 Fair Drive
Costa Mesa, California 92626

March 17, 1992
Work Order 500074

Attention: Mr. Hank Vidal

Subject: Report of Preliminary Geotechnical Investigation for Centennial Farm Barn at Orange County Fair and Exposition Center, Costa Mesa, California

Gentlemen:

As requested by you, a preliminary geotechnical investigation has been conducted at the subject site. This report presents the results of that investigation along with grading and design recommendations for the subject project. A Site Plan at a scale of 1/16 inch equals 1 foot was utilized during this firm's investigation. A print of that plan showing approximate locations of this firm's borings accompanies this report (pocket enclosure).

PROPOSED CONSTRUCTION

Proposed development consists of mass grading of the site to prepare a pad for construction of a two-story, wood frame barn with conventional shallow footings and slab-on-grade. Maximum anticipated wall and column loads, as determined by Langston & Associates, Structural Consultants, are on the order of 3 kips per lineal foot and 15 kips, respectively.

SITE LOCATION & DESCRIPTION

The site of the proposed structure is located within the Centennial Farm at Orange County Fair and Exposition Center, in the City of Costa Mesa, California. Man-made features onsite consist of exhibit cages for animals (Rabbits, chicken etc.),

unpaved walkways and landscaped areas (grass). The site is relatively level and does not display any distinct drainage pattern.

FIELD INVESTIGATION

The site was investigated on March 4, 1992 by drilling four borings to depths ranging from 15 to 25 feet below the existing ground surface utilizing an 18-inch diameter bucket drill rig. Borings had to be placed in strategic locations to avoid destruction of the existing underground utility lines and existing exhibits. The excavated materials were visually classified in the field in accordance with the Unified Soil Classification System, Plate A as noted on the log of borings. The log of borings is presented on Plates A-1 through A-4.

LABORATORY TESTING

Laboratory testing was conducted to establish engineering properties of the site soils. Results of these tests are shown on the log of borings, summary of laboratory test results, Table I, Plates B-1 through B-3 and C-1 through C-3 of the Appendix.

SITE SOIL CONDITION

Materials encountered in this firm's borings consist of medium clays, underlain with silty clays containing crusted calcium carbonates (caliche). These materials in turn were underlain with clayey silts to the depth explored. Shallow man-made fills associated with landscaping, walkways and exhibit pads were encountered in all borings. The depth of man-made fills ranged from 4 to 24 inches below the existing ground surface. Underground services and utility lines (sewer, water, electricity) cross the site. Above ground structures are temporary in nature and consist of exhibit cages, box planters, and wood fences. Ground water was not encountered in any of this firm's borings.

CONCLUSIONS AND RECOMMENDATIONS

Based upon our field exploration, visual observations and results of laboratory testing, it is concluded that the site is suitable for development as proposed. That conclusion is based on the assumption that the recommendations presented in this report will be incorporated into the design and construction of the project. The recommendations that follow are specific to the currently proposed development. Any deviation from the superimposed loads, structures sitings, and building type, or alterations to the existing conditions are subject to review by the geotechnical consultants and could require significant modifications to the recommendations that follow.

A. GRADING

A grading Plan is not available at this time and should be reviewed by this firm when available. Present site topography however, suggests that only a minor amount of grading will be required to establish pad elevation and maintain drainage. Based upon that observation, the following grading recommendations are presented. All grading should be conducted under the observation and testing of the geotechnical engineer.

1. Clearing

Prior to initiation of grading, all structures and all debris resulting from demolition, vegetation, and other organic or deleterious materials should be cleared and wasted from the site.

a. Underground Structures

All underground structures and conduits below the building areas should be removed or crushed in-place and the resulting cavities backfilled in accordance with the recommendations of this report. Outside of building areas, as an alternate to total removal, the abandoned conduits may be filled with lean concrete and capped.

2. **Remedial Grading**

In order to provide uniform and adequate support for the structures and any additional fill, remedial grading will be required. Prior to placing any fills on the site, all existing man-made fills and other unsuitable materials should be removed and replaced with properly compacted fill. Maximum depth of man-made fills encountered in this firm's borings is on the order of 2 feet below the existing ground surface, although localized areas of deeper fills or unsuitable soils associated with the old utility trench backfills may be exposed during grading. Depth of removals therefore, should be a minimum of 2 feet inches or to remove all existing man-made fills, whichever is greater. Removals should extend a minimum of five feet beyond the exterior face of the footings.

If design cuts are sufficient to remove all the existing unsuitable soils, no further overexcavation will be required. Exposed surface of the cut areas should however be processed and compacted in accordance with the recommendations of this report.

3. **Treatment of Removal Bottoms**

After the required removals have been accomplished, the supporting ground should be inspected by the soils engineer and upon his approval, the exposed soils should be scarified to a depth of 8 inches, moisture conditioned to near optimum moisture content, and compacted to a minimum of 90 percent of maximum dry density as determined in accordance with the compaction standards specified in this report.

4. **Fill Placement**

After removals and processing of the exposed ground have been accomplished, the required fills should be placed in loose lifts not exceeding 8 inches in thickness (bulk) and compacted to a minimum of 90 percent of the applicable compaction standard. The compaction should be achieved slightly above optimum moisture content by means of a sheepsfoot roller or

similar kneading-type compaction equipment. All grading should be conducted under the observation of the soil engineer or his representative.

5. Fill Materials

Fill material should consist of clean onsite or imported soils and shall be free of vegetation, hazardous, and other organic or deleterious materials. Import soils shall be approved, at the borrow site, at least 48 hours prior to importing to the site.

6. Compaction Standards

All fills and exposed surface of cuts should be compacted to a minimum of 90% of maximum dry density. Aggregate base below Portland cement concrete and/or asphaltic concrete pavements should be compacted to a minimum of 95% of maximum dry density.

Laboratory Standard ASTM:D 1557-78 applies for compaction of fill, backfill, and subgrade. Test method California 216 applies for compaction of aggregate base material for pavements. The attached Earthwork Specifications, where applicable, should be used as a guide to accomplish proper compaction.

7. Temporary Cuts

Vertical cuts exceeding 5 feet in height should be shored or sloped back for safety. Temporary slopes not exceeding 15 feet in height may be cut back at an inclination not steeper than 1 horizontal to 1 vertical (1:1).

8. Shrinkage and Subsidence

An average shrinkage factor of approximately 5 percent is estimated to apply to the existing fill when removed and recompacted. The same shrinkage factor is applicable to materials excavated below the existing fill surface. The subsidence of the supporting ground due to processing and placing of the compacted fill is estimated to be 1 1/2+ inches. These factors are approximate and are provided as a guide for balancing earth quantities.

9. Utility Trench Backfill

All utility trench backfills should be compacted to a minimum of 90 percent of the laboratory standard. Onsite soils will not be suitable for bedding, but are generally suitable for reuse as trench backfill provided mechanical compactive effort is applied. Flooding or jetting of native backfill soils will not be permitted.

10. Finished Grades and Surface Drainage

Finished grades should be designed and accomplished in such a manner to maintain positive drainage away from structures at all times. Some of the onsite soils are very high in expansion potential and control of drainage will be essential to the satisfactory performance of the improvements. Planters in proximity to structures should be sealed and drained. Roof gutters and downspouts should be provided to effectively discharge rain water well away from the structure.

B. DESIGN

The existing onsite soils exhibits medium to very high expansion potential when tested in accordance with UBC Standard 29-2 (see Table I of Appendix).. The natural soils or properly compacted fill are considered capable of providing adequate support for conventional shallow foundations provided that the remedial grading measures described in the grading section of this report are implemented. Based upon expansion characteristics and load carrying capabilities of the improved soils, the following preliminary design recommendations are presented. Foundation plans should be reviewed by this firm when they become available. Final recommendations should be based upon the as-graded soil conditions and should be evaluated upon completion of grading.

1. **Foundation Design**

Allowable Bearing:	2000 lbs./sq.ft.
Lateral Bearing:	350 lbs./sq.ft. at a depth of 18 inches plus 150 lbs./sq.ft.. for each additional one foot of embedment to a maximum of 2000 lbs./sq.ft.
Footing Width:	Minimum of 15 inches
Footing Depth (min.)	24 inches below lowest adjacent grade for exterior and 18 inches for interior footings
Footing Reinforcement: (all continuous footings)	Minimum four (4) number 4 bars placed two near the top and two near the bottom of footings.

Allowable bearing values may be increased as allowed by Code for transient loads such as wind or seismic. Code and structural considerations may exceed the above minimum footing depths and reinforcing requirements.

2. **Building Concrete Slabs**

Concrete slabs should have a minimum thickness of 5 inches and should be reinforced with a minimum of No. 4 bars placed at 24 inches on-center each way, or approved equivalent, placed at mid-height of the slab. All concrete slabs should be underlain with a minimum of 4 inches of sand or crushed aggregate. The sand should have a sand equivalent of 30 or more. Slab subgrade soils should be presoaked to contain at least optimum moisture content plus 5% (by the dry weight) to a depth of 12 inches prior to placing the concrete. The presaturation should be verified by the Soil Engineer at least 24 hours in advance. Final slab thickness and reinforcement should be based upon "as-graded" soil conditions and should be reevaluated after the completion of grading. Structural considerations may exceed the above minimum slab thickness and reinforcement. Adequate jointing should be

provided to control cracking (at least every ± 10 ft.).

3. Other Concrete Flatwork

Sidewalks and other exterior concrete flatwork should have a minimum thickness of 4 inches (actual) and be underlain with a minimum of 4 inches of sand. The subgrade shall be pre soaked to contain at least optimum moisture content plus 5% (by the dry weight) at the time of concrete placement and be verified by the Soil Engineer. Subgrade below all concrete slabs should be compacted to a minimum of 90 percent of maximum dry density. Longitudinal control joints should be provided (at least every ± 10 feet).

4. Settlement

Anticipated settlement of the proposed structures, using the recommended bearing values and assumed loads, is estimated to be less than 1/2 inch. Half of the total settlement is expected to occur as differential settlement.

5. Other Design Considerations

a. Chemical Analyses

Chemical analyses are being performed on representative samples of the onsite soils in an effort to determine the soluble sulfate content and resistivity of the materials as related to the type of concrete and corrosivity characteristics of the onsite soils. Results of these tests will be forth coming and will be reported under separate cover. It is anticipated that in consideration of the use of the interior slabs and cleaning of the same with detergents and solvents, use of sulfate resistant concrete will be required.

Materials of similar characteristics usually possess low resistivity. These materials are corrosive to the underground metallic structures. All such structures in direct contact with the site soils should be protected against corrosive attack.

Above recommendations are presented for budgeting purposes Recommendations based on the actual test results will be provided when the tests are complete.

The findings and recommendations contained in this report are based upon the specific excavations, observations, and laboratory tests as noted. The materials immediately adjacent to or beneath those observed may have different characteristics and no representations are made as to the quality or extent of materials not observed.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

By: _____
MIKE RAZBAN,
Project Engineer

Reviewed by:

_____
JAMES B. CASTLES,
Executive Vice President

Dist: (6) Addressee

MR:JBC/rb-01

APPENDIX

A. Field Investigation

Four (4) borings were excavated to depths ranging from 15 to 25 feet below the existing ground surface, using a 18-inch diameter bucket drill rig. Logs of the borings are presented on Plates A-1 through A-3.

Undisturbed samples, for detailed testing in our laboratory were obtained from the borings by driving a sampling spoon into the material. A split barrel type spoon, having inside diameter of 2.5 inches, with a tapered cutting tip at the lower end was used. The barrel is lined with thin brass rings, each one-inch length. The spoons penetrated into the soil approximately 12 inches. The central portion of the sample was retained for testing. All samples in the natural field condition were sealed in air-tight containers and transported to the laboratory. Bulk samples representative of the surface and/or near-surface materials were also obtained.

Blow counts were noted for each sample and are presented in the Log of Borings (Plates A-1 through A-4). Ground water was not encountered in any borings, caving did not occur in any borings.

B. Laboratory Tests

Shear tests (ASTM:D 3080-72) were made with a direct shear machine of the strain control type in which the rate of strain is 0.05-inch per minute. Specimens were subjected to shear under various normal loads at various moisture conditions. The results, expressed as friction angle and cohesion, are presented in Table I, Laboratory Test Results. and are graphically presented on Plates B-1 through B-3.

Consolidation tests (ASTM:D 2435-80) were performed on specimens of the representative soils. The consolidometers are designed to receive the specimens in the rings in the natural field condition. Porous stones, placed at the top and bottom of each specimen, permit the free flow of water from the specimen during the test. Progressive and final settlements under increasing load increments were recorded to an accuracy of 0.0001-inch. The final settlements so obtained are plotted to determine the curves shown on Plates C-1 through C-3.

Laboratory maximum density and optimum moisture content were determined on samples of the existing surface materials to determine the suitability of these soils for compaction. Tests were conducted in accordance with ASTM:D 1557-78. Results of these tests are shown on the accompanying Table I.

Particle size determinations were conducted to aid in classification of the soils (modified hydrometer portion ASTM:D 422-72).

Chemical and resistivity tests are being conducted (by other) to determine soluble sulfate concentrations and the minimum resistivity of the representative materials. Results of these tests will be presented in the future.

Expansion Index Tests were conducted in accordance with UBC Standard 29-2.

Moisture-density tests were performed on undisturbed samples of the subsurface materials.

The results of these and other tests are summarized on the Log of Borings and Table I.

GEOTECHNICAL BORING LOG

PROJECT NO.	500074	PROJECT NAME	FAIR AND EXPOSITION CENTER		
DATE STARTED	3/4/92	GROUND ELEV.		BORING DESIG.	B-1
DATE FINISHED	3/4/92	GW DEPTH (FT)		LOGGED BY	MR
DRILLER	LEDEZMA	DRIVE WT.	VARIES	NORTHING	
TYPE OF DRILL RIG	BUCKET AUGER	DROP	12 in	EASTING	

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
				2577 lbs			grass on surface, approx. 4" of fill.				
							ALLUVIUM (Qal)				
							medium clay, brown, stiff, very moist.				
		D		6		CL	small amount of white precipitates.	16.6	112	88	DSR
		B									
5		D		6		CL	silty clay, light brown to buff, with white precipitates, caliche stringers, stiff, moist.	18.6	106	85	CON
							lighter color.				
							olive/tan, increase in silt content.				
10		D		6		ML	clayey silt, tan, moist, some caliche.	14.5	115	85	
15		D		6		ML	sandy silt, tan/olive, micaceous, moist, stiff, with lenses of oxidized silty clay.	18.2	97	66	
20		D		8				11.1	109	55	
				1648 lbs							
25		D		6		CL/ML	silty clay/clayey silt, tan/olive, moist, micaceous, some caliche.	23.3	101	95	
							Total Depth 26 ft., No Water				

SAMPLE TYPES:
- C ROCK CORE
- B BULK SAMPLE
- S SPLIT SPOON
- T TUBE SAMPLE
- D DRIVE SAMPLE

- GROUNDWATER
- SEEPAGE
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO. 500074
DATE STARTED 3/4/92
DATE FINISHED 3/4/92
DRILLER LEDEZMA
TYPE OF DRILL RIG BUCKET AUGER

PROJECT NAME FAIR AND EXPOSITION CENTER
GROUND ELEV.
GW DEPTH (FT)
DRIVE WT. VARIES
DROP 12 in

BORING DESIG. B-2
LOGGED BY MR
NORTHING
EASTING

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
				2577 lbs			6" of clayey sand on walkway.				
						CL	ALLUVIUM (Qal) medium clay, dark brown, very moist, firm.				
		B					light brown/buff, caliche.				
5		D		3				24.2	101	99	
							silty clay, light brown, caliche, moist, firm.				
							light brown/buff, caliche.				
10		D		3		ML		18.5	108	88	
							clayey silt, tan/olive, moist, stiff, micaceous, minor amount of organic clay.				
15		D		5		ML		21.5	103	91	
							Total Depth 16 ft., No Water, No Caving				

SAMPLE TYPES:
[C] ROCK CORE [B] BULK SAMPLE
[S] SPLIT SPOON [T] TUBE SAMPLE
[D] DRIVE SAMPLE

GROUNDWATER
SEEPAGE
[B] BEDDING PLANE
[J] JOINTING
[C] CONTACT
[F] FAULT
[S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO. 500074
DATE STARTED 3/4/92
DATE FINISHED 3/4/92
DRILLER LEDEZMA
TYPE OF DRILL RIG BUCKET AUGER

PROJECT NAME FAIR AND EXPOSITION CENTER
GROUND ELEV.
GW DEPTH (FT)
DRIVE WT. VARIES
DROP 12 in

BORING DESIG. B-3
LOGGED BY MR
NORTHING
EASTING

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
				2577 lbs		CL	ARTIFICIAL FILL (Qaf) medium to coarse grained gravelly sand. silty clay/clayey silt, mottled dark to red brown, soft.				
							ALLUVIUM (Qal) medium clay, dark brown, moist, some white precipitates, firm.				
		D		3		CL		18.0	111	93	DS
5		D		5				18.6	106	85	
10		D		5		ML	clayey silt/silty clay, tan/olive, caliche, moist, stiff.	17.3	108	84	CON
							minor amounts of organic clay.				
15		D		11		ML/SM	sandy silt/silty fine-grained sand,tan/olive, stiff, micaceous.	7.3	103	31	
							lenses of oxidized clay, caliche, moist.				
20		D		7				17.7	110	90	
							Total Depth 21 ft., No Water				

SAMPLE TYPES:
[C] ROCK CORE [B] BULK SAMPLE
[S] SPLIT SPOON [T] TUBE SAMPLE
[D] DRIVE SAMPLE

GROUNDWATER
SEEPAGE
[B] BEDDING PLANE
[J] JOINTING
[C] CONTACT
[F] FAULT
[S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	500074	PROJECT NAME	FAIR AND EXPOSITION CENTER	BORING DESIG.	B-4
DATE STARTED	3/4/92	GROUND ELEV.		LOGGED BY	MR
DATE FINISHED	3/4/92	GW DEPTH (FT)		NORTHING	
DRILLER	LEDEZMA	DRIVE WT.	VARIES	EASTING	
TYPE OF DRILL RIG	BUCKET AUGER	DROP	12 in		

DEPTH (Feet)	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
			2577 lbs			ARTIFICIAL FILL (Qaf) silty clay, mottled black to rust brown, very moist, soft.				
	B				CL	ALLUVIUM (Qal) medium clay, dark brown, moist, firm.				DSR
						white precipitates.				
						light brown, caliche.				
5	D		4			silty clay, light brown, buff, moist, caliche.	19.5	104	84	
10	D		7		CL/ML	silty clay/clayey silt, tan, moist, stiff, caliche.	11.8	115	68	
15	D		10		ML	sandy silt/silty fine-grained sand, tan/olive, moist, stiff.	19.8	97	73	CON
						Total Depth 16 ft., No Water				

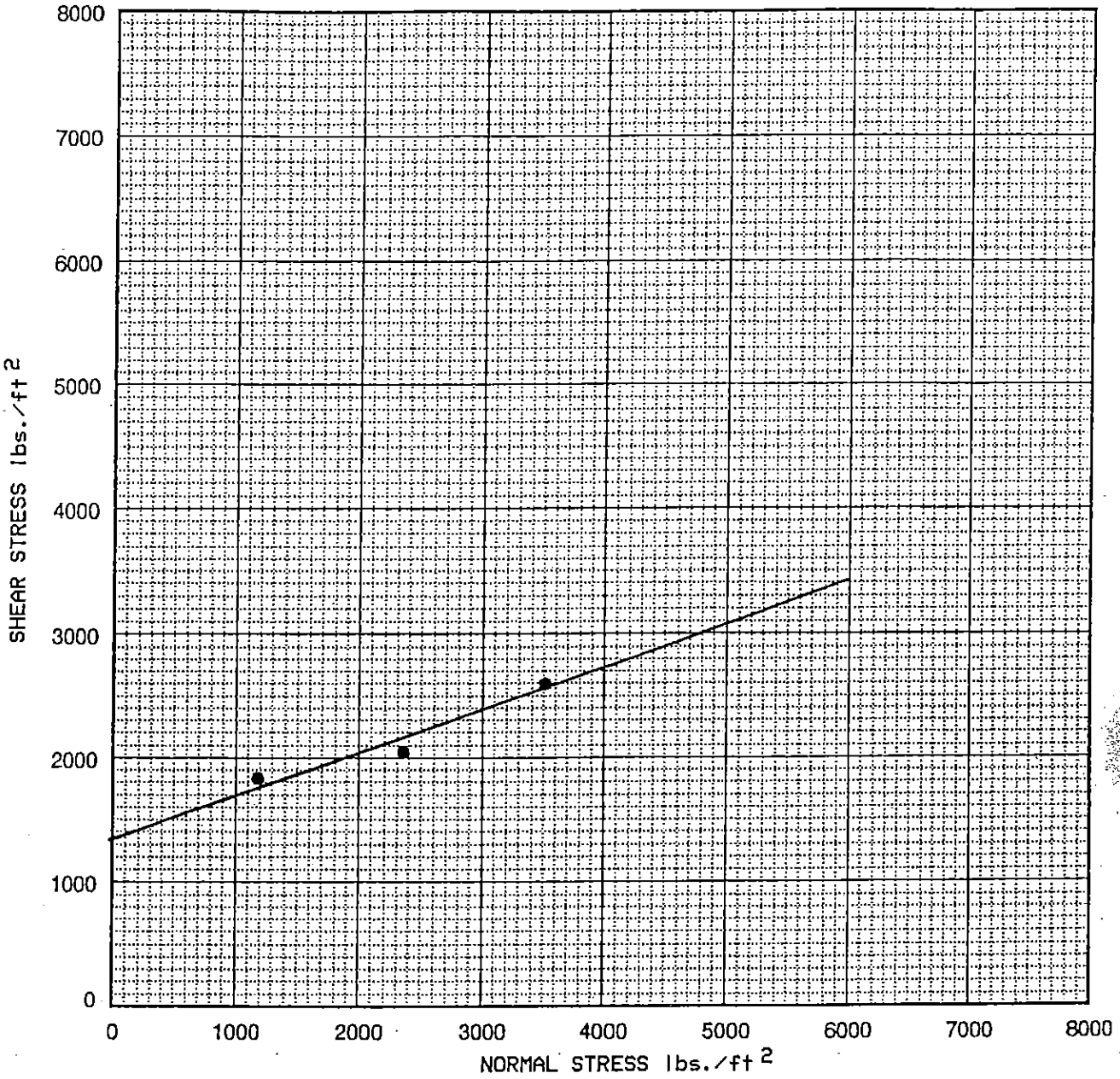
SAMPLE TYPES:
- C ROCK CORE
- B BULK SAMPLE
- S SPLIT SPOON
- T TUBE SAMPLE
- D DRIVE SAMPLE

- GROUNDWATER
- SEEPAGE
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

DIRECT SHEAR TESTS
REMOLDED



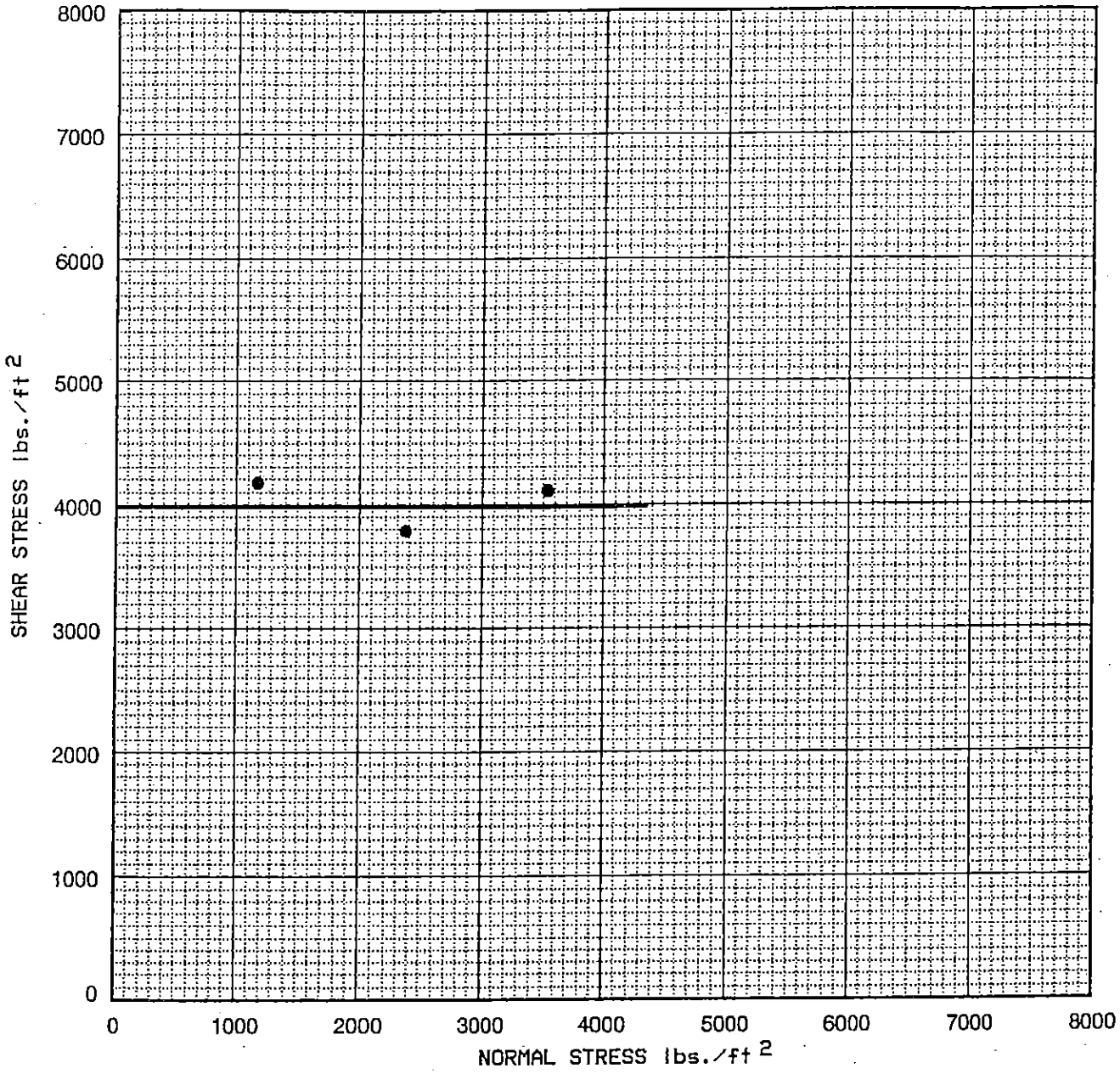
MEDIUM CLAY	COHESION 1300.0 psf.
CL	FRICTION ANGLE 20.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-1	2.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
W.O. 500074 DATE 3/17/92
PLATE B-1

DIRECT SHEAR TESTS
UNDISTURBED



MEDIUM CLAY	COHESION 4000.0 psf.
CL	FRICTION ANGLE 0.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-3	3.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
W.O. 500074 DATE 3/17/92
PLATE B-2

RECEIVED MAR 31 1989

PARKING LOT "A"
MARKET PLACE

PACIFIC SOILS ENGINEERING, INC.
17909 FITCH, IRVINE, CALIFORNIA 92714-6027
TELEPHONE: (714) 863-9118

L.A. COUNTY OFFICE
1402 W. 240th Street
Harbor City, Ca. 90710-1307
(213) 325-7272 or 775-6771

SAN DIEGO OFFICE
7370 Opportunity Road
Suite "N"
San Diego, CA 92111
(619) 560-1713

Division of Fairs & Expositions
1010 Hurley Way
Suite 200
Sacramento, California 95825

March 23, 1989
Work Order 101617

Attention: Joe Pierog

NOW "A"

Subject: Soils Investigation for Fair Grounds Parking Lot "E" Rehabilitation, Fair Drive and the 55 Freeway, City of Costa Mesa, California

Gentlemen:

This report presents soil engineering data and R-Value test results relative to grading and design for the subject parking lot. Fifteen, twelve-inch backhoe auger borings were excavated through the existing asphalt and base to a depth of 20 inches. The existing asphalt sections are presented in Table A. Representative samples for laboratory testing and visual examinations were obtained during our field investigations and transported to the laboratory.

T A B L E A

Auger Excavation	Existing Section Asphaltic Concrete, AC (inches)	Aggregate Base (inches)
1	3"	3 1/2"
2	3 1/2"	4"
3	5 1/2"	0"
4	1"	0"
5	2 1/4"	0"
6	7 1/2"	0"
7	2 1/2"	0"
8	3"	0"
9	3"	0"
10	2 1/2"	3"
11	2 1/4"	4"
12	3 1/4"	3 3/4"
13	2 1/4"	4 1/2"
14	2 3/4"	3 1/2"
15	2 1/4"	0"

A. GRADING

1. Demolition

a. The existing AC and Base should be removed from the proposed parking rehabilitation (Lot E) and stock-piled for hauling offsite.

b. The existing AC and base could be crushed (by a crushing machine) to a two inch maximum size and reused as fill material. Curbs and concrete gutters if destroyed can also be crushed and used as fill material.

2. Subgrade Preparation

a. The existing subgrade should be evaluated at the time of grading.

1) All areas requiring fill to attain design grades should be scarified 8 inches, moisture conditioned and recompacted to project standards prior to placing additional fill

2) All areas requiring cut to attain design grades should be cut to design grades scarified eight inches, moisture conditioned, and recompacted to project standards.

3) After scarification and recompaction has been completed the existing surface should be approved by the soils engineer to ascertain that a firm and unyielding surface exists at design subgrade elevations.

b. If crushing the existing A.C. and base alternative is implemented, overly wet and yielding areas could be stabilized with onsite crushed materials.

3. Compaction and Grading Operations

a. Compaction Standards

All fill and processed natural ground should be compacted to a minimum relative compaction of 90 percent, and as generally discussed in the attached "Earthwork Specifications." If miscellaneous base is used, 95 percent compaction should be achieved based on the Cal 216 Standard. Compaction should be achieved with the use of sheepsfoot rollers or similar kneading type equipment.

b. Fill Placement

After removals, scarification and compaction in-place are completed, additional fill may be placed. Fills should be placed in thin lifts (8-inch bulk), compacted and tested as grading progresses until final grades are achieved.

c. Mixing

In order to prevent layering of different soil types and/or different moisture contents, mixing of materials may be necessary. The mixing should be accomplished prior to and as part of compaction of each fill lift. Under excessively dry or wet conditions, discing may be required.

d. Inspection

All areas requiring fill should be observed by the soil engineer and governing agency (as required) after removals and prior to fill placement.

4. Pavement Design

Traffic indices have not been assigned and it is not within the scope of this firm's investigation to ascertain the future traffic load for the fair grounds, parking or related activities. However, design sections for a general range of traffic indices are presented below.

The onsite soils are high in expansion potential and the design of A.C. pavement sections must consider that potential. For preliminary design purposes an average R-Value of 2 has been assigned to the site materials. Based on that R-Value and the range of traffic indices shown in Table B, the following recommended sections are presented:

T A B L E B

Pavement Section (inches)	Traffic Index 4.5	5.0	5.5	6.0	7.0
Asphalt Concrete	3	3	3	3	3
Aggregate Base	8.5	11.5	12.5	14.5	18

As an alternative design section the following is presented utilizing a four inch asphaltic concrete thickness.

Pavement Section (inches)	Traffic Index 4.5	5.0	5.5	6.0	7.0
Asphalt Concrete	4	4	4	4	4
Aggregate Base	6.5	6.5	10.5	12.5	16.5

The base course and the asphaltic concrete should be compacted to 95% of the laboratory standard. The thickness of each course should be verified by lines and grade certification of subgrade and base sections.

5. Other Pavement Requirements

   a. An overly wet subgrade area northerly of the snack bar was observed and has been recently overlain. A 4" concrete cut off wall placed behind the curb extending to a depth of two feet could be constructed to mitigate water from planter area irrigation encroaching into the pavement subgrade.

   b. The fire lane centrally located in an east/west direction should be given consideration of a thicker section.

The findings and recommendations contained in this report are based upon the specific excavations, observations and laboratory tests as noted. The materials immediately adjacent to or beneath those observed may have different characteristics and no representations are made as to the quality or extent of materials not observed.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

By: Frank C. Wilson
FRANK C. WILSON,
Staff Engineer

Reviewed by:

JAMES B. CASTLES,
Vice President

REGISTERED PROFESSIONAL ENGINEER
JAMES B. CASTLES
No. 192
Exp. 3-31-92
GEOTECHNICAL
STATE OF CALIFORNIA

By: Theodore C. Schafnitz (wb)
THEODORE C. SCHAFNITZ,
Staff Engineer

Dist: (4) Addressee
(2) 32nd District Agricultural Assoc.
Attn: Hank Vidal

FCW:TCS:JBC/lb/wb-0001

TABLE I

DATE	TEST NO.	LOCATION	ELEV.*	MOIST. %	UNIT DRY WT. (pcf)	REL. COMP. %	SOIL TYPE	TEST TYPE
7/25/89	101-SG	LOT E	SG	13.4	115.6	99	A	
"	102-SG	LOT E	SG	12.7	113.9	97	A	
"	103-SG	LOT E	SG	12.2	114.2	98	A	
"	104-SG	LOT E	SG	13.0	115.0	98	A	
7/26/89	105-SG	LOT E	SG	12.8	111.8	96	A	
"	106-SG	LOT E	SG	13.1	113.9	97	A	
"	107-SG	LOT E	SG	11.9	110.0	94	A	
"	108-SG	LOT E	SG	14.2	111.2	95	A	
"	109-SG	LOT E	SG	13.4	112.1	96	A	
"	110-SG	LOT E	SG	14.0	112.7	96	A	
7/27/89	111-SG	LOT E	SG	14.4	111.7	95	A	
"	112-SG	LOT E	SG	12.1	112.8	96	A	
"	113-SG	LOT E	SG	11.9	114.0	97	A	
"	114-SG	LOT E	SG	13.6	111.0	95	A	
"	115-SG	LOT E	SG	14.0	113.1	97	A	
"	116-SG	LOT E	SG	12.8	112.5	96	A	
7/28/89	117-SG	LOT E	SG	14.0	112.7	96	A	
"	118-SG	LOT E	SG	12.9	111.1	95	A	
"	119-SG	LOT E	SG	13.3	114.1	97	A	
"	120-SG	LOT E	SG	12.8	113.2	97	A	
"	121-SG	LOT E	SG	13.8	112.5	96	A	
"	122-SG	LOT E	SG	11.9	111.3	95	A	
7/31/89	123-B	LOT E	BG	8.9	127.3	96	B	
"	124-B	LOT E	BG	9.0	128.0	97	B	
"	125-B	LOT E	BG	8.1	126.8	96	B	
8/1/89	126-B	LOT E	BG	9.5	129.0	98	B	
"	127-B	LOT E	BG	10.4	130.4	99	B	
"	128-B	LOT E	BG	9.1	128.4	97	B	
"	129-B	LOT E	BG	9.5	127.0	96	B	
"	130-B	LOT E	BG	10.6	128.1	97	B	
"	131-B	LOT E	BG	9.2	129.8	98	B	
"	132-B	LOT E	BG	9.0	126.9	96	B	
"	133-B	LOT E	BG	9.9	127.5	97	B	
"	134-B	LOT E	BG	10.0	128.4	97	B	

Pac Amp

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVENUE, SUITE 514, TUSTIN, CALIFORNIA 92780
TELEPHONE: (714) 730-2122, FAX: (714) 730-5191

JOHN SERGIO FISHER AND ASSOCIATES
5567 Reseda Boulevard, Suite 209
Tarzana, CA 91356

August 24, 2004
Work Order 500643

Attention: Ms. Eva Hsieh

Subject: **SUPPLEMENTAL GEOTECHNICAL COMMENTS**
Proposed Pacific Amphitheatre Renovation
Orange County Fair and Exposition Center
88 Fair Drive, Costa Mesa, California

References: See Appendix

Dear Ms. Hsieh:

Presented herein are Pacific Soils Engineering, Inc.'s (PSE) supplemental geotechnical comments regarding the proposed Pacific Amphitheatre renovation at Orange County Fair and Exposition Center, located at 88 Fair Drive in the City of Costa Mesa, California. These comments are intended to resolve questions and clarify issues that were discussed in a meeting on August 18, 2004 with representatives of KPFF Consulting Engineers, the project structural engineer.

Vertical Loads on Piles

- The vertical capacities presented on Plates B through I of the Reference 4 report are allowable loads.

Lateral Loads on Piles

The following comment are presented with respect to lateral loads on the proposed pile foundation system:

- The passive resistance provided by a pile cap/grade be may be combined with lateral resistance provided by the piles. The lateral bearing values presented in Section 5.1 of the Reference 4 report may be used when design the pile cap/grade beam.

- The lateral resistance indicated on Plate J of the Reference 4 report is an ultimate value. Typically, a factor of safety on the order of 3 is used when determining allowable loads.

- Per the structural engineer's request, the following tables summarize lateral load design data for pile head deflections on the order of ¼ and ½ inches for both 36 and 24-inch diameter piles. The capacities are for piles with lengths equal to or greater than the depths to negligible moment. The pile capacities below are from a geotechnical perspective, based on strengths of materials. The pile sections should be checked by the structural engineer to evaluate the structural capacity of the piles. The lateral capacities below are ultimate values and should not be increased for wind or seismic loads. The deflections and moments presented below were estimated assuming a lateral load applied at the ground surface and that the top of pile is coincident with the ground surface. As such, the depths to maximum and negligible moment indicated in the tables below are from the ground surface.

Lateral Load Design Data 24-Inch Diameter Piles				
	Pile Head Deflection (inches)			
	¼		½	
Pile Head Condition	Free	Fixed	Free	Fixed
Lateral Load (kips)	10	28	23	57
Maximum Moment (kip-ft)	57	193	132	393
Depth to Maximum Moment (ft)	9	0	9	0
Depth to Negligible Moment (ft)	31	9	31	9

Lateral Load Design Data 36-Inch Diameter Piles				
	Pile Head Deflection (inches)			
	¼		½	
Pile Head Condition	Free	Fixed	Free	Fixed
Lateral Load (kips)	22	55	44	110
Maximum Moment (kip-ft)	177	525	354	1048
Depth to Maximum Moment (ft)	14	0	14	0
Depth to Negligible Moment (ft)	42	13	42	13

Elevator Shaft Pit Wall

The following additional comments are presented regarding the proposed elevator shaft pit wall:

- When designing to resist seismic forces, the seismic increment for the proposed elevator pit shaft wall should consider the combined height of the existing retaining wall and proposed, subjacent elevator pit shaft wall. The seismic increment can be considered as an ultimate load. As allowed by Code, a one-third increase in bearing values may by utilized when designing to resist short-term loads such as wind or seismic.

- In addition to the 2,200 lb. (per foot of width) surcharge resultant from the vertical bearing of the existing retaining wall footing that was mentioned in Reference 4, the elevator pit shaft wall should consider an additional horizontal force applied by the existing retaining wall

footing. This force can be considered as being equal to the passive resistance originally provided by the soil in front of the existing retaining wall footing.

Geotechnical Observation and Testing

The bearing values for shallow foundations presented in Section 5.1 of Reference 4 assume that the proposed footings are situated in competent native soils or compacted fill. Consequently, footing excavations should be observed and tested (as necessary) by the geotechnical engineer's representative prior to steel or concrete placement. Based on field conditions, additional recommendations may be necessary. As indicated in Reference 4, this may involve removal of potentially expansive soils and replacement with compacted selected materials as well as removal and recompaction of soils disturbed during demolition.

Also, as indicated in Reference 4, geotechnical observation of the drilled pile excavations should be performed during construction to verify the assumptions used in developing the design recommendations.

CLOSURE

The recommendations presented in Reference 4 remain valid unless specifically superceded herein. Should you have any questions, please do not hesitate to contact this firm at (714) 730-2122.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

Ronald A. Reed

RONALD A. REED/RGE 2524
RCE 53581/Reg. Exp.: 6-30-07
Manager of Geotechnical Services

Distribution: (4) Addressee
(2) KPFF Consulting Engineers, Attn.: Ms. Marie-Dominique Seta
RAR:rb:kz-500643, August 24, 2004 (Supplemental Comments)

APPENDIX

Selected Geotechnical References

1. Geotechnical Report for Proposed Pacific Amphitheatre for Nederlander West, Inc., Orange County Fair and Exposition Center, Costa Mesa, California; by Pacific Soils Engineering, Inc., dated June 26, 1981 (W.O. 100957).

2. UBC Design Parameters, Proposed Pacific Amphitheatre Renovation, Orange County Fairgrounds, Costa Mesa, California; by Pacific Soils Engineering, Inc., dated June 14, 2004 (W.O. 500643).

3. Geotechnical Comments, Deep Foundation Design Parameters, Proposed Pacific Amphitheatre Renovation, Orange County Fairgrounds, Costa Mesa, California; by Pacific Soils Engineering, Inc., dated July 20, 2004 (W.O. 500643).

4. Geotechnical Comments, Proposed Pacific Amphitheatre Renovation, Orange County Fair and Exposition Center, 88 Fair Drive, Costa Mesa, California; by Pacific Soils Engineering, Inc., dated August 11, 2004 (W.O. 500643).

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JOHN SERGIO FISHER AND ASSOCIATES
5567 Reseda Boulevard, Suite 209
Tarzana, CA 91356

August 11, 2004
Work Order 500643

Attention: Ms. Eva Hsieh

Subject: **GEOTECHNICAL COMMENTS**
Proposed Pacific Amphitheatre Renovation
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, California

References: See Appendix A

Dear Ms. Hsieh:

Presented herein is Pacific Soils Engineering, Inc.'s (PSE) geotechnical review and comments regarding the proposed Pacific Amphitheatre renovation at Orange County Fair and Exposition Center, located at 88 Fair Drive in the City of Costa Mesa, California. Our review is based on the architectural plans prepared by John Sergio Fisher and Associates, dated June 26, 2004.

EXECUTIVE SUMMARY

The comments and recommendations included herein are based on PSE's previous studies of the site (Reference 1). The proposed development plan includes an expansion of the existing stage area, the addition of dressing rooms, storage spaces and other varied improvements.

Marine terrace deposits underlie the site. The site is not within an Alquist–Priolo Earthquake Fault Zone, or within a State defined zone as having a potential for earthquake-induced liquefaction or landsliding.

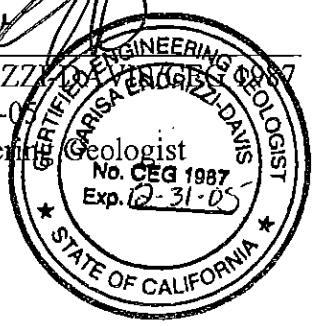
Piles will be required to support the proposed stage area/dressing room structures in order to minimize loading on the existing 25± foot tall retaining wall and it's foundation. Based on our review of the referenced reports, the recommended piles should be advanced to below elevation 30± feet in order to penetrate into a dense sand layer.

Based on PSE's review, it is our opinion that development is feasible from a geotechnical point of view, provided that recommendations presented herein and developed during more detailed future investigations are incorporated in the design and construction of the project.

Should you have any questions, please do not hesitate to contact this firm at (714) 730-2122.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

CARISA ENDRIZZI-DAVIS/CEG 1987
Reg. Exp.: 12-31-05
Certified Engineering Geologist



RONALD A. REED/RGE 2524
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(2) KPFF Consulting Engineers, Attn.: Ms. Marie-Dominique Seta

CED:RAR:rb-500643, August 11, 2004 (OCFair Comments)

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Appendix A - Selected References

Appendix B - Seismicity Study (Plates B-1 through B-4 and Table B-1)

Appendix C - Pile Embedment Figures (Plates B through J)

1.0 INTRODUCTION

This report presents the results of a recently completed limited data and plan review. The review is intended to aide in the design and construction of the proposed development.

1.1 Scope of Study

The scope of this study consisted of the following tasks:

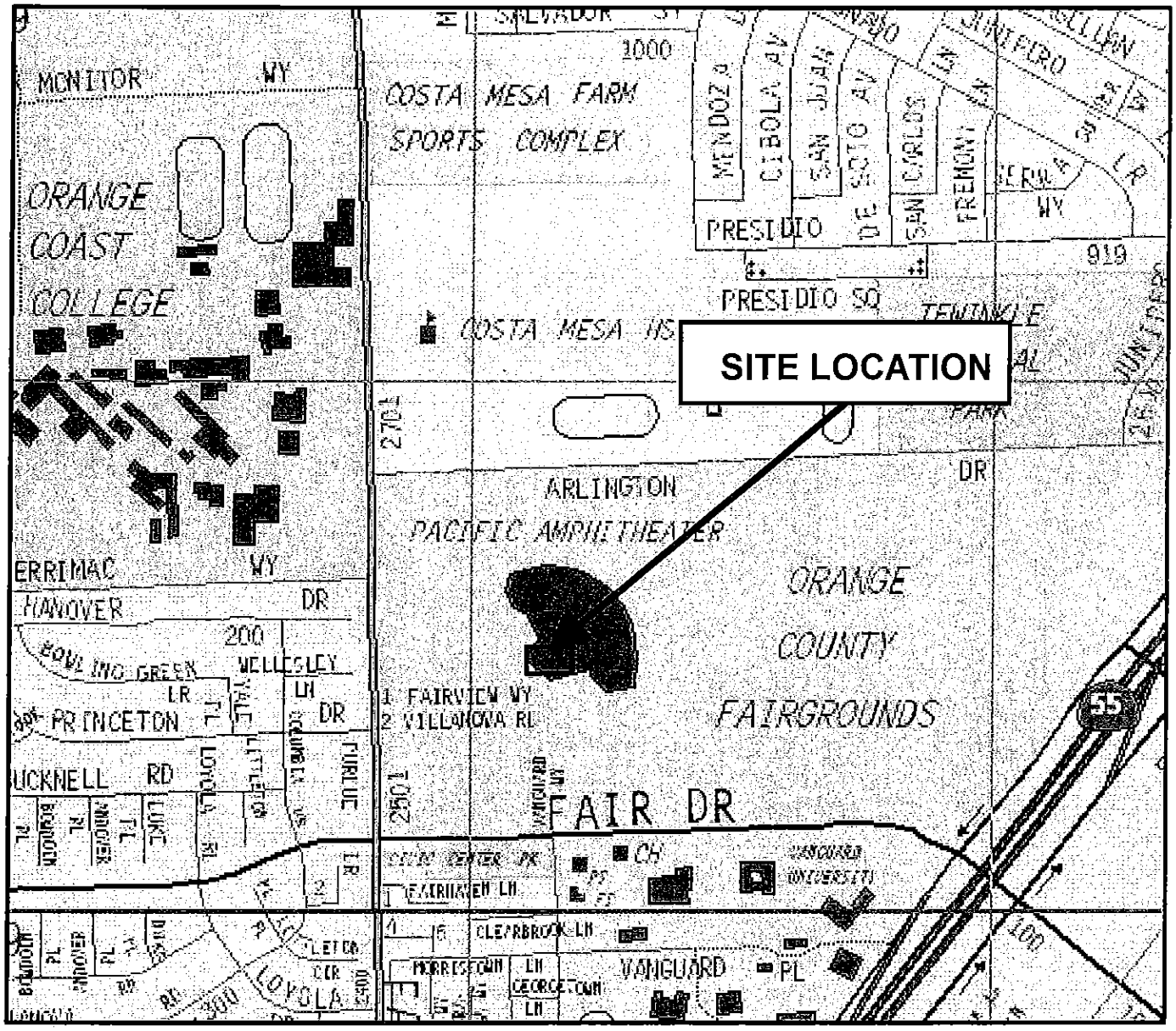
- Reviewing published documents, maps, and geotechnical reports concerning the general area of the subject site.
- Conducting a limited seismicity study.
- Preparing this report to present general conclusions and recommendations relative to the geotechnical constraints that may affect development of the subject site.

1.2 Site Location and Description

The Pacific Amphitheatre is located within the Orange County Fair and Exposition Center at 88 Fair Drive in the City of Costa Mesa. A site location map is included as Figure 1. The facility consists of an open-air amphitheatre and support facilities located on about 11± acres. Cut/fill grading was utilized during original construction to construct the bowl-type configuration of the amphitheatre with the stage foundation excavated some 40 feet into the ground and the surrounding berm was filled as much as 50 feet above original grades. The current stage and support area consists of structures supported on piles and retaining walls.

1.3 Proposed Development

It is our understanding that the proposed renovation would involve expansion of the existing stage and the addition of dressing rooms, storage spaces and other varied improvements.



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SITE LOCATION MAP

FIGURE 1

SOURCE MAP: THE THOMAS GUIDE
2004 STREET GUIDE

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2.0 GEOLOGIC CONDITIONS

2.1 Regional Setting

The site lies within the southern margin of the Los Angeles Basin, located within the larger geomorphic province known as the Peninsular Ranges. This province is characterized by northwest trending valleys and mountains that, in part, owe their existence to regional northwest trending geologic structures. The site is situated on the broad, relatively low-lying coastal plain, which has been uplifted in part due to the northwest-trending Newport-Inglewood Fault.

2.2 Surficial Deposits/Stratigraphy

Based on boring data provided in the Reference 1 report and our general knowledge of the site, surficial units at the site consist primarily of marine terrace deposits.

The terrace deposits consist of sands, silts and clays in varying proportions. These deposits are largely fine-grained above elevation 30 (approx.). Below elevation 30, the soils become largely granular in nature, consisting mostly of silty sands and sands. The terrace deposits have been broadly warped as a result of uplift and are essentially flat lying.

2.3 Geologic Structure/Regionally Mapped Active Faults

Complex faulting and folding dominate the geologic structure of the Los Angeles Basin and surrounding mountain ranges. In addition to the more widely known and studied faults such as the nearby Newport-Inglewood and the Whittier-Elsinore, research conducted by Grant et al (1999, 2002) theorizes the existence of a local blind thrust fault known as the San Joaquin Hills Blind Thrust. Grant et al. propose that uplift of the nearby San Joaquin Hills was generated by movement on the above mentioned fault due to partitioned strike-slip and compressive shortening across the southern Newport Inglewood fault zone. Uplift of the marine terrace deposits in the Newport, Costa Mesa area, on which

the site lies, may also be the result of movement on the San Joaquin Hills Blind Thrust. However, the San Joaquin Hills Blind Thrust has not yet been studied in sufficient detail to determine the existence, location, or subsurface geometry of the fault let alone classify it as "Active" pursuant to the guidelines of the Alquist-Priolo Earthquake Fault Zoning Act. The San Joaquin Hills have been rising tectonically at an average of 0.21-0.27 m/k.y during the last 122,000 years (Grant et al., 1999, 2002).

There are several large active fault systems in the region, which are capable of affecting the site in the form of seismic shaking. These fault systems have been studied extensively and in a large part control the geologic structure of southern California. The prominent regional fault systems are the Newport-Inglewood fault system and the Whittier fault system. The southern Los Angeles basin has been estimated to have low seismic hazard relative to the greater Los Angeles Region (WGCEP, 1995), in part because it has fewer known active faults and historically lower rates of seismicity. Current standard of practice suggests that the San Joaquin Hills Blind Thrust be considered a seismic source in regional hazard assessment (Grant, et al). It should be noted that the distances between the fault and the site can vary depending on how the attenuation curves analyze the fault geometry and from which portion of the fault the distance is measured (other reference points include but are not limited to: surface projection along fault trace or along the rupture area, and the seismogenic rupture). The following distances are approximate, and unless otherwise noted are between a point within the site boundary to the closest distance of the projection of a possible rupture area along the fault trace.

2.3.1 San Joaquin Blind Thrust Fault System

This newly postulated fault system is based on Grant and others (1999, 2002) research findings. The fault system reportedly extends approximately from San Clemente State Beach to the Santa Ana River.

The model assumed in the FRISK analysis for this fault has a 23-degree southwest dip extending from 2 km to 8 km depth. The rupture bottom is approximately coincident with the location of the offshore Newport-Inglewood fault zone. The slip rate is 0.50 +/-0.20 mm/yr, and it is based on the average late Quaternary uplift rate of the San Joaquin Hills of 0.21 to 0.27 mm/r and inferred dip of 20 to 30 degrees. The maximum magnitude (Mw) is 6.6. In the analysis performed with FRISK software, the closest distance from the site to the projection of the postulated rupture area along the fault trace is approximately 6 km.

2.3.2 Newport-Inglewood Fault System

The Los Angeles Basin branch of the Newport-Inglewood fault system is located approximately 5 to 6 kilometers west of the subject site. This fault system, approximately 66 kilometers long, extends northwesterly from a point approximately 8 kilometers offshore of Laguna Beach to the Santa Monica Mountains. The Newport-Inglewood is a right-lateral fault system characterized by a series of en echelon (sub-parallel) faults which exhibit considerable offset at depth with little or no evidence of surface displacement. The slip rate for this fault is about 1.5 mm per year, with a maximum magnitude (Mw) of 6.9, and a characteristic rate of 0.00154 (events/yr).

2.3.3 Whittier Fault System

The active Whittier fault system lies approximately 29 kilometers from the site. The Whittier fault, which runs between Santa Ana Canyon and Whittier Narrows, is the northwesterly extension of the Elsinore fault. This fault is a right-lateral strike-slip fault with some reverse-oblique slip, which may be partially responsible for the uplift of the Puente Hills. The slip rate for this fault is about 2.5 mm per year, with a maximum magnitude (Mw) of 6.8.

2.4 Groundwater

Boring data from the Reference 1 report reveals that groundwater was encountered at depths of about 68 feet below the original ground surface or at an elevation of approximately 0 feet. The Seismic Hazard Zone Report for the Newport Beach 7.5-minute Quadrangle (Reference 4) reports that the historically highest groundwater depths recorded were approximately 30 feet below the surface. Based on the levels observed during the previous exploration, groundwater is not expected to impact the proposed development. Special considerations may be required if the piles penetrate below elevation 0.

2.5 Earthquake Hazards

2.5.1 Seismicity

Southern California is a tectonically active region. Several faults in Southern California serve to alleviate stresses in the earth's crust that result from differential movements between the Pacific and North American Plates.

The type or severity of seismic hazards affecting the site is chiefly dependent upon the distance to the causative fault, the intensity of the seismic event, and the soil characteristics. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction or dynamic settlement.

Seismic hazard maps of the area generated from the Seismic Hazard Zone Report of the Newport Beach 7.5 Minute Quadrangle 1997(Revised 2001), delineate contours of peak ground acceleration with 10% probability of Exceedence in fifty years for firm and soft rock conditions as well as for alluvium. For the subject site, values for alluvium would apply. The report indicates that the corresponding peak ground acceleration level under the Pacific Amphitheatre is .36 for alluvium soil conditions.

However, these published accelerations do not account for the San Joaquin Hills Blind Thrust nor do they utilize the more conservative Upper Bound Earthquake (UBE) Ground Motion, which is defined as a 10% probability of Exceedence in one hundred (100) years.

A probabilistic seismic hazard analysis of the site was performed using FRISKSP software (R. Blake, 1994-2000). We selected Boore (1997), Campbell and Bozognia (1997 Rev.), and Sadigh et al. (1997) attenuation relationships for alluvium-type condition considering both the Upper Bound Earthquake (UBE) Ground Motion (10% probability of Exceedence in 100 years), and the Design-Basis Earthquake (DBE) Ground Motion (10% probability of Exceedence in 50 years). These levels of ground motion correspond to return periods of approximately 949 years and 475 years respectively. The following discussion presents the accelerations calculated using an unpublished model of the San Joaquin Hills Blind Thrust Fault.

Average peak ground acceleration for the site was calculated, using the attenuation relationships listed above. The FRISK analysis resulted in an acceleration of: 0.45g for the UBE and 0.36g for the DBE with the postulated San Joaquin Hills Thrust Fault included but weighted 25%. Included in Appendix B is the complete seismic analysis.

2.5.2 Surface Rupture

The site is not in an Alquist-Priolo Earthquake Fault Zone as established by the State of California, Division of Mines and Geology. Further, based on our review of published geologic data, no active faults have been identified on-site at the near surface. Recent information theorizes that the San Joaquin Hills Thrust Faults may be active. This fault as hypothesized,

lies at depth, beneath the subject site. However, being a blind thrust fault it would not express surface rupture.

The nearest mapped active fault to the site is the Newport-Inglewood Fault (Type B) located approximately 6 kilometers to the southwest (UBC, 1997). Based on literature review (references), the potential for fault surface rupture on the subject site is unlikely, although in seismically active California that possibility can never be categorically ruled out.

2.5.3 Liquefaction

Liquefaction is the phenomenon where the buildup of excess pore pressures, in saturated granular soils due to seismic agitation, results in a temporary "quick" or "liquefied" condition. According to the State of California Seismic Hazard Zone Map for the Newport Beach 7.5-Minute Quadrangle the underlying terrace deposits are not within an area that is susceptible to liquefaction. This is likely due to the fines content exhibited by the majority of site soils and the density of the underlying sands as revealed by the previous borings. Additionally, groundwater was not encountered during the previous field investigation to depths within 68 feet. As such, the potential for liquefaction at the site is considered remote.

2.5.4 Seiches

A seiche is a free or standing-wave oscillation on the surface of water in an enclosed or semi-enclosed basin. The wave can be initiated by an earthquake and can vary in height from several centimeters to a few meters. The site is not located adjacent to any freestanding bodies of water. Therefore, it is our opinion that there is not a significant seiche hazard at the site.

2.5.5 Dynamic Settlement

Dynamic (dry sand) settlement can occur during a seismic event and can be of greatest significance when it results in non-uniform surface settlement. The majority of underlying alluvial materials generally do not possess grain size distribution characteristics associated with dry sand settlement. Accordingly, dry sand settlement is not considered to be a significant design constraint.

2.5.6 Seismically Induced Landsliding

The potential for seismically induced landsliding at the site is considered low due to the relatively flat terrain that surrounds the site.

3.0 ENGINEERING CHARACTERISTICS OF ONSITE EARTH MATERIALS

The major engineering characteristics that require consideration are as follows:

- Compressibility/collapsibility of in-situ, natural surficial soil deposits;
- Excavation characteristics;
- Earthwork adjustments;
- Geotechnical properties;
- Expansion potential;
- Shear strengths;

Presented below is a more detailed discussion of the soil characteristics identified above.

3.1 Compressibility/Collapsibility (Non-Dynamic)

Considering that the improvement will be founded in previously placed compacted fill or "deep" native soils, compressibility/collapsibility is not anticipated to be a design constraint.

3.2 Excavation Characteristics

The on-site soils can be easily excavated using conventional grading equipment. Pile excavation is not anticipated to present difficulties to normally utilized equipment. Casing is not anticipated at this time. Final pile depth should be provided to the geotechnical engineer for review and additional comments, as necessary.

3.3 Earthwork Adjustments

The onsite materials are anticipated to shrink on the order of 10 percent when excavated and recompacted as structural fill.

3.4 Geochemical Analysis

The soils were not tested for soluble sulfates as part of the Reference 1 investigation that serves as a basis for this report. Additional testing for pH, sulfates and resistivity is recommended during grading/construction to develop a more comprehensive evaluation of the conditions.

3.5 Expansion Potential

Expansion index testing (UBC Standard 18-2, formerly Standard 29-2) was performed as part of the Reference 1 investigation and indicated "high" to "very high" expansion potential for some onsite soils when classified in accordance with Table 18-I-B of the UBC.

3.6 Shear Strength

Shear strength testing was performed on selected "undisturbed" ring and bulk samples obtained during the previous investigation. Results at the tests were presented in Reference 1.

4.0 GRADING RECOMMENDATIONS

Based on the proposed architectural plan, significant site grading is not anticipated to be required to complete the proposed renovation. However, onsite soils disturbed by

demolition operations, backfill associated with retaining walls, etc. should be treated as follows.

4.1 Proposed/Remedial Grading

Significant amounts of proposed grading are not depicted on the plans. However, shallow fills and or cuts on the order of 2± feet may be necessary in some areas. Remedial grading is anticipated to consist of removing potentially expansive soils underlying slabs and replacement with compacted, select materials as well as removal and recompaction of soils disturbed during demolition operations.

4.2 Compaction Standards

All fill and processed natural ground within building areas shall be compacted to a minimum relative compaction of 90 percent, as determined by ASTM Test Method: D-1557-91. Compaction shall be achieved at slightly above the optimum moisture content. Mixing and moisture conditioning may be required in order to achieve the required moisture conditions.

5.0 DESIGN AND CONSTRUCTION RECOMMENDATIONS

5.1 Shallow Foundation Design

Footings supporting the proposed improvements bearing in competent native soils or compacted fill should be designed using the following recommendations.

- Allowable Bearing: 2,000 lbs./sq.ft.
- Lateral Bearing: 200 lbs./sq.ft. per foot of embedment to a maximum of 3,000 lbs./sq.ft.
- Sliding Coefficient 0.33
- Footings should be embedded a minimum of 18 inches below lowest adjacent grade.
- Given the highly expansive nature of some onsite soils, foundations/footings should be minimally reinforced with f bars; two (2) near the top and two (2) near the bottom. The minimum recommendations from a geotechnical perspecti and/or code requirements may govern.

5.2 Deep Foundation Design Recommendations

In order to reduce the impact of the proposed improvements on the existing structures it is proposed to support the proposed dressing room and major stage area structural improvements on a deep foundation system. Proposed piles should not be located within 16 horizontal feet of the back the retaining wall in order to reduce the effects that lateral loading may have on the existing retaining wall. This restriction may require additional reinforcement of the dressing room floor in order to span between supporting pile elements. Foundation plans for the existing improvements should be reviewed to confirm that the proposed new foundations do not interfere or create stress increases on the existing foundation system. The drilled piles should be founded in a silty sand/sand layer that was encountered in PSE's previous exploration (see referenced report) at an approximate elevation of 30± feet. This corresponds to a depth of roughly 13± feet below the stage area and 36± below the existing ground surface at the top of the wall. A minimum embedment of 5 five feet into the sand layer will be required. Soils above the sand layer should not be considered as providing vertical load carrying capacity. The following recommendations are presented for such a system.

- Axial (vertical) load capacity of the piles may be estimated using attached Plates B through E in Appendix C. Plates B and C pertain to pile elements founded behind the existing retaining wall, while Plates D and E pertain to piles in front of the wall.
- As allowed by Code, a one-third increase in allowable stresses may be used when considering short-term loads such as wind or earthquake.
- Allowable uplift capacity for the piles is presented on Plates F through I in Appendix C. These values do not include the weight of the pile.
- Lateral Resistance (Pile): Lateral resistance provided by the soil to the piles may be determined using accompanying Plate J in Appendix C.
- Coefficient of Lateral Subgrade Reaction (tons.ft^3) 12 $^z/_D$; where z = depth below lowermost finish grade; D= pile diameter.

- Minimum diameter for the proposed piles should be 24 inches and the minimum spacing of the piles should be three (3) diameters. Structural considerations may govern the minimum pile diameter.
- Depth to fixity may be assumed to be 10 feet from the top of ground surface or finish floor elevation.
- Additional recommendations may be necessary based on input from the structural engineer.
- Geotechnical observation of the drilled pile excavations should be performed during construction to very the assumptions used in developing the design recommendations.

5.3 Design Settlement Potential

The allowable pile capacities presented herein assume that some settlement will occur so that frictional resistance along the pile can be developed. This settlement is generally on the order of ¾ to 1± inch. Differential settlement on the order of half of the aforementioned values should be anticipated.

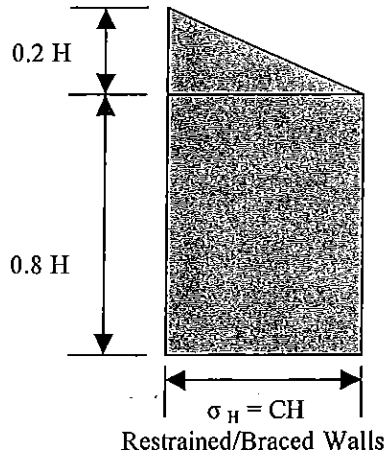
5.4 Slab Design

Non-structural slabs should be a minimum of four (4) inches in thickness and should be placed over four (4) inches of clean sand. Subgrade below the sand should be moisture conditioned to 140% of optimum moisture content to a depth of 12 inches. Structural slabs should be designed per the structural engineer's recommendations.

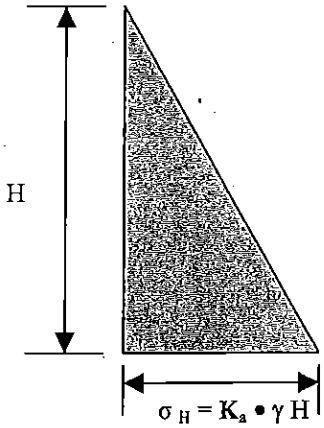
5.5 Retaining Wall Design

Unrestrained retaining walls, free to rotate at least 0.001 radians, may be designed to resist lateral pressures imposed by a fluid with a unit weight determined in accordance with Table 5-1. The table also presents design parameters for restrained retaining walls. These parameters may be used to design retaining walls that may be considered as restrained due to the method of construction or location (corner sections of unrestrained retaining walls). Retaining walls should

be designed to resist lateral forces determined in accordance with the following figures and Tables.



Restrained/Braced Walls



Unrestrained Walls

TABLE 5-1
RETAINING WALL DESIGN PARAMETERS

Slope of Retained Material (Horizontal:Vertical)	Unrestrained, $K_a \bullet \gamma$ (pcf)		Restrained, C (pcf)	
	Select Backfill	In-Situ Soils	Select Backfill	In-Situ Soils
Level	40	85	30	64

- The design loads presented in the above table are to be applied on the retaining wall in a horizontal fashion and as such friction between wall and retained soils should not be allowed in the retaining wall analyses.
- Additional allowances should be made in the retaining wall design to account for the influence of construction loads, temporary loads, and possible nearby structural loads such.
- Seismic forces in addition to the static loading may need to be considered in the design of the walls. The seismic load can be modeled as a thrust load applied at a point ⅔H above the base of the wall, where H is equal to the wall height. This load (in pounds per lineal foot of wall) is equal to $22H^2$, where H is equal to the height of the wall (in feet). When combining both static and seismic loading

conditions, an overall factor of safety on the order of 1.2 is typically required.

- Unit weights of 120 pcf and 130 pcf may be used to model the dry and wet unit weight of on-site compacted fill materials.
- Select backfill should be granular, structural quality backfill with a Sand Equivalent of 30 or better and an ASCE Expansion Index of 20 or less. The select backfill must extend at least one-half the wall height behind the wall; otherwise, the values presented in the **Native Backfill** columns must be used for the design. Native backfill should have an ASCE Expansion Index of 50 or less. The upper one-foot of backfill should be comprised of native on-site soils. The recommended retaining wall backfill and drain system profile is shown on Plate A.
- As a minimum, a 1-foot wide zone of select backfill should be placed behind the wall to provide drainage. Otherwise, the wall design should include the potential for hydrostatic forces to develop behind the wall.
- Retaining wall designs should include waterproofing (where appropriate) and backdrains or weep holes for relieving possible hydrostatic pressures. The backdrain should be comprised of a 4-inch perforated PVC pipe in a 1 ft. by 1 ft., ¾-inch gravel matrix, wrapped with a geofabric. The backdrain should be installed with a minimum gradient of 2 percent and should be outletted to an appropriate location.
- No backfill should be placed against concrete until minimum design strengths are achieved in compression tests of cylinders.

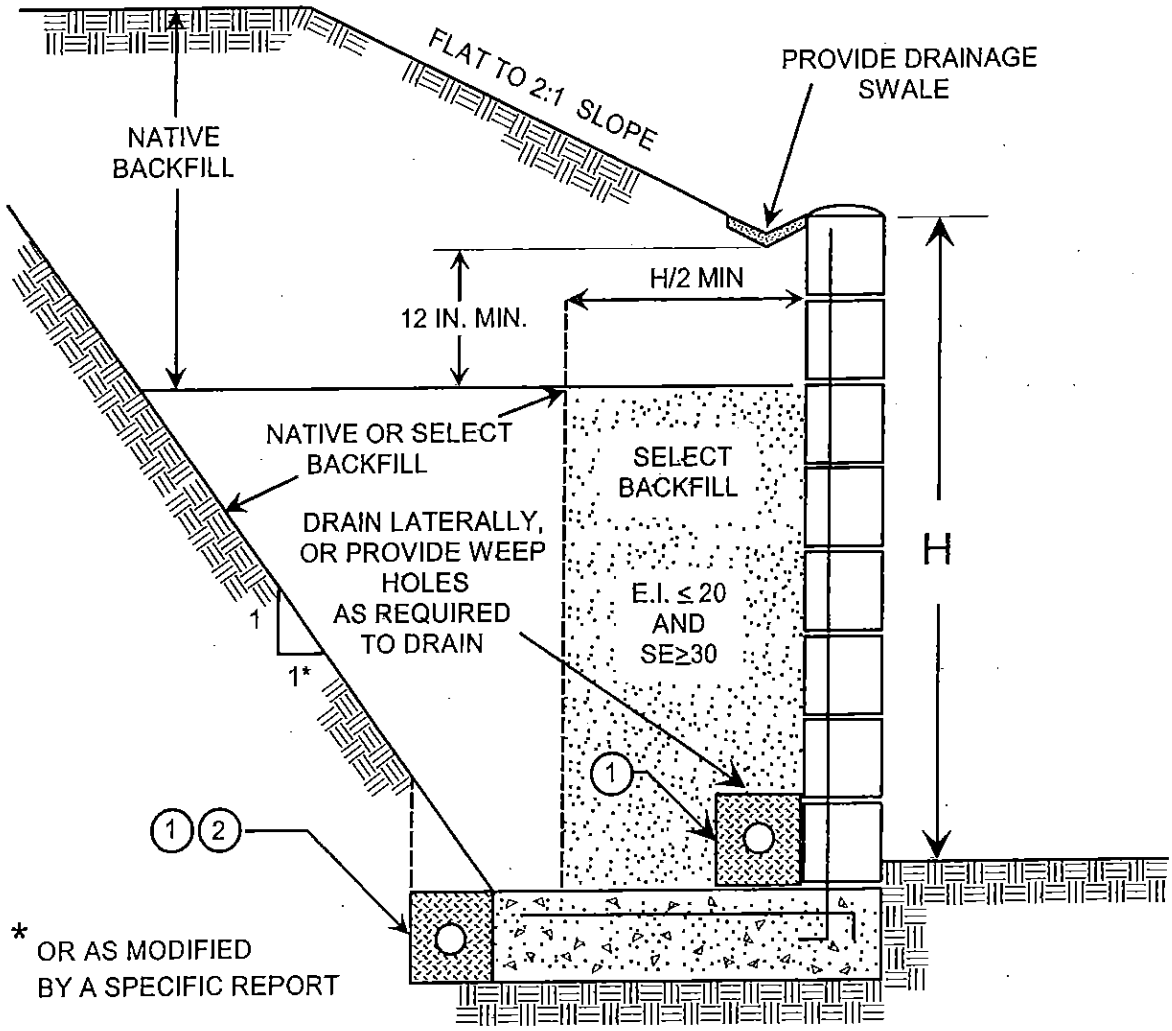
5.6 Elevator Pit Shaft Wall

The elevator pit shaft wall located adjacent to the existing retaining wall should be designed to consider the footing surcharge from the retaining wall. For design purposes, it was assumed that the existing wall footing applies a 2,000 psf bearing stress at a distance of four (4) feet away from the back of the proposed wall face.

It may be possible to temporarily support the existing footing during construction by using piles. These piles could possibly be integrated into the ultimate wall design. The piles should be designed to resist lateral earth pressures presented in

RETAINING WALL BACKFILL

N.T.S.



(1) 4 INCH PERFORATED PVC, SCHEDULE 40, SDR 35 OR APPROVED ALTERNATE, PLACE PERFORATIONS DOWN AND SURROUND WITH 1 CU. FT. PER FT. OF 3/4 INCH ROCK OR APPROVED ALTERNATE AND MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT

(2) OPTIONAL - PLACE DRAIN AS SHOWN WHERE MOISTURE MIGRATION IS UNDESIRABLE

PLATE A

PACIFIC SOILS ENGINEERING, INC
3002 DOW AVENUE, SUITE 514, TUSTIN CALIFORNIA 92780

Table 5-1. Temporary piles that are to be free to rotate slightly can use the unrestrained values for in-situ materials. Permanent wall designs should use restrained values presented in Table 5-1. An additional horizontal load of 2,200 lbs. (per foot of width) should be considered in the wall design. This load can be considered as acting roughly 6½ feet above the bottom of the proposed wall. The ultimate wall design should consider the potential for hydrostatic pressures to develop if a drainage system cannot be provided behind the wall.

5.7 Concrete Mix Design

As mentioned previously, soluble sulfate testing was not performed as part of the previous investigation. Testing should be performed during grading/construction to evaluate the soluble sulfate content of the onsite soils. However, consideration may be given to utilizing concrete designed for "severe" sulfate exposure levels per Table 19-A-4 of the 1997 UBC pending results of the sulfate testing. Final recommendations should be based on as-graded conditions.

5.8 Seismic Design Parameters

According to referenced reports, no active faults have been mapped onsite by the State of California. A probabilistic seismic analysis has been conducted for the project (Appendix B). A random horizontal acceleration of 0.45g has been computed for the Upper Bound Earthquake (10 percent chance of Exceedence in 100 years) and .36g for the Design-Basis Earthquake (10 percent chance of Exceedence in 50 years). These values should be used in the design of the structures.

Presented in Table 5-2 are the 1997 Uniform Building Code (ICBO, 1997) seismic parameters for the subject buildings. Based on the ICBO Map of Known Active Fault Near-Source Zones, the subject site is approximately 6 kilometers from the Newport-Inglewood Fault, which is a Seismic Source Type B fault. This fault is predominantly right lateral/strike slip. It has a maximum magnitude of 7.1

and a slip rate of 1.0 mm/yr (plus minus 0.5 mm). It should be noted that the San Joaquin Hill Thrust Fault, although now considered by the state to be an active seismic source, has purposely been excluded from the UBC. This information is based on communication with Mr. William A. Bryant (State Geologist). In consideration of this, the seismic design parameters presented here may be subject to change, pending updates to the current ICBO Map.

TABLE 5-2
SEISMIC DESIGN PARAMETERS

Seismic Parameter	Recommended Value	UBC – 1997 Chapter 16 Table No.
Seismic Zone Factor (Z)	0.4	16-I
Soil Profile Type	S_D	16–J
Seismic Coefficient (C_a)	0.44	16-Q
Seismic Coefficient (C_v)	0.64	16-R
Near-Source Factors (N_a)	1.0	16-S
Near-Source Factors (N_v)*	1.16	16-T
Seismic Source Type (Newport Inglewood Fault) Distance: ~6 kilometers	B	16-U

*Value linearly interpolated for the 6-kilometer distance as allowed by Code.

5.9 Trench Excavations and Backfill

Trench excavations should be shored or laid back in conformance with Cal-OSHA requirements. On-site soils may be used as backfill, but are unlikely to be suitable for use as bedding sands for the utilities, since it is not anticipated that the materials will possess a Sand Equivalent (SE) greater than 30.

6.0 CLOSURE/FUTURE NEEDS

The information presented herein is intended to assist the project designers. The conclusions and recommendations presented are based on the current design concept and available data. Plan changes and additional data should be evaluated by a geotechnical consultant.

6.1 Geotechnical Review

As is the case with all gradually construction projects, multiple working hypotheses are established utilizing the available data, and the most probable model is used for the analysis. Information collected during the grading operations is necessary to evaluate the hypothesis and some of the assumptions summarized herein may need to be changed as more information becomes available. Some modification of the grading recommendations may become necessary, should the conditions encountered in the field differ significantly than those hypothesized to exist.

The pertinent plans and sections of the project specifications should be reviewed by Pacific Soils Engineering, Inc., to evaluate conformance with the intent of the recommendations contained in this report. Geotechnical review of plans will be required in the future when details are available. Those reviews will include:

- Foundation Plans
- Retaining Wall Plans

If the project description or final design varies from that described in this report, Pacific Soils Engineering, Inc., must be consulted regarding the applicability of, and the necessity for, any revisions to the recommendations presented herein. Pacific Soils Engineering, Inc., accepts no liability for any use of its recommendations if the project description or final design varies and Pacific Soils Engineering, Inc., is not consulted regarding the changes.

6.2 Limitations

This report is based on the project as described and the information obtained from the referenced reports. The results reflect an interpretation of the direct evidence obtained. Services performed by Pacific Soils Engineering, Inc., have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality

under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by geotechnical engineers and engineering geologists who are familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during construction are consistent with the geologic representations and corresponding recommendations presented in this report. Pacific Soils Engineering, Inc., should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations of this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of Pacific Soils Engineering, Inc.

Pacific Soils Engineering, Inc., has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the CONTRACTOR, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

APPENDIX A

SELECTED REFERENCES

APPENDIX A

Selected References

Geotechnical References

1. Geotechnical Report for Proposed Pacific Amphitheatre for Nederlander West, Inc., Orange County Fair and Exposition Center, Costa Mesa, California; by Pacific Soils Engineering, Inc., dated June 26, 1981 (W.O. 100957).

2. UBC Design Parameters, Proposed Pacific Amphitheatre Renovation, Orange County Fairgrounds, Costa Mesa, California; by Pacific Soils Engineering, Inc., dated June 14, 2004 (W.O. 500643).

3. Geotechnical Comments, Deep Foundation Design Parameters, Proposed Pacific Amphitheatre Renovation, Orange County Fairgrounds, Costa Mesa, California; by Pacific Soils Engineering, Inc., dated July 20, 2004 (W.O. 500643).

4. County of Orange General Plan, Safety Element.

Geologic References

5. Grant Lisa B., Ballenger Leslie J., and Runnerstrom Eric E., 2002, *Coastal Uplift of the San Joaquin Hills, Southern Los Angeles Basin, California, by a Large Earthquake since A.D. 1635,* Bulletin of Seismological Society of America, Vol. 92 No. 2, March 2002.

6. Jennings, Charles W., 1994 – *Fault activity Map of Co. and Adjacent Areas with locations of Recent Volcanic Eruptions, California Division of Mines and Geology, Map No. 6.*

7. California Division of Mines and Geology, *Geology and Engineering Aspects of the South Half of the Tustin Quadrangle, Orange County, California, 1976,* Special Report 126.

Seismology References

8. State of California, Department of Conservation, Division of Mines and Geology, *Seismic Hazard Zone Report for the Anaheim and Newport Beach 7.5-Minute Quadrangles, Orange County, California, 1997 (Revised 2001)*, Seismic Hazard Zone Report 003.

9. California Geological Survey and United States Geological Survey, Cao, Bryant, et al., *The Revised 2002 California Probabilistic Seismic Hazard Maps, June 2003.*

APPENDIX B

SEISMICITY STUDY

APPENDIX B
PROBABILISTIC SEISMIC ANALYSIS

Rationale

The classic "deterministic" approach to seismic hazard analysis usually begins with assignment of maximum probable (for design of most structures) and/or maximum credible (for high-rise structures) earthquakes to local active faults, followed by measurements of the shortest distance (site radius) between the subject site and each of those faults. Hypothetical design accelerations are then determined by using any of several dozen empirical ground acceleration attenuation equations that relate hypothetical site ground accelerations to postulated earthquakes and site radii.

Deterministic analyses of seismic hazard (site acceleration in this case) deal with absolutes, are not time-dependent, and assume a kind of "certainty". In essence, they assume a very large earthquake will occur along a given fault at precisely its closest point to the subject site, and they do not consider the likelihood of that earthquake occurring within a given exposure period (structure lifetime). Therefore, probabilistic methods of seismic risk determination that account for uncertainties in time, recurrence intervals, size, and location (along faults) of hypothetical earthquakes have been developed and are suitable for use with engineering analyses. These methods thus account for likelihood (rather than certainty) of occurrence and provide levels of ground acceleration that might be more reasonably hypothesized for a finite exposure period. For example, a commonly accepted level of risk is the "statistical" chance that a certain acceleration will only have a 10 percent probability of being exceeded within a 50-year period (roughly the life of an average development). This level of risk is accepted, in principle, in the UBC (Blake 2000). One probabilistic method reliable software program particularly suitable for this study is FRISKSP, developed from United States Geological Survey software (FRISKSP) by Blake (2000). Various attenuation relationships, including the Boore et al. (1997), Sadigh et al (1997), Campbell and Borzognia (1997 Rev)) relationships used herein, can be employed. In addition, various useful parameters of known regional and local faults are embedded in the source code. Accordingly, our analysis uses that software package. For complete discussion of the software and probabilistic methods, the reader is referred to Blake (2000).

Methodology

For this FRISKSP probabilistic analysis, this firm specified a search of the FRISKSP data base of major known active faults within a 100-kilometer radius; and then a 10% probability of Exceedence in a 100-year and 50-year exposure period using three (3) different attenuation relations: Boore et al. (1997), Sadigh et.al. (1997), and Campbell and Borzognia (1997 Rev). Based on the site conditions, we computed constant random horizontal acceleration for alluvium conditions using each of the three attenuation relations and averaging the values obtained.

FRISKSP found and analyzed input from 36 faults within a 100-kilometer radius from the subject site (Table B-1 and Figure B-4). Blake (2000) discusses each fault, including maximum earthquakes, slip rates, recurrence intervals and constants; and the reviewer is so referred. FRISKSP does not account for, assuming regular recurrences cycles, whether each fault is early, median or late in its recurrence interval.

Results

FRISKSP computed the mean plus one sigma random horizontal acceleration that hypothetically has a UBC-consistent 10 percent chance of being exceeded in 100 years Upper Bound Earthquake (UBE) and in 50 years Design Basis Earthquake (DBE), the equivalent of approximately a 949-year and a 475-year average return period, respectively, according to generally accepted probabilistic (statistical) approach. By averaging the probability of Exceedence plots (Figures B-1 through B-3), **a mean plus one sigma random horizontal acceleration of 0.45g was computed for the UBE and 0.36g was computed for the DBE.** The San Joaquin Blind Thrust fault was included but with a weighting of only 25%. This is consistent with recommendations made by the California Geologic Survey and with industry practice.

In sum, these results are based upon many unavoidable geological and statistical uncertainties, but yet are consistent with current standard-of-practice. As engineering seismology evolves, and as more fault-specific geological data are gathered, more certainty and different methodologies may also evolve.

APPENDIX B

References

1. Blake, T.F., 1998, FRISKSP Ver. 3.01b, and 2000, FRISKSP Ver. 4.00, "*A computer program for the probabilistic estimation of peak acceleration and uniform hazard spectra using 3-D faults as earthquake sources*", Thomas F. Blake, Newbury Park, California.

2. 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, pp. 128-153.

3. California Division of Mines and Geology, 1997b, Guidelines for evaluation and mitigating seismic hazards in California; Special Publication 117.

4. State of California, Dept. of Conservation, Division of Mines and Geology, *Seismic Hazard Zone Report for the Tustin 7.5-Minute Quadrangle, Orange County, California, 1997 (Revised 2001)*, Open File Report 97-20.

5. Campbell, K.W., 1997, Empirical near-source attenuation relationships for horizontal and vertical components of peak ground acceleration, peak ground velocity, and pseudo-absolute acceleration response spectra: Seis. Res. Let. v. 68, n. 1, p. 154-179.

6. Grant Lisa B., Ballanger Leslie J., Runnerstrom Eric 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, March 2002.

7. International Conference of Building Officials (ICBO), 1997 Uniform Building Code, Volume 2, Structural Engineering Design Provisions.

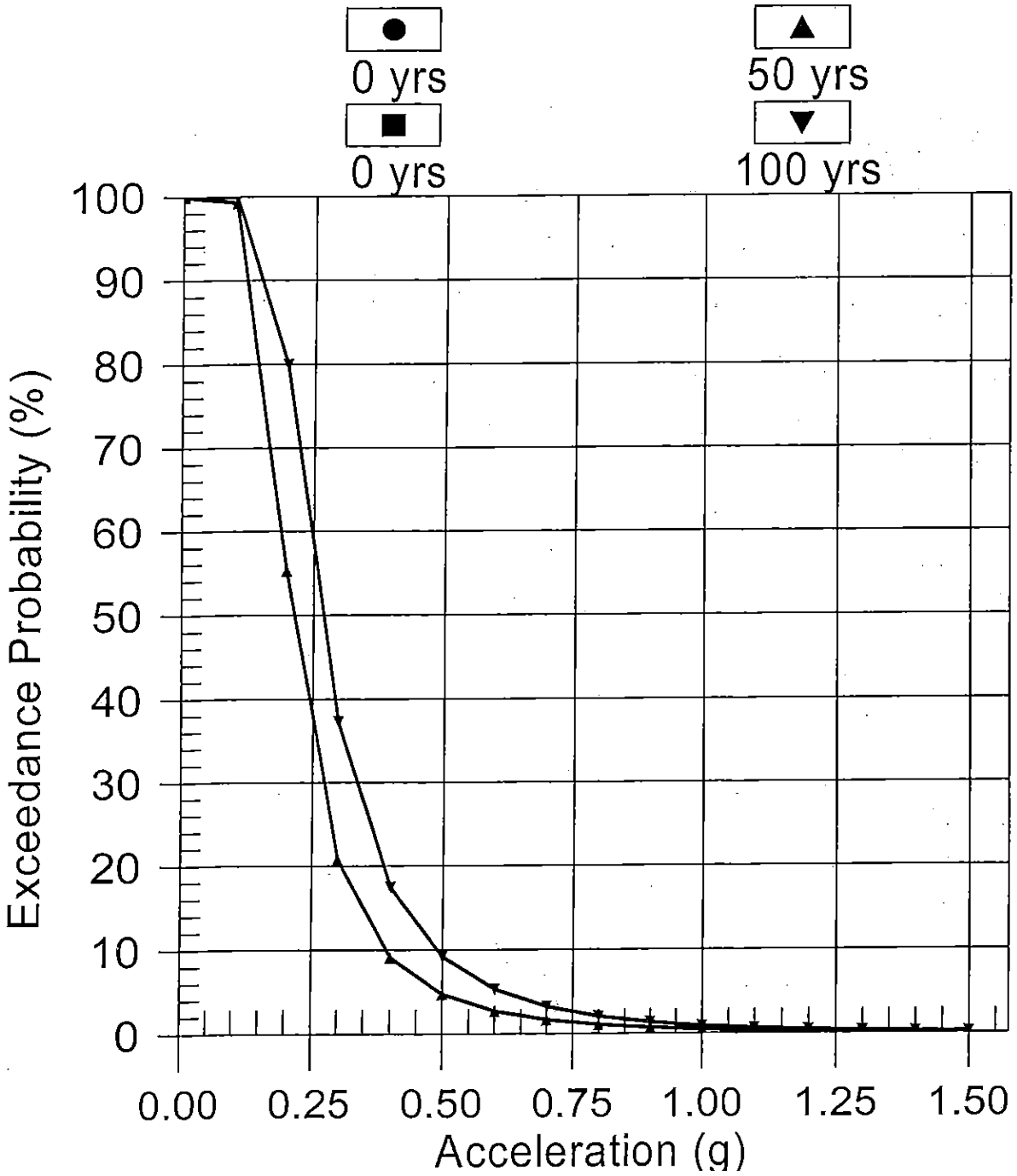
8. ICBO, *1998 Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada*; prepared by California Division of Mines and Geology (CDMG), published by ICBO, February 1998.

9. Joyner W.B., and Fumal T.E., 1985, "*Predictive Mapping of Earthquake Ground Motion in the Los Angeles Region – An Earth-Science Perspective*", U.S. Geol. Surv. Prof. Paper 1360.

10. Sadigh, K., Chang, Y., Egan, J.A., Makdisi, F., and Youngs, R.R., 1997, "*Attenuation relationships for shallow crustal earthquakes based on California strong motion data*", Seis. Res. Let. v. 68, n.l.

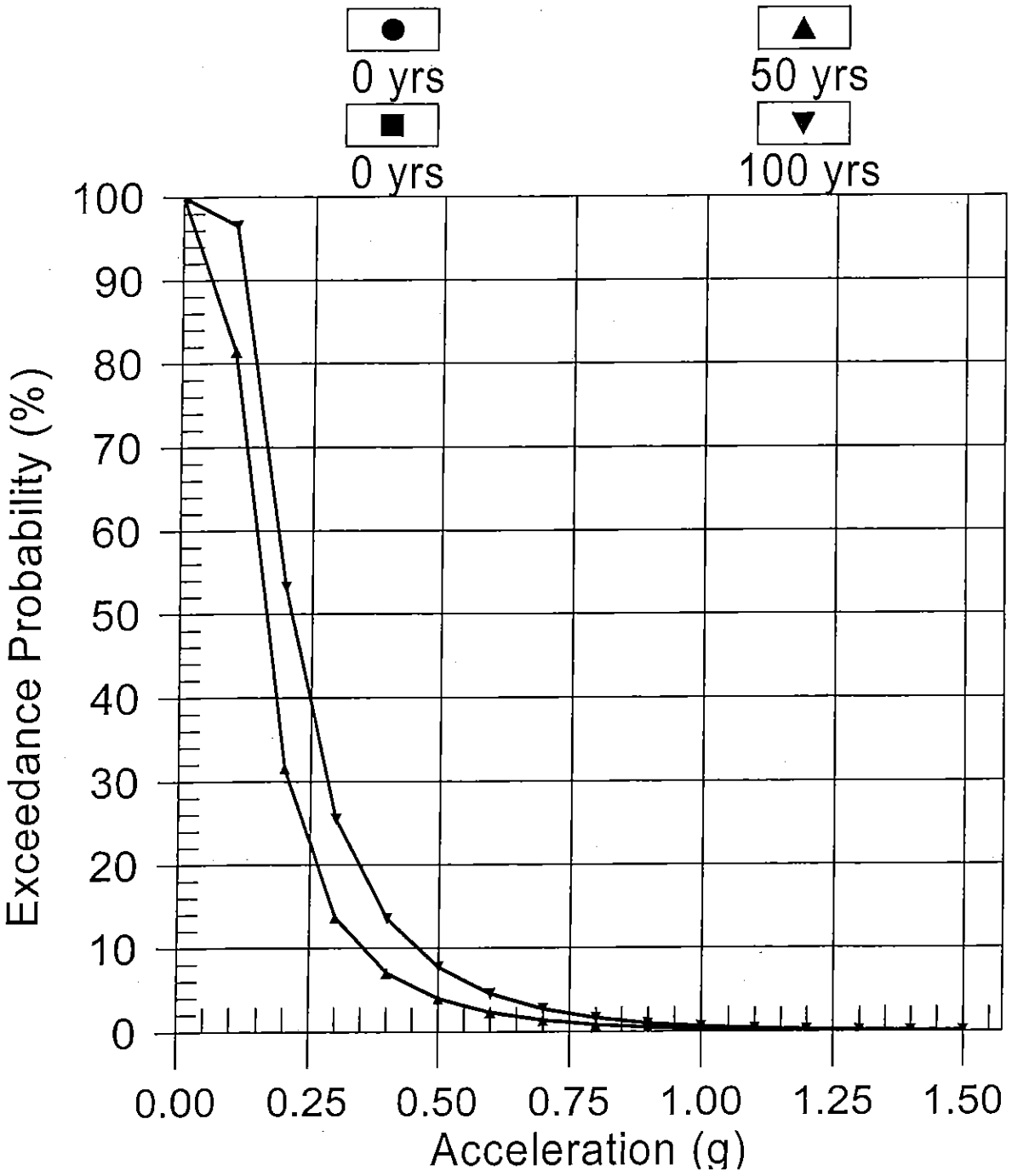
PROBABILITY OF EXCEEDANCE

BOORE ET AL(1997) NEHRP D (250)1 W.O. 500643



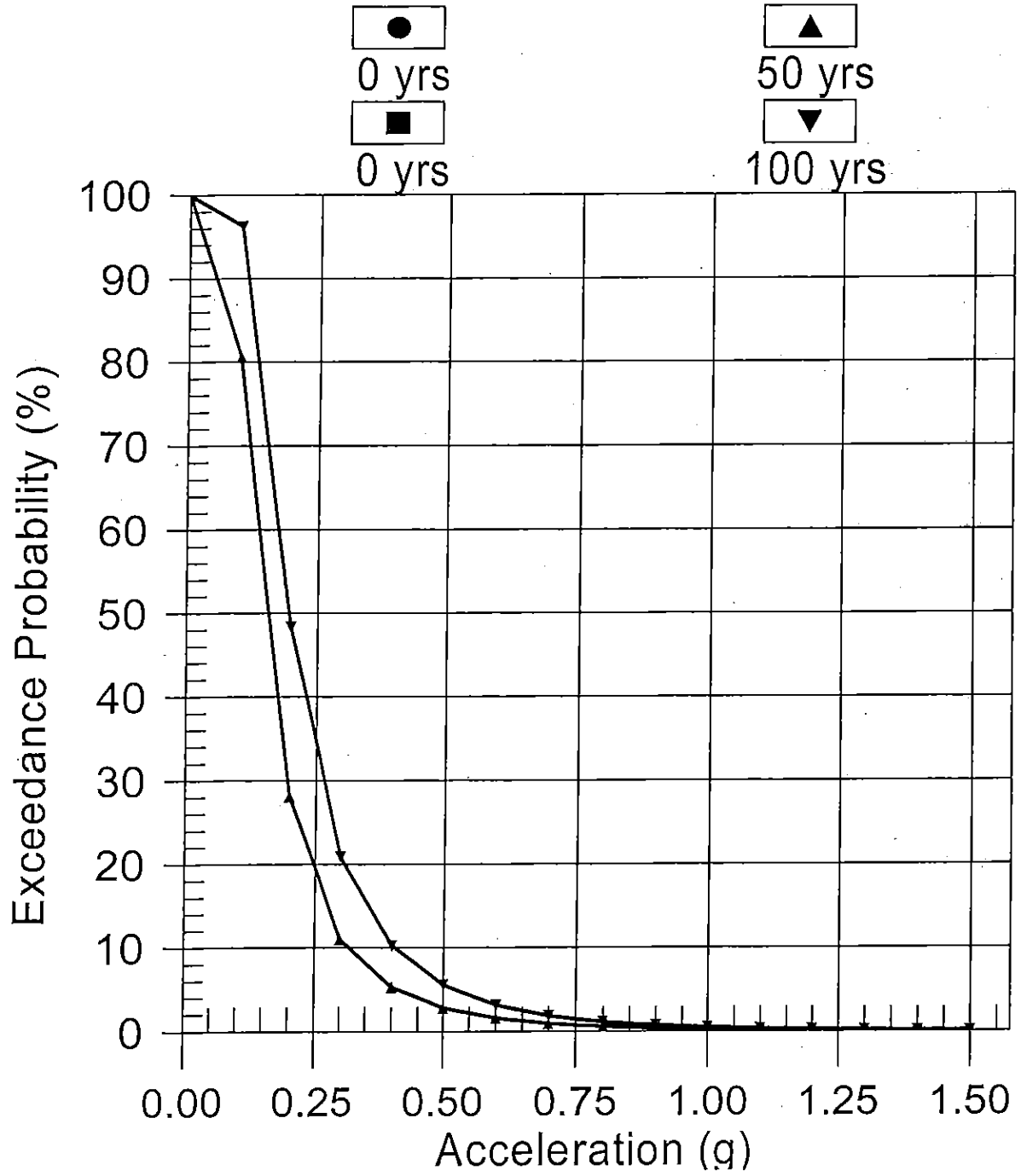
PROBABILITY OF EXCEEDANCE

CAMP. & BOZ. (1997 Rev.) AL 1 W.O. 500643



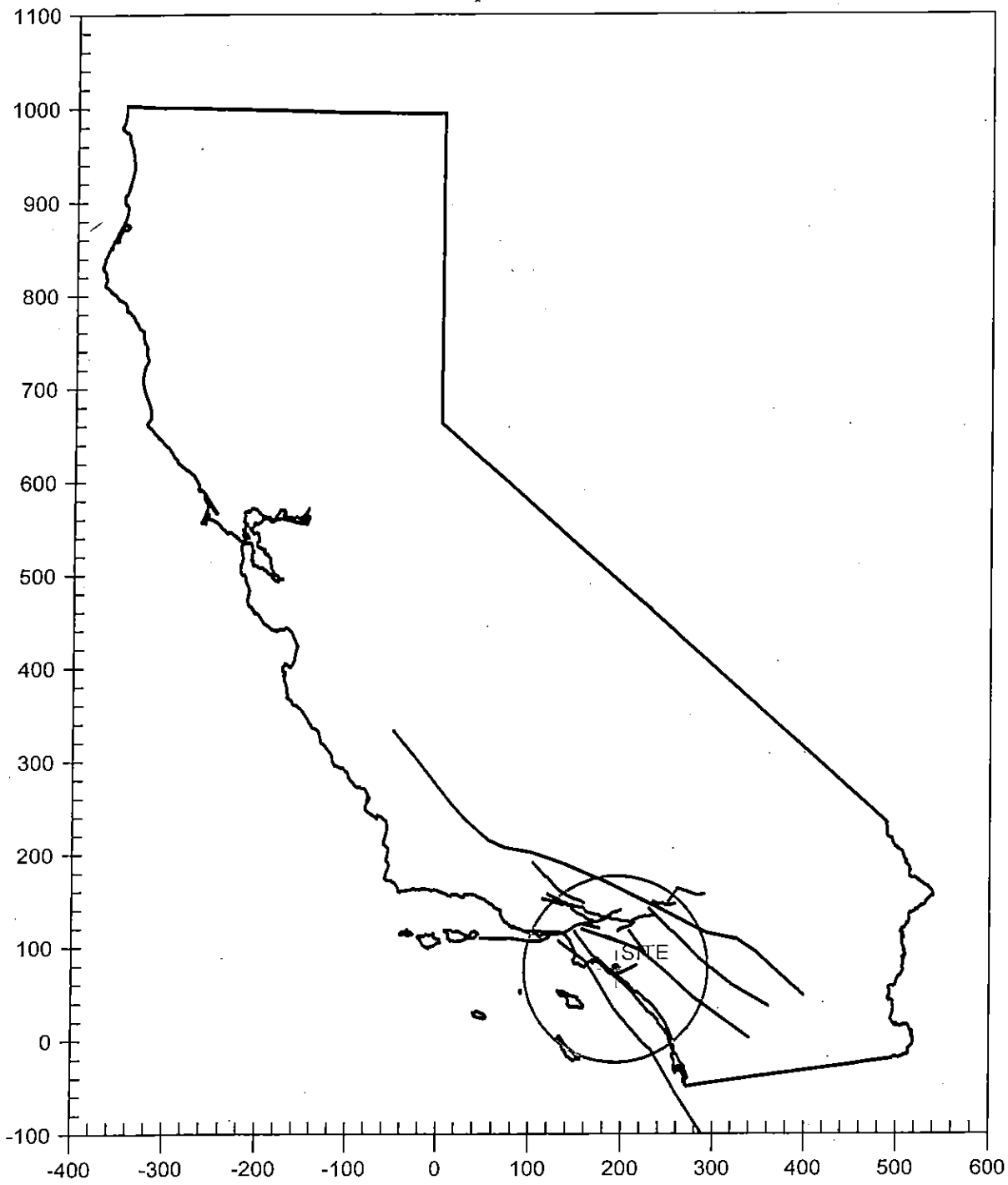
PROBABILITY OF EXCEEDANCE

SADIGH ET AL. (1997) DEEP SOIL 1 W.O. 500643



CALIFORNIA FAULT MAP

W.O. 500643 Pacific Amphitheater N 33.6671 E 117.9053



CLOSEST DISTANCES BETWEEN SITE AND FAULT RUPTURES

TABLE B–1

NO.	FAULT NAME	CD_1DRP	CD_2DRP	CDIST	CLODIS	CD_EPI	CD_HYPO
1	NEWPORT-INGLEWOOD LA Basin 6/03	5.5	5.5	5.5	5.5	5.5	5.6 km
2	SAN JOAQUIN HILLS BT (6/03mod)	5.8	0.0	3.7	3.7	0.1	3.7 km
3	NEWPORT-INGLEWOOD Offshore 6/03	8.5	8.5	8.5	8.5	9.2	9.2 km
4	PALOS VERDES (6/03mod)	24.1	24.1	24.1	24.1	24.1	24.1 km
5	WHITTIER	28.7	28.7	28.7	28.7	29.0	29.0 km
6	PUENTE HILLS-BT (6/03mod)	29.4	29.4	29.8	29.8	30.7	31.1 km
7	ELSINORE-GLEN IVY	32.4	32.4	32.4	32.4	32.6	32.6 km
8	CHINO-CENTRAL AVE. (Elsinore)	35.7	28.5	32.4	32.4	29.0	32.4 km
9	SAN JOSE	41.5	41.5	41.5	41.5	42.3	42.3 km
10	CORONADO BANK	44.4	44.4	44.4	44.4	45.2	45.2 km
11	ELYSIAN PARK UPPER(6/03mod Blind	48.3	48.3	48.4	48.4	49.5	49.6 km
12	ELSINORE-TEMECULA	51.6	51.6	51.6	51.6	52.5	52.5 km
13	SIERRA MADRE (6/03mod)	52.4	52.4	52.4	52.4	53.3	53.3 km
14	CUCAMONGA (6/03mod)	53.5	53.5	53.5	53.5	54.8	54.8 km
15	RAYMOND (6/03 mod)	54.9	54.9	54.9	54.9	55.2	55.2 km
16	VERDUGO	56.5	56.5	56.5	56.5	57.8	57.8 km
17	CLAMSHELL-SAWPIT	57.4	57.4	57.4	57.4	58.6	58.6 km
18	HOLLYWOOD	58.6	58.6	58.6	58.6	59.4	59.4 km
19	SANTA MONICA (6/03mod)	65.4	65.4	65.4	65.4	66.0	66.0 km
20	MALIBU COAST	70.7	70.7	70.7	70.7	71.8	71.8 km
21	SAN JACINTO-SAN BERNARDINO	70.8	70.8	70.8	70.8	70.8	70.8 km
22	SAN JACINTO-SAN JACINTO VALLEY	73.1	73.1	73.1	73.1	73.5	73.5 km
23	ROSE CANYON (6/03mod)	74.5	74.5	74.5	74.5	75.6	75.6 km
24	SIERRA MADRE (San Fernando)	76.9	76.9	76.9	76.9	77.9	77.9 km

25 SAN ANDREAS-Mojave (6/03 mod)	78.8	78.8	78.8	78.8	78.8	78.8 km
26 SAN ANDREAS-San Bernardino 6/03	78.8	78.8	78.8	78.8	78.8	78.8 km
27 SAN ANDREAS - Southern	79.1	79.1	79.1	79.1	79.1	79.1 km
28 SAN ANDREAS - 1857 Rupture	79.5	79.5	79.5	79.5	79.6	79.6 km
29 SAN GABRIEL	80.3	80.3	80.3	80.3	81.2	81.2 km
30 ANACAPA-DUME	81.1	81.1	81.1	81.1	82.4	82.4 km
31 NORTHRIDGE (E. Oak Ridge)	82.3	76.0	78.5	78.5	77.3	79.6 km
32 CLEGHORN	82.4	82.4	82.4	82.4	82.6	82.6 km
33 ELSINORE-JULIAN	88.7	88.7	88.7	88.7	89.7	89.7 km
34 SANTA SUSANA	91.2	91.2	91.2	91.2	91.9	91.9 km
35 NORTH FRONTAL FAULT ZONE (West)	91.7	91.7	91.7	91.7	92.8	92.8 km
36 SAN JACINTO-ANZA	91.8	91.8	91.8	91.8	92.6	92.6 km

EXPLANATION

CD_1DRP = Closest distance to projection of rupture area along fault trace.
CD_2DRP = Closest distance to surface projection of the rupture area.
CDIST = Closest distance to seismogenic rupture.
CLODIS = Closest distance to subsurface rupture.
CD_EPI = Closest epicentral distance.
CD_HYPO = Closest hypocentral distance.

APPENDIX C

PILE EMBEDMENT FIGURES

Depth of Embedment Into Sand Vs. Capacity for 2' Dia. Pile
(Use for Piles Behind the Existing Retaining Wall)

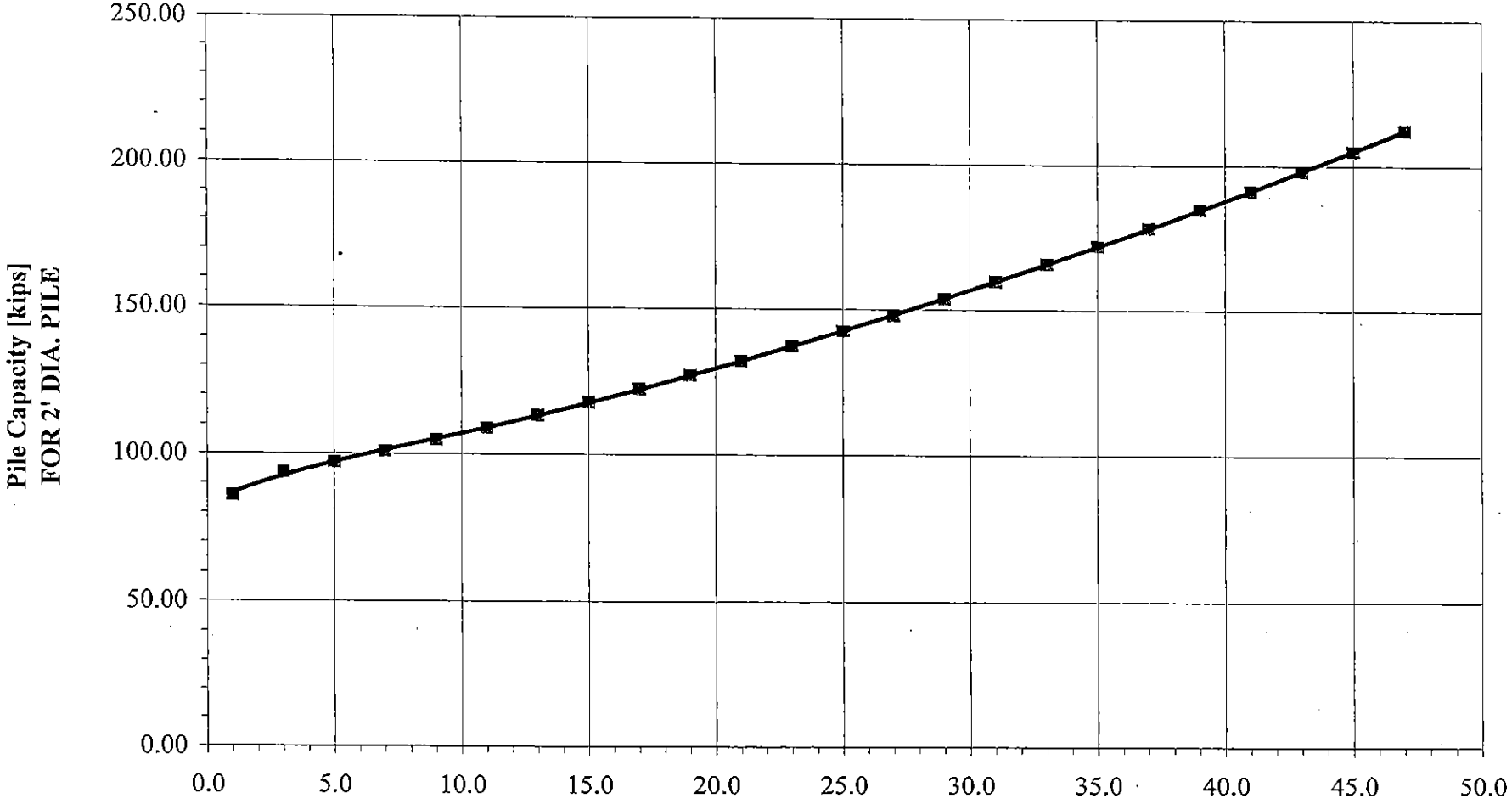


Plate B
W.O. 500643

Depth of Embedment Into Sand Vs. Capacity for 3' Dia. Pile
(Use for Piles Behind the Existing Retaining Wall)

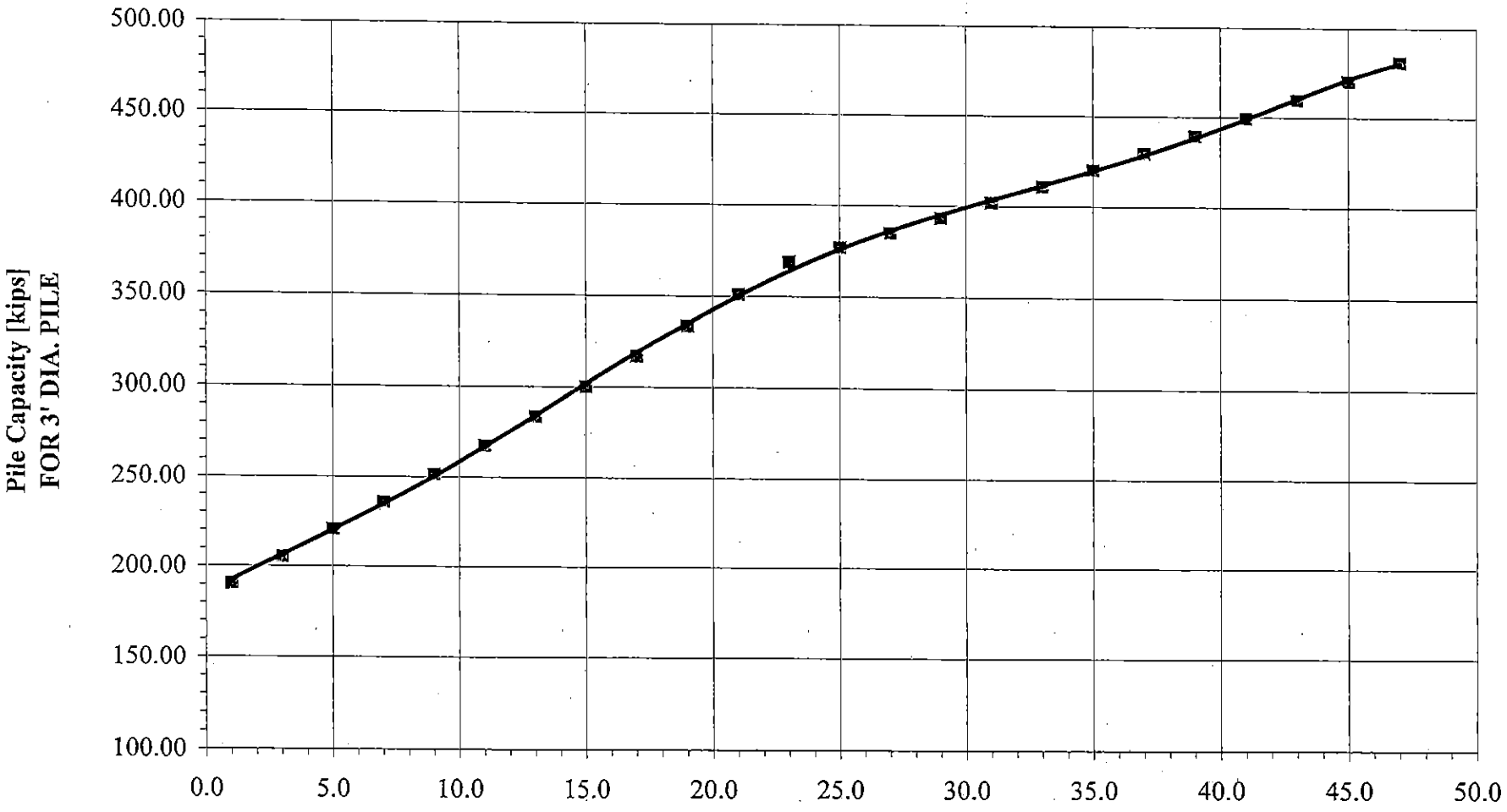


Plate C
W.O. 500643

Depth of Embedment Into Sand Vs. Capacity for 2' Dia. Pile
(Use for Piles in Front of the Existing Retaining Wall)

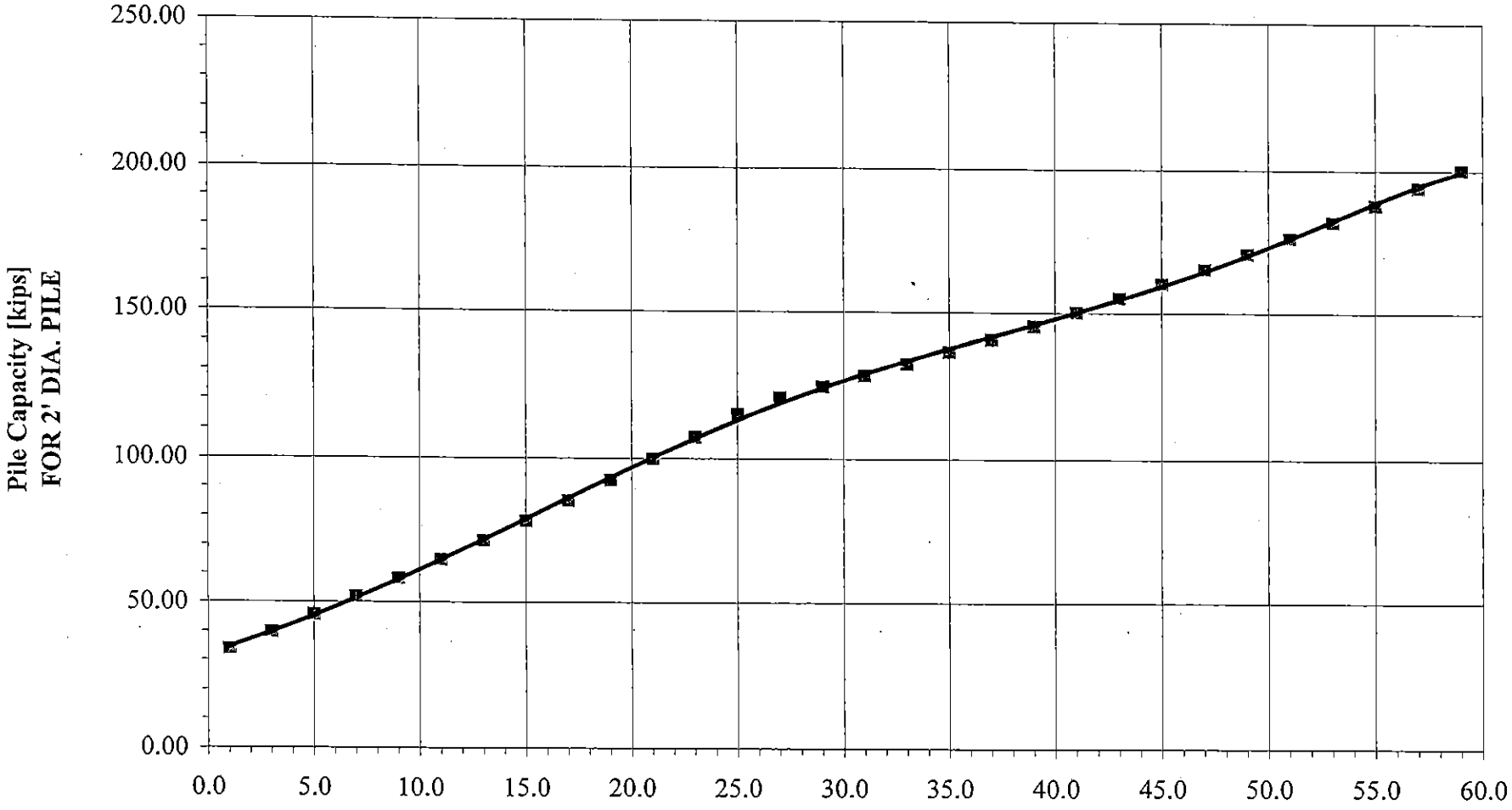


Plate D
W.O. 500643

Depth of Embedment Into Sand Vs. Capacity for 3' Dia. Pile
(Use for Piles in Front of the Existing Retaining Wall)

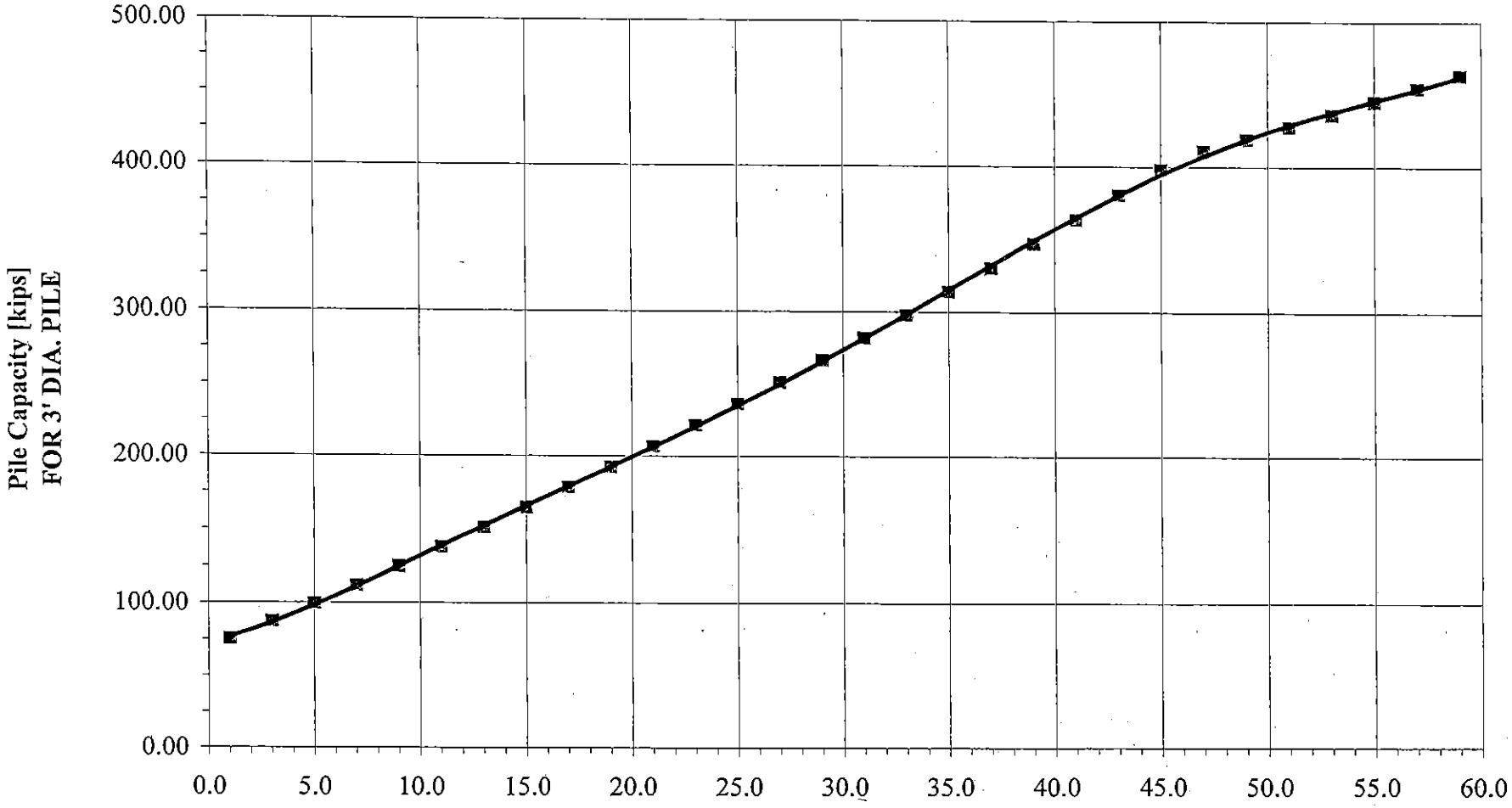


Plate E
W.O. 500643

Depth of Embedment Into Sand Vs. Uplift Capacity for 2' Dia. Pile
(Use for Piles Behind the Existing Retaining Wall)

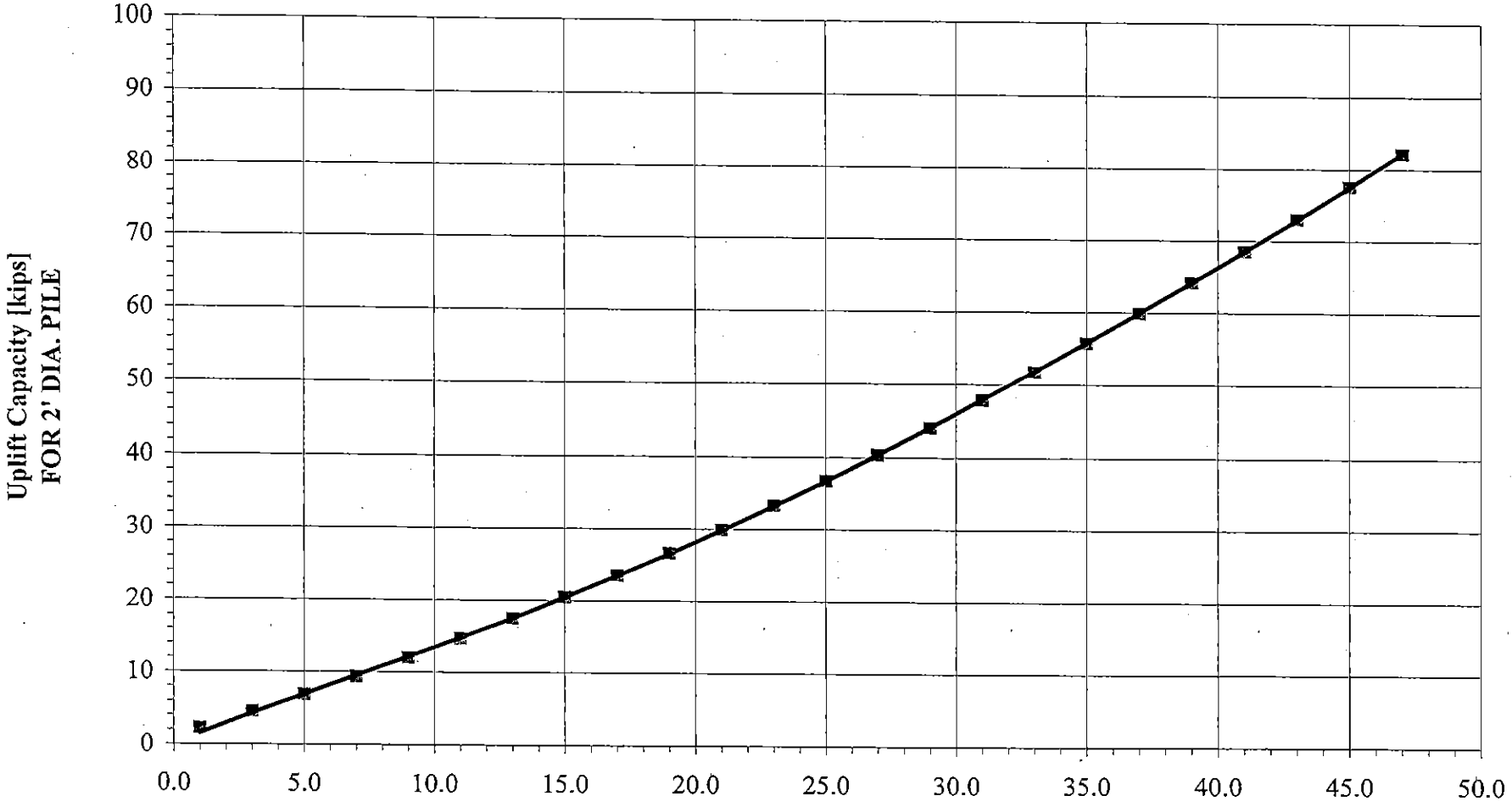


Plate F
W.O. 500643

Depth of Embedment Into Sand Vs. Uplift Capacity for 3' Dia. Pile
(Use for Piles Behind the Existing Retaining Wall)

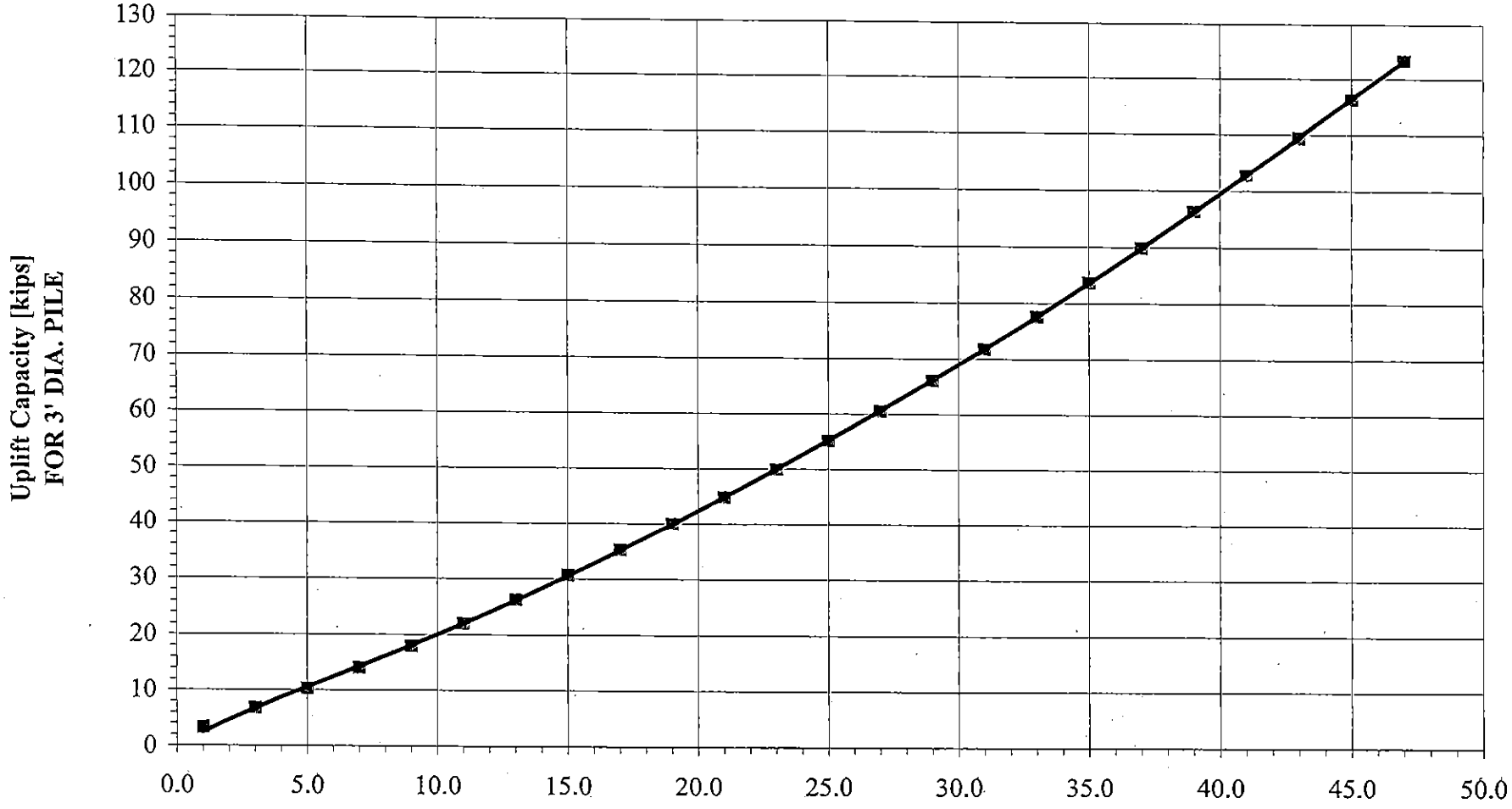


Plate G
W.O. 500643

Depth of Embedment Into Sand Vs. Uplift Capacity for 2' Dia. Pile
(Use for Piles in Front of the Existing Retaining Wall)

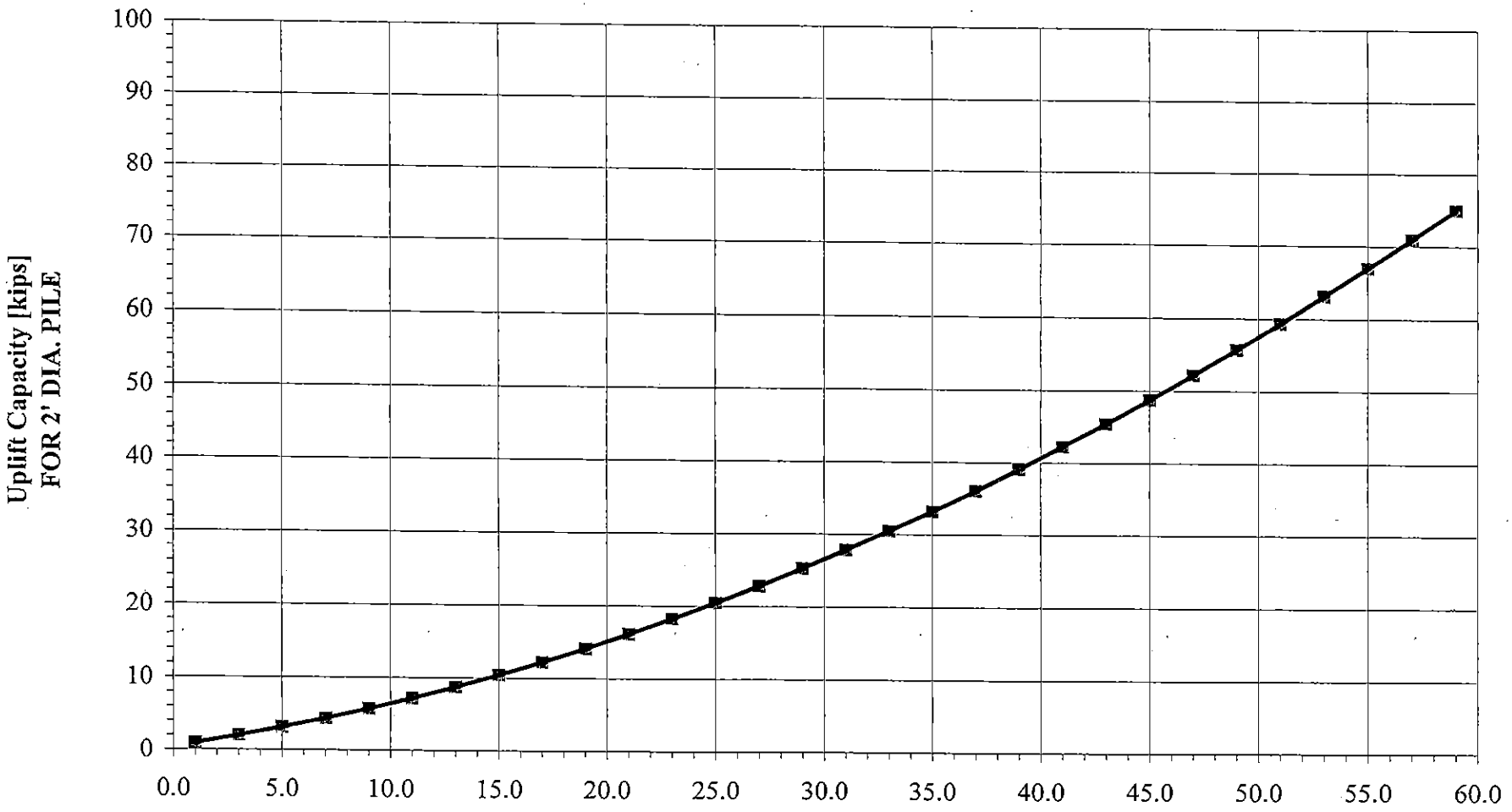


Plate H
W.O. 500643

Depth of Embedment Into Sand Vs. Uplift Capacity for 3' Dia. Pile
(Use for Piles in Front of the Existing Retaining Wall)

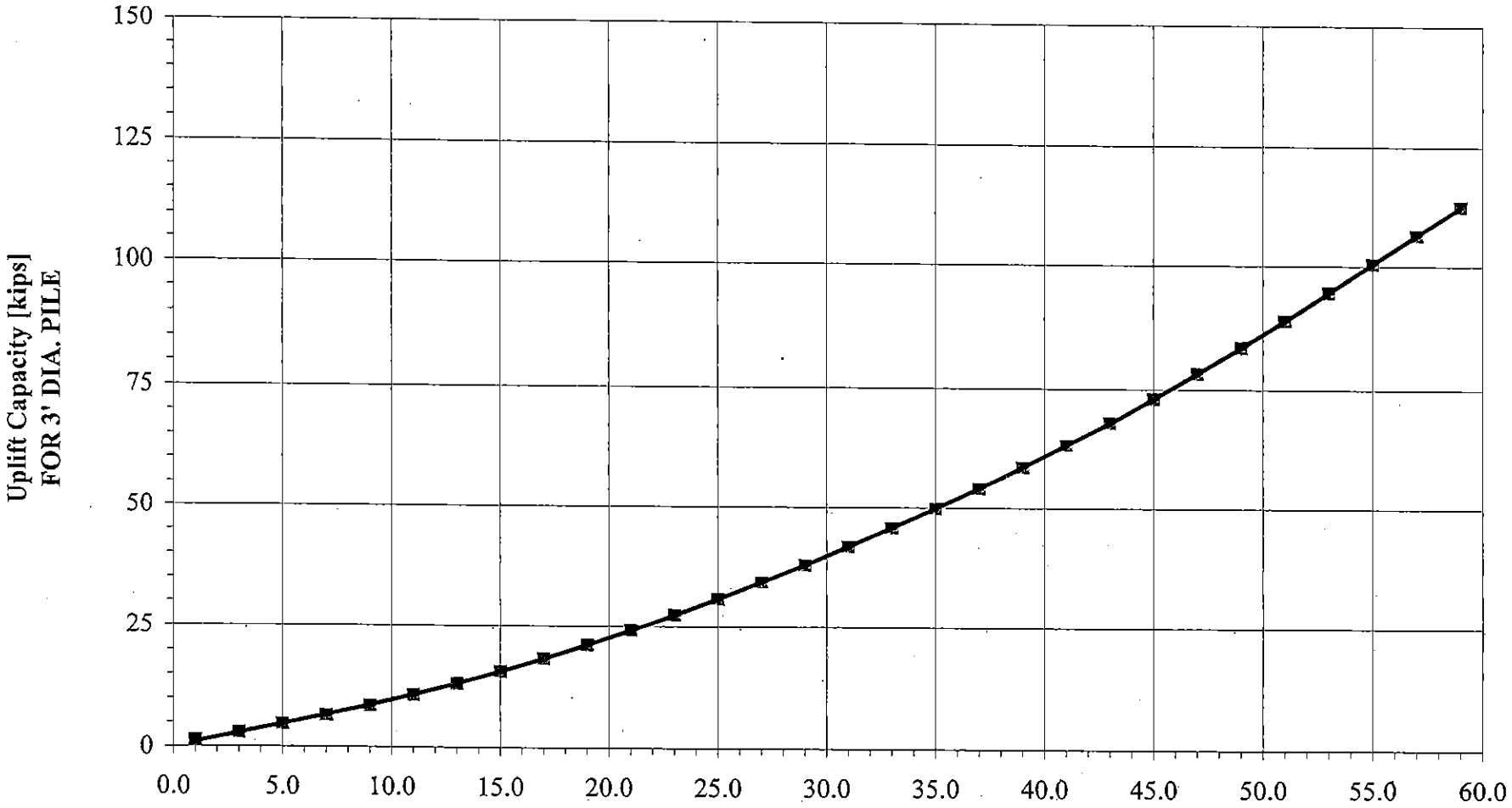


Plate I
W.O. 500643

ASSUME:
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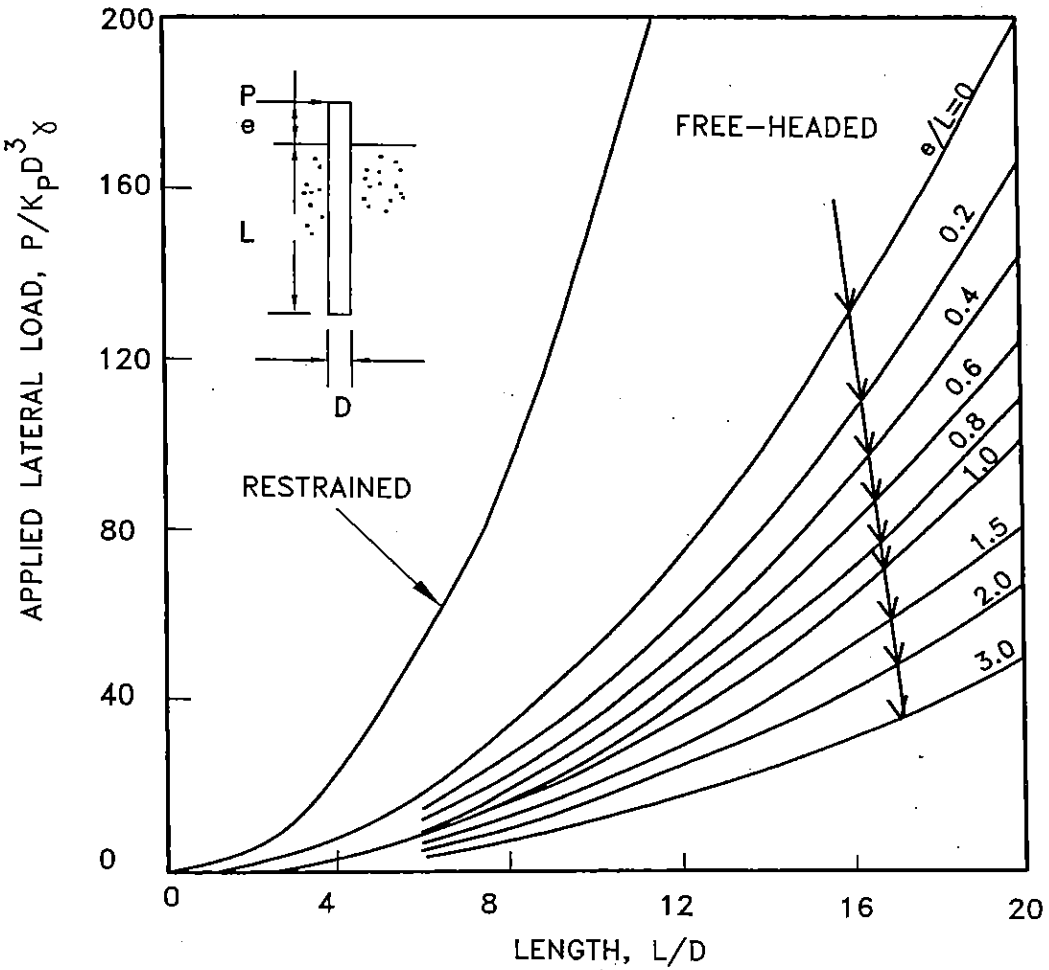
γ =120pcf



ULTIMATE LATERAL RESISTANCE FOR COHESIONLESS SOILS RELATED TO EMBEDMENT LENGTH

PLATE J

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W.O. 500643 DATE: 8/11/04

c:drafting/500643/figure/plate_J