APPENDIX D

GEOTECHNICAL REPORT

GEOTECHNICAL EVALUATION

FOR

LOS ANGELES CITY COLLEGE

LOS ANGELES, CALIFORNIA

GEOBASE

SOIL/ROCK MECHANICS AND FOUNDATION ENGINEERING

GEOTECHNICAL EVALUATION

For

Los Angeles City College
Los Angeles, California

Prepared for:

DMJMH+N
Los Angeles, California

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GEOBASE, INC.

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I. INTRODUCTION

GEOBASE, INC. (GEOBASE) was authorized by DMJMH+N to perform a geotechnical evaluation for the proposed Long Range Master Plan of the Los Angeles City College (LACC), Los Angeles, California. The site location is shown on the Location Map, Figure A-1, Appendix A.

For this preliminary geotechnical evaluation, we were provided with a Topographic Plan and a Proposed Long Range Master Plan prepared by others. This Topographic Plan is reproduced herein as Figure A-2, Appendix A, Site and Boring Locations Plan and the Proposed Long Range Master Plan s reproduced herein as Figure A-3, Appendix A. The boring locations were selected by DMJMH+N and LACC.

The purpose of this study is to obtain preliminary information on the subsurface conditions in order to assist in an evaluation of the proposed development. This study includes the assessment of the potential for liquefaction and geological/geotechnical hazards at the subject site. In addition, suitable foundations types are discussed and a range of load carrying capacities for preliminary design purposes is provided.

This report describes the site investigation and summarizes the results of both field and laboratory testing. The results of the field and laboratory tests are discussed with reference to the proposed development. General recommendations pertinent to suitable site development and preliminary foundation design are given. Construction guidelines related to the geotechnical aspects of the project are also addressed.

II. SITE AND PROJECT DESCRIPTION

2.1 Project Description

Based on the Proposed Long Range Master Plan, the proposed development will consist of:

- A two (2) level parking structure (one [1] level below ground and one [1] level above ground) with tennis courts on the roof at the northwestern corner of the LACC Campus.
- Science and Technology Building at the northeastern corner of the LACC Campus.
- Athletic field and underground parking at the southwestern corner of the LACC Campus.
- Other minor buildings and future expansions.

2.2 Site Description

The LACC Campus is bounded by Vermont Avenue to the east, Melrose Avenue to the south, Heliotrope Drive to the west, and Willowbrook Avenue to the north. The campus slopes gently towards the south and east with elevations ranging from approximately 325.0 feet above Mean-Sea-Level (MSL) at the northwestern corner of the campus to 301.0 feet above MSL at the Parking Lot at the southwestern corner of the campus, and 312.0 feet above MSL at the existing Athletic Field to 301.0 feet above MSL at the corner of Vermont Avenue and Monroe Street.

III. SITE INVESTIGATION

3.1 Field Program

The field investigation was carried out on December 21 and 26, 2001 and consisted of advancing six (6) borings at the site, at the approximate locations shown on the Site and Boring Locations Plan, Figure A-2, Appendix A. The borings were located in the field utilizing cloth tape and elevations were estimated from the contours shown on the Topographical Survey prepared by Landdata Site Services, Inc. Therefore, the boring locations and elevations should be considered accurate only to the degree implied by the methods used.

The boring was advanced to a maximum depth of sixty and one-half (60.5) feet utilizing a truck mounted CME 75 drill rig fitted with hollow stem augers. The Log of Borings together with an Explanation of Terms and Symbols used are given in Appendix B, Figures B-1 thru B-7, inclusive.

Field testing consisted of the Standard Penetration Test (SPT). The SPT test involves failure of the soil around the tip of a split spoon sampler for a condition of constant energy transmittal. The split spoon, two (2) inches outside diameter and one and three-eighths (1 3/8) inches inside diameter, is driven eighteen (18) inches and the number of blows required to drive the sampler the last foot is recorded as the "N" value or SPT blow count. The driving energy is provided by a 140 pound weight dropping thirty (30) inches.

Sampling consisted of:

- Collection of disturbed samples at selected locations retrieved from the auger;
- Collection of samples from the split spoon sampler; and,
- Collection of relatively undisturbed soil samples at selected locations using a California Modified Sampler. The soil samples were retained in a series of brass rings, each having an inside diameter of 2.41 inches and a height of one (1) inch. These ring samples were placed in close-fitting, moisture-tight containers for shipment to the laboratory.

3.2 Laboratory Testing

The samples obtained during the field program were returned to the laboratory for visual examination and testing. The soils were classified in accordance with ASTM and the Unified Soil Classification System.

The laboratory testing program consisted of the following:

- Laboratory determination of water (moisture) content of soil, rock and soil-aggregate mixtures (ASTM D 2216) and dry density;
- Liquid limit, plastic limit and plasticity index of soils (ASTM D 4218);
- Particle Size Analysis of Soils (ASTM D 1140 and D 422);

- Expansion Potential of Soils (ASTM D 4829/UBC 29-2); and,
- Water soluble sulfates content of soils (CAL. 417A), pH, electrical resistivity and soluble chlorides.

The field and laboratory test results are presented on the Log of Boring, Figures B-2 thru B-7, inclusive, Appendix B, where applicable, and in Appendix C.

IV. GEOLOGY

4.1 Site Geologic Conditions

The Los Angeles City College campus is located in the northern portion of the greater Los Angeles Basin. Within the Los Angeles Basin, the project site is located in the border area between the Transverse Ranges Geomorphic Province on the north and the Peninsular Ranges Geomorphic Province on the south. The east-west trend of the Santa Monica-Hollywood fault zone (2.9 km north of the site) is typical of the structural features of the Transverse Ranges while the structural features of the Peninsular Ranges are defined by the northwest trending Newport-Inglewood fault zone (11.4 km to the southwest). In more detail, the site is located on the western edge of the Elysian Hills, west of Silver Lake Reservoir in western Los Angeles. The south border of the Santa Monica Mountains is located not quite two (2) miles to the north. The La Brea Plain is located just to the west. Elevations on campus range from approximately 300.0 feet above MSL on the south to just over 320.0 feet above MSL on the north.

Several active blind thrust faults are located at depth beneath the Los Angeles Basin. These blind thrust faults are generally low angle and terminate within folds or other faults, and do not break the surface. These faults are not considered a hazard with regard to surface rupture but are capable of generating earthquakes with potential strong ground motions that may affect the site. These blind thrust faults include the Elysian Park thrust. The closest boundary of the projection to the ground surface of this fault is located approximately four (4) kilometers (km) to the northwest of the site. The approximate length of the Elysian thrust is thirty-four (34) km (Petersen, et.al., 1996).

The site is overlain with up to forty (40) feet of Pleistocene age older alluvium, based on the borings, which were comprised of sandy clays, sandy silts and silty sands.

Tertiary age sedimentary bedrock assigned to the Upper Miocene Puente formation underlies the older alluvium. The bedrock consists primarily of siltstones and standstones. The contact between the older alluvium and bedrock is likely an uneven surface. In this respect, the ground surface in the general site area is marked by knobs of bedrock sticking through surficial sediments.

A geologic map of the site region is included as Figure A-4, Geologic Map, Appendix A.

4.2 Subsurface Conditions

An asphaltic concrete pavement section consisting of approximately three (3) inches and six (6) inches of asphaltic concrete was encountered at borings B-6 and B-1 locations, respectively. Landscape lawn and approximately three (3) to four (4) inches of top soil was encountered at borings B-1 and B-4 locations.

The general stratigraphic profile at the boring locations consists of two (2) to six (6) feet of fill soils (sandy clays) overlying native sandy silts, sandy clays, silty sands and sands, which are in turn underlain by siltstone/sandstone bedrock. The depth to bedrock at each boring location is summarized in Table I. The thickness of fill soils observed may be thicker at other locations, particularly at utility trenches and adjacent to existing basements.

TABLE I
SUMMARY OF SUBSURFACE CONDITIONS AT BORING LOCATIONS

Boring No.	Existing Ground Surface Elevation (Ft.)*	Groundwater** Level at Drilling Completion Depth (Ft)/Elevation (Ft)	Bedrock Level Depth (Ft)/Elevation (Ft)
B-1	321.0	13.0/308.0	45.0/276.0
B-2	315.0	30.0/285.0	35.0/280.0
B-3	311.0	14.0/276.0	41.0/270.0
B-4	310.0	34.0/276.0	25.0/285.0
B-5	304.0	18.0/286.0	31.0/273.0
B-6	301.0	19.0/282.0	41.0/260.0

* Estimated from the contours shown on the Topographical Survey prepared by Landdata Site Services, Inc.

** Groundwater conditions may be altered by geologic conditions between borings, by seasonal and meteorological variations and by construction activities.

Based on SPT results at the boring locations, the native sandy silts and sandy clays have a stiff to hard consistency and the sands and silty sands are inferred to be medium dense to very dense. The native siltstone and sandstone bedrock is considered to have a hard consistency and are inferred to be dense to very dense, respectively.

4.3 Groundwater

Groundwater was encountered at all six (6) boring locations. The groundwater level observed at the completion of drilling is summarized in Table I; however, groundwater conditions may be altered by geologic conditions between borings, by seasonal and meteorological variations and by construction activities.

The north boundary of the relatively shallow Bellflower Aquiclude is mapped south of the site (DWR Bulletin 104). Trends of shallower (borings B-1, B-3, B-5 and B-6) and deeper (borings B-2 and B-4) groundwater occurrence may be related to the topography of the unconformable bedrock/older alluvium interface. In addition, studies of the 1904 records (USGS Professional Paper 1360, page 289) indicate that the groundwater in the site region is considered artesian (i.e. under pressure). The studies also show a decreasing extent, overtime, of the artesian deposits that existed before 1905, however, if groundwater management practices change and pumping is reduced, the authors also note that recharge may occur from below as well as from above. Therefore, rather than a blanket type of occurrence, groundwater could be substantial and distinctly spotty because of the character of the substrata and local geological conditions.

V. SEISMOLOGICAL CONDITIONS

5.1 Faulting

There are no known or mapped active or potentially active faults that if projected would trend toward or through the site. The property does not lie in any special studies fault zone, such as the Alquist-Priolo Fault Zone.

A summary list of faults within a 100 kilometers of the site, as obtained from a search using the program UBCSEIS (Blake, 2000), is presented in Table II. The table lists the approximate distance of each fault to the site in kilometers, the fault source type, maximum magnitude of earthquake associated with the fault, slip rate and the type of the fault.

These results indicate that the closest active fault to the site and the one that could cause the most damage from earthquake ground motions is the Hollywood Fault. The Hollywood Fault is located approximately two (2) miles (2.9 kilometers) from the site. This Type B fault is dip-slip (DS) with a slip rate of about one (1) millimeters per year. The Hollywood Fault due to its proximity to the site, will also affect the site relative to strong ground shaking. Other more distant active faults may also produce notable ground motions but not to the same degree as the Hollywood Fault.

A map of faults within a 100 mile radius from the site is shown on Figure A-5, Appendix A.

5.2 Historic Earthquakes

A computer search for all earthquakes that occurred between 1800 and 2000, within a sixty-five (65) mile [one hundred (100) kilometers] radius of the site and with magnitudes of M4.0 to M9.0, was made for this project using the computer program EQSEARCH, Version3.0 (Blake, 2000).

Historic earthquake epicenters from 1800 to 2000, within a sixty-five (65) mile [one hundred (100) kilometers] radius of the site and exceeding a magnitude of M4.0 on the Richter Scale, are shown on Figure A-6, Appendix A. Historic earthquakes exceeding a magnitude of M6.0 are tabulated on Table III. Historic site accelerations were obtained using the attenuation relationship proposed by Boore et al. (1997). The seismic recurrence curve, based on historical earthquakes is provided on Figure A-7, Appendix A.

5.3 Site Accelerations - Probabilistic

The probabilistic seismic risk analysis is based on the premise that moderate to large earthquakes occur on mappable Quaternary faults and that the occurrence rate of earthquakes on each fault is

TABLE II

Summary of Parameters of Faults within a One Hundred (100) kilometer Radius of the Project Site

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE FROM SITE (km)	SOURCE TYPE (A, B, C)	MAXIMUM MAGNITUDE (Mw)	SLIP RATE (mm/y)	FAULT TYPE (SS, DS)
Hollywood	2.9	B	6.5	1.00	DS
Raymond	7.6	B	6.5	0.50	DS
Verdugo	9.7	B	6.7	0.50	DS
Santa Monica	10.6	B	6.6	1.00	DS
Newport-Inglewood (Los Angeles Basin)	11.4	B	6.9	1.00	SS
Sierra Madre (Central)	16.3	B	7.0	3.00	DS
Sierra Madre (San Fernando)	21.0	B	6.7	2.00	DS
Malibu Coast	22.0	B	6.7	0.30	DS
San Gabriel	25.7	B	7.0	1.00	SS
Palos Verdes	26.5	B	7.1	3.00	SS
Elsinore-Whittier	27.7	B	6.8	2.50	SS
Clamshell-Sawpit	28.1	B	6.5	0.50	DS
Santa Susana	32.3	B	6.6	5.00	DS
San Jose	36.9	B	6.5	0.50	DS
Anacapa-Dume	38.6	B	7.3	3.00	DS
Holser	41.1	B	6.5	0.40	DS
Chino-Central Avenue (Elsinore)	47.4	B	6.7	1.00	DS
Cucamonga	49.6	A	7.0	5.00	DS
Oak Ridge (Onshore)	50.2	B	6.9	4.00	DS
Simi-Santa Rosa	51.7	B	6.7	1.00	DS
San Andreas - 1857 Rupture	53.9	A	7.8	34.00	SS
San Cayetano	58.1	B	6.8	6.00	DS
Newport-Inglewood (Offshore)	65.2	B	6.9	1.50	SS
Elsinore-Glen Ivy	65.7	B	6.8	5.00	SS
San Jacinto - San Bernardino	74.4	B	6.7	12.00	SS
San Andreas -Southern	74.7	A	7.4	24.00	SS
Santa Ynez (East)	77.6	B	7.0	2.00	SS
Cleghorn	80.3	B	6.5	3.00	SS
Ventura - Pitas Point	83.2	B	6.8	1.00	DS
M. Ridge - Arroyo Parida - Santa Ana	90.9	B	6.7	0.40	DS
North Frontal Fault Zone (West)	96.4	B	7.0	1.00	DS
Coronado Bank	97.0	B	7.4	3.00	SS
Red Mountain	97.4	B	6.8	2.00	DS
San Jacinto -San Jacinto Valley	97.6	B	6.9	12.00	SS
Garlock (West)	98.6	A	7.1	6.00	SS
Pleito Thrust	99.8	B	6.8	2.00	DS

NOTES: SS – Strike-Slip
DS – Dip-Slip

TABLE III
HISTORIC EARTHQUAKES – 1800 to 2000
(Exceeding six (6) on the Richter Scale of Magnitude within sixty-five [65] miles Radius of the Project Site)

DATE (mm/dd/yy)	RICHTER MAGNITUDE (M)	APPROXIMATE DISTANCE SITE TO EPICENTER (miles)	SITE ACCELERATION (g)
12/08/1812	7.0	41.6	0.08
09/24/1827	7.0	40.9	0.08
11/27/1852	7.0	57.5	0.06
07/11/1855	6.3	11.1	0.15
12/16/1858	7.0	45.8	0.08
12/19/1880	6.0	63.9	0.04
04/04/1893	6.0	22.9	0.08
07/30/1894	6.0	42.2	0.05
07/22/1899	6.5	47.6	0.06
05/15/1910	6.0	57.7	0.04
07/23/1923	6.3	60.0	0.04
03/11/1933	6.3	37.4	0.06
02/09/1971	6.4	23.2	0.09
01/17/1994	6.7	16.4	0.14

proportional to the Quaternary fault-slip-rate. This analysis assumes that earthquakes are distributed uniformly and therefore does not consider when the last earthquake occurred on the fault. The length of rupture of the fault as a function of earthquake magnitude is accounted for, and ground motion estimates at a site are made using the magnitude of the earthquake and the closest distance from the site to the rupture zone. The probabilistic risk analysis has explicitly taken into account uncertainties associated with:

- The earthquake magnitude;
- The rupture length given magnitude;
- The location of the rupture zone on the fault;
- The maximum possible magnitude of earthquakes; and,
- The acceleration at the site given magnitude of earthquake and distance from the rupture zone to the site.

Probabilistic risk analyses were performed using the computer program FRISKSP, Version 4.0, 2000 Edition, by Blake. The fault data base was obtained from the California Division of Mines and Geology (CDMG). FRISKSP models earthquake sources and computes site-specific probabilities of exceedence of given acceleration levels or pseudo-relative velocity levels for each earthquake source.

The program offers a choice of attenuation relationships proposed by various researchers to evaluate the attenuation of earthquake energy with distance from the source. For this study, based on field testing results at the boring locations, the attenuation proposed by Boore, et.al. (1997) - Soil (310), Campbell and Bozorgnia (1997, revised) - Deep Soil and Sadigh, et.al. (1997) - Alluvium were used. Calculated peak ground accelerations using these three (3) attenuation relationships were performed for two (2) probabilities of exceedence/return periods. A ten (10) percent chance of exceedence in fifty (50) years or return period of 475 years, and a ten (10) percent chance of exceedence in 100 years or a return period of 949 years were evaluated.

Table IV presents a summary of peak ground accelerations for the LACC campus.

TABLE IV
SUMMARY OF PEAK GROUND ACCELERATIONS

Attenuation Relationship	Peak Ground Accelerations (g)	
	475 years*	949 years**
Boore, et.al. (1997) – Soil (310)	0.56	0.68
Campbell and Bozorgnia (1997, revised) – Deep Soil	0.58	0.72
Sadigh (1997) – Alluvium	0.58	0.74

***NOTE*:** * Ten (10) percent in fifty (50) years
** Ten (10) percent in one hundred (100) years

The seismic response of a structure or element is dependent upon its strength, damping characteristics, and the stress-strain relationship for the structure considered. The response spectrum is defined as a graphical relationship of maximum response of a single-degree-of-freedom elastic system with damping to dynamic motion or forces. The most usual measures of response are maximum displacement, D, which is a measure of the strain in the spring element of the system, maximum pseudo relative velocity, V, which is a measure of the energy absorption in the spring of the system, and maximum pseudo acceleration, A, which is a measure of the maximum force in the spring of the system. Seismic response spectra for the ground accelerations for the return periods of 475 and 949 years tabulated above are provided as Figures A-8 and A-9, inclusive, Appendix A.

It is suggested that the design spectrum for vertical response be considered equal to two-thirds (2/3) that for horizontal response. It is reasonable to combine the effects of the several components of motion in a probabilistic manner, by taking the maximum stress, deflection, or other specific response as the square root of the sums of the squares of the corresponding response to the individual components of motion.

5.4 Earthquake Effects

5.4.1 Tsunami/Seiche, Inundation and Flooding

The property is far and high enough from the coast or large inland body of water to preclude damage from a tsunami or seiche wave. The site is not located in the one hundred (100) year flood zone as defined by the Federal Emergency Management Agency (FEMA). The location of the LACC campus is shown on the official FEMA map which is presented as Figure A-10, Appendix A.

5.4.2 Liquefaction Potential

Liquefaction occurs when the pore pressures generated within a soil mass equals the overburden pressure. This results in a loss of strength and the soil then possesses a certain degree of mobility.

Factors considered to evaluate liquefaction potential include groundwater conditions, soil type, particle size distribution, earthquake magnitude and acceleration, and soil density obtained through the Standard Penetration Test (SPT). Soils subject to liquefaction comprise saturated fine grained sands to coarse silts. Coarser-grained soils are considered free-draining and therefore dissipate excess pore pressures, while fine-grained soils possess undrained shear strength.

Based on the Seismic Hazard Zones, Hollywood Quadrangle prepared by the California Division of Mines and Geology dated March 25, 1999, the LACC Campus is located outside the area where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required (see Figure A-11, Appendix A). In addition, the possibility of liquefaction at the site is considered very low due to the indurated older alluvium (low plastic clays/silts and medium to very dense silty sands) and shallow bedrock.

5.4.3 Seismically Induced Settlement

The potential of significant differential settlement due to seismic shaking exists in loose sandy soils. Based on the log of borings presented in Appendix B, the project site is underlain mainly by clayey soils, with some medium to very dense sandy materials that are not susceptible to significant differential settlement due to seismic shaking; however, the potential for seismic settlement should be confirmed based on a more detailed site specific investigation.

5.4.4 Lateral Spreading

Seismically induced lateral spreading involves primarily movement of earth materials due to ground shaking. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the project site and in the immediate vicinity of the site is relatively flat. Therefore, the potential for lateral spreading at the subject site is considered very low.

5.4.5 Surface Rupture

The likelihood of direct surface fault rupture at the site is considered very low based on the presently known tectonic framework. Cracking due to shaking from distant events is not considered a significant hazard, although it is a possibility at any site.

5.4.6 Landsliding

The site is relatively flat and lies far enough from the nearest significant upland slopes to preclude the hazards of induced landsliding.

5.5 UBC Seismic Design Parameters

For seismic design by 1995 California Building Code and 1994 UBC static force procedure, the project site coefficient is Type S_2 (S-factor=1.2). This procedure does not take into account the higher seismic exposure of sites located near active faults relative to other sites within Seismic Zone 4.

For seismic design by the 1997 UBC Static Force Procedure, which includes "near source" factors for sites located close to active faults, additional site parameters are required. The project site is located within two (2) miles (2.9 kilometers) of the Hollywood Fault, which is considered Type B seismic source based on 1997 UBC. The near source factors are N_a= 1.2 and N_v=1.5.

Based on SPT blow counts from the field investigation, Appendix B, the site is Type S_D (15<N<50).

The seismic design response spectrum based on UBC 1997 is provided as Figure A-12, Appendix A.

VI. CONCLUSIONS

6.1 General

Based on the results of our site investigation, and geologic and seismicity study, it is our opinion that the site is suitable for the proposed development. From a geotechnical engineering standpoint, the following observations which may influence design and construction decisions were noted.

6.2 Underground Parking Structure

Based on the preliminary layout plan prepared by Amphibian Architects, it is understood that the Finish Floor Elevation of the underground parking structure at the northwestern corner of the LACC Campus will be at 302.0 feet above MSL (approximately fifteen [15] to twenty [20] feet below existing ground surface).

A braced or tieback shoring system, or temporary cut slopes may be required for the basement excavation. It should be noted that groundwater was observed at elevations 308.0 and 285.0 feet above MSL at borings B-1 and B-2 locations, respectively. Dewatering may be required to bring the groundwater level below the level of excavation and to maintain a dry working condition. It is recommended that additional borings be drilled within the parking structure footprint to evaluate the groundwater conditions.

6.3 Other Observations

The soils at the site have a "low" to "medium" expansion potential (Expansion Indices = 28 to 65). Soils with medium expansion potential should have little or no impact on the proposed development.

The soils at the site have "severe" to "very severe" corrosive potential with respect to steel and other metals, and "low" to "very severe" corrosive potential with respect to concrete. Protection of steel against corrosion will be required for steel structures placed in contact with the subsoils at the site. Type V Portland cement should be used for construction of concrete structures in contact with the subsoils at the site.

Potential geologic and seismic-related hazards are discussed in Section V. Based on this study, no major geologic and seismic-related hazards are identified at the project site; however, all proposed structures should be designed for the seismic factors (e.g. ground acceleration) discussed in Section V.

VII. PRELIMINARY RECOMMENDATIONS

7.1 General

The following recommendations are provided for preliminary design and planning purposes, and are not intended for use for final design or construction. Site-specific investigations with additional borings within the proposed building area will be required to establish soil parameters for final design. All proposed structures should be designed for the seismic factors discussed in Section V. Foundations and slab reinforcement configurations should meet, as a minimum, the requirements of the governing agencies and the Uniform Building Code (UBC). In this respect, the results of the expansion potential test shows the on-site soils at the boring locations have a "low" to "medium" expansion potential (Expansion Indices = 28 to 65).

7.2 Grading

7.2.1 Clearing

All undocumented fills, surface vegetation, trash, debris, underground pipes and concrete pieces after demolition of the existing structures and its foundations should be cleared and removed from the proposed site. Topsoil is not considered suitable for structural support, but it may be stockpiled for landscaping purposes.

Underground facilities such as utilities, irrigation pipes or underground storage tanks may exist at the site. Removal of underground tanks is subject to state law as regulated by County or City Health and/or Fire Department agencies. If storage tanks containing hazardous or unknown substances are encountered, the proper authorities must be notified prior to any attempts at removing such objects.

Septic tanks should be removed in their entirety. Cesspools or seepage pits should be pumped of their contents and removed in their entirety.

Any water wells, if encountered during construction, should be exposed and capped in accordance with the requirements of the regulating agencies.

Depressions resulting from the removal of foundation of existing structures, buried obstructions and/or mature trees should be backfilled with properly compacted material.

7.2.2 Subgrade Preparation

The subgrade for the proposed structures and paved areas should be properly prepared to provide adequate support for the structures. In this respect, all loose soils and any uncertified fill soils that may exist within the proposed buildings or paved areas should be removed and replaced as properly compacted fill (minimum ninety [90] or ninety-five [95] percent relative compaction, based on ASTM D 1557). At the boring locations, up to six (6) feet of fills were observed.

Additional site-specific investigations will be required to provide a better estimate of the volume of earthwork required at the site.

7.2.3 Fill Placement/Compaction

Fill soils should be placed in loose lifts of six (6) to eight (8) inches, moisture conditioned(wetted or dried) to near optimum for granular soils and approximately two (2) to four (4) percentage points above optimum for cohesive soils. Fill soils should be compacted to a minimum of ninety (90) or ninety-five (95) percent relative compaction (ASTM D 1557).

7.2.4 Excavatability

All types of deposits encountered in the borings and within the planned depths of development are considered economically rippable in open excavations with conventional grading and excavation equipment (backhoes, dozers and loaders).

7.2.5 Site Drainage

Proper surface drainage should be maintained during and after construction for proper performance of the structures. To enhance future site performance, it is recommended that no planters be constructed adjacent to proposed footings.

7.3 <u>Foundations</u>

Spread or continuous footing foundations will likely be the most feasible foundations for supporting the structures proposed for the development. Drilled reinforced concrete pile foundations may also be used to support the proposed buildings.

7.3.1 Footing Foundations

Spread or continuous footings may be used for support of the proposed underground parking structure and other at grade buildings. Footings should be based a minimum of three (3) feet, below lowest adjoining grade.

Spread or continuous footings for the underground parking structures, founded on undisturbed native soils, may be preliminarily designed for an allowable dead-plus-live load of 4,500 to 5,000 psf. Footings for at grade building structures, founded on undisturbed native soils, may be designed for allowable dead-plus-live load bearing pressure of 3,000 psf. The aforementioned allowable bearing pressures may be increased by one-third (1/3) for short-term wind or seismic loads. These parameters should be confirmed based on a more detailed site specific investigation.

7.3.2 Pile Foundations

Drilled cast-in-place concrete pile foundations may also be used for supporting the proposed structures.

Based on the SPT results at the boring locations and for cost estimating purposes, drilled, cast-in-place concrete piles may be designed on the basis of average allowable skin friction (compression) of 800 psf for the portion of the shaft below five (5) foot depth. Allowable resistance to uplift may be determined on the basis of an average allowable skin friction (tension) of 400 psf for the full shaft length. These parameters should be confirmed based on a more detailed site specific investigations.

7.4 Temporary Excavations

Temporary construction excavations are anticipated for construction of underground parking structure, pile caps, footings and utility trenches.

Temporary construction excavations at this site may be made vertically without shoring to a depth of approximately four (4) feet below adjacent surrounding grade. For deeper cuts, the slopes should be properly shored or sloped back, at least 1H:1V (Horizontal:Vertical) or flatter.

Excavations that extend below an imaginary plane inclined at forty-five (45) degrees below the edge of adjacent structures and buildings should be properly shored to maintain foundation support of the adjacent structures and buildings.

Temporary shoring consisting of a conventional soldier pile and lagging shoring system or a sheet pile shoring system may be used to support vertical cut excavations such as for the construction of the underground parking structure. For excavation depths of ten (10) to fifteen (15) feet a cantilevered shoring system may be used but only in areas where lateral movement of soils behind the wall can be tolerated. A braced or tieback shoring system should be used in areas where the performance of the adjacent structures is susceptible to movements and for excavation depths in excess of fifteen (15) feet.

Based on the results of the present investigation, the earth pressures listed below may be used for preliminary design of temporary shoring wall supporting a horizontal surface; however, these parameters should be confirmed based on more detailed site specific investigations.

- For cantilever wall, use an equivalent fluid pressure of thirty-five (35) pcf (triangular pressure distribution).

- For braced/tieback wall, use a rectangular pressure distribution of twenty-five (25) H psf; where H is height of wall above base of excavation in feet.

Figure A-13, Appendix A, shows the active pressure distribution for a shoring wall supporting a horizontal surface. Where appropriate, hydrostatic pressures and surcharge effects for uniform surcharge loads including sloped excavation may be computed using the pressure distribution diagrams provided in Figure A-14, Appendix A. Allowable passive pressures equivalent to a fluid pressure of 300 pcf may be used for soldier piles embedded in native soils.

All excavations and shoring systems should meet, as a minimum, the requirements given by the State of California Occupational Safety and Health Standards. Stability of temporary slopes are the responsibility of the contractor.

7.5 Basement and Retaining Walls

7.5.1 Earth Pressures

The walls may be designed to resist lateral pressures imposed by the surrounding soils and surcharge loads. For static loading conditions: walls which are free to rotate at the top (at least 0.01 radian deflection) may be designed to resist a lateral pressure imposed by an equivalent fluid weighing thirty-five (35) pcf; and, walls which are structurally braced against movement at the top may be designed to resist a lateral pressure equivalent to that imposed by a fluid weighing fifty-five (55) pcf. In addition, a uniform pressure on one-third (1/3) and one-half (½) of any vertical pressure adjacent to the structure may be assumed to act on the walls for free and braced walls, respectively. These aforementioned pressures assume that positive drainage will be provided, otherwise, hydrostatic pressures will have to be added. These parameters should be confirmed based on site-specific investigations.

VIII. RECOMMENDATIONS FOR ADDITIONAL WORK

The preliminary recommendations presented in the previous sections were intended for use for preliminary design and planning of the proposed development at the project site and not intended for final design or construction purposes. Site-specific investigations should be carried out after the proposed structure locations have been finalized. This work may include:

- Additional borings within the proposed building footprints and paved areas and additional laboratory testing to confirm the subsurface and groundwater conditions.

- Additional R-Value Tests and Expansion Index Tests should be performed.

IX. LIMITATIONS

The preliminary geotechnical evaluation presented herein was performed in accordance with generally accepted geotechnical engineering principles and practice. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is intended for use with regard to the specific project discussed herein. ***This report does not relate any conclusions or recommendations about the potential for hazardous and/or contaminated materials existing at the site.*** The conclusions and recommendations contained in this report are based on the data relating only to the project and location discussed herein.

The analyses and recommendations submitted in this report are intended for preliminary design and planning purposes, and are based upon the observations noted during drilling of the borings shown on the site plan, interpretation of laboratory test results and geological evidence. This report does not reflect any variations which may occur between the borings.

Respectfully submitted
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D:\backup\wp{wp}.bk1

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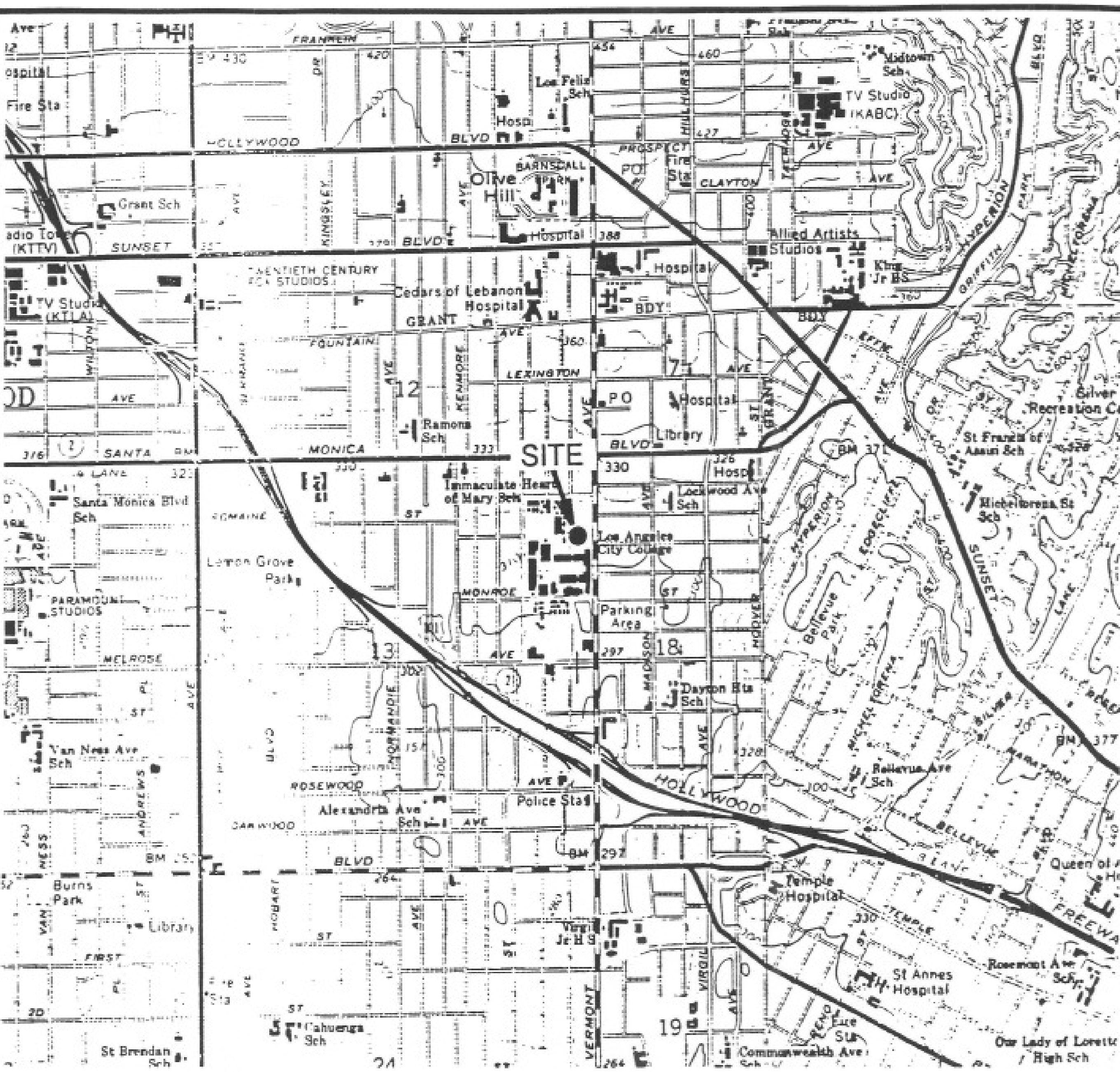
APPENDIX A



NOTE:

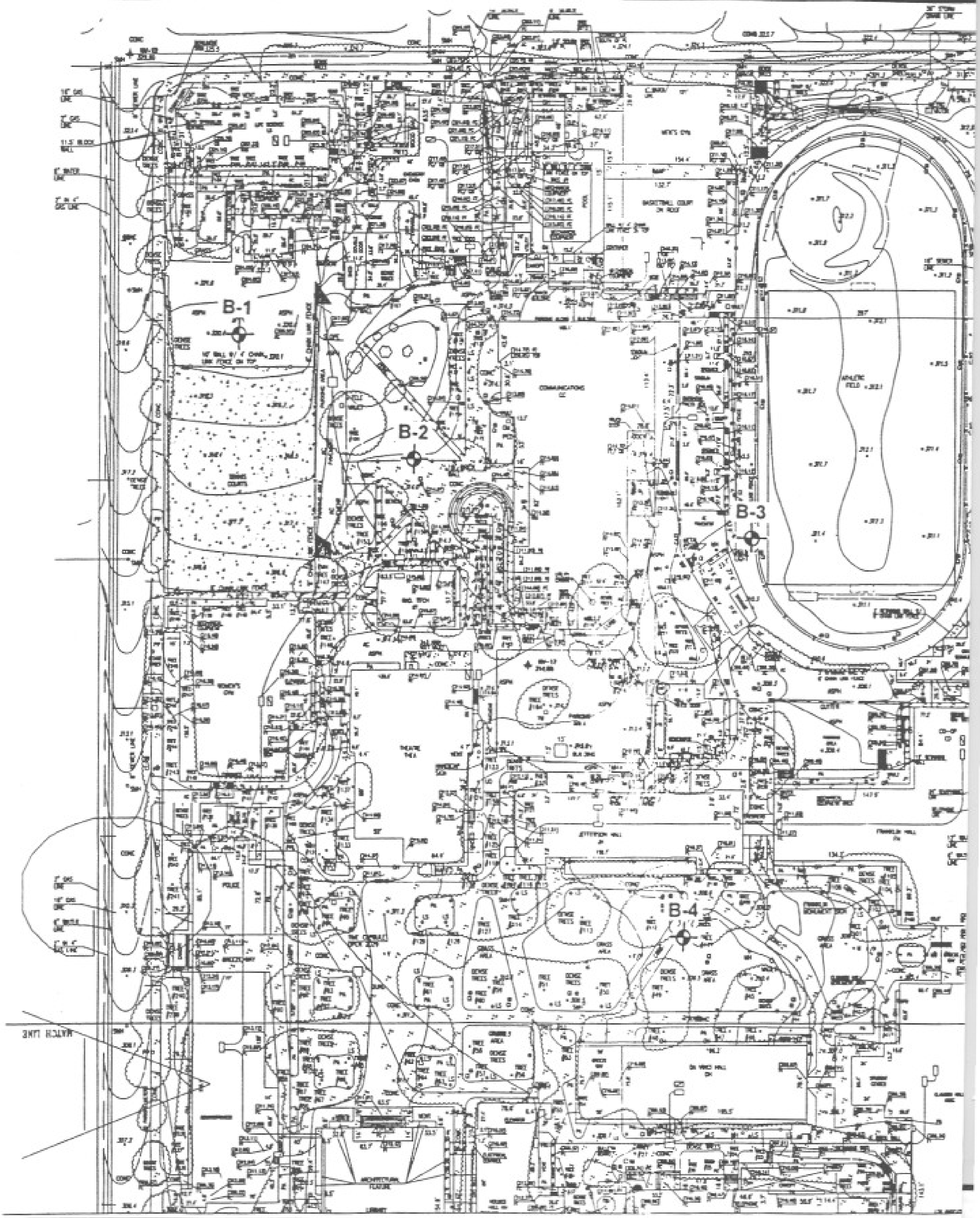
Base map from USGS 7.5 minute series Hollywood
(1966, photorevised 1981), California Topographic Quadrangle

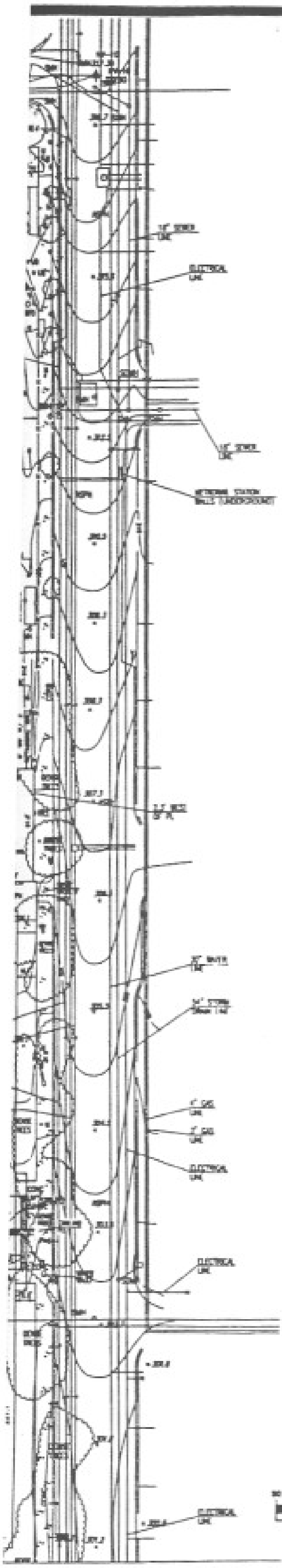
NORTH

0 1/2 1

SCALE IN MILES

GEOBASE	LOCATION MAP Los Angeles City College Los Angeles, California
	P.312.01.00 Figure A-1


B-1
B-2
B-3
B-4

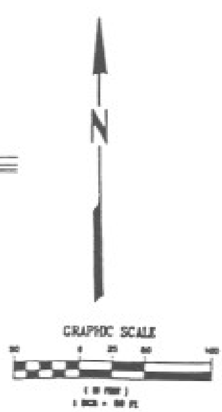


EXPLANATION

⌖ Approximate Boring Locations

NOTES:

1. GEOBASE, INC., has added only geotechnical data to this plan prepared by others. We have not checked any other information on this plan and give no assurance of its accuracy.
2. This drawing is part of GEOBASE, INC.'s report P.312.01.00 dated January 2002 and should be read with the complete report for evaluations.

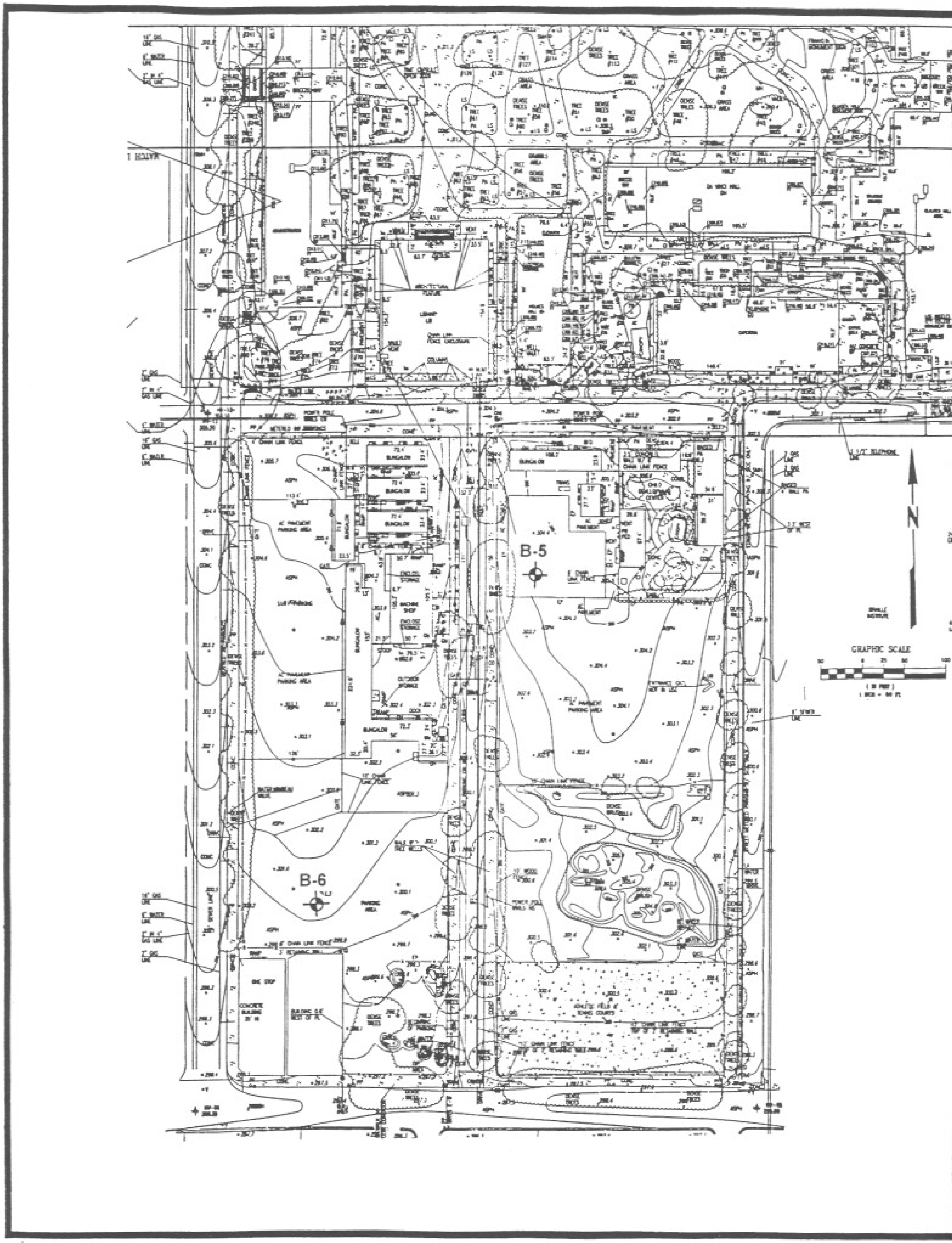


GEOBASE

SITE AND BORING LOCATIONS PLAN
Los Angeles City College
Los Angeles, California

P.312.01.00

Figure A-2 (Sheet 1 of 2)


B-5
B-6
GRAPHIC SCALE
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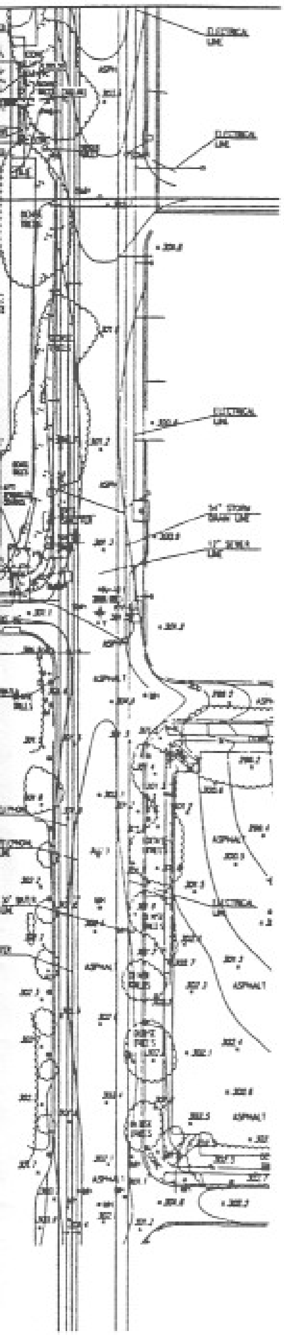


EXPLANATION

Approximate Boring Locations

NOTES:

1. GEOBASE, INC., has added only geotechnical data to this plan prepared by others. We have not checked any other information on this plan and give no assurance of its accuracy.

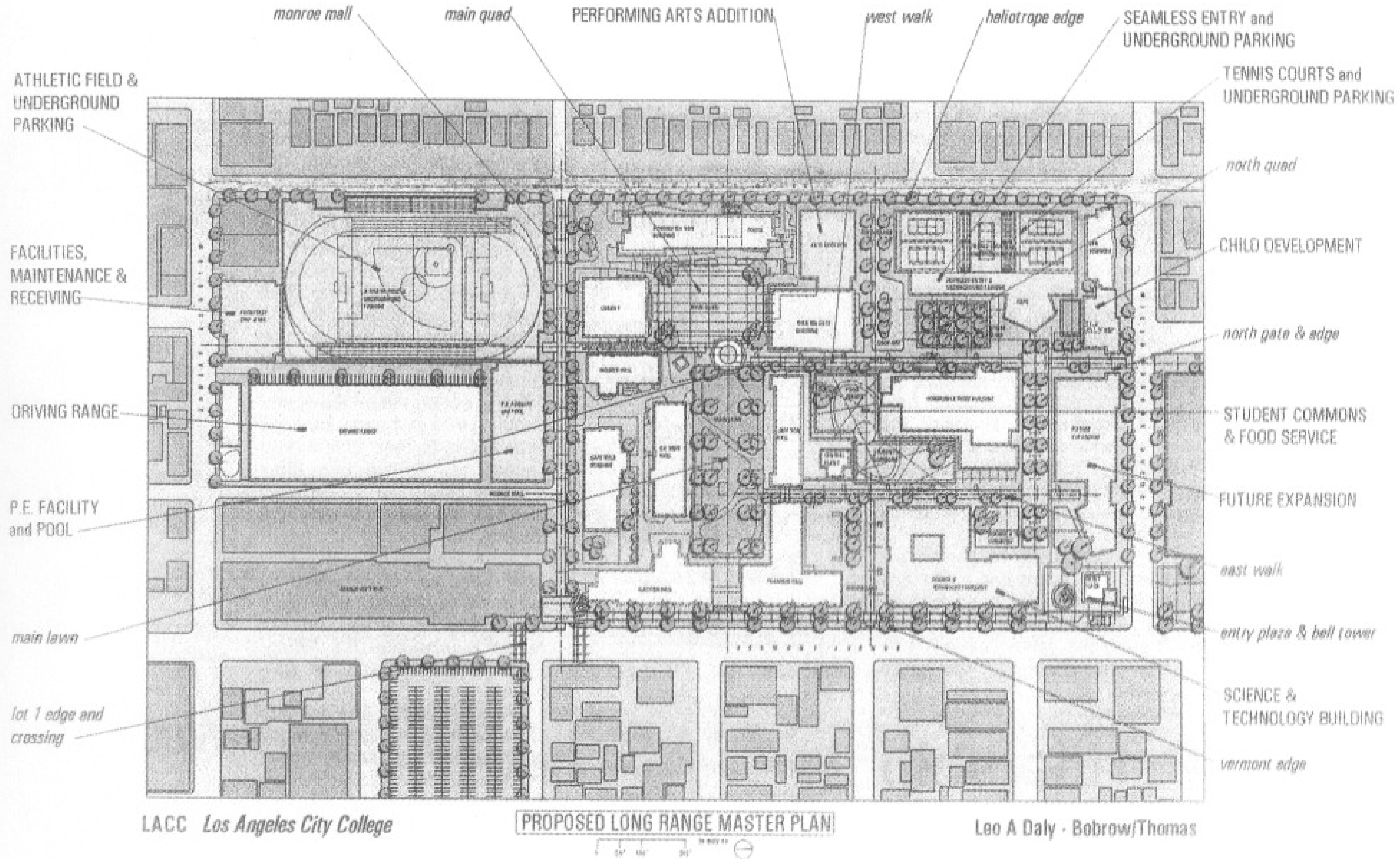
2. This drawing is part of GEOBASE, INC.'s report P.312.01.00 dated January 2002 and should be read with the complete report for evaluations.

GEOBASE

SITE AND BORING LOCATIONS PLAN
Los Angeles City College
Los Angeles, California

P.312.01.00

Figure A-2 (Sheet 2 of 2)



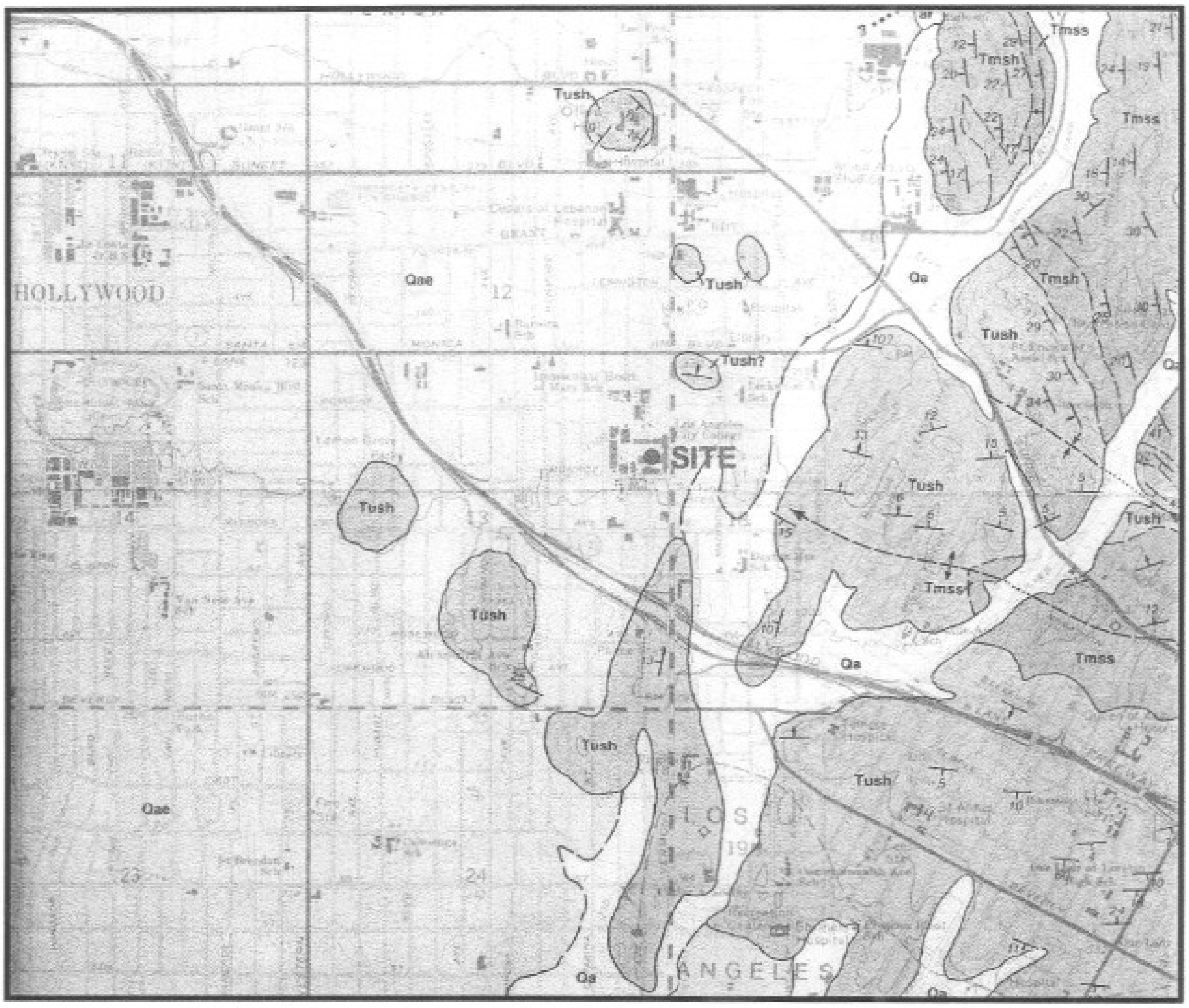
GEOBASE

PROPOSED LONG RANGE MASTER PLAN

Los Angeles City College
Los Angeles, California

P.312.01.00

Figure A-3



Qae Qop Qoa

OLDER SURFICIAL SEDIMENTS

unconsolidated to weakly consolidated; dissected and eroded where elevated; late Pleistocene age

Qae *similar to Qa, but slightly elevated and dissected; includes alluvial fan sediments*
Qop *paleosol in Baldwin Hills (Fox Hills residual paleosol of Weber et al. 1982); moderately indurated, erosion-resistant, gray to rusty brown pebbly and sandy paleosol or "hardpan" on Qoa*
Qoa *older alluvium, gray to light brown cobble-gravel, sand, silt, and clay of detritus derived from Santa Monica Mountains; similar to Qae, but slightly consolidated; in Baldwin Hills designated as Baldwin Hills sandy gravel (Weber et al. 1982), where it is much dissected and eroded*

—UNCONFORMITY—
In mountain areas

Tush

UNNAMED SHALE

(included in Puente Formation by Lamar 1970, and Weber 1980; equivalent to upper Modelo Formation of Hoots 1931; upper Modelo Formation of Durrell 1954, in Santa Monica Mountains; and to Sisquoc Shale of Dibblee 1989, in Ventura Basin)

marine clastic; late Miocene age ("Delmontian" and upper Mohnian Stages)

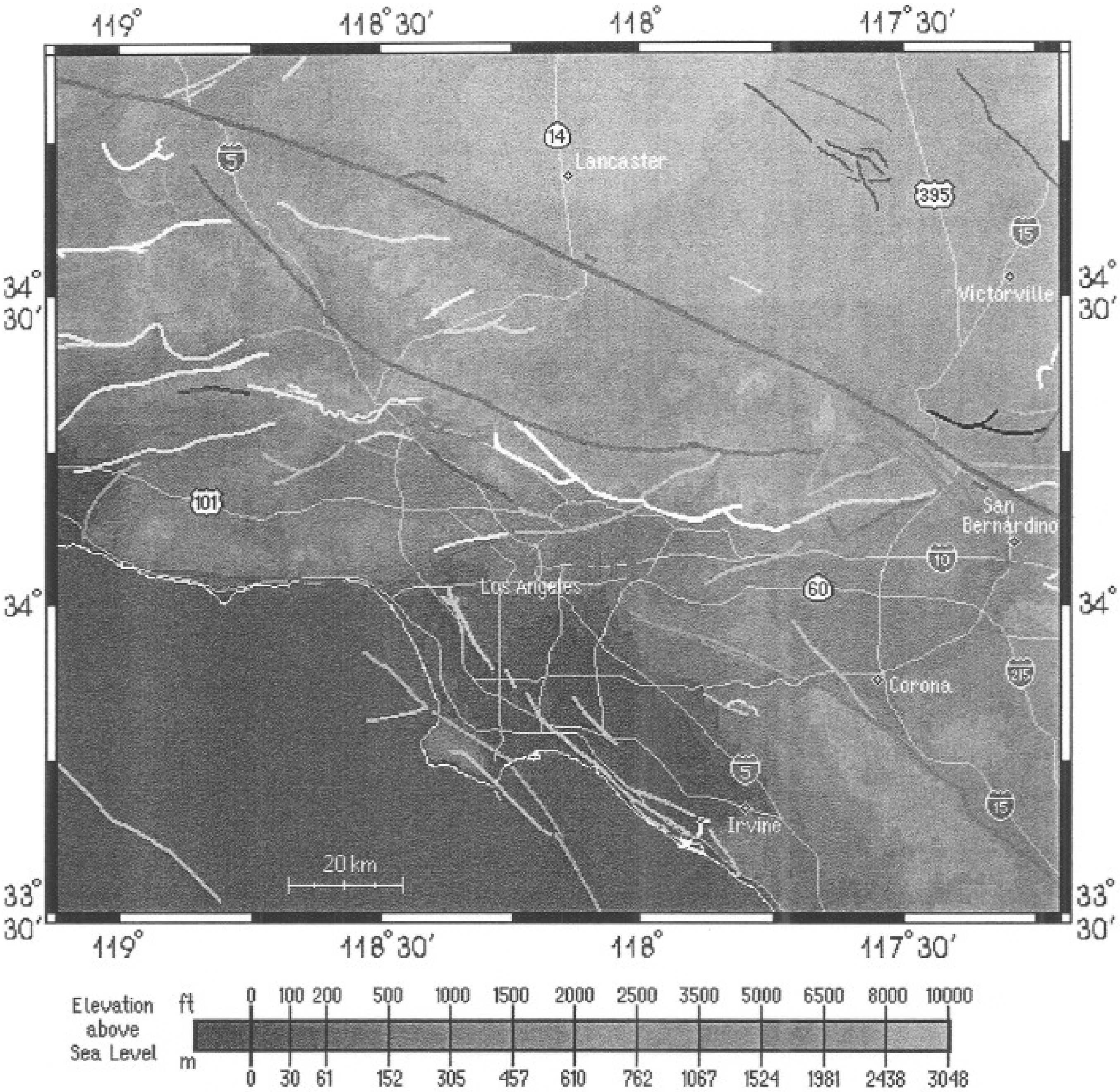
Tush *gray to light brown, thin-bedded silty clay shale, soft and crumbly; locally contains scattered hard calcareous nodules; in places contains laminae of fine grained soft sandstone*

Approximate Scale: 1:32,000

↑ N

Source: Dibblee, Thomas, W., Dibblee, 1991, Geologic Map of the Hollywood and Burbank Quadrangle, Map DF-30, Scale 1:24,000, Pubished by The Dibblee Geological Foundation

GEOBASE	**GEOLOGIC MAP** **Los Angeles City College** Los Angeles, California
P.312.01.00	Figure A-4



Source: Southern California Earthquake Center, 2001, Faults in California, Los Angeles Region.
Web Site: http://www.sce.cdc.scec.org/lafault.html

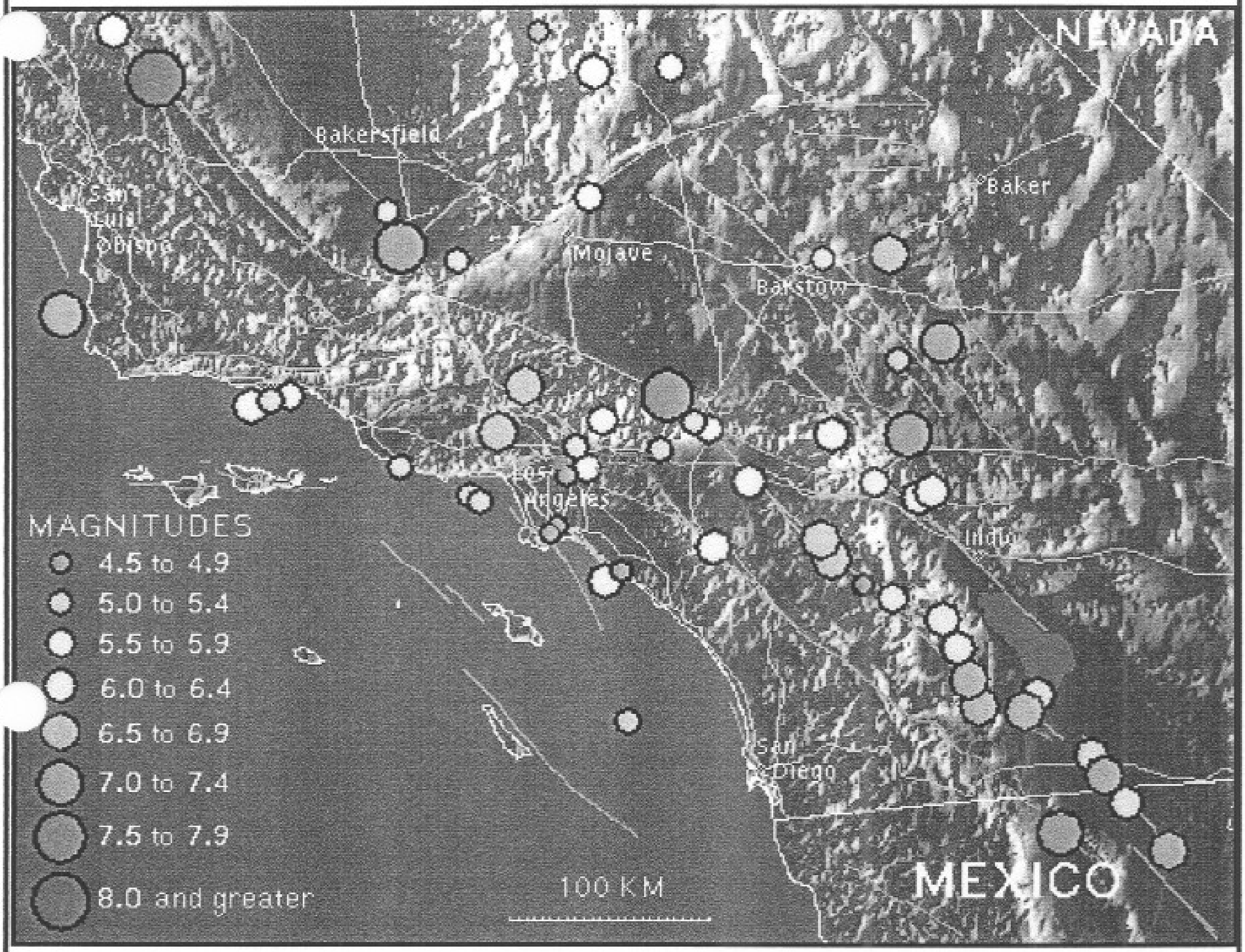
GEOBASE

SOUTHERN CALIFORNIA FAULT MAP

Los Angeles City College

Los Angeles, California

P.312.01.01 **Figure A-5**



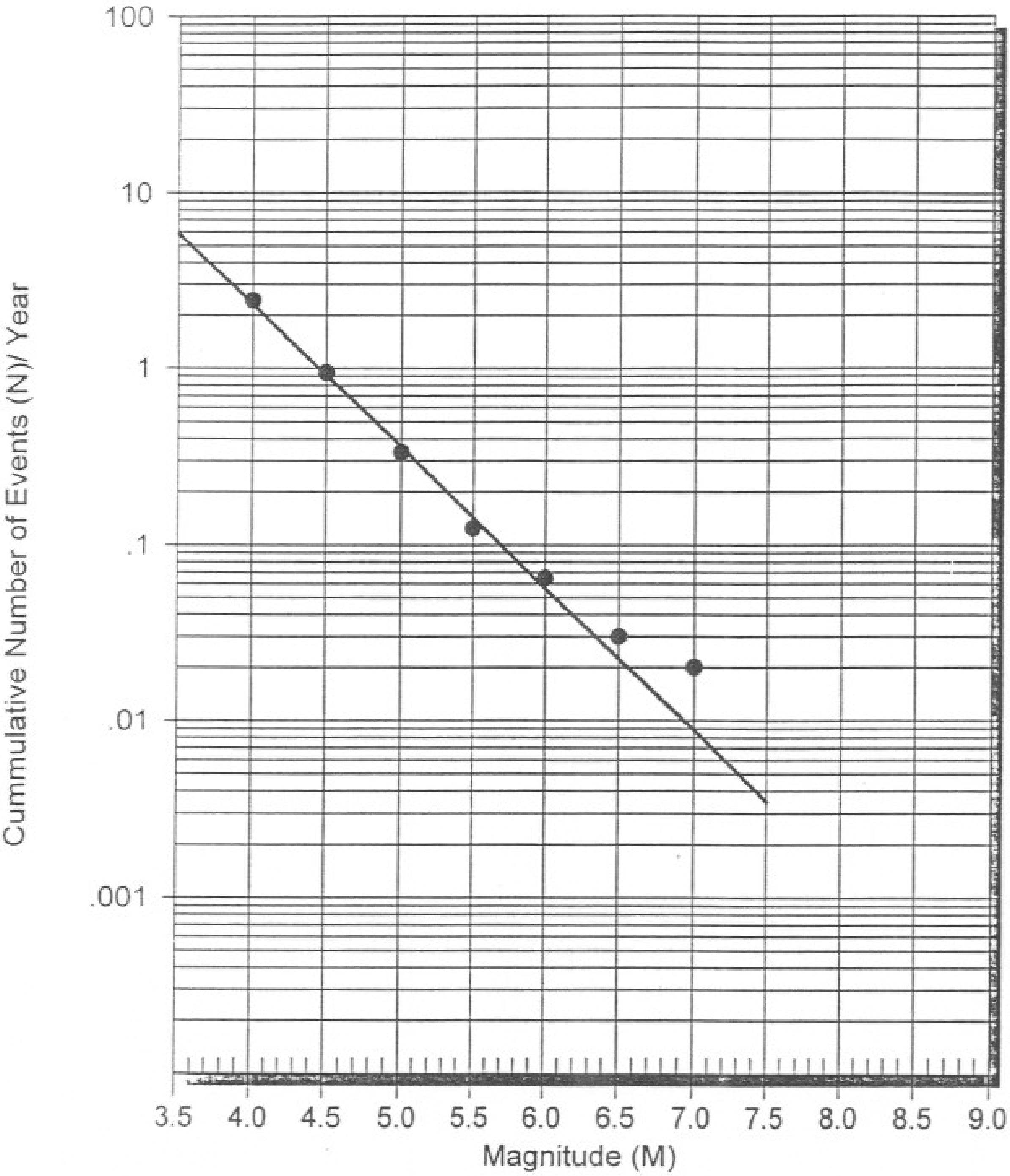
N

Source: Southern California Earthquake Center, 2001, Southern California Earthquakes.

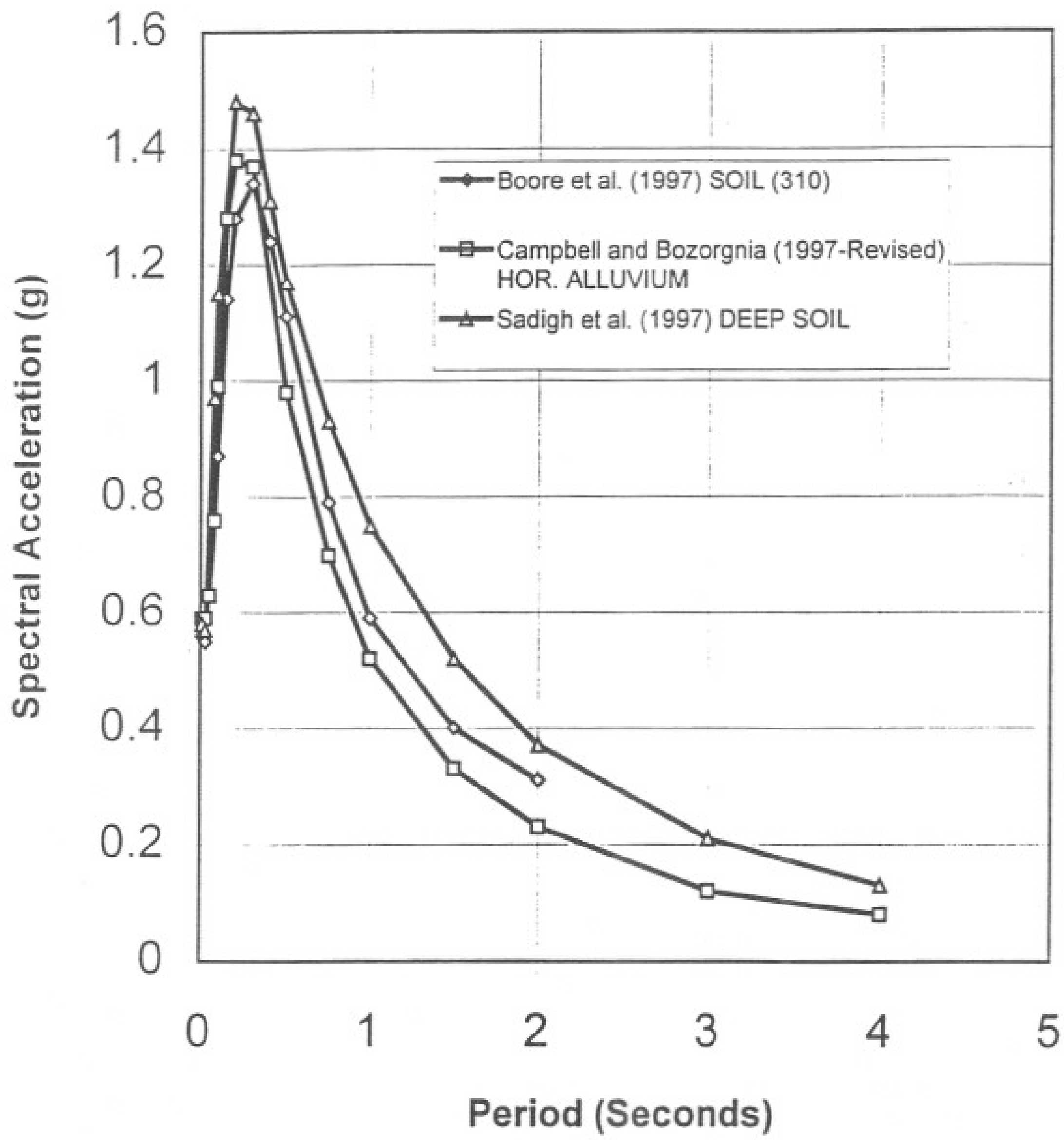
Web Site: http://www.scec.dc.sccc.org/clickmap.html

GEOBASE	**HISTORIC EARTHQUAKES 1800-2000** Los Angeles City College Los Angeles, California P.312.01.01 Figure A-6

EARTHQUAKE RECURRENCE CURVE

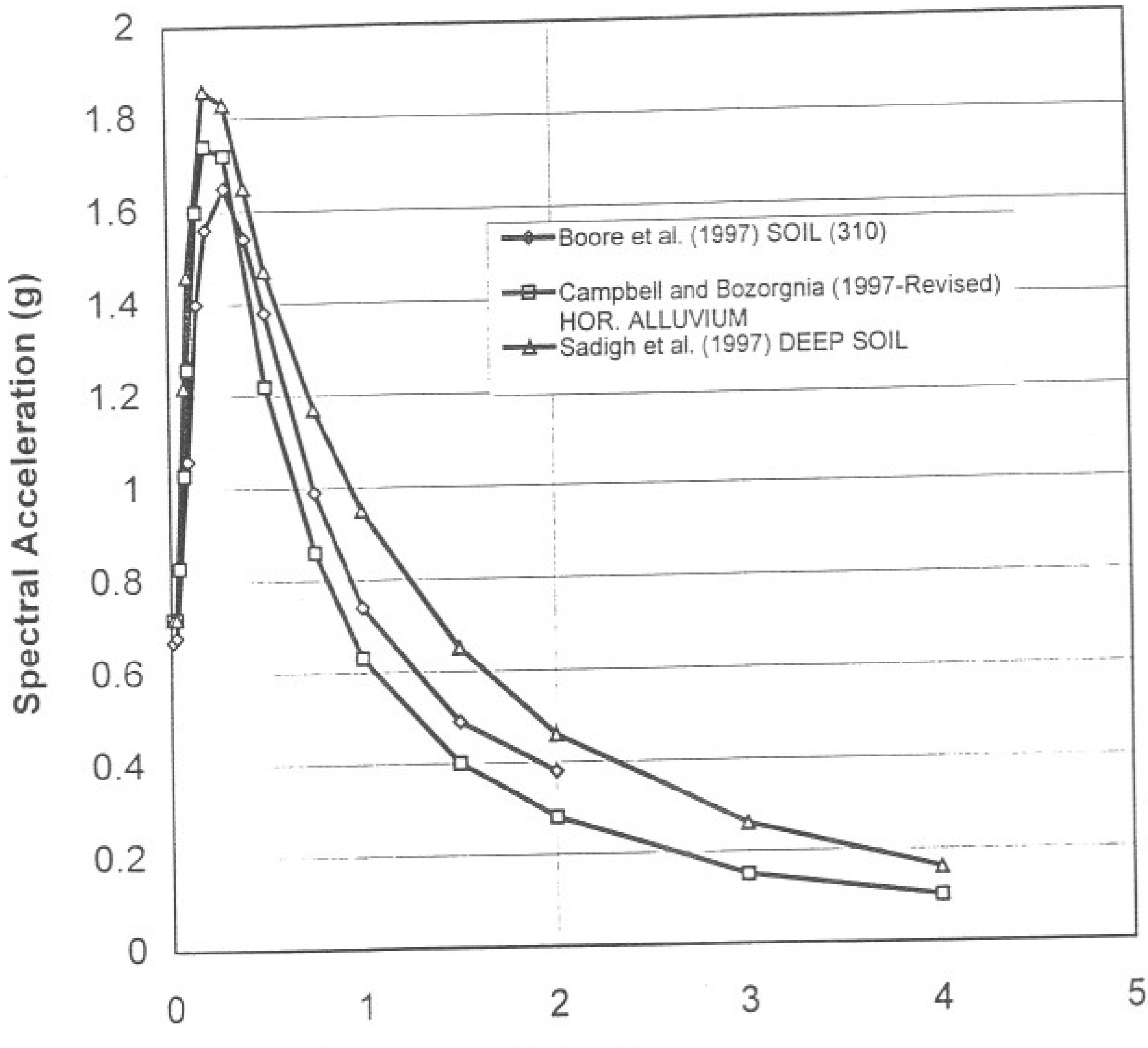


GEOBASE	SEISMIC RECURRENCE CURVE Los Angeles City College Los Angeles, California P.312.01.00 Figure A-7



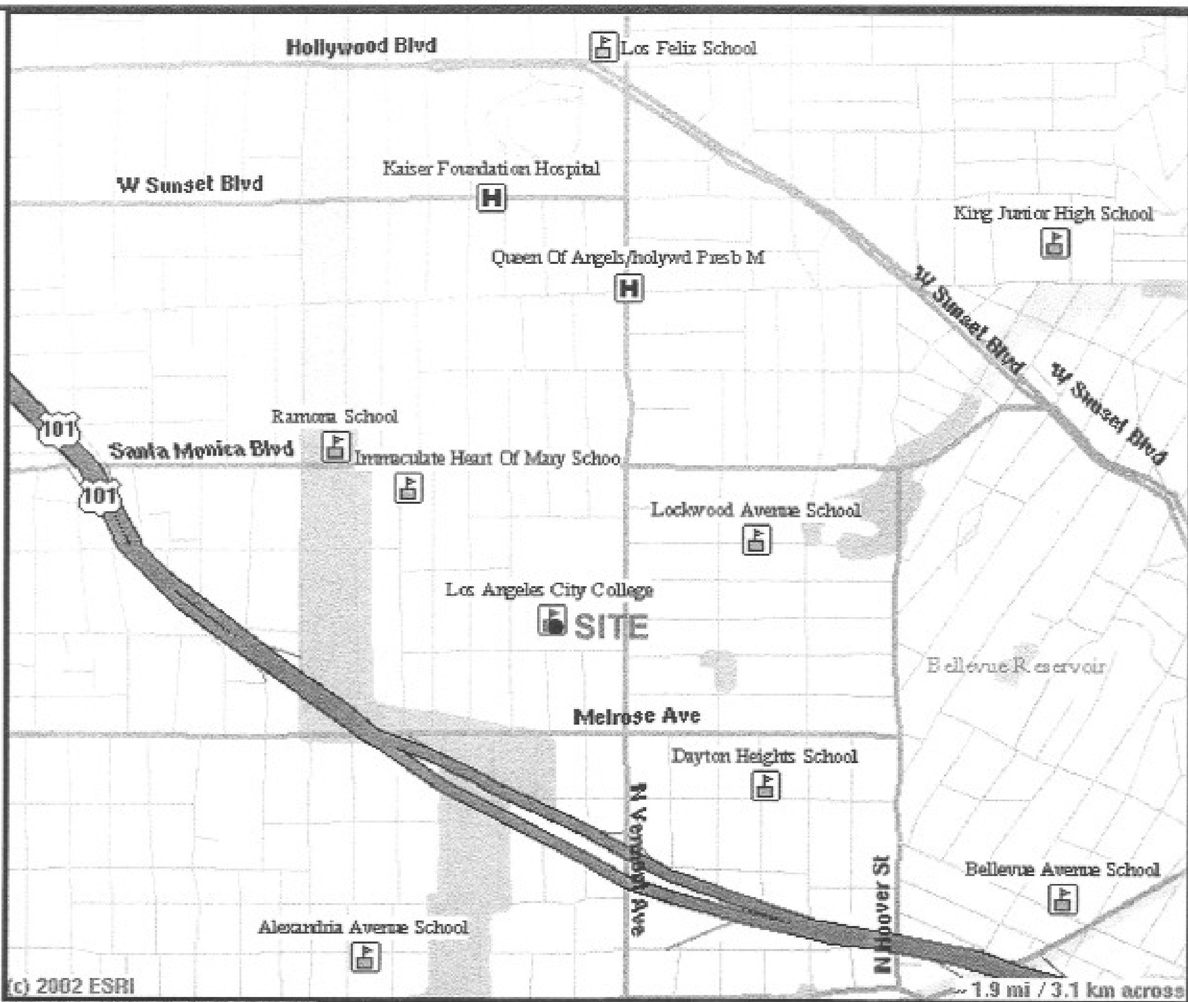
Response Spectra - 5% damping
475 Year Return Period

GEOBASE	RESPONSE SPECTRA - 475 YEAR RETURN PERIOD Los Angeles City College Los Angeles, California P.312.01.00 Figure A-8



Response Spectra - 5% damping
949 Year Return Period

GEOBASE	RESPONSE SPECTRA - 949 YEAR RETURN PERIOD Los Angeles City College Los Angeles, California P.312.01.00 Figure A-9



US FLOOD HAZARD AREAS

Flood Data

- 100 – Yr Flood
- 500 – Yr Flood
- Water Bodies
- No Data

Source: FEMA, US Flood Hazard Areas
Web Site: http://www.esri.com/harzards/makemap.html

↑ N

GEOBASE

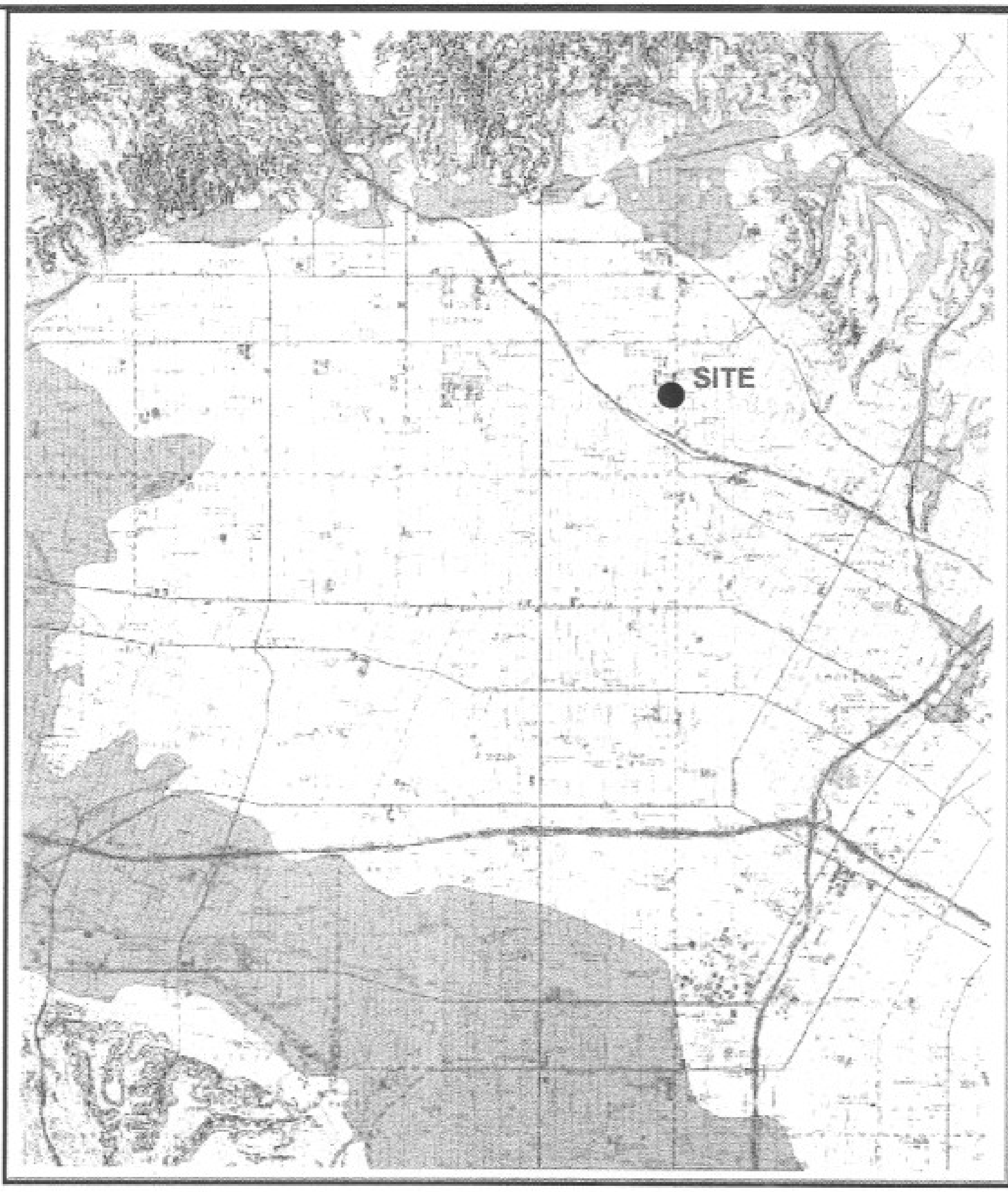
ESRI/FEMA FLOOD MAP

Los Angeles City College

Los Angeles, California

P.312.01.00

Figure A-10



Areas Susceptible to Liquefaction

Areas Susceptible to Earthquake Induced Landslides

N

Source: Division of Mines and Geology 2001, Seismic Hazard Zones, Hollywood Quardrangle, Web Site:http//www.consrv.ca.gov/ dmg/shezp/maps/p_newp.htm

GEOBASE

LIQUEFACTION AND LANDSLIDE SUSCEPTIBILITY

Los Angeles City College

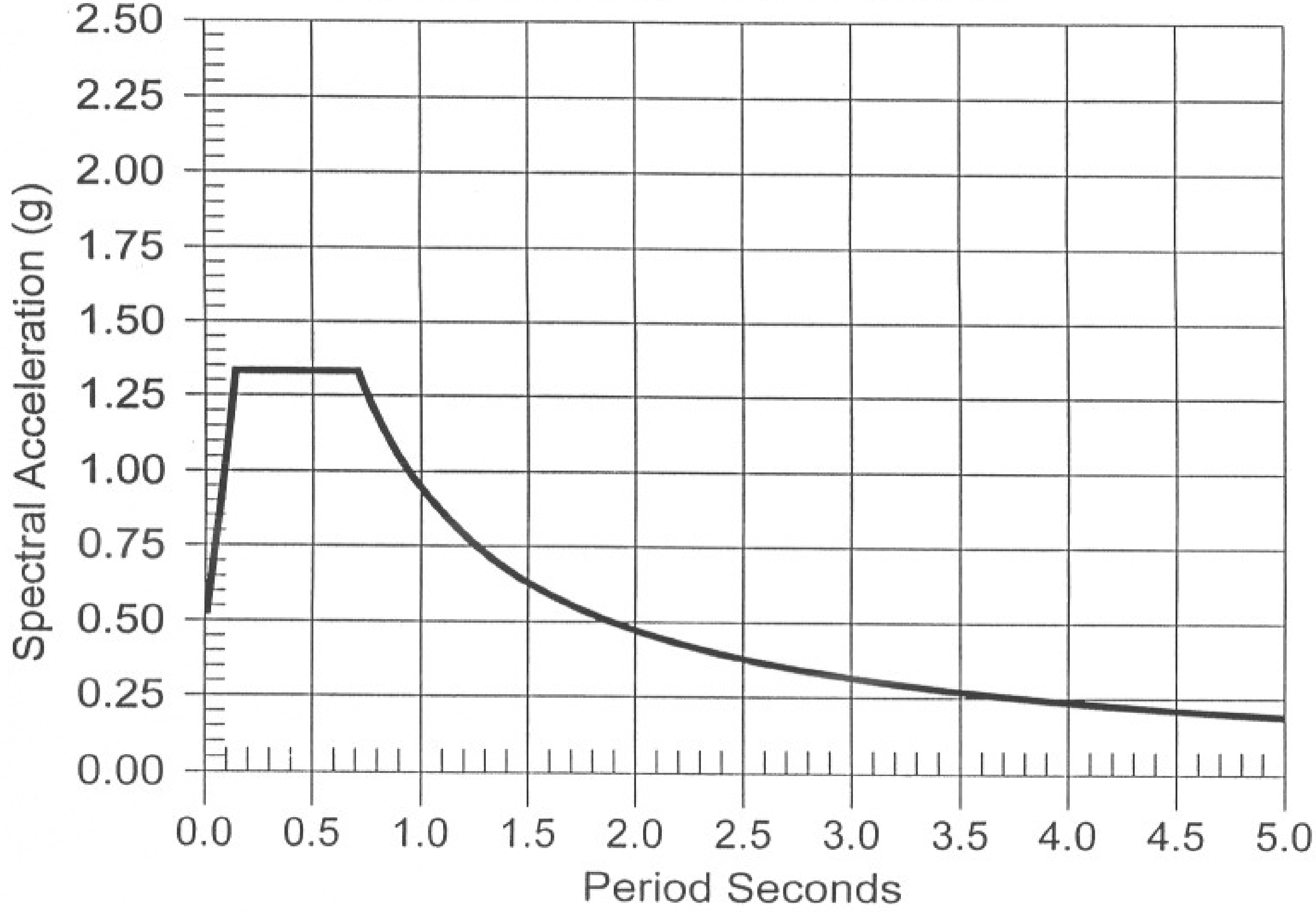
Los Angeles, California

P.312.01.00

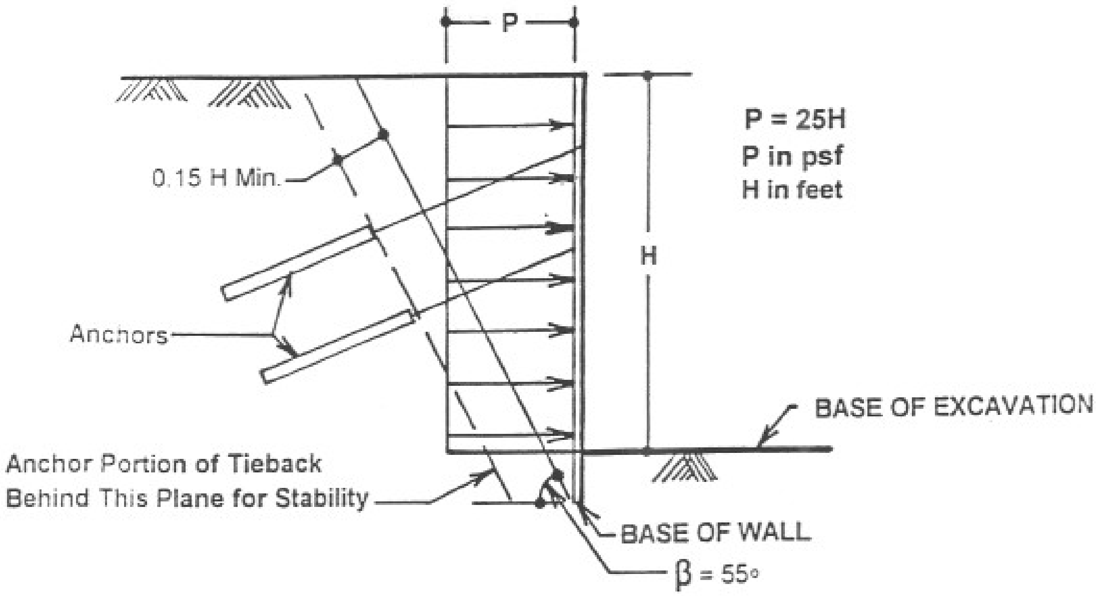
Figure A-11

DESIGN RESPONSE SPECTRUM

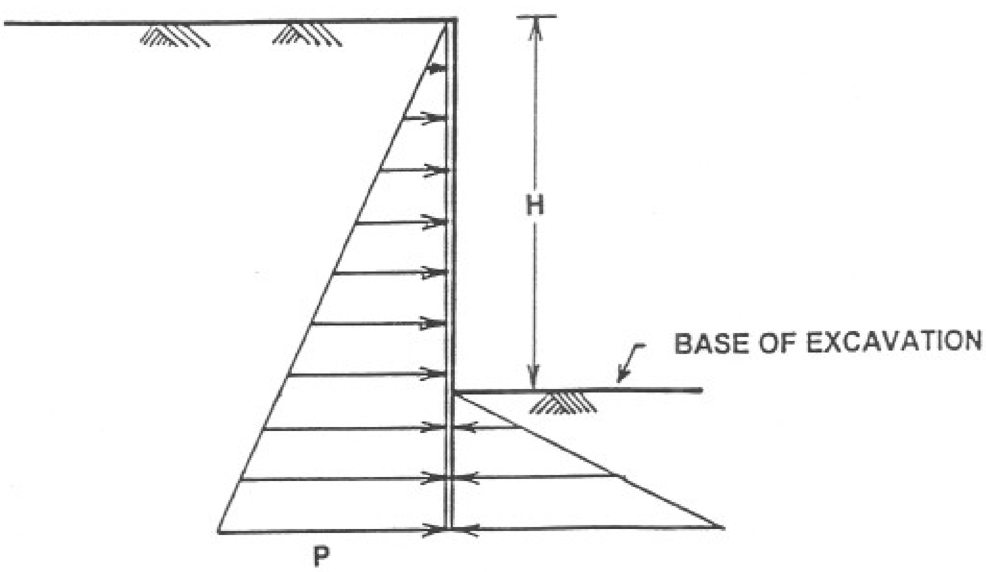
Seismic Zone: 0.4 Soil Profile: SD



GEOBASE	**UBC 1977 DESIGN RESPONSE SPECTRA** **Los Angeles City College** **Los Angeles, California** **P.312.01.00** **Figure A-12**



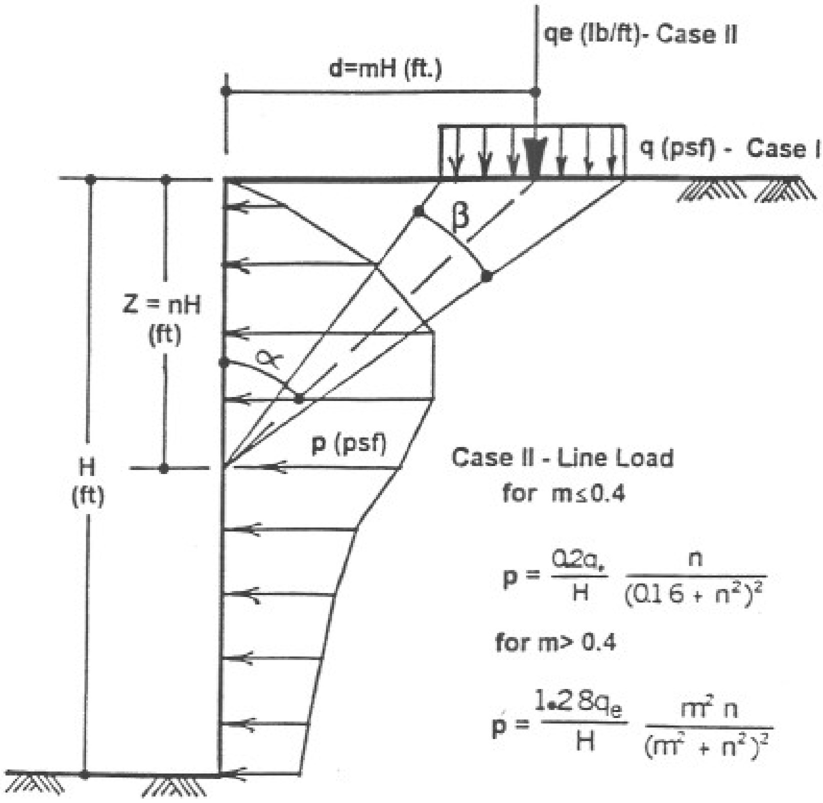
a) Tieback Shoring



b) Cantilevered Shoring

GEOBASE	EARTH PRESSURE AND TIEBACK GEOMETRY Los Angeles City College Los Angeles, California P.312.01.00 Figure A-13

Case I - Strip Load : $p = \frac{2q}{\pi}(\beta - \sin\beta \cos 2\alpha)$



Case II - Line Load

for $m \leq 0.4$

$$p = \frac{0.2 q_e}{H} \frac{n}{(0.16 + n^2)^2}$$

for $m > 0.4$

$$p = \frac{1.28 q_e}{H} \frac{m^2 n}{(m^2 + n^2)^2}$$

NOTE. Construction surcharge is assumed to be line load or strip load.

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ADDITIONAL LATERAL EARTH PRESSURES ON SHORING

Los Angeles City College
Los Angeles, California

P.312.01.00

Figure A-14

APPENDIX B

The terms and symbols used on the Log of Borings to summarize the results of the field investigation and subsequent laboratory testing are described in the following:

It should be noted that materials, boundaries, and conditions have been established only at the boring locations, and are not necessarily representative of subsurface conditions elsewhere across the site.

A. PARTICLE SIZE DEFINITION (ASTM D2487 and D422)

Boulder	-- larger than 12-inches
Cobble	-- 3-inches to 12-inches
Gravel, coarse	-- 3/4-inch to 3-inches
Gravel, fine	-- No. 4 sieve to 3/4-inch
Sand, coarse	-- No. 10 to No. 4 sieve
Sand, medium	-- No. 40 to No. 10 sieves
Sand, fine	-- No. 200 to No. 40 sieves
Silt	-- 5µm to No. 200 sieves
Clay	-- smaller than 5µm

B. SOIL CLASSIFICATION

Soils and bedrock are classified and described according to their engineering properties and behavioral characteristics. The soil of each stratum is described using ASTM D2487 and D2488.

The following adjectives may be employed to define percentage ranges by weight of minor components:

trace	-- 1-10%
little	-- 10-20%
some	-- 20-35%
"and" or "y"	-- 35-50%

The following descriptive terms may be used for stratified soils:

parting	-- 0 to 1/16-in. thickness;
seam	-- 1/16 to 1/2-in. thickness;
layer	-- 1/2-in. to 12-in. thickness;
stratum	-- greater than 12-in. thickness.

C. SOIL DENSITY AND CONSISTENCY

The density of coarse grained soils and the consistency of fine grained soils are described on the basis of the Standard Penetration Test:

COARSE GRAINED SOILS		FINE GRAINED SOILS		
Density	SPT Blows per foot	Estimated Consistency	SPT Blows per foot	Estimated Range of Unconfined Compressive Strength (tsf)
very loose	less than 4	very soft	less than 2	less than 0.25
loose	4 to 10	soft	2 to 4	0.25 to 0.50
medium	10 to 30	firm (medium)	4 to 8	0.50 to 1.0
dense	30 to 50	stiff	8 to 15	1.0 to 2.0
very dense	over 50	very stiff	15 to 30	2.0 to 4.0
		hard	over 30	over 4.0

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EXPLANATION OF TERMS AND SYMBOLS

Figure B1

02493-2.DRW

D: STANDARD PENETRATION TEST (SPT) -- D1586

The SPT test involves failure of the soil around the tip of a split spoon sampler for a condition of constant energy transmittal. The split spoon, 2-inches outside diameter and 1 3/8-inches inside diameter, is driven eighteen (18) inches. The sampler is seated in the first six (6) inches and the number of blows required to drive the sampler the last foot is recorded as the "N" value or SPT blow count. The driving energy is provided by a 140 pound weight dropping thirty (30) inches.

E. SAMPLE TYPE

■ Thin walled tube | SPT split spoon | ☒ California modified sampler | Disturbed | No recovery | Core

F. ABBREVIATION OF LABORATORY TEST DESIGNATIONS

C	Consolidation	PP	Pocket Penetrometer
CBR	California Bearing Ratio	PS	Particle Size
Ch	Water Soluble Chlorides	RV	R-Value
DS	Direct Shear	SE	Sand Equivalent
EI	Expansion Index	SG	Specific Gravity
ER	Electrical Resistivity	SO_4	Water Soluble Sulfates
k	Permeability	TX	Triaxial Compression
MD	Moisture/Density Relationship	TV	Torvane Shear
O	Organic Content	U	Unconfined Compression
pH	pH		

G. STRATIFICATION LINES

The stratification lines indicated on the boring logs and profiles represent the approximate boundary between material types and the transition may be gradual.

GEOBASE, INC.

EXPLANATION OF TERMS AND SYMBOLS

Figure B1

02493-4 DRW

SOIL CLASSIFICATION SYSTEM (ASTM D2487)

MAJOR DIVISION			GROUP SYMBOL	GRAPHIC SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
HIGHLY ORGANIC SOILS			Pt	▤	Peat and other highly organic soils	Strong color or odor and often fibrous texture	
COARSE-GRAINED SOILS (More than half by weight larger than No. 200 sieve size)	GRAVELS (More than half coarse fraction larger than No. 4 sieve size)	CLEAN GRAVELS	GW	░	Well-graded Gravels, Gravel-Sand mixtures (<5% fines)	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			GP	░	Poorly-graded Gravels and Gravel-Sand mixtures (<5% fines)	Not meeting all above requirements	
		DIRTY GRAVELS	GM	░	Silty Gravels, Gravel-Sand-Silt mixtures (>12% fines)	Atterberg limits below "A" line or $I_p < 4$	
			GC	▨	Clayey Gravels, Gravel-Sand-Clay mixtures (>12% fines)	Atterberg limits above "A" line or $I_p > 7$	
	SANDS (More than half coarse fraction smaller than No. 4 sieve size)	CLEAN SANDS	SW	░	Well-graded Sands, Gravelly Sands (<5% fines)	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			SP	░	Poorly-graded Sands or Gravelly Sands (<5% fines)	Not meeting all above requirements	
		DIRTY SANDS	SM	▥	Silty Sands, Sand-Silt mixtures (>12% fines)	Atterberg limits below "A" line or $I_p < 4$	
			SC	▨	Clayey Sands, Sand-Clay mixtures (>12% fines)	Atterberg limits above "A" line or $I_p > 7$	
FINE-GRAINED SOILS (More than half by weight passes No. 200 sieve size)	SILTS Below "A" line on plasticity chart: negligible organic content		ML	▥	Inorganic Silts and very fine Sands, Rock Flour, Silty Sands of slight plasticity	$W_L < 50$	See chart below
			MH	▥	Inorganic Silts micaceous or diatomaceous, fine Sandy or Silty soils	$W_L > 50$	
	CLAYS Above "A" line on plasticity chart: negligible organic content		CL	▨	Inorganic Clays of low plasticity, Gravelly, Sandy, or Silty Clays, lean Clays	$W_L < 30$	
			CI	▨	Inorganic Clays of medium plasticity, Silty Clays	$W_L > 30, < 50$	
			CH	▨	Inorganic Clays of high plasticity, fat Clays	$W_L > 50$	
	ORGANIC SILTS & ORGANIC CLAYS Below "A" line on plasticity chart		OL	▥	Organic Silts and organic Silty Clays of low plasticity	$W_L < 50$	
			OH	▨	Organic Clays of high plasticity	$W_L > 50$	

The soil of each stratum is described using ASTM D2487 and D2488 modified slightly so that an inorganic clay of "medium plasticity" is recognized.

ADDITIONAL SOIL CLASSIFICATION

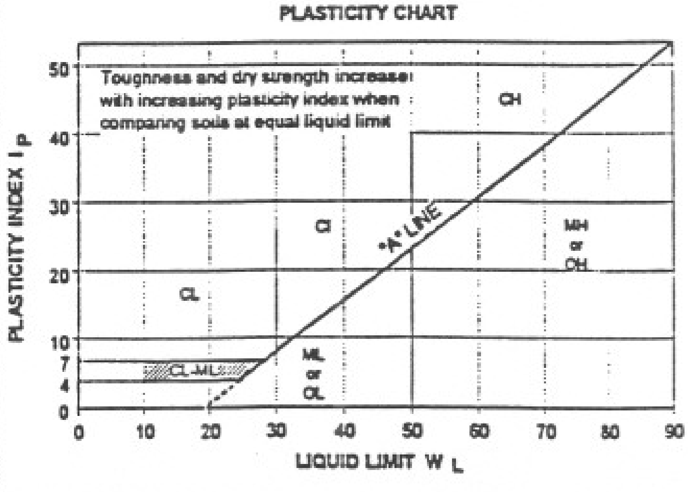
▩ Fill Soil

▤ Ss Sandstone

▨ Cs Claystone

▥ Ms Siltstone

PLASTICITY CHART



GEOBASE, INC.

EXPLANATION OF TERMS AND SYMBOLS

Figure B1

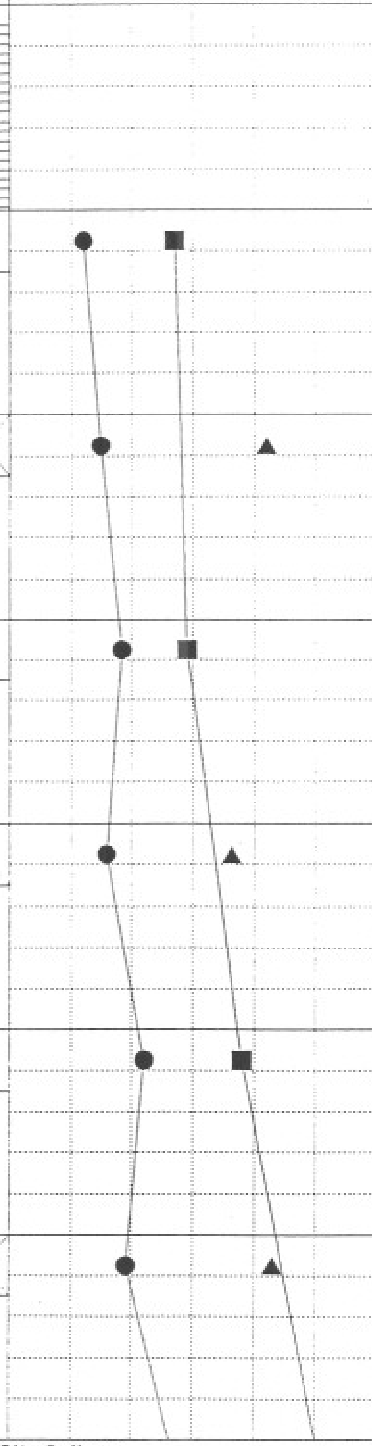
02493-6.CRW

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
0	Pavement = 6 inches asphaltic concrete.		
	CLAY (FILL), brown, some fine to coarse grained sand to sandy, moist.	CL	Bulk Samples from 0 to 5.0 feet. SO_4, Ch, ER, pH EI = 28 (Low)
5	SAND, reddish brown, clayey, medium dense, moist.	SC	
10	SILT, brown, little fine to coarse grained sand, little clay, hard, moist.	ML	PP = >4.5 tsf. DS
15	SAND, brown, fine to medium grained, silty, dense, moist.	SM	200 Wash
20	SAND, brown, fine to coarse grained, clayey, dense, moist.	SC	C, 200 Wash
25	CLAY, brown, hard, moist.	CL	
30	at 30.0 feet; silt lens.		PP = 4.25 tsf.
35			

DRY DENSITY (PCF): 80, 90, 100, 110, 120
Water Content (%): ●
Plastic Limit (W_P) |—| Liquid Limit (W_L)
Penetration, blows/foot: ■ 10, 20, 30, 40, 50



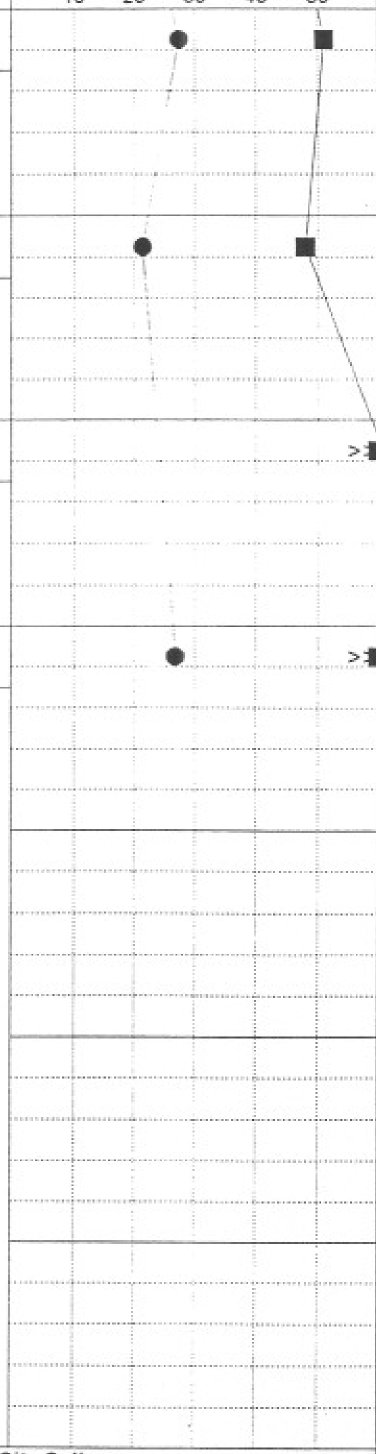
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO. B-1
	DEPTH TO WATER 13.0 feet	SURFACE ELEV. ± 321.0 feet	LOGGED BY SC	PROJECT NO. P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/21/01	FIGURE NO. B-2

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%): ●; Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, light brown, fine to coarse grained, some silt, very dense, wet.	SP			
40		CLAY, brown, little coarse sand to sandy, hard, moist.	CL			
45		SILTSTONE/SANDSTONE (BEDROCK), brown, very fine grained sand, hard, moist.	Ms/Ss		>■	50 blows for 6 inches.
50					>■	50 blows for 6 inches.
55		* End of boring at 51.5 feet. * Boring backfilled with bentonite chips. * Groundwater at 13.0 feet at completion of drilling.				
60						
65						
70						



GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-1
	DEPTH TO WATER 13.0 feet	SURFACE ELEV. ± 321.0 feet	LOGGED BY SC	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/21/01	FIGURE NO.	B-2

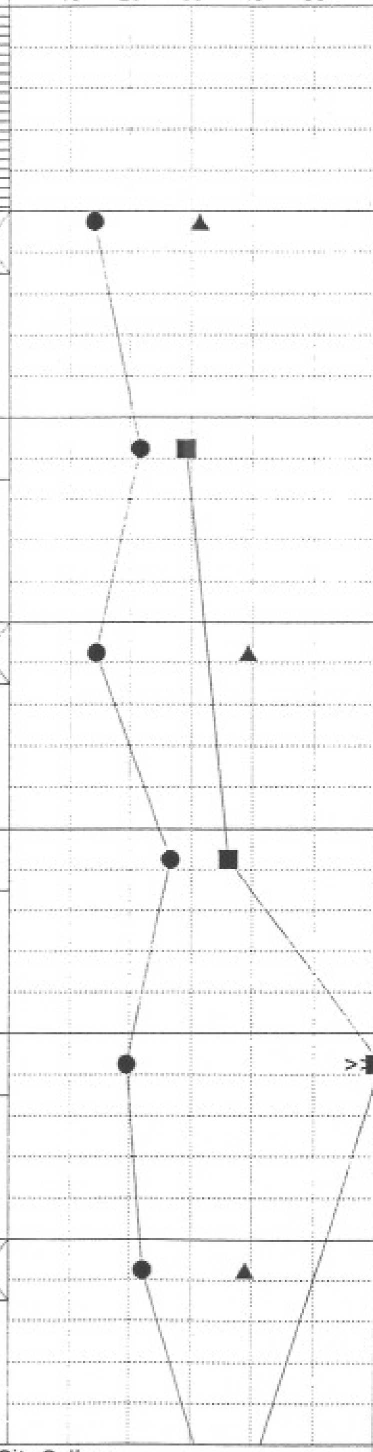
Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: ■ THIN WALLED TUBE — SPT SPLIT SPOON — CALIFORNIA MODIFIED SAMPLER — DISTURBED — NO RECOVERY — CORE

Legend: DRY DENSITY (PCF) ▲ 80, 90, 100, 110, 120; Water Content (%): ●; Plastic Limit (W_P) ├──┤ Liquid Limit (W_L); Penetration, blows/foot: ■ 10, 20, 30, 40, 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	REMARKS/ OTHER TESTS
0	CLAY (FILL), reddish brown, sandy, fine to coarse grained, moist	CL	Disturbed	Landscape lawn with 3 to 4 inches top soils at surface. Bulk Samples from 0 to 5.0 feet.
5	... trace orange-gray-brown, siltstone bedrock fragments.		California Modified Sampler	PP = >4.5 tsf.
	CLAY, reddish brown, trace orange-gray-brown, some fine to coarse grained sand to sandy, moist.			
10	... brown, very stiff, moist.	CL	SPT	
15	SILT, light brown, some fine to coarse grained sand, moist.	ML	California Modified Sampler	PP = >4.5 tsf.
20	SAND, gray, fine to coarse grained, silty, dense, moist.	SM	SPT	
	SILT, brown, moist.	ML		
25	... hard.		SPT	50 blows for 6 inches.
30	SAND, brown, fine to coarse grained, silty, moist.	SM	California Modified Sampler	
35				



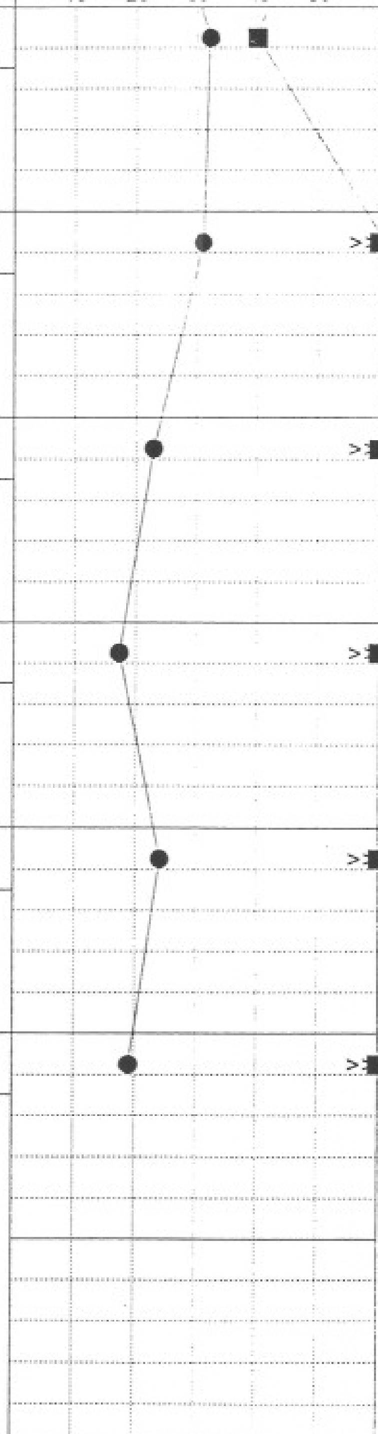
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO. B-2
	DEPTH TO WATER 30.0 feet	SURFACE ELEV. ± 315.0 feet	LOGGED BY SC	PROJECT NO. P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/21/01	FIGURE NO. B-3

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%): ●; Plastic Limit (W_P) ⊢—⊣ Liquid Limit (W_L); Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
		<u>SILTSTONE</u> (BEDROCK), greenish-gray, clayey, hard, moist.	Ms			
40						>N = 68
45						>50 blows for 6 inches.
50						>50 blows for 6 inches.
55		... greenish-gray, some red sand.				>50 blows for 6 inches.
60						>50 blows for 6 inches.
		* End of boring at 61.5 feet. * Boring backfilled with bentonite chips. * Groundwater at 30.0 feet at completion of drilling.				
65						
70						



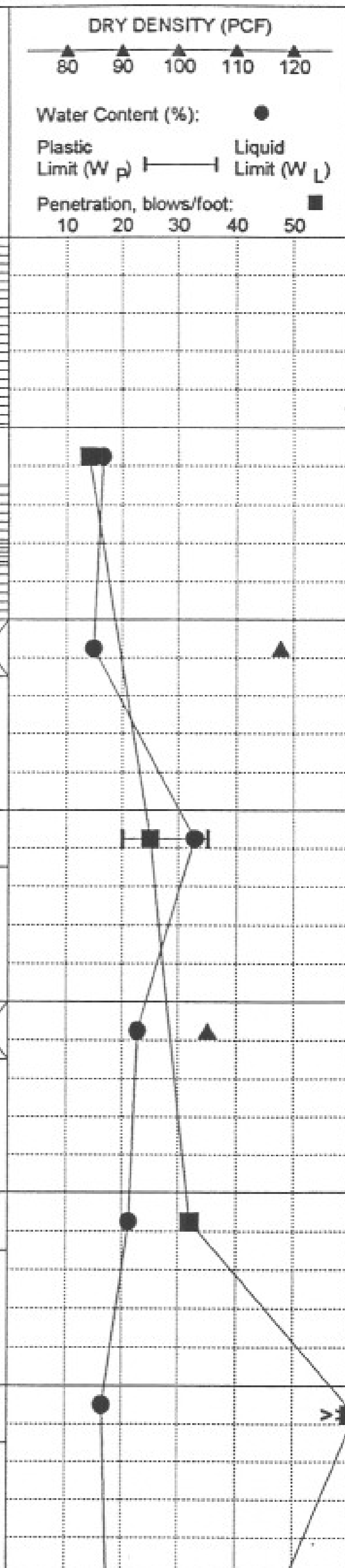
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-2
	DEPTH TO WATER 30.0 feet	SURFACE ELEV. ± 315.0 feet	LOGGED BY SC	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/21/01	FIGURE NO.	B-3

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
0	SAND (FILL), red, fine to medium grained, trace silt.	SP/SM	Athletic track sand at surface.
	CLAY (FILL), brown, some fine to medium grained sand to sandy, moist	CL	Bulk samples from 0 to 5.0 feet. SO$_4$, Ch, ER, pH EI = 47 (Low)
5	CLAY, dark brown to black, some fine to medium grained sand to sandy, stiff, moist	CL	Bulk samples from 5.0 to 10.0 feet.
10			C
15	... stiff to very stiff, wet.		
20	... gray to brown.		PP = 2.25 tsf
23	at 23.0 feet; sand lenses.		
25	... hard.		
30	... fine to coarse grained.		50 blows for 6 inches.
33	at 33.0 feet; sand lenses.		
35			



GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-3
	DEPTH TO WATER 14.0 feet	SURFACE ELEV. ± 311.0 feet	LOGGED BY SC	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/21/01	FIGURE NO.	B-4

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
35–41	CLAY, brown to gray, sandy, fine to medium grained, hard, moist	CL	
40			N = 83
41–50.5	SILTSTONE/SANDSTONE, olive brown to yellowish brown, laminated, hard, moist.	Ms/Ss	
45			50 blows for 6 inches.
50			50 blows for 6 inches.

DRY DENSITY (PCF): 80, 90, 100, 110, 120
Water Content (%)
Plastic Limit (W_P) — Liquid Limit (W_L)
Penetration, blows/foot: 10, 20, 30, 40, 50

* End of boring at 50.5 feet.
* Boring backfilled with bentonite chips.
* Groundwater at 14.0 feet at completion of drilling.

Depth scale: 40, 45, 50, 55, 60, 65, 70

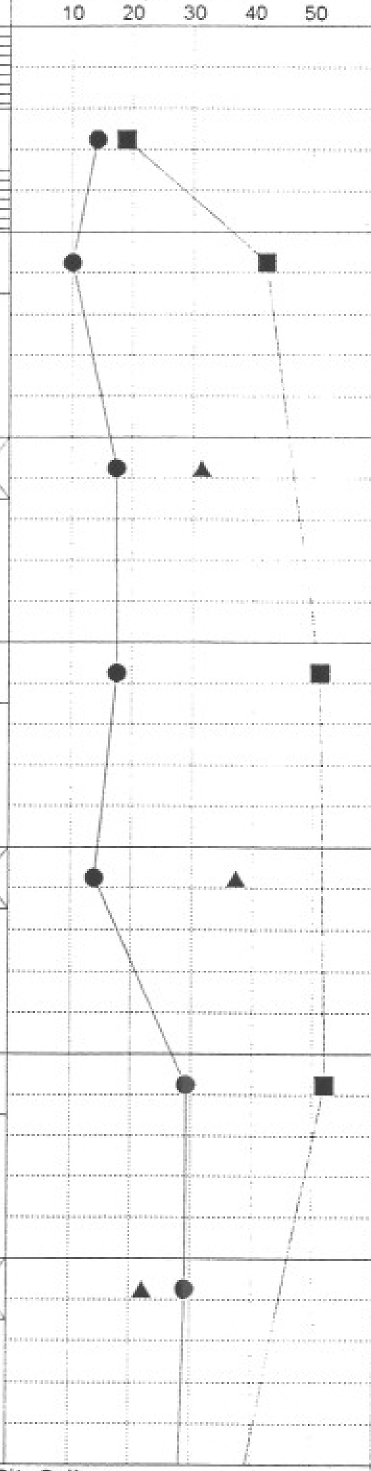
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO. B-3
	DEPTH TO WATER 14.0 feet	SURFACE ELEV. ± 311.0 feet	LOGGED BY SC	PROJECT NO. P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/21/01	FIGURE NO. B-4

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%): ●; Plastic Limit (W_P) ├──┤ Liquid Limit (W_L); Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
		CLAY (FILL), medium brown, some fine to medium sand, moist.	CL			Landscape lawn with 3 to 4 inches top soil at surface. Bulk samples from 0 to 5.0 feet.
		SILT, yellowish brown, some fine to medium sand, very stiff, moist.	ML			
		SAND, yellowish brown, fine to medium grained, silty, moist.	SM			
5		... dense.				
10		SILT, medium brown, sandy, moist.	ML			PP = 4.25 tsf.
		at 11.0 feet; trace fine sand.				
15		SAND, yellowish brown, medium to coarse grained, silty, very dense, moist.	SM			
20		... fine to medium grained.				
25		SILTSTONE/SANDSTONE, light olive brown to yellowish brown, laminated, hard, moist.	Ms/Ss			
30						PP = >4.5 tsf.
35						



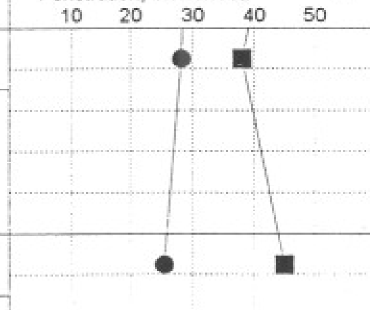
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-4
	DEPTH TO WATER 34.0 feet	SURFACE ELEV. ± 310.0 feet	LOGGED BY HNH	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/26/01	FIGURE NO.	B-5

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%): ●; Plastic Limit (W_P) ├──┤ Liquid Limit (W_L); Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
		SILTSTONE/SANDSTONE, light olive brown to yellowish brown, laminated, hard, moist.	Ms/Ss			
40						
45		* End of boring at 41.5 feet. * Boring backfilled with bentonite chips. * Groundwater at 34.0 feet at completion of drilling.				
50						
55						
60						
65						
70						



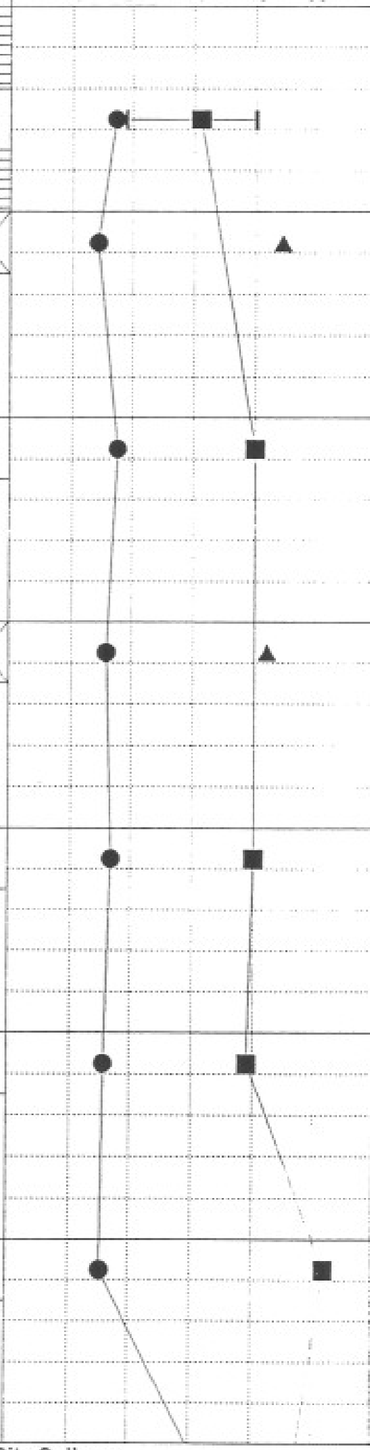
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-4
	DEPTH TO WATER 34.0 feet	SURFACE ELEV. ± 310.0 feet	LOGGED BY HNH	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/26/01	FIGURE NO.	B-5

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: ■ THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120 / Water Content (%): ● / Plastic Limit (W_P) ├─┤ Liquid Limit (W_L) / Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
		CLAY (FILL), brown, sandy, trace gravel to 1/2 inches, trace asphaltic concrete, moist.	CL			Bulk Samples from 0 to 5.0 feet. EI = 43 (Low)
		CLAY, brown, sandy, hard, moist.	CL			
5		... some medium to coarse sand.				PP = >4.5 tsf.
10		SILT, light yellowish brown, trace medium grained sand, hard, moist.	ML			
15		... sandy.				
▼						
20		... yellowish brown to light olive brown.				
25		SAND, light yellowish brown, medium to coarse grained, silty, dense, wet. ... white to light yellowish brown.	SM			
30		SILTSTONE/SANDSTONE, light olive brown to yellowish brown, laminated, hard, moist.	Ms/Ss			
35						



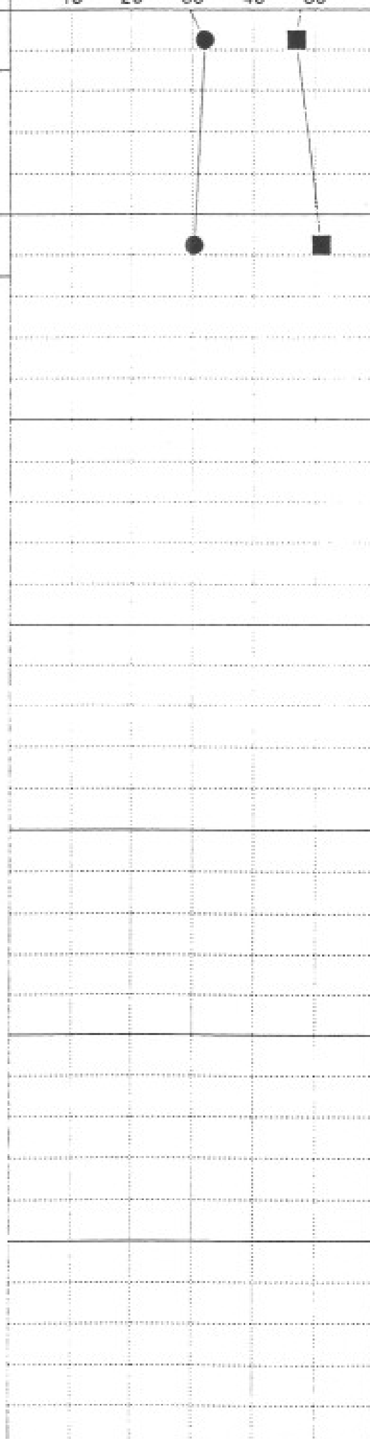
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-5
	DEPTH TO WATER 18.0 feet ▼	SURFACE ELEV. ± 304.0 feet	LOGGED BY HNH	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/26/01	FIGURE NO.	B-6

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%): ●; Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
		SILTSTONE/SANDSTONE, light olive brown to yellowish brown, laminated, hard, moist.	Ms/Ss			
40						
		* End of boring at 41.5 feet. * Boring backfilled with bentonite chips. * Groundwater at 18.0 feet at completion of drilling.				
45						
50						
55						
60						
65						
70						



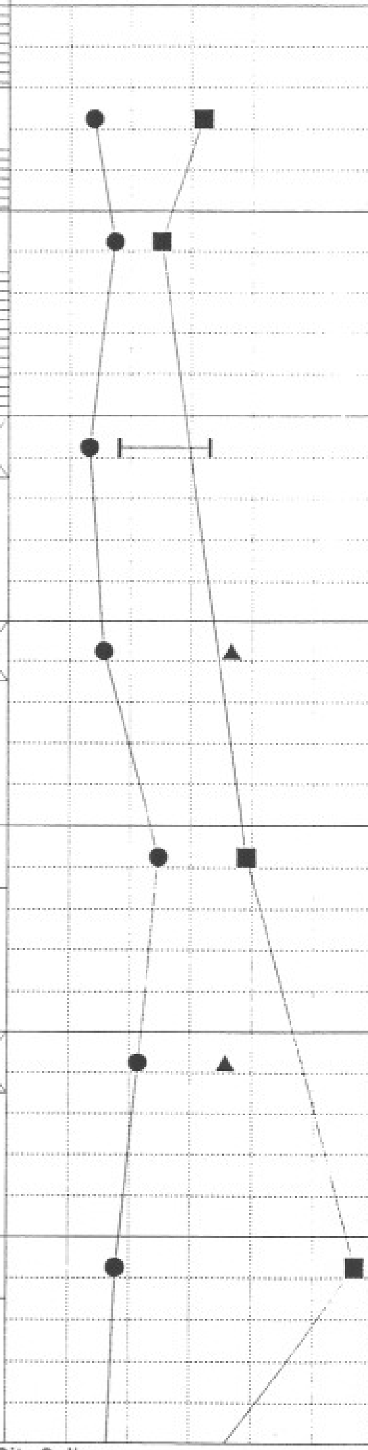
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-5
	DEPTH TO WATER 18.0 feet	SURFACE ELEV. ± 304.0 feet	LOGGED BY HNH	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/26/01	FIGURE NO.	B-6

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120 / Water Content (%): ● / Plastic Limit (W_P) ├─┤ Liquid Limit (W_L) / Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
0		Pavement = 3 inches asphaltic concrete.				Bulk samples from 0 to 5.0 feet.
		CLAY (FILL), very dark brown, sandy, trace brick fragments, trace gravel to 1 inches, moist.	CL			EI = 52 (Low)
		CLAY, very dark brown, sandy, trace gravel to 1 inches, moist.	CL			
5						Bulk samples from 5.0 to 10.0 feet. SO_4, Ch, ER, pH EI = 65 (Medium)
10			ML/CL			PP = >4.5 tsf.
15		... trace igneous rocks to 1/4 inches.				
20		... sandy.				
25		SILT, olive brown to yellowish brown, sandy, moist.	ML			
30		SAND, light brown, coarse grained, some silt to silty, very dense, moist.	SM			
		SILT, olive brown to yellowish brown, sandy.	ML			
35						



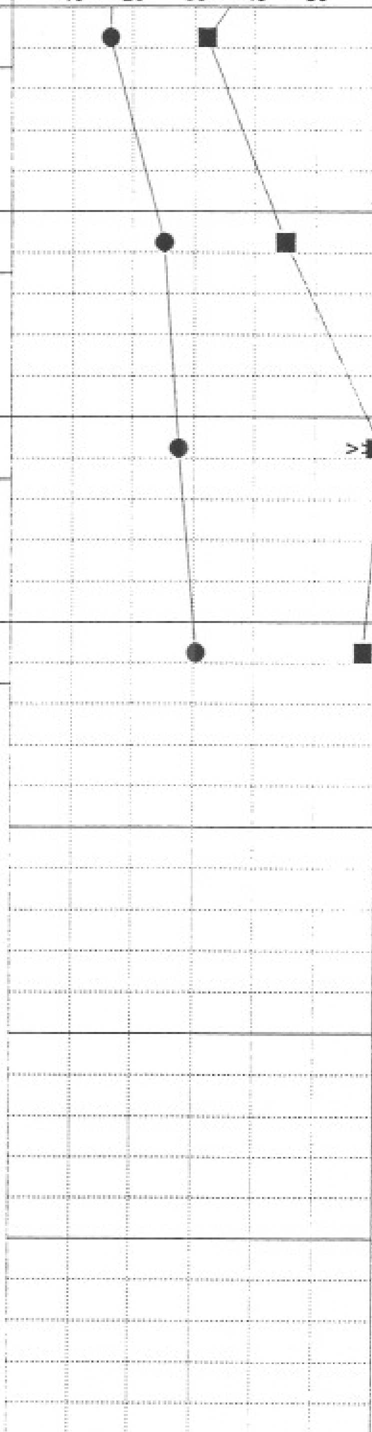
GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO. B-6
	DEPTH TO WATER 19.0 feet	SURFACE ELEV. ± 301.0 feet	LOGGED BY HNH	PROJECT NO. P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/26/01	FIGURE NO. B-7

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%): ●; Plastic Limit (W_P) ⊢⊣ Liquid Limit (W_L); Penetration, blows/foot: ■ 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, light brown, coarse grained, some silt to silty.	SP/SM			
40						
		SILTSTONE/SANDSTONE, olive brown to yellowish brown, laminated, hard, moist.	Ms/Ss			
45					>■	N = 63
50						
55		* End of boring at 51.5 feet. * Boring backfilled with bentonite chips. * Groundwater at 19.0 feet at completion of drilling.				
60						
65						
70						



GEOBASE, INC.	PROJECT	Los Angeles City College Los Angeles, California		BORING NO.	B-6
	DEPTH TO WATER 19.0 feet	SURFACE ELEV. ± 301.0 feet	LOGGED BY HNH	PROJECT NO.	P.312.01.00
	DEPTH TO SLOUGH	DRILL CME 75	DATE LOGGED 12/26/01	FIGURE NO.	B-7

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

APPENDIX C

GEOBASE, INC.

SUMMARY OF LABORATORY TEST RESULTS

PROJECT: Los Angeles City College, Los Angeles, CA | **PROJECT NO:** P.312.01.00 | **DATE:** January 2002

BORING	DEPTH (feet)	MOISTURE CONTENT (Percent)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				OTHER TESTS	DESCRIPTION AND REMARKS
				LL (%)	PL (%)	PI (%)	CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)		
B-1	0-5.0	--									EI, pH, Ch, ER, SO_4	CL
	5.0-6.5	12										SC
	10.0-11.5	15	111.8								DS	ML
	15.0-16.5	18					41					SM
	20.0-21.5	16	106.2				31				C	SC
	25.0-16.5	22										CL
	30.0-31.5	19	112.8									CL
	35.0-36.5	27										SP
	40.0-41.5	21										CL
	50.0-50.5	27										Ms/Ss
B-2	0-5.0	--										CL
	5.0-6.5	14	101.2									CL
	10.0-11.5	22										CL
	15.0-16.5	14	109.1									ML
	20.0-21.5	27										SM
	25.0-26.0	20										ML
	30.0-31.0	22	108.8									SM
	35.0-36.5	32										Ms
	40.0-41.5	31										Ms
	45.0-46.0	23										Ms
	50.0-50.5	17										Ms
	55.0-55.5	24										Ms
	60.0-60.5	19										Ms
B-3	0-5.0	--									EI, pH, Ch, ER, SO_4	CL

GEOBASE, INC.

SUMMARY OF LABORATORY TEST RESULTS

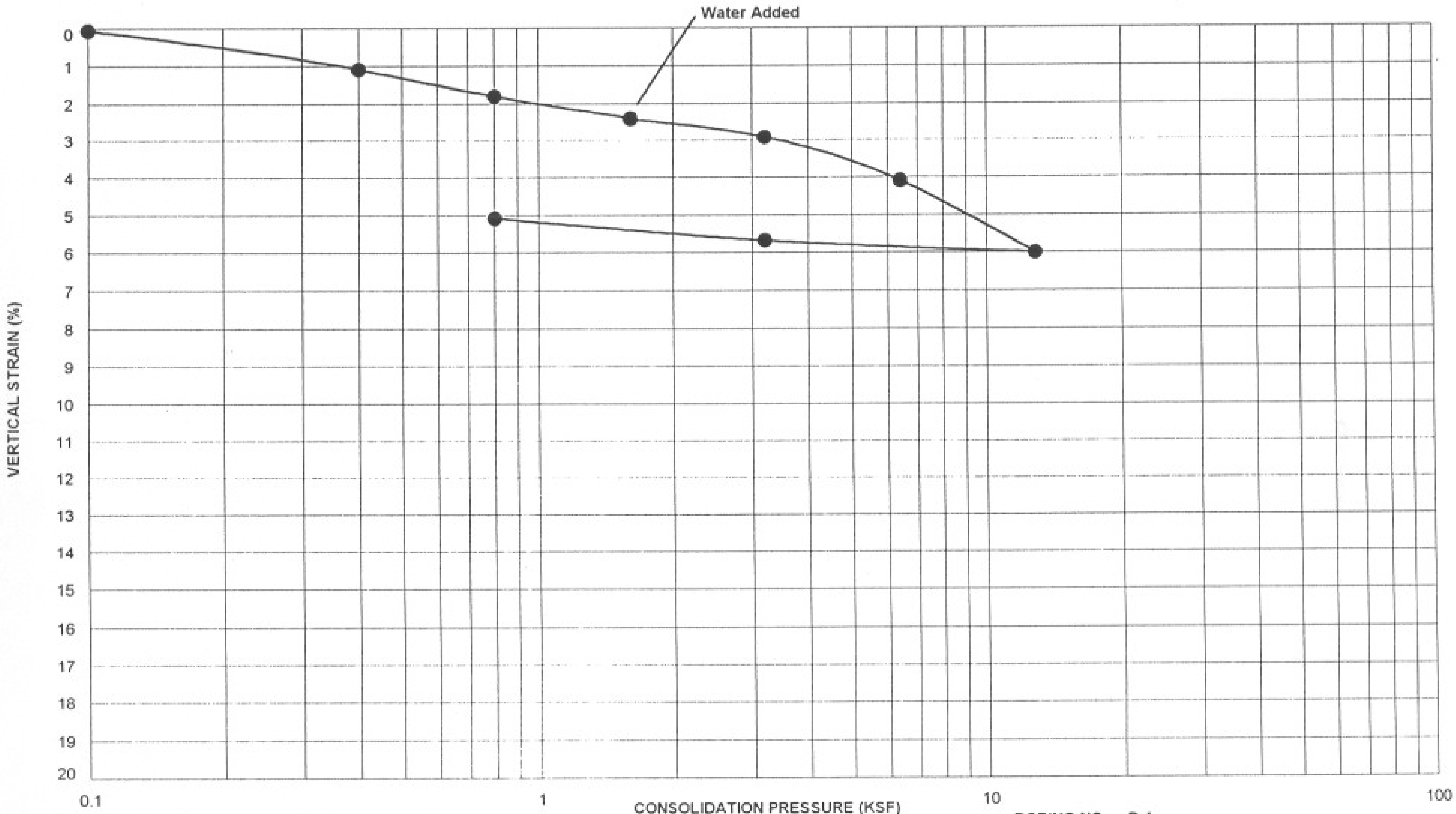
PROJECT: Los Angeles City College, Los Angeles, CA				PROJECT NO: P.312.01.00					DATE: January 2002			
BORING	DEPTH (feet)	MOISTURE CONTENT (Percent)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				OTHER TESTS	DESCRIPTION AND REMARKS
				LL (%)	PL (%)	PI (%)	CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)		
B-3	5.0-6.5	16										CL
	5.0-10.0	--										CL
	10.0-11.5	15	117.6								C	CL
	15.0-16.5	33		35	20	15						CL
	20.0-20.5	23	104.9									CL
	25.0-26.5	21										CL
	30.0-31.0	16										CL
	35.0-36.5	17										CL
	40.0-41.5	29										CL
	45.0-46.0	27										Ms/Ss
	50.0-50.5	28										Ms/Ss
B-4	0-5.0	--										CL
	2.0-3.5	14										ML
	5.0-6.5	10										SM
	10.0-11.5	17	101.2									ML
	15.0-16.5	14										SM
	20.0-21.5	14	107.0									SM
	25.0-26.5	29										Ms/Ss
	30.0-31.5	29	91.5									Ms/Ss
	35.0-36.5	28										Ms/Ss
	40.0-41.5	26										Ms/Ss
B-5	0-5.0	--									EI	CL
	2.0-3.5	17		40	19	21						CL
	5.0-6.5	14	114.3									CL

GEOBASE, INC.

SUMMARY OF LABORATORY TEST RESULTS

PROJECT: Los Angeles City College, Los Angeles, CA	PROJECT NO: P.312.01.00	DATE: January 2002

BORING	DEPTH (feet)	MOISTURE CONTENT (Percent)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				OTHER TESTS	DESCRIPTION AND REMARKS
				LL (%)	PL (%)	PI (%)	CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)		
B-5	10.0-11.5	18										ML
	15.0-16.5	16	112.0									ML
	20.0-21.5	17										ML
	25.0-26.5	16										SM
	30.0-31.5	15										SM
	35.0-36.5	32										Ms/Ss
	40.0-41.5	30										Ms/Ss
B-6	0-5.0	--									EI	CL
	5.0-10.0	--									EI, pH, Ch, ER, SO_4	CL
	2.0-3.5	14										CL
	5.0-6.5	17										CL
	10.0-11.5	13		32	18	14						CL
	15.0-16.5	16	106.4									CL
	20.0-21.5	25										CL
	25.0-26.5	21	105.6								C	ML
	30.0-31.5	18										SP/ML
	35.0-36.5	16										SP
	40.0-41.0	24										Ms/Ss
	41.0-41.5	25										SP/Ms
	45.0-46.5	27										Ms/Ss
	50.0-50.5	18										Ms/Ss
	50.5-51.5	30										Ms/Ss



BORING NO.: B-1

DEPTH (ft): 20.75

SAMPLE DESCRIPTION: SAND, brown, fine to coarse grained, clayey, dense.

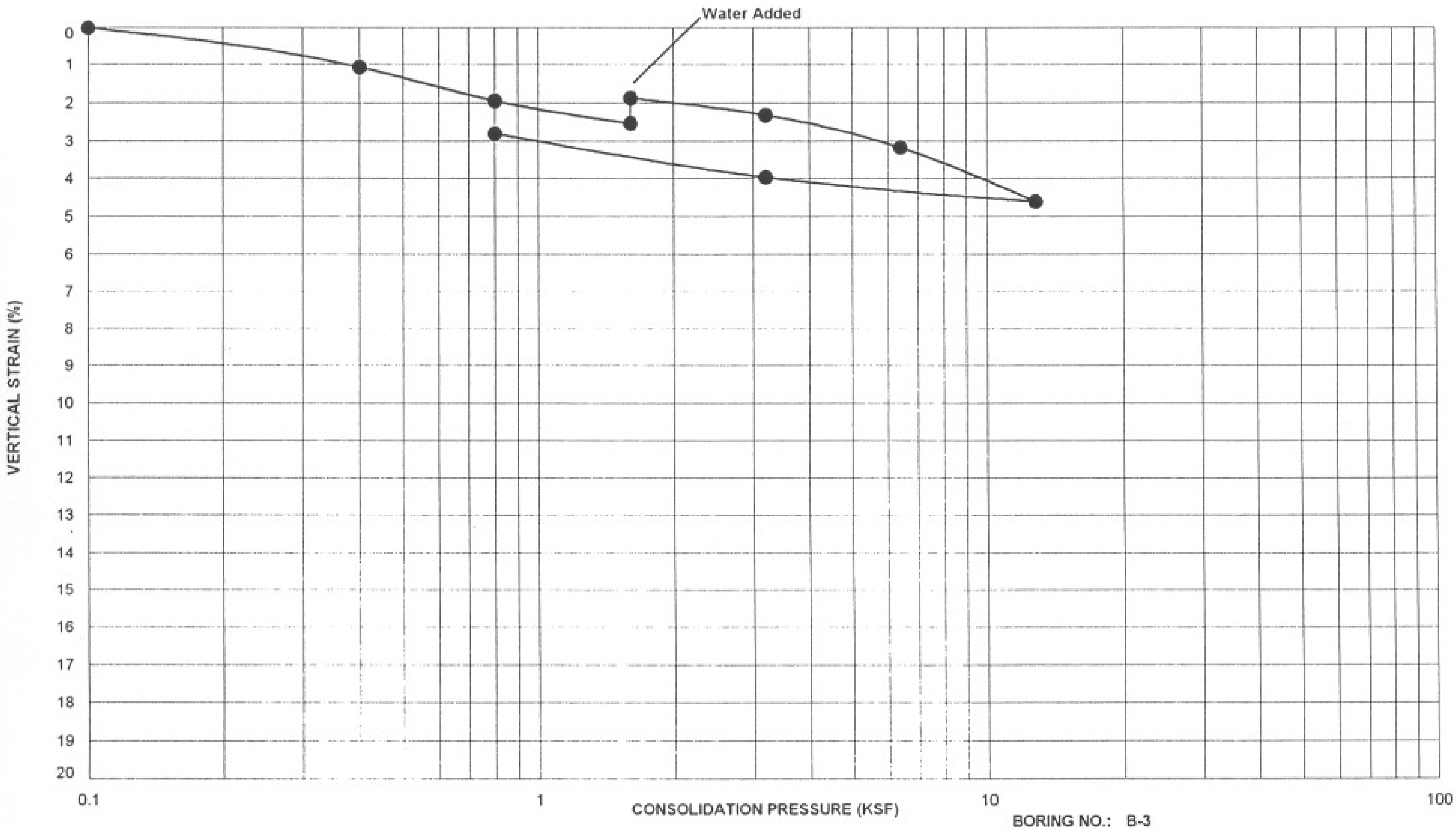
GEOBASE

Consolidation Test Results

Los Angeles City College
Los Angeles, California

P.312.01.00

Figure C-2



BORING NO.: B-3

DEPTH (ft): 10.75

SAMPLE DESCRIPTION: CLAY, dark brown, some fine to medium grained sand to sandy.

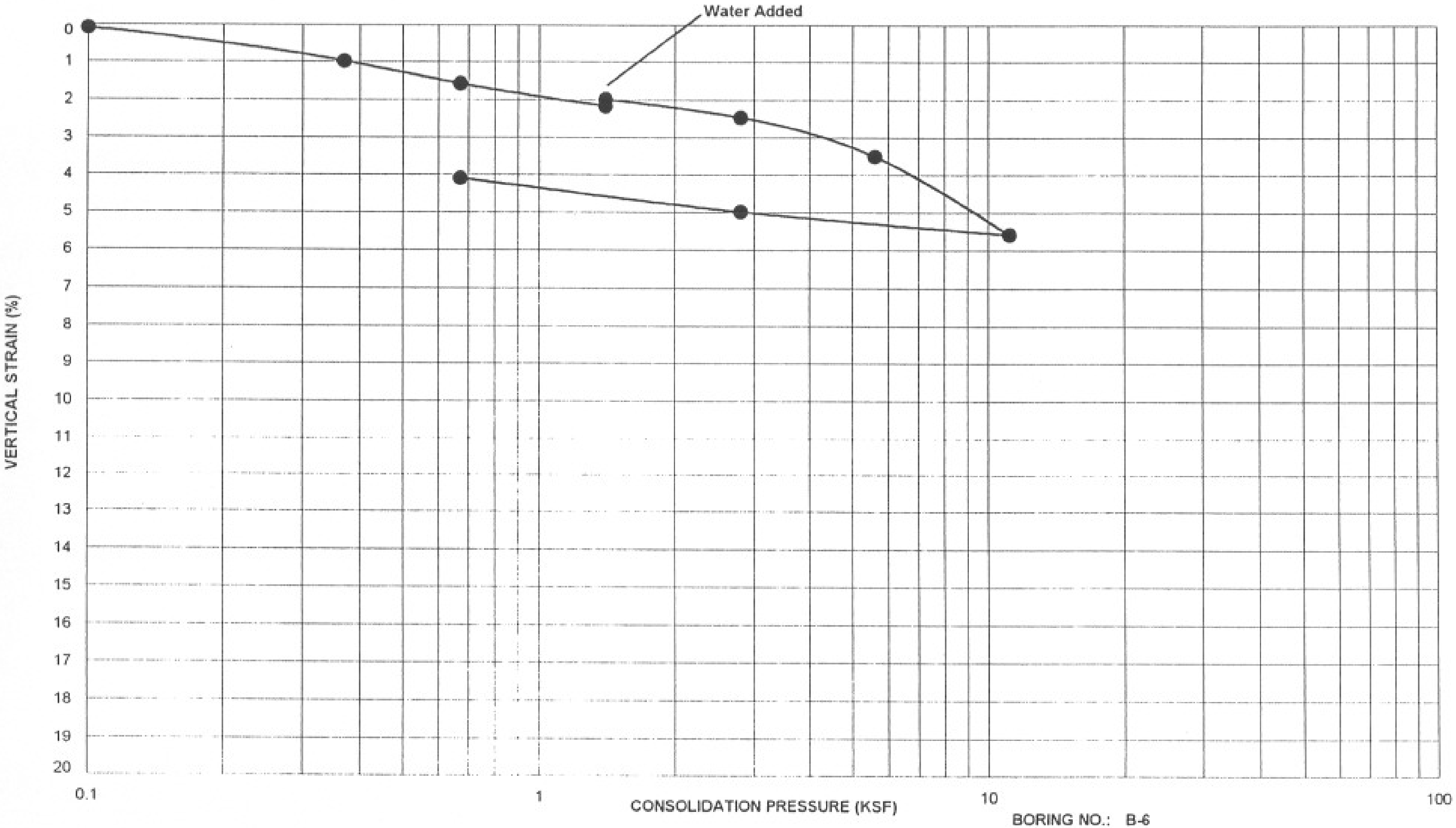
GEOBASE

Consolidation Test Results

Los Angeles City College
Los Angeles, California

P.312.01.00

Figure C-3



BORING NO.: B-6

DEPTH (ft): 25.75

SAMPLE DESCRIPTION: SILT, olive brown to yellowish brown, sandy.

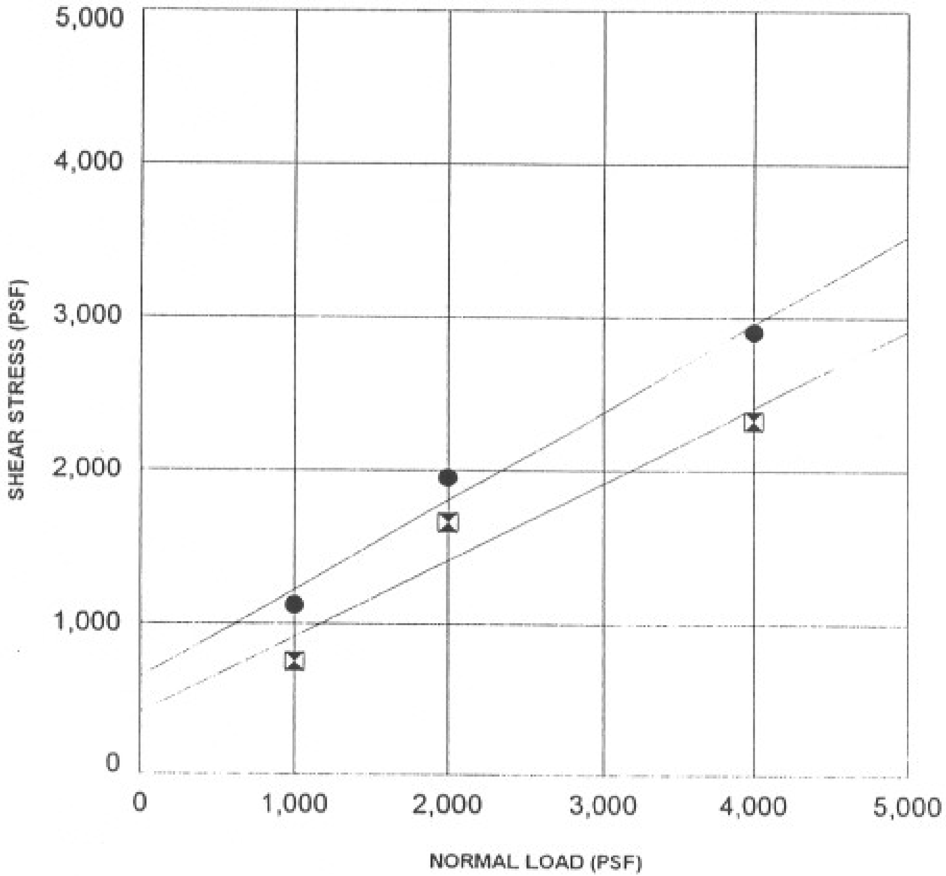
GEOBASE

Consolidation Test Results

Los Angeles City College
Los Angeles, California

P.312.01.00

Figure C-4



SAMPLE DESCRIPTION: SILT, brown, little fine to coarse sand, little clay, hard.
BORING NO.: B-1
DEPTH INTERVAL (ft): 10.0 - 11.5
NOTES:

HEIGHT (in): 1.0
AREA (sq in): 4.56
SHEAR RATE (in/min): 0.002

DRY DENSITY (pcf): 111.9
INITIAL MOISTURE (%): 14.9
FINAL MOISTURE (%): 19.7

	PEAK ●	ULTIMATE ⊠
COHESION (psf)	644	410
FRICTION ANGLE (deg)	30	27

GEOBASE

Direct Shear Test Results

Los Angeles City College
Los Angeles, California

P.312.01.00

Figure C-5

EXPANSION POTENTIAL
ASTM D 4829/U.B.C. No. 29-2

SOIL SAMPLE LOCATION (feet)	EXPANSION INDEX	EXPANSION POTENTIAL
B-1 at 0 to 5.0	28	Low
B-3 at 0 to 5.0	47	Low
B-5 at 0 to 5.0	43	Low
B-6 at 0 to 5.0	52	Medium
B-6 at 5.0 to 10.0	65	Medium

WATER-SOLUBLE SULFATES
CAL. 417-A

SOIL SAMPLE LOCATION (feet)	SOLUBLE SULFATES PPM	POTENTIAL FOR ATTACK ON CONCRETE
B-1 at 0 to 5.0	40	Low
B-3 at 0 to 5.0	4535	Very Severe
B-6 at 5.0 10.0	28	Low

CORROSIVITY SERIES TEST

SOIL SAMPLE LOCATION (feet)	pH (CAL 747)	SOLUBLE CHLORIDE (CAL.422) (PPM)	ELEC. RESISTIVITY (CAL.643) (OHM-CM)	POTENTIAL FOR ATTACK ON STEEL (SENATOROFF)
B-1 at 0 to 5.0	7.8	40	1241	Severe
B-3 at 0 to 5.0	7.2	297	600 Maximum	Very Severe
B-6 at 5.0 to 10.0	8.2	25	934	Severe

ANAHEIM TEST LABORATORY

3008 S. ORANGE AVENUE
SANTA ANA, CALIFORNIA 92707
PHONE (714) 549-7267

TO: GEO BASE:
2336 PERALTA DR. #4&6
LAGUNA HILLS, CA. 92653

ATTN: WING

DATE: 1/10/02

P.O. No. VERBAL

Shipper No.

Lab. No. B 9614 1-3

Specification:

Material: SOIL

PROJECT: #P312.01.00

LOS ANGELES CITY COLLEGE.

ANALYTICAL REPORT

CORROSION SERIES
SUMMARY OF DATA

	pH	SOLUBLE SULFATES per Ca. 417 ppm	SOLUBLE CHLORIDES per Ca. 422 ppm	MIN. RESISTIVITY per Ca. 643 ohm-cm
#1 B-3 @ 0-5'	7.2	4,535	297	600 max
#2 B-1 @ 0-5'	7.8	40	40	1,241
#3 B-6 @ 5-10'	8.2	28	25	934

RESPECTFULLY SUBMITTED

POPPY BRIDGER Chief Chemist

FIGURE C-7

FORM #2