Earth Systems
Southern California

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July 10, 2002

VT-22503-04
02-7-34

Santa Barbara Zoological Foundation
Attention: Mr. Richard A. Block
500 Ninos Drive
Santa Barbara, CA 93103

Project: Santa Barbara Zoological Gardens
Proposed Channel Island Fox Exhibit and Condor Exhibit
Santa Barbara, California

As authorized, we have performed a geotechnical study for the proposed Channel Island Fox Exhibit and Condor Exhibit to be located at the Santa Barbara Zoological Gardens in Santa Barbara, California. The accompanying Geotechnical Engineering Report presents the results of our subsurface exploration and laboratory testing programs, as well as our conclusions and recommendations pertaining to geotechnical aspects of project design.

We have appreciated the opportunity to be of service to you on this project. Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

EARTH SYSTEMS SOUTHERN CALIFORNIA

Todd J. Tranby
Engineering Geologist

REGISTERED GEOLOGIST
TODD J. TRANBY
No. 2078
CERTIFIED
ENGINEERING
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Reviewed and Approved

Richard M. Beard
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
RICHARD M. BEARD
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STATE OF CALIFORNIA

Copies: 5 - TynanGroup
1 - Blackbird Architects, Attention: Kelly Kish
1 - VTA File

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INTRODUCTION

A. Project Description

This report presents results of a Geotechnical Engineering study performed for the proposed new construction at the existing Channel Islands Fox Exhibit and proposed Condor Exhibit located at the Santa Barbara Zoological Gardens in Santa Barbara, California. It is assumed herein that both of the exhibits will consist of a mesh canopy supported by pole foundations. Pole heights will range from 13 feet above the existing ground surface on the southwest sides of the exhibit to about 17 feet above the existing ground surface at the northeast side of the exhibit. A new 64-foot long, raised wooden walkway will also be constructed in-between the existing Channel Islands Foxes viewing platform and the existing Bald Eagle viewing platform.

Because the "structures" will be supported by poles, it is assumed the "flagpole type" foundation will be incorporated into the project.

B. Purpose and Scope of Work

The purpose of the geotechnical study that led to this report was to evaluate the soil conditions of the site with respect to design and construction of the proposed canopies and raised walkway. These conditions include surface and subsurface soil types, bearing capacity, and the presence or absence of subsurface water. The scope of our work included:

1. Reconnaissance of the site and review of past geotechnical report by Earth Systems Southern California.
2. Hand augering, sampling and logging of five continuous borings to study soil and groundwater conditions.
3. Laboratory testing of soil samples obtained from the subsurface exploration to determine their physical and engineering properties.
4. Analyzing the geotechnical data obtained.
5. Consulting with owner representatives.
6. Preparing this report.

Contained in this report are:

1. Descriptions and results of field and laboratory tests that were performed.
2. Discussions pertaining to the local soil and groundwater conditions.
3. Conclusions and recommendations pertaining to site grading and structural design.

C. Site Setting

The Santa Barbara Zoological Gardens is located south of U.S. Route 101, north of Cabrillo Boulevard, west of Andree Clark Bird Refuge, and east of Ninos Drive in Santa Barbara, California (see attached Vicinity Map). The site lies on a northeast facing, approximately 3:1 (horizontal to vertical) natural slope. The slope has been modified with landscape boulders, planting, and several small ponds. A smaller canopy currently exists in the Channel Islands Foxes exhibit.

SEISMICITY

Although the site is not within a State-designated "fault rupture hazard zone", it is located in an active seismic region where large numbers of earthquakes are recorded each year. Historically, major earthquakes felt in the vicinity of the subject site include the December 21, 1812 "Santa Barbara Region" earthquake, that was presumably centered in the Santa Barbara Channel (CDMG, 1975), the 1857 Fort Tejon earthquake, the 1872 Owens Valley earthquake, and the 1952 Arvin-Tehachapi earthquake.

It is the standard of practice when evaluating the seismicity to consider the design basis (10% probability of exceedance in 50 years) accelerations. The California Division of Mines and Geology, in concert with the U.S. Geological Survey and the scientific community, has recently presented results of a statewide probabilistic seismic hazard assessment (CDMG, Seismic Shaking Map Sheets, Map Sheet 48, 1999). The focus of the assessment was to generate a seismic hazard map showing zones of estimated peak ground accelerations at a hazard level of 10% probability of exceedance in 50 years. The site location plots between 0.60 g to 0.70 g acceleration potential. A contour map of the estimated magnitude of earthquake that causes the dominant hazard for peak ground acceleration at 10% probability of exceedance in 50 years with alluvial site conditions was also prepared as part of the statewide seismic hazard assessment survey. The site location plots within a zone of magnitude 6.5 to 7.0. The structure should be

designed for UBC Zone 4 requirements; however, the project Structural Engineer should be made aware of the design basis acceleration.

For the project site the 1997 UBC Seismic Design Parameters are:

Parameter	Table No.	Value
Seismic Zone Factor (Z)	16-I	0.40
Soil Type Profile	16-J	S_D
Seismic Coefficient (C_a)	16-Q	$0.44N_a$
Seismic Coefficient (C_v)	16-R	$0.64N_v$
Near Source Factor (N_a)	16-S	1.3
Near Source Factor (N_v)	16-T	1.6
Seismic Source Type	16-U	B

These values area based on a distance of less than 2 kilometers from the Red Mountain Fault as determined from the UBC Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada.

The structural designs for the building in this project should at minimum conform to the UBC requirements. The project Structural Engineer should be made aware of the probabilistically estimated peak horizontal accelerations (0.60 to 0.70 g) to determine if any additional strengthening is warranted.

SOIL CONDITIONS

Evaluation of the subsurface indicates that soils near the proposed construction generally consist of interbedded medium dense sands to stiff clays. Soils encountered are characterized by relatively low in-place densities.

The proposed building sites are underlain primarily by Older Alluvial Deposits as indicated on the Regional Geology Map (Dibblee, Geologic Map of the Santa Barbara Quadrangle, 1986) included in Appendix A of this Report.

Groundwater was not encountered in any of the borings.

Samples for near-surface soils were tested for pH, resistivity, soluble sulfates and soluble chlorides. The test results provided in Appendix B should be provided to the project designers for their interpretations pertaining to the corrosivity or reactivity of various construction materials (such as concrete and piping) with the soils.

LIQUEFACTION

A major cause of damage during earthquakes is a significant reduction of soil strength or stiffness, generally referred to as liquefaction. Liquefaction can cause translational instability, bearing failure, settlement, ground loss, and other related phenomena. Translational instabilities can be slope failures or lateral spreading. Bearing failure can occur when soil strength loss is near a foundation. Settlement can occur when bearing failure is precluded, but volumetric compression occurs. Ground loss results from sand boils and is usually very localized. Liquefaction is typically a design problem only if it occurs in the upper 50 feet of the subsurface soils. However, on sloping ground or when foundations reach beyond that depth, liquefaction should be considered to a greater depth.

The soils most susceptible to liquefaction are sandy soils and silty soils of low plasticity. Cohesive soils with fines content greater than 30% are generally not susceptible to liquefaction if their fines classify as clays, or they have a plasticity index greater than 30%. Generally, if a soil has a clay content greater than 15%, or the water content is less than 0.9 times the liquid limit, liquefaction can be a ruled out. However, cohesive soils, if sensitive, can lose significant strength even if they cannot liquefy, and there may be a need to address this problem. Although widely believed to be non-liquefiable, gravelly soils can be susceptible to liquefaction if internal drainage is impeded.

In order for liquefaction to occur, a potentially liquefiable soil must be saturated and subjected to rapid cyclic loading that is sufficiently intense to overcome a soil's internal resistance to liquefaction.

Liquefaction analyses were performed during the preparation of a Geotechnical Engineering Report (Earth Systems Southern California, 2001) for the proposed Cats of Africa Exhibit and the proposed Discovery Pavilion. The liquefaction analysis indicates that the proposed Discovery Pavilion site, which lies on younger alluvial deposits, has a total estimated liquefaction induced settlement of about 2 inches. The liquefaction analyses indicated no

liquefaction potential at the proposed Cats of Africa Exhibit which lies on older alluvial deposits. The older alluvial deposits below the proposed structures are similar to the older alluvial deposits encountered below the proposed Cats of Africa Exhibit. Because the older alluvial deposits below the proposed Cats of Africa Exhibit were considered non-liquefiable. it is also assumed that the older alluvial deposits below the proposed structures are non-liquefiable.

CONCLUSIONS AND RECOMMENDATIONS

The site is suitable for the proposed development from a Geotechnical Engineering standpoint provided that the recommendations contained in this report are successfully implemented into the project.

A. Grading

1. Pre-Grading Considerations

   a. Grading at a minimum should conform to Chapter 33 of the 1997 California Building Code.

   b. The existing ground surface should be initially prepared for structures and other improvements by removing all vegetation, debris piles, large roots, any other organics, and any noncomplying fill. Voids created by removing such material should be properly backfilled and compacted. No compacted fill should be placed unless a representative of the Geotechnical Engineer has observed the underlying soil.

   c. Fill and backfill placed at near optimum moisture in layers with loose thickness not greater than 8 inches should be compacted to a minimum of 90% of the maximum dry density obtainable by the ASTM D 1557 test method unless otherwise recommended or specified. Random compaction tests by Earth Systems Southern California can assist the Grading Contractor in evaluating whether the Grading Contractor is meeting compaction requirements. Compaction tests pertain only to a specific location, however, and do not guaranty that all fill has been compacted to the prescribed percentage of maximum density. It is the ultimate responsibility of the Grading Contractor to achieve uniform compaction in accordance with the requirements of this report and the grading ordinance.

   d. Shrinkage of soils affected by compaction is estimated to be about 5%.

e. Import soils used to raise site grade should be equal to. or better than. on-site soils in strength, expansion, and compressibility characteristics. Import soil can be evaluated, but will not be prequalified by the Geotechnical Engineer. Final comments on the characteristics of the import will be given after the material is at the project site.

f. Roof draining systems should be designed so that water is not discharged into bearing soils or near the structure. Final site grade could be such that all water is diverted away from the structure, and is not allowed to pond. In landscape areas adjacent to the building we recommend a minimum gradient of 2% toward either hardscapes or drain inlets.

g. Earth Systems Southern California should be retained to provide Geotechnical Engineering services during site development and grading, and foundation construction phases of the work to observe compliance with the design concepts, specifications and recommendations. This will allow for timely design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

h. Plans and specifications should be provided to Earth Systems Southern California prior to grading. Plans should include the grading plans, foundation plans, and foundation details. Earth Systems Southern California will review these plans only for conformity with geotechnical parameters not including drainage. It is the responsibility of the Client and other Engineers to review and approve designs and plans for conformity with all engineering and design requirements necessary to the proper function and performance of the structure.

2. Rough Grading/Areas of Development

a. Because of the presence of variable density soils and variable expansive soils at the bearing depth, overexcavation and recompaction of soils in the proposed foundation areas will not be necessary.

b. Areas to receive fill, exterior slabs-on-grade. sidewalks or paving should be overexcavated through any uncertified fill and loose soils. The resulting surface should then be scarified an additional 1 foot, moisture conditioned and recompacted to a minimum of 90% of the maximum dry density.

c. The bottom of all excavations should be observed by a representative of this firm prior to processing or placing fill.

d. Voids created by dislodging cobbles and boulders during scarification should be backfilled and recompacted, and the dislodged cobbles larger than 8 inches in diameter should be removed from the subgrade.

e. On-site soils may be used for fill once they are cleaned of all organic material, rock, debris and irreducible material larger than 8 inches.

f. Fill and backfill placed at near optimum moisture in layers with loose thickness not greater than 8 inches should be compacted to a minimum of 90% of the maximum dry density obtainable by the ASTM D 1557 test method.

g. Import soils used to raise site grade should be equal to, or better than, on-site soils in strength, expansion, and compressibility characteristics. Import soil can be evaluated, but will not be prequalified by the Geotechnical Engineer. Final comments on the characteristics of the import will be given after the material is at the project site.

h. If pumping soils or otherwise unstable soils are encountered during the overexcavation, stabilization of the excavation bottom will be required prior to placing fill. This can be accomplished by various means. One method would be drying the soils by aeration. Another would be working thin lifts of one and one-half inch (minimum size) float rock into the excavation bottom until stabilization is achieved. Use of a geotextile fabric such as Mirafi 500X, or the equivalent, is another possible means of stabilizing the bottom. If this material is used, it should be laid on the excavation bottom and covered with approximately 6 to 12 inches of float rock prior to placing of fill materials derived from on-site soils. It is anticipated that pumping soils will be encountered during grading and utility placement in isolated areas.

3. Utility Trenches

a. Utility trench backfill should be governed by the provisions of this report relating to minimum compaction standards. In general, on-site service lines may be backfilled with native soils compacted to 90% of maximum density. Backfill of offsite service lines will be subject to the specifications of the jurisdictional agency or this report, whichever are greater.

b. Backfill operations should be observed and tested by the Geotechnical Engineer to monitor compliance with these recommendations.

c. Jetting should not be utilized for compaction in utility trenches.

B. Structural Design

1. Pole Foundations

a. An allowable adhesion value in psf at any point between a pole foundation and the older alluvial deposits can be taken as equal to 25D+100 where D is the depth in feet. This formula includes a factor of safety of 2.5. The pole foundation excavations should be observed by a representative of this office to verify conformance with these recommendations. The upper 2 feet of soil should be disregarded when making such a determination.

b. Passive resistance against the side of a pole foundation can be determined using an equivalent fluid weight of 275 pcf. The upper 2 feet of soil should be disregarded when making such a determination. The above value includes a factor of safety of 1.5.

c. The pole foundation penetration into the firm, older alluvial deposits should not be less than 5 feet deep.

d. Because pole foundations will be utilizing only skin friction for support, it will not be necessary to thoroughly clean the bottoms of the excavation. However, excessive loose debris and slough should be removed.

e. It is recommended that concrete used in the pole foundations be placed with a slump of 4 to 6 inches in dry excavations. In dry excavations the concrete can free-fall so long as it is dropped vertically and does not strike the reinforcing cage or the pole. In wet excavations, the concrete should be tremmied to the bottom of the pole foundation excavation. The discharge point on the tremmie should be kept several feet below the top of the concrete column. Concrete shall be forced into the excavation until clean concrete is delivered out of the top of the excavation.

f. Pole foundation construction should be monitored by the Geotechnical Engineer's representative to verify compliance with the intent of this report.

2. Settlement Considerations

Static settlement is estimated to be less than one inch assuming the proposed structures will be founded onto firm, soils.

ADDITIONAL SERVICES

This report is based on the assumption that an adequate program of monitoring and testing will be performed by Earth Systems Southern California during construction to check compliance with the recommendations given in this report. The recommended tests and observations include, but are not necessarily limited to the following:

1. Review of the building and grading plans during the design phase of the project.
2. Observation and testing during site preparation, grading, placing of engineered fill, and foundation construction.
3. Consultation as required during construction.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The analysis and recommendations submitted in this report are based in part upon the data obtained from the borings hand augered on the site. The nature and extent of variations between and beyond the borings may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air, on, below, or around this site. Any statements in this report or on the soil boring logs regarding odors noted, unusual or suspicious items or conditions observed, are strictly for the information of our client.

Findings of this report are valid as of this date; however, changes in conditions of a property can occur with passage of time whether they be due to natural processes or works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur whether they result from legislation or broadening of knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of 1 year.

In the event that any changes in the nature, design, or location of the structure and other improvements are planned, the conclusions and recommendations contained in this report shall

not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

This report is issued with the understanding that it is the responsibility of the Owner, or of his representative to insure that the information and recommendations contained herein are called to the attention of the Architect and Engineers for the project and incorporated into the plan and that the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

As the Geotechnical Engineers for this project, Earth Systems Southern California (ESSC) strives to provide our services in accordance with the generally accepted geotechnical engineering practices in this community at this time. No warranty or guarantee is expressed or implied. This report was prepared for the exclusive use of TynanGroup and their authorized agents.

It is recommended that ESSC be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications. If ESSC is not accorded the privilege of making this recommended review, we can assume no responsibility for misinterpretation of our recommendations.

REFERENCES

1. CDMG, 1972 (Revised 1997), Fault Rupture Hazard Zones in California, Special Publication 42.
2. California Division of Mining and Geology Board, 1997, Special Publication 117 Guidelines for Evaluating and Mitigating Seismic Hazards in California.
3. Earth Systems Southern California, July 12, 2001, Geoptechnical Engineering Report for the Santa Barbara Zoological Gardens, Proposed Discovery Pavilion and Cats of Africa Exhibit.
4. Ishihara, K., 1985, Stability of Natural Deposits During Earthquakes, Proceedings of the International Conference on Soil Mechanics and Foundation Engineering.
5. Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel. A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., 1999, Probabilistic Seismic Hazard Assessment for the State of California.

6. Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 124, No. 4, April.

7. Tokimatsu, K., and Seed, H.B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering-August 1987.

APPENDIX A

Field Study
Vicinity Map
Geologic Map
Site Plan
Boring Logs
Symbols Commonly Used on Boring Logs
Unified Soil Classification

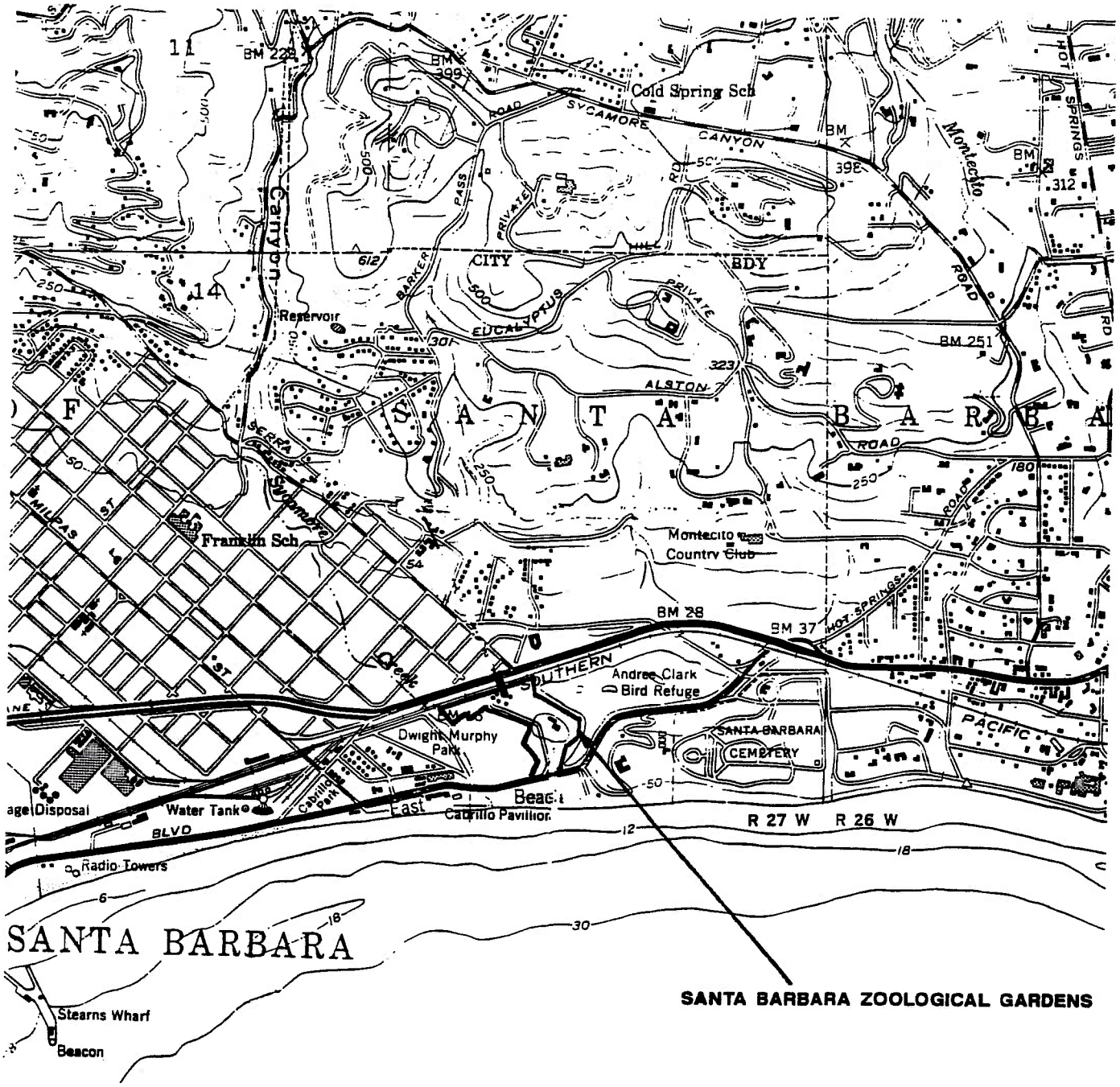
FIELD STUDY

A. On June 10, 2002, 6 borings were hand augered using a subcontracted hand excavating crew to observe the soil profile and to obtain samples for laboratory analysis. The maximum depth explored was approximately 15.5 feet below the existing ground surface. The approximate locations of the test borings were determined in the field by pacing and sighting, and are shown on the Site Plan in this Appendix.

B. Samples were obtained within the test borings with a Modified California (M.C.) ring sampler (ASTM D 3550 with shoe similar to ASTM D 1586). The M.C. sampler has a 3.00-inch outside diameter and a 2.37-inch inside diameter. The samples were obtained within the hand augered borings with a lightweight hand operated slide hammer.

C. Bulk samples of the soils encountered were gathered from the auger cuttings.

D. The final logs of the borings represent our interpretation of the contents of the field logs and the results of laboratory testing performed on the samples obtained during the subsurface study. The final logs are included in this Appendix.



SCALE

1" = 2,000'

NORTH

* Taken from USGS 7.5' Santa Barbara Quadrangle

EARTH SYSTEMS SOUTHERN CALIFORNIA

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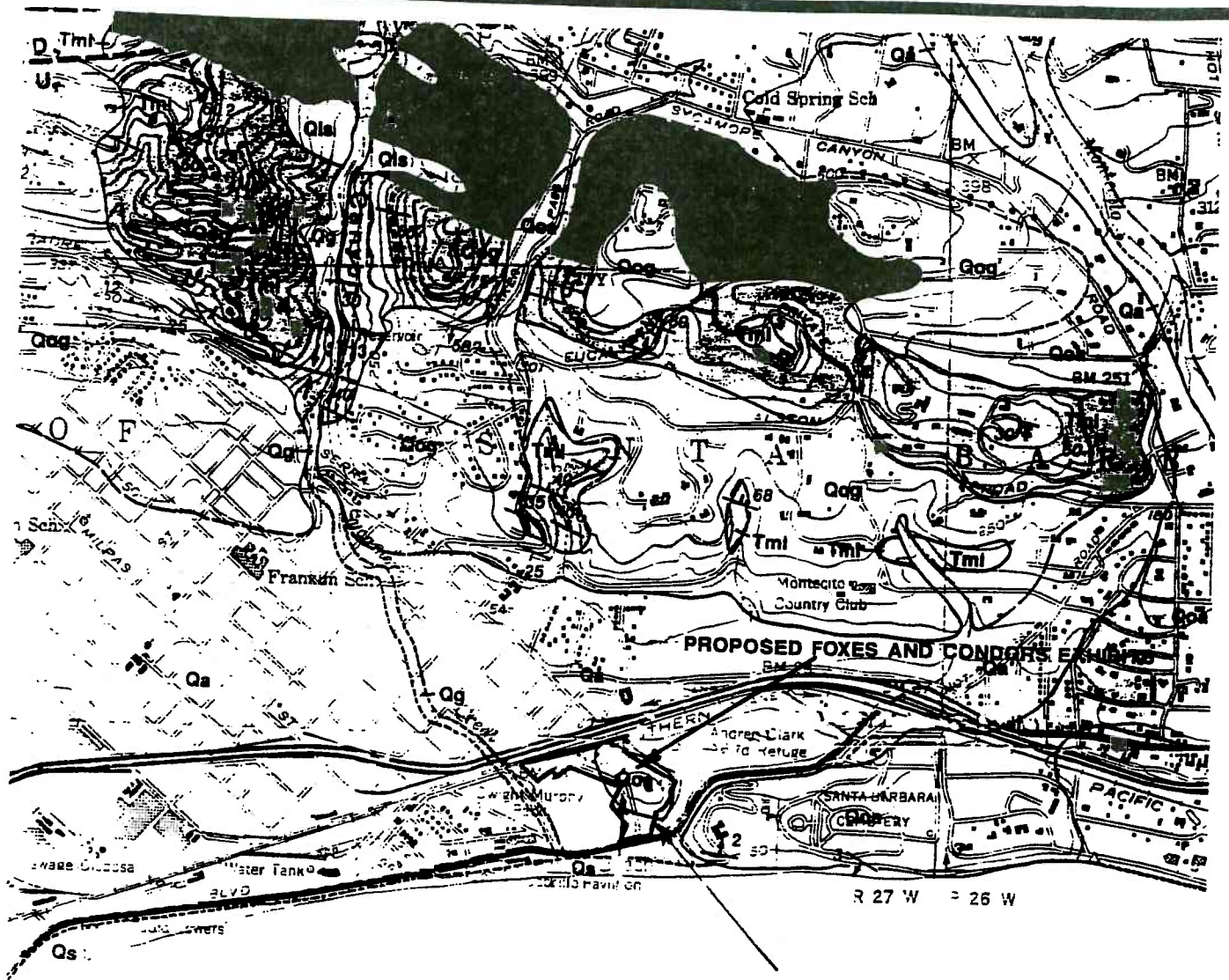
VICINITY MAP *

Santa Barbara Zoological Gradens
Santa Barbara, California

July 2001 Job No. VT-22503-04



SANTA BARBARA

Stearns Wharf

Beach

Qs

SCALE

1" = 2,000'

NORTH

* Taken from Thomas W. Dibblee, Geologic Map of the Santa Barbara Quadrangle, 1986

EARTH SYTEMS SOUTHERN CALIFORNIA

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REGIONAL GEOLOGY *

Santa Barbara Zoological Gradens
Santa Barbara, California

JULY 2002 VT-22503-04

GENERAL

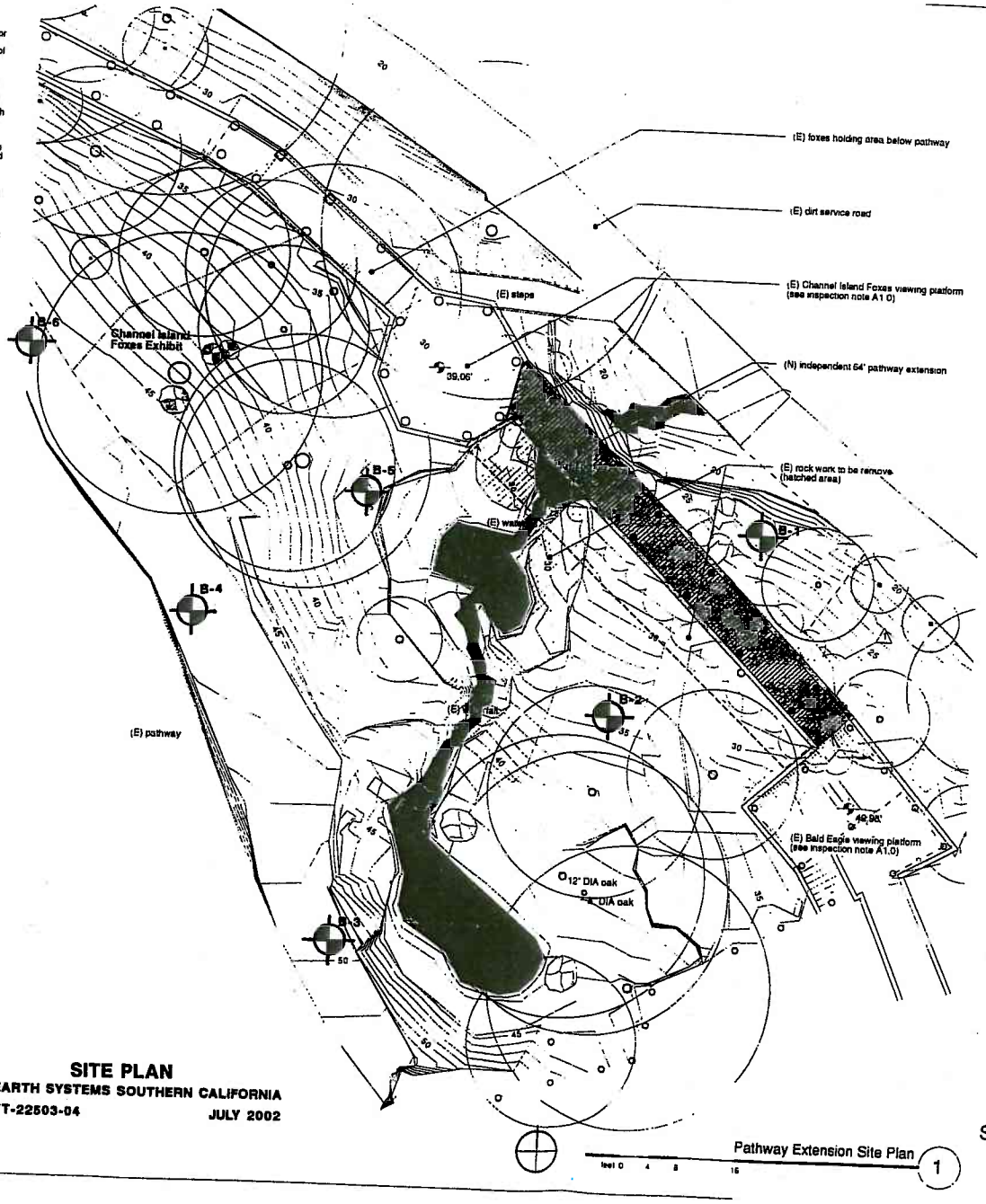
- These plans are the property of Blackbird Architects. Use or copy is permitted by contract only. Any revisions to these drawings or use of these drawings or specifications regardless of scope, without permission of Blackbird Architects is prohibited and shall thereby absolve Blackbird Architects from any liability claims, suits, or litigation by any interested parties in the project.
- All Work shall conform to the current editions in force of the Uniform Building Code, the Uniform Plumbing Code, the Uniform Mechanical Code, the National Electric Code, the Americans With Disabilities Act, and all other applicable requirements, orders, ordinances, and regulations.
- The Construction Drawings and Specifications together form the complete Construction Documents and represent the finished structure unless noted or shown otherwise. They do not indicate the method of construction. The Contractor shall supervise and direct the work to completion of the project as indicated in the drawings and specifications and shall be solely responsible for all construction means, methods, and procedures.
- The Construction Documents are provided to illustrate the design desired and imply the finest quality workmanship throughout. Any design or detail which appears to be inconsistent with the above should be immediately brought to the attention of the Architects by the Contractor.
- The Contractor shall not take advantage of any manifestly unintentional error or omission in the drawings or specifications. The Contractor is expected to furnish all necessary items of materials, labor, etc., which sound construction demands and which are necessary to make a complete job to the true meaning and intent of these drawings and specifications, whether shown on the drawings or not.
- Permits and Inspections: The Owner shall pay for all plan checking and building permit fees. Each Contractor shall secure and pay for permits required for their work and for all inspections which may be required of their work.
- Testing: The Contractor shall arrange for all testing and inspection required by applicable building codes, ordinances, and directives of the building official. The Owner shall pay for all costs of such testing if the tests indicate conformance. The Contractor shall pay costs when tests indicate non-conformance.
- Any Work or materials shown on the drawings and not mentioned in the notes, or vice versa, shall be provided and installed by the contractor the same as if specifically mentioned or shown or both. In the event that work or materials are shown on one drawing and not shown on another, it shall be the same as shown on either or both drawings.
- The Contractor shall verify all construction documents, site dimensions, and other conditions, and shall notify the Architects of any discrepancies or inconsistencies prior to starting Work.
- Applicable trades shall use a common datum to be designated by the Contractor for all critical measurements. Do not scale drawings.
- Specific notes and details take precedence over more general notes and details. Consult the Architects regarding discrepancies.
- Wherever existing Work is damaged by any other construction operation, it shall be repaired or replaced with new materials to match the existing as approved by the Architects.
- The locations of underground utilities are shown in an approximate way only and have not been independently verified by the Owner or its representative. The Contractor shall determine the exact location of all existing utilities before commencing Work, and agrees to be fully responsible for any and all damage which might be occasioned by the Contractor's failure to exactly locate and preserve any and all underground utilities.
- The Contractor shall verify the locations and clearances of all inserts and embedded items with all applicable drawings prior to pouring the concrete.
- All shop drawings for specialties and/or metal work shall be submitted to the Architects for approval prior to fabrication.
- Material and paint color samples are to be submitted to the Architects prior to installation.
- All dimensions are to face of stud, concrete, or masonry to center lines of doors and windows, and to the inside of the curb for skylight dimensions, unless noted otherwise.
- Substitutions, revisions or changes may be allowed only if such items are submitted to the Architects in a timely manner in writing and subsequently approved by the Architects in writing. All substitutions must be at least of equal quality, design, and performance to the items originally specified. The Contractor is liable for replacement, repair, and delays caused by any unauthorized substitution of any item of this project.

GUARDRAILS

- Commercial guardrails shall not be less than 42" in height and have intermediate rails or ornamental pattern so that no object 4" in diameter, or larger, can pass through. Guardrails shall resist a load of 20 pounds per lineal foot min. applied horizontally to the top rail, and 200 pounds applied in any direction at any point on the rail.

FRAMING

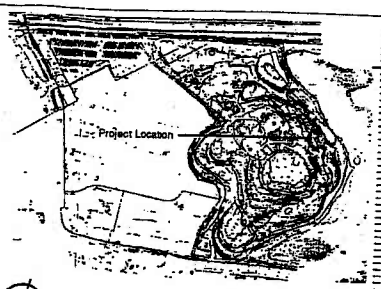
1. All framing lumber shall be pressure treated Douglas Fir #1, except gaurd rail posts shall be PTDF select structural, unless noted otherwise.
2. All framing nails shall be Simpson Co. SS16D (stainless steel, 16 penny)
3. All bolts, shall be ASTM A-307 galvanized
4. All steel plates, clips, hangers, etc. shall be galvanized or epoxy coated.
5. All decking shall be Douglas Fir-Larch (North) select grade



SITE PLAN

EARTH SYSTEMS SOUTHERN CALIFORNIA

VT-22503-04 **JULY 2002**



Vicinity Map 1

Project Description

The Santa Barbara Zoological Gardens seeks to connect two existing viewing platforms with a continuation of the existing raised pathway. The continuation of the existing pathway will span roughly 64', and enable visitors to move along the approximately 600 feet of pathway and viewing platforms without having to backtrack along the same route. This extension will simplify circulation, save visitors time and effort, and increase exhibit viewing opportunities.

Project Information

Owner	Santa Barbara Zoological Gardens
Project Address	500 Ninos Drive Santa Barbara, CA. 93103
Assessor's Parcel Number	017-362-002
Zone	P-R/SD-3
Type of construction	VN
Occupancy	NA
Gross lot area	Approx. 18.1 Acres
Setbacks	
side yard	Not less than 10 feet
rear yard	Not less than 10 feet
front yard	N/A
Required Parking	N/A - No change to parking
Design District	El Pueblo Viejo
Slope of Property	Less than 5%
Cut	Less than 50 cubic yards
Fill	Less than 50 cubic yards
Area	360 sq. ft.
Structure Area as % of Site Coverage	Less than 1/10th of 1%

Archeaology Note:

Prior to the start of any vegetation or paving removal, demolition, trenching or grading, contractors and construction personnel shall be alerted to the possibility of uncovering unanticipated subsurface archaeological features or artifacts associated with past human occupation of the parcel. In the unlikely event such cultural resources are encountered or suspected, work shall be halted immediately, the City Environmental Analyst shall be notified and a City-approved archaeologist shall be consulted to evaluate the potential significance of the find, pursuant to City MEA for Cultural Resources criteria. If the discovery consists of potentially human remains, the Santa Barbara County Coroner and the California Native American Heritage Commission shall also be contacted. Work in the area shall only proceed after authorization is granted by the Environmental Analyst.

Inspection Note:

The Foxes and Bald Eagle viewing platforms are as built of similar construction materials and methods as the (N) pathway extension. The project engineer shall perform structural inspections of both platforms and make recommendations in writing to the owner and the city building department as necessary to correct any deficiences. This inspection shall occur during the course of new construction. Contact Mike Gonee, Civil Engineer, 805.966.2259, 48 hours in advance of commencement of construction of the boardwalk extension.

Abbreviations

BM	beam
CL	center line
CONC.	concrete
DF	Douglas Fir
DIA.	diameter
(E)	existing
EQ	equal
GALV.	galvanized
HORIZ.	horizontal
(N)	new
OC	on center
PTD	painted
PT	pressure treated
REQD.	required
TYP	typical
V.I.F.	verify in field

Sheet Index

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santa barbara zoological gardens

North America Pathway Extensio

Santa Barbara Zoological Garde
500 Ninos Drive
Santa Barbara, CA 93103

JUN 17 2002

Revisions 05.19.2

LICENSED ARCHITECT KENNETH G. PAUTHEY C-26751 REN 7 31 2003 STATE OF CALIFORNIA

Site Plan

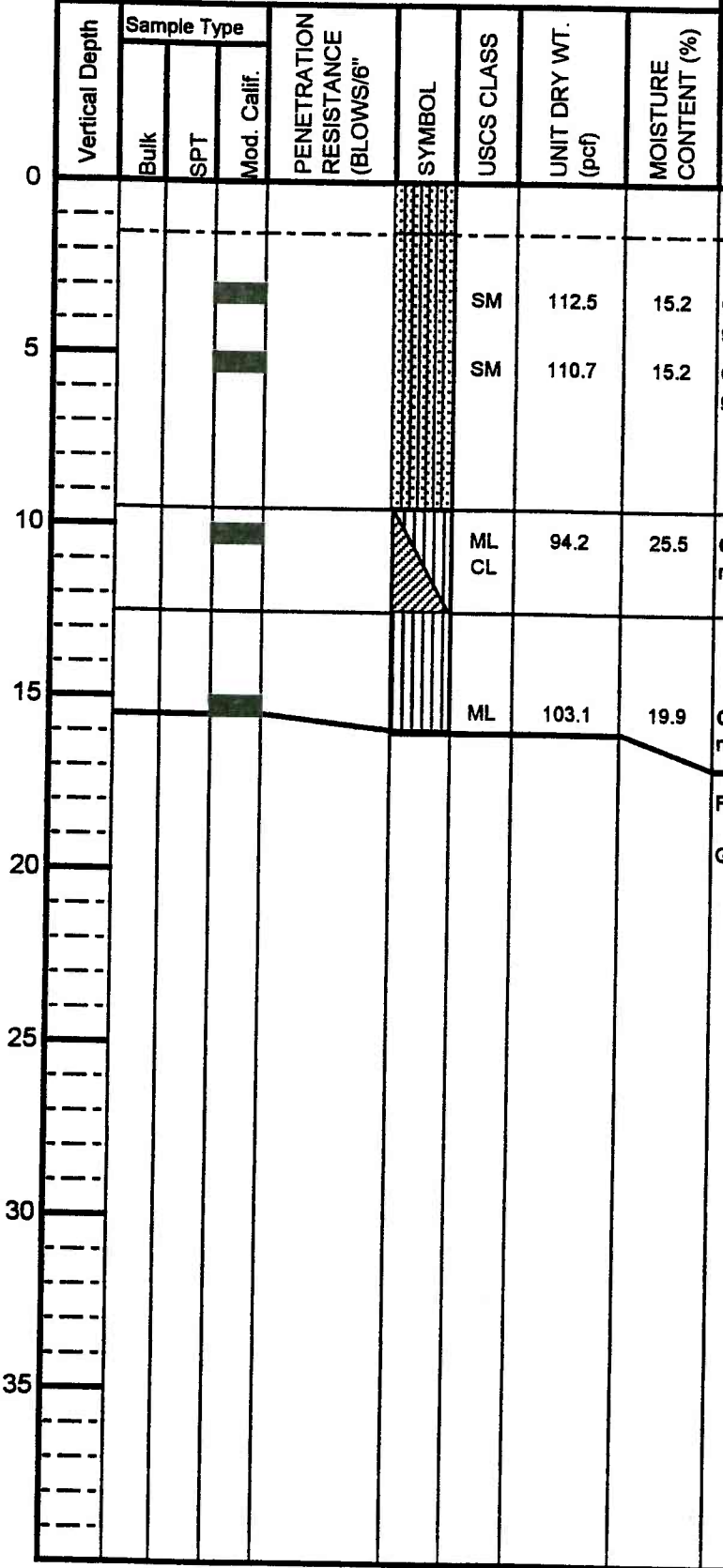
Vicinity Map
Project Information

A1.0

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B1
PROJECT NAME: Santa Barbara Zoological Gardens
PROJECT NUMBER: VT-22503-04
BORING LOCATION: Per Plan

DRILLING DATE: June 10, 2002
DRILLING METHOD: Hand Auger
DRILL: 3" Auger
LOGGED BY: Wesley Smith



USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
			TOPSOIL: Sandy SILT, trace rootlets, brown
SM	112.5	15.2	**OLDER ALLUVIAL DEPOSITS:** Silty fine to coarse SAND, trace fine gravel, moderate brown
SM	110.7	15.2	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, trace fine gravel and trace clay, dark to moderate brown
ML CL	94.2	25.5	**OLDER ALLUVIAL DEPOSITS:** Clayey SILT, trace fine sand, nonplastic, reddish orange to reddish brown
ML	103.1	19.9	**OLDER ALLUVIAL DEPOSITS:** Clayey SILT, trace fine sand, nonplastic, reddish orange to yellowish brown
			Final Depth: 15' 6"
			Groundwater was not encountered

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B2
PROJECT NAME: Santa Barbara Zoological Gardens
PROJECT NUMBER: VT-22503-04
BORING LOCATION: Per Plan

DRILLING DATE: June 10, 2002
DRILLING METHOD: Hand Auger
DRILL: 3" Auger
LOGGED BY: Wesley Smith

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									**TOP SOIL:** Sandy SILT, trace rootlets, brown
						SM ML	99.5	15.7	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, trace clay, dark yellowish brown
5						SM	98.9	11.5	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, trace clay, well graded, moderate yellowish brown
						SC			
10						ML	70.8	16.8	**OLDER ALLUVIAL DEPOSITS:** Clayey SILT, trace very fine sand, orange-brown to light yellowish brown
15						SM	102.1	14.5	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, moderately graded, seams of clay, reddish brown to orangish brown
									Final Depth: 15'6"
20									Groundwater was not encountered
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

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BORING NO: B3
PROJECT NAME: Santa Barbara Zoological Gardens
PROJECT NUMBER: VT-22503-04
BORING LOCATION: Per Plan

DRILLING DATE: June 10, 2002
DRILLING METHOD: Hand Auger
DRILL: 3" Auger
LOGGED BY: Wesley Smith

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									**TOP SOIL:** Silty fine to coarse SAND, trace gravel, dark brown
			■			SM	108.7	15.2	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, trace rootlets and trace clay, well graded, black to dark brown
5			■			SC	102.2	21.2	**OLDER ALLUVIAL DEPOSITS:** Fine to medium SAND, trace clay, dark to moderate yellowish brown
10			■			ML	112.6	17.5	**OLDER ALLUVIAL DEPOSITS:** Clayey SILT, non-plastic, trace sand, moderate brown
15									Final Depth: 10'6" Groundwater was not encountered
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

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PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B4
PROJECT NAME: Santa Barbara Zoological Gardens
PROJECT NUMBER: VT-22503-04
BORING LOCATION: Per Plan

DRILLING DATE: June 10, 2002
DRILLING METHOD: Hand Auger
DRILL: 3" Auger
LOGGED BY: Wesley Smith

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									**TOP SOIL:** Silty fine to coarse SAND, trace gravel, dark brown
			■			SM ML	110	16.3	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, well graded, seams of clay and trace rootlets, moderate brown
5			■			SM	102.8	9.5	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, well graded, trace gravel and trace clay, dark to moderate brown
10			■			SW	–	–	**OLDER ALLUVIAL DEPOSITS:** Fine to coarse SAND, well graded, trace silt and trace clay, reddish brown
15									Final Depth: 10' Groundwater was not encountered
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

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1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B5
PROJECT NAME: Santa Barbara Zoological Gardens
PROJECT NUMBER: VT-22503-04
BORING LOCATION: Per Plan

DRILLING DATE: June 10, 2002
DRILLING METHOD: Hand Auger
DRILL: 3" Auger
LOGGED BY: Wesley Smith

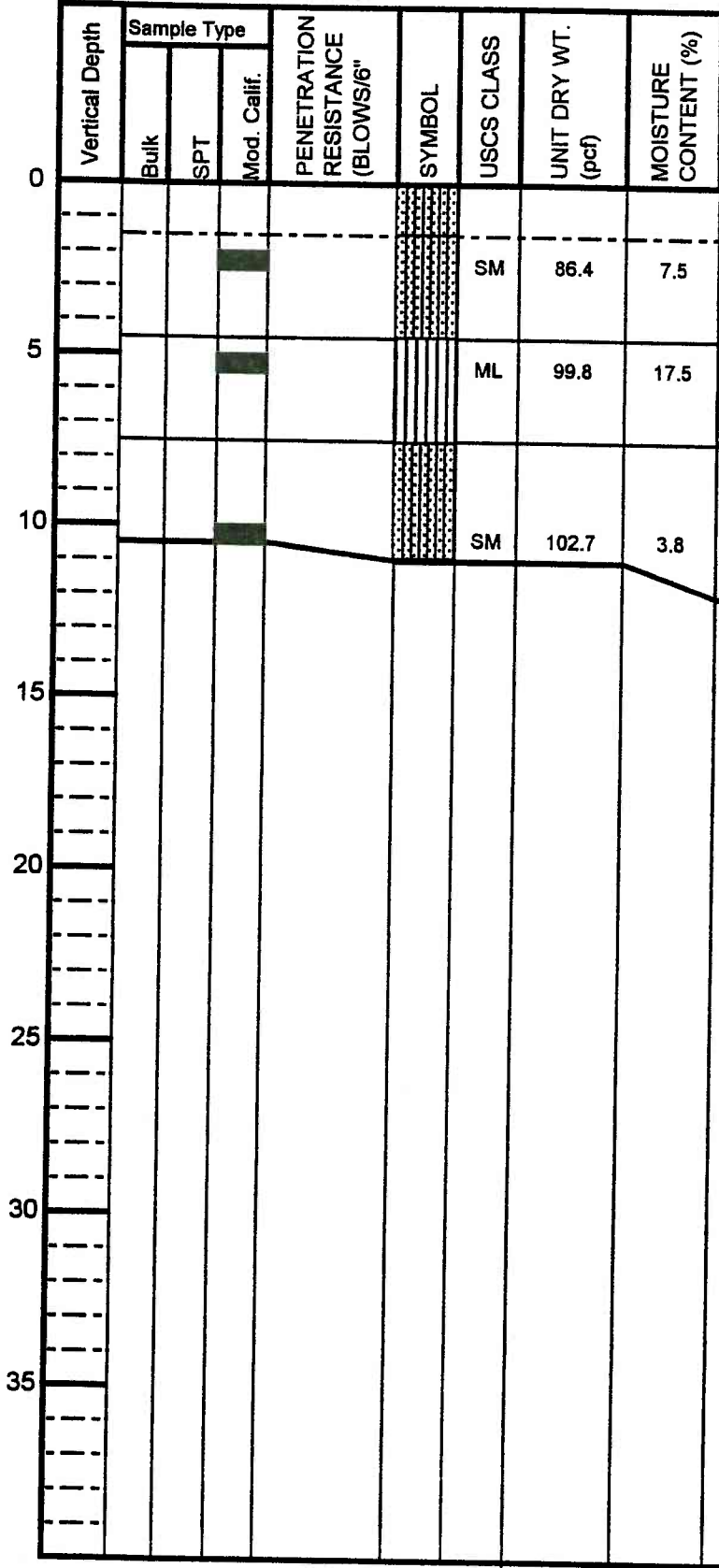
Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									**TOP SOIL:** Silty fine to coarse SAND, trace gravel, dark brown
			■			SM	94.4	5.3	**OLDER ALLUVIAL DEPOSITS:** Silty fine to medium SAND, well graded, trace rootlets, dark brown
5	X		■			SM	99.9	16.5	**OLDER ALLUVIAL DEPOSITS:** Silty fine SAND, poorly graded, trace clay, light yellowish to moderate brown
									Final Depth: 7'
									Groundwater was not encountered
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B6
PROJECT NAME: Santa Barbara Zoological Gardens
PROJECT NUMBER: VT-22503-04
BORING LOCATION: Per Plan

DRILLING DATE: June 10, 2002
DRILLING METHOD: Hand Auger
DRILL: 3" Auger
LOGGED BY: Wesley Smith



DESCRIPTION OF UNITS

TOP SOIL: Silty fine to coarse SAND, trace gravel, dark brown

OLDER ALLUVIAL DEPOSITS: Silty fine to medium SAND, well graded, trace rootlets and trace clay, dark grayish brown

OLDER ALLUVIAL DEPOSITS: Sandy SILT, trace clay, moderate yellowish to grayish brown

OLDER ALLUVIAL DEPOSITS: Silty fine to medium SAND, light grayish brown

Final Depth: 10'6"

Groundwater was not encountered

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Modified California Split Barrel Sampler

Modified California Split Barrel Sampler - No Recovery

Standard Penetration Test (SPT) Sampler

Standard Penetration Test (SPT) Sampler - No Recovery

Perched Water Level

Water Level First Encountered

Water Level After Drilling

Pocket Penetrometer (tsf)

Vane Shear (ksf)

1. The approximate locations of borings were determined by sighting and pacing from nearby prominent topographic or cultural features. Borehole elevations were estimated by interpolating between available plan contour intervals. The location and elevation of each boring should be considered accurate only to the degree implied by this method.

2. Stratification lines represent the approximate boundary between soil and/or rock types. The transition between statigraphic units may be gradual.

3. Water level readings taken in boreholes are approximate and apply only to the time and date of drilling. Fluctuations in the level of groundwater from the time of initial measurement may occur due to variations in rainfall, tides, barometric pressure, temperature, or other factors.

EARTH SYSTEMS SOUTHERN CALIFORNIA

1731-A Walter Street, Ventura, California 93003
PH: (805) 642-6727 FAX: (805) 642-1325

Symbols Commonly Used on Boring Logs

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		G W	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE			G P	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		G M	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				G C	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		S W	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				S P	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SAND WITH FINES (APPRECIABLE AMOUNT OF FINES)		S M	SILTY SANDS, SAND-SILT MIXTURES
				S C	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT **LESS** THAN 50		M L	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				C L	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				O L	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT **GREATER** THAN 50		M H	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				C H	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				O H	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				P T	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

EARTH SYSTEMS SOUTHERN CALIFORNIA

1731-A Walter Street, Ventura, California 93003
PH: (805) 642-6727 FAX: (805) 642-1325

Unified Soil Classification System (USCS)

APPENDIX B

Laboratory Testing
Tabulated Test Results
Individual Test Results
Soil Chemistry Results

LABORATORY TESTING

A. Samples were reviewed along with field logs to determine which would be analyzed further. Those chosen for laboratory analysis were considered representative of soils that would be exposed and/or used during grading, and those deemed to be within the influence of proposed structures. Test results are presented in graphic and tabular form in this Appendix.

B. In-situ moisture content and unit dry weight for the ring samples were determined in general accordance with ASTM D 2937.

C. The relative strength characteristics of the soils were determined from the results of direct shear tests on undisturbed samples. Specimens were placed in contact with water at least 24 hours before testing, and were then sheared under normal loads ranging from 0.5 to 2.0 kips per square foot in general accordance with ASTM D 3080.

D. A maximum density test was performed to estimate the moisture-density relationship of typical soil materials. The test was performed in accordance with ASTM 1557.

E. Concrete and metal corrosion potential of the near surface soil was determined by measuring pH, resistivity, and soluble sulfate and soluble chloride contents. The tests were performed by Capco.

TABULATED TEST RESULTS

REMOLDED SAMPLES

BORING AND DEPTH	B-2 & 5 (composite) @ 0-7'
USCS	SM
MAXIMUM DENSITY (pcf)	112.5
OPTIMUM MOISTURE (%)	17

RELATIVELY UNDISTURBED SAMPLES

BORING AND DEPTH	TP-1 @ 10'	TP-2 @ 2'
USCS	ML	SM/ML
IN-PLACE DENSITY (pcf)	94.2	99.5
IN-PLACE MOISTURE (%)	25.5	15.7
COHESION (psf)	750	880
ANGLE OF INTERNAL FRICTION	36	20

BORING AND DEPTH	TP-2 @ 5'	TP-3 @ 10'
USCS	SM	ML
IN-PLACE DENSITY (pcf)	98.9	112.6
IN-PLACE MOISTURE (%)	11.5	17.5
COHESION (psf)	210	1850
ANGLE OF INTERNAL FRICTION	43	49

BORING AND DEPTH	TP-4 @ 5'
USCS	SM
IN-PLACE DENSITY (pcf)	102.8
IN-PLACE MOISTURE (%)	9.5
COHESION (psf)	290
ANGLE OF INTERNAL FRICTION	38

VT-22727-01

Jul 1, 2002

MAXIMUM DENSITY / OPTIMUM MOISTURE

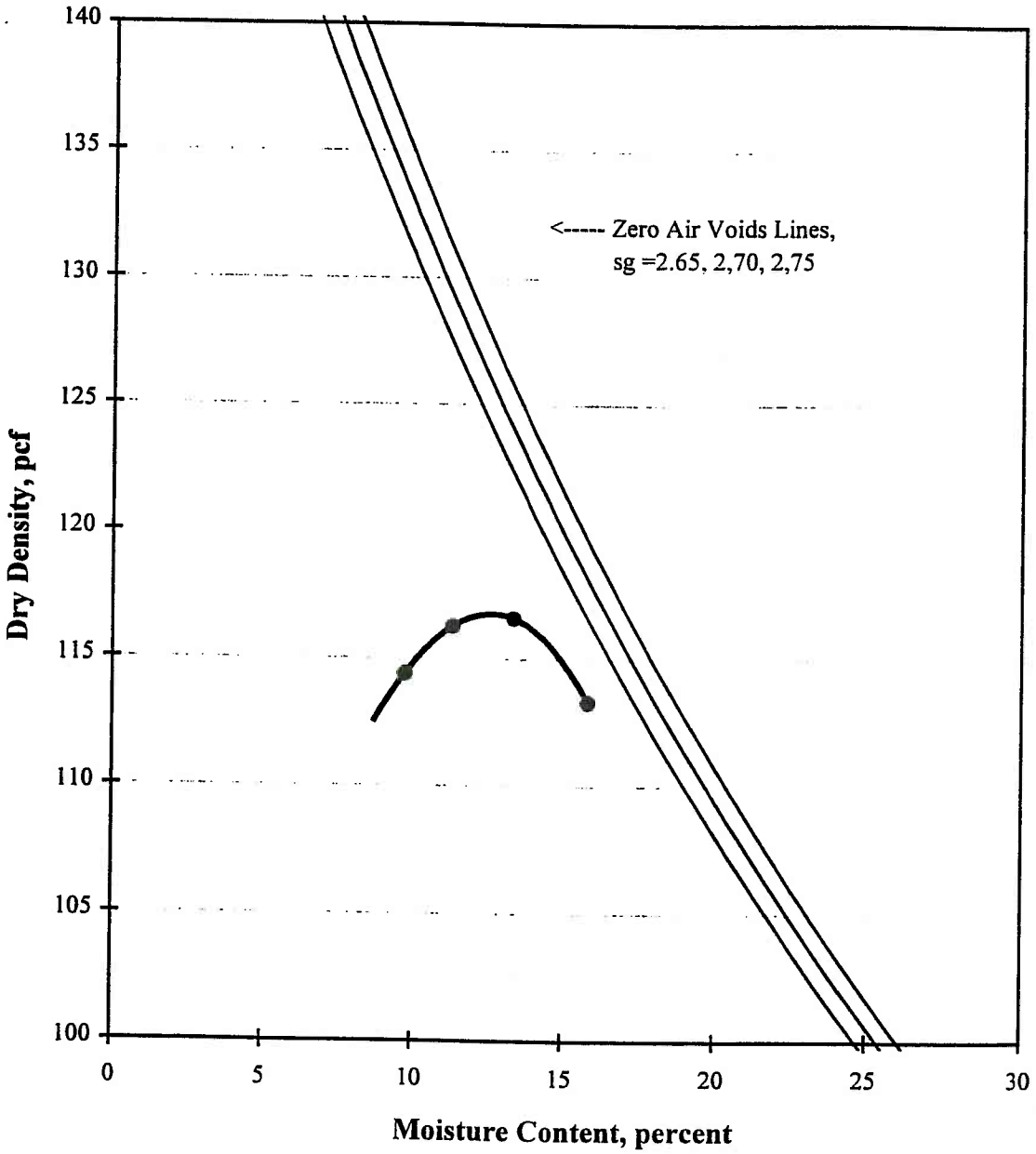
ASTM D 1557-91 (Modified)

Job Name: Santa Barbara Zoo - Foxes and Condors
Sample ID: B2&5 @ 0 - 7
Location:
Description: Silty Sand

Procedure Used: B
Prep. Method: Moist
Rammer Type: Manual

Maximum Density: **112.5 pcf**
Optimum Moisture: **17%**

Sieve Size	% Retained
3/4"	0.0
3/8"	0.0
#4	0.0

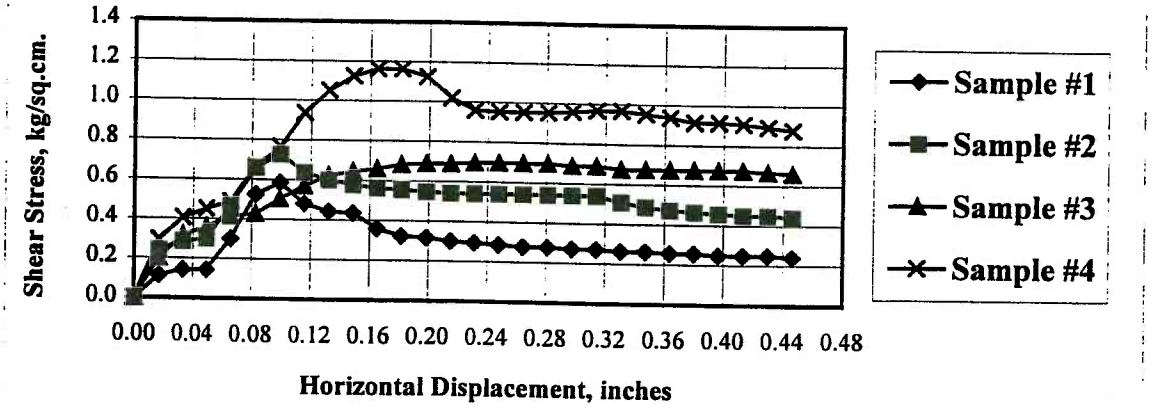


DIRECT SHEAR

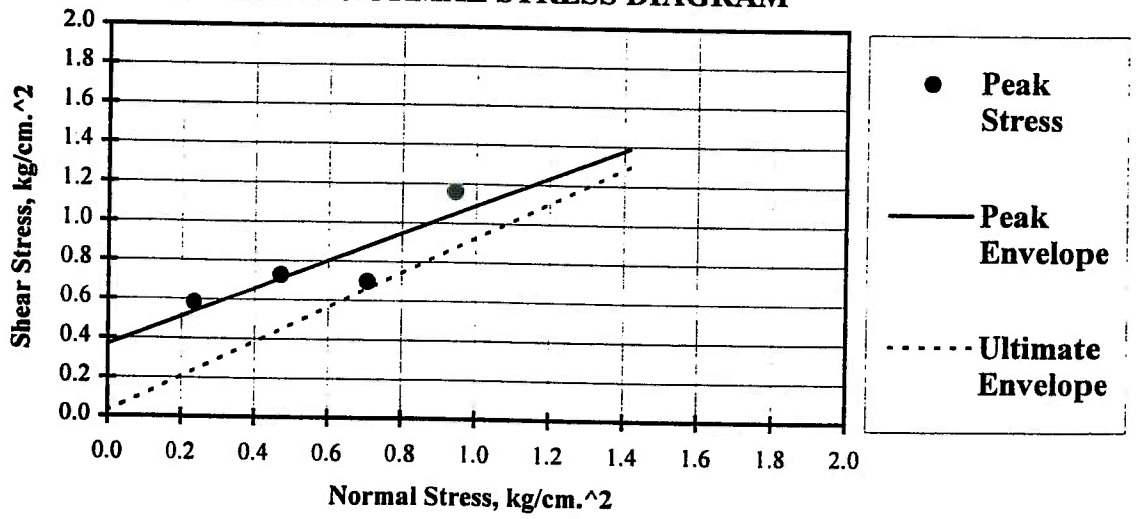
Santa Barbara Zoo - Foxes and Condors
1 @ 10
Clayey Silt
Undisturbed

Initial Dry Density: 95.0 pcf
Initial Mosture Content: 25.5 %
Peak Friction Angle (Ø): 36°
Cohesion (c): 0.367 kg/cm^2 (750 psf)

Sample No.	1	2	3	4	Average
Initial					
Dry Density, pcf	95.1	98.1	92.6	94.3	95.0
Moisture Content, %	25.5	25.5	25.5	25.5	25.5
Saturation, %	91	97	85	89	90
At Test					
Moisture Content, %	27.2	25.8	28.8	28.2	27.5
Saturation, %	96	99	96	98	97
Normal Stress, kg/cm^2	0.24	0.47	0.71	0.94	
Peak Stress, kg/cm^2	0.58	0.73	0.70	1.16	
Ultimate Stress, kg/cm^2	0.24	0.44	0.66	0.88	



SHEAR vs. NORMAL STRESS DIAGRAM

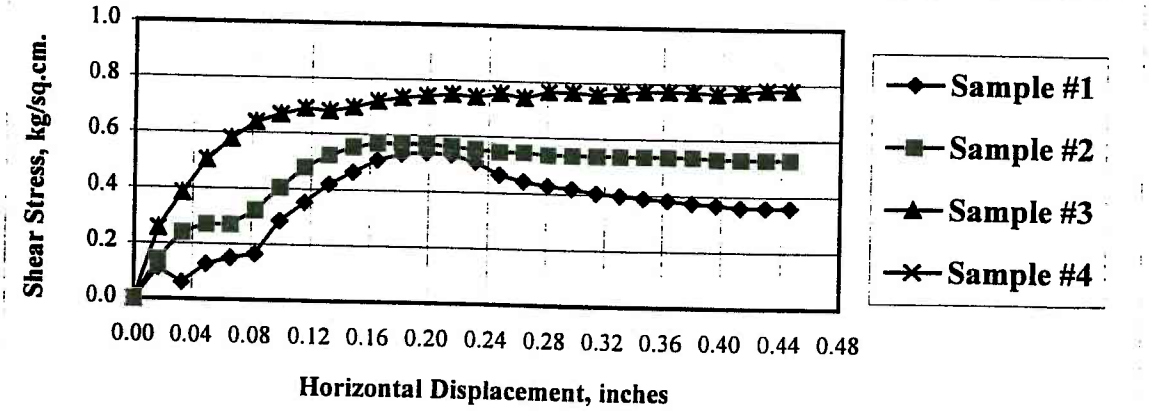


DIRECT SHEAR

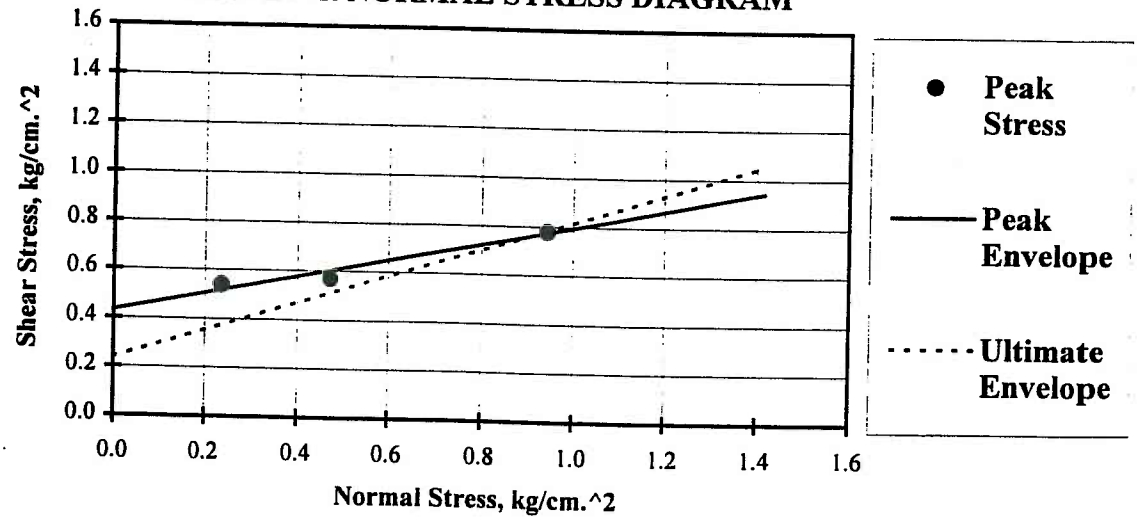
Santa Barbara Zoo - Foxes and Condors
2 @ 2
Silty Sand
Undisturbed

Initial Dry Density: 98.8 pcf
Initial Moisture Content: 15.7 %
Peak Friction Angle (Ø): 20°
Cohesion (c): 0.432 kg/cm^2 (880 psf)

Sample No.	1	2	3	4	Average
Initial					
Dry Density, pcf	106.2	101.6	93.7	93.7	98.8
Moisture Content, %	15.7	15.7	15.7	15.7	15.7
Saturation, %	74	66	54	54	62
At Test					
Moisture Content, %	20.1	21.9	28.2	28.2	24.6
Saturation, %	94	91	97	97	95
Normal Stress, kg/cm^2	0.24	0.47	0.94	0.94	
Peak Stress, kg/cm^2	0.54	0.57	0.78	0.78	
Ultimate Stress, kg/cm^2	0.36	0.53	0.78	0.78	



SHEAR vs. NORMAL STRESS DIAGRAM

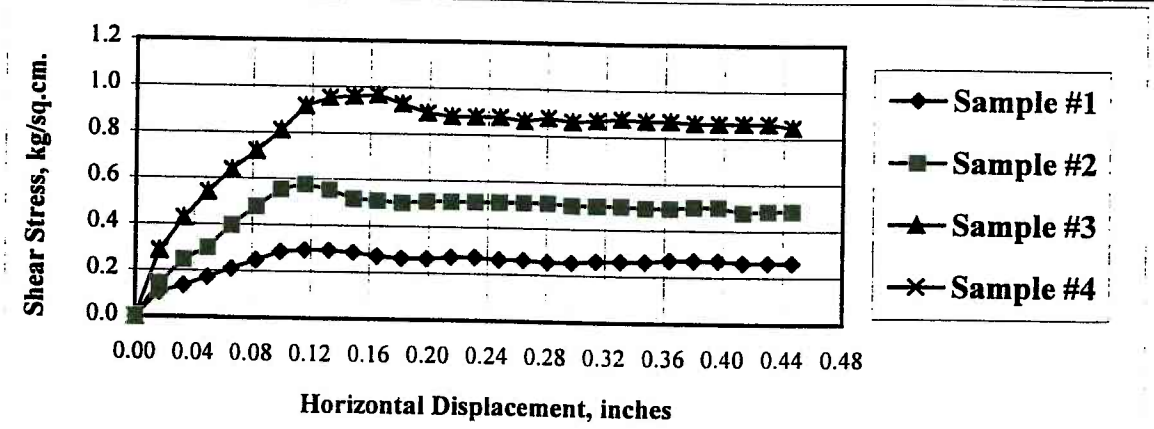


DIRECT SHEAR

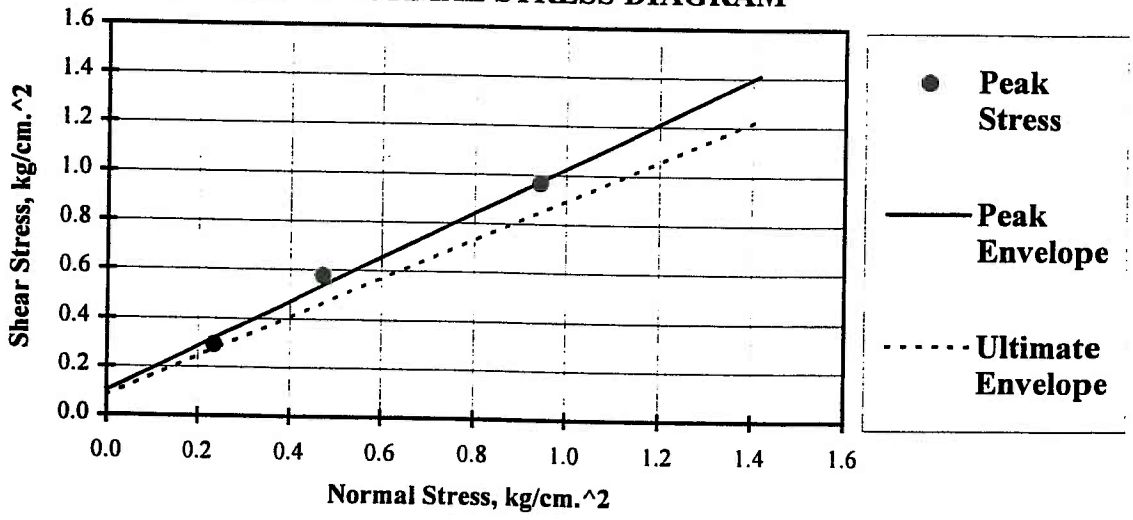
Santa Barbara Zoo - Foxes and Condors
2 @ 5
Silty Sand
Undisturbed

Initial Dry Density: 97.3 pcf
Initial Moisture Content: 11.5 %
Peak Friction Angle (Ø): 43°
Cohesion (c): 0.101 kg/cm^2 (210 psf)

Sample No.	1	2	3	4	Average
Initial					
Dry Density, pcf	95.3	100.9	96.5	96.5	97.3
Moisture Content, %	11.5	11.5	11.5	11.5	11.5
Saturation, %	41	47	42	42	43
At Test					
Moisture Content, %	26.0	23.5	26.2	26.2	25.5
Saturation, %	93	96	96	96	95
Normal Stress, kg/cm^2	0.24	0.47	0.94	0.94	
Peak Stress, kg/cm^2	0.29	0.58	0.97	0.97	
Ultimate Stress, kg/cm^2	0.26	0.48	0.85	0.85	



SHEAR vs. NORMAL STRESS DIAGRAM

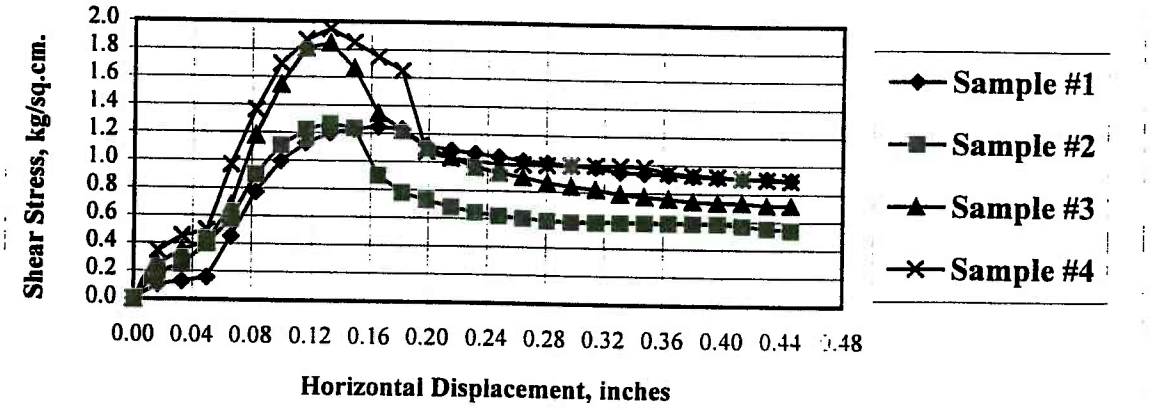


DIRECT SHEAR

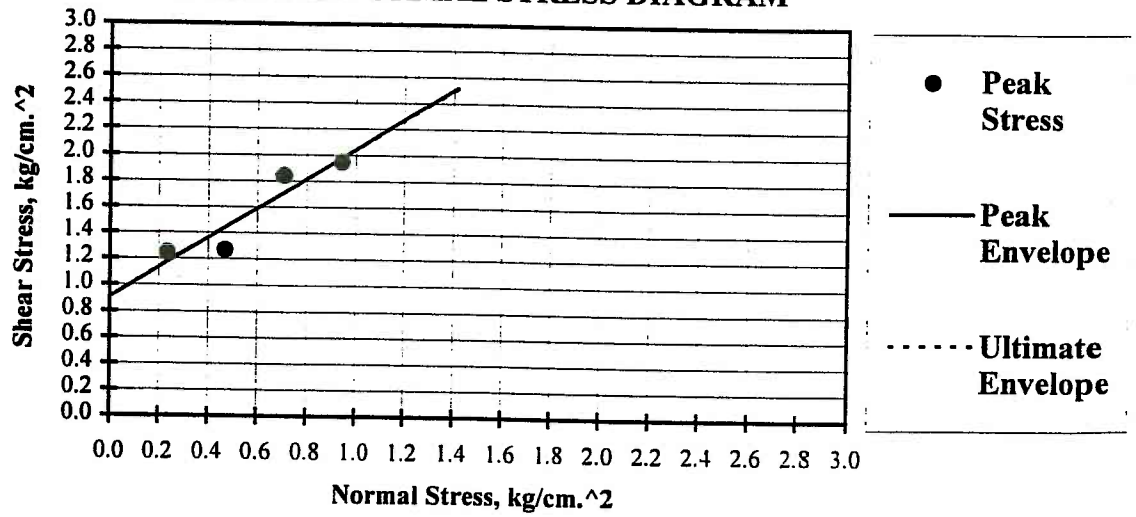
Santa Barbara Zoo - Foxes and Condors
3 @ 10
Sandy Silt
Undisturbed

Initial Dry Density: 112.3 pcf
Initial Moisture Content: 17.5 %
Peak Friction Angle (Ø): 49°
Cohesion (c): 0.903 kg/cm^2 (1850 psf)

Sample No.	1	2	3	4	Average
Initial					
Dry Density, pcf	109.7	113.1	112.3	114.3	112.3
Moisture Content, %	17.5	17.5	17.5	17.5	17.5
Saturation, %	90	99	97	100	97
At Test					
Moisture Content, %	18.5	16.9	17.3	16.0	17.2
Saturation, %	95	95	95	93	95
Normal Stress, kg/cm^2	0.24	0.47	0.71	0.94	
Peak Stress, kg/cm^2	1.24	1.27	1.84	1.95	
Ultimate Stress, kg/cm^2	1.24	1.27	1.84	1.95	



SHEAR vs. NORMAL STRESS DIAGRAM

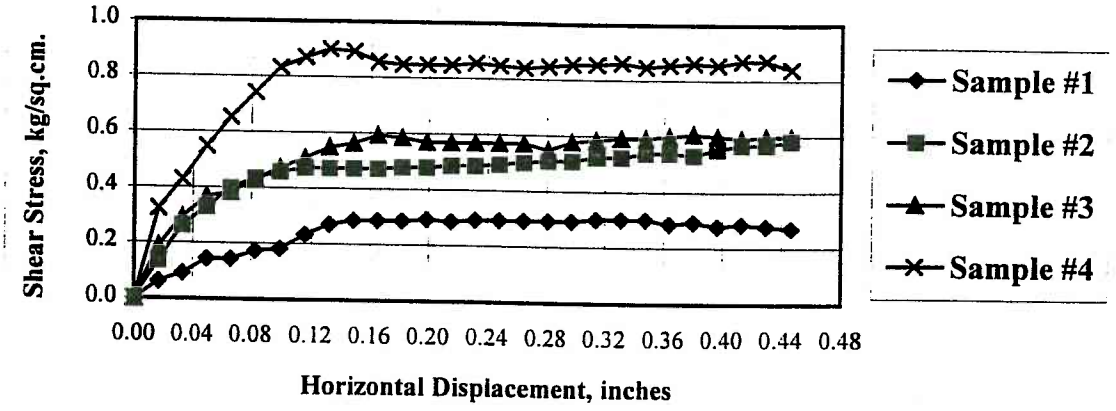


DIRECT SHEAR

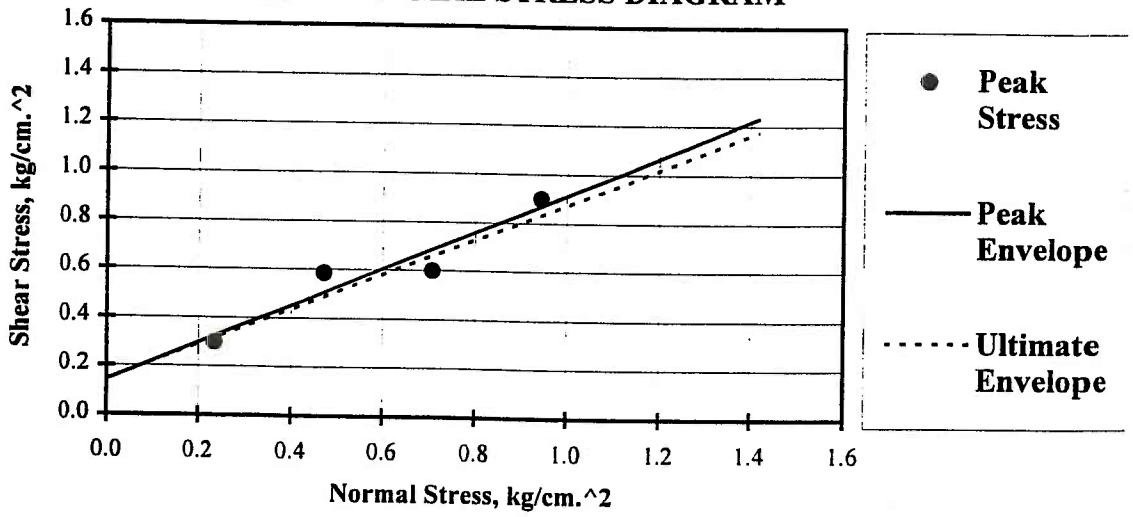
Santa Barbara Zoo - Foxes and Condors
4 @ 5
Silty Sand
Undisturbed

Initial Dry Density: 100.6 pcf
Initial Mosture Content: 9.5 %
Peak Friction Angle (Ø): 38°
Cohesion (c): 0.142 kg/cm^2 (290 psf)

Sample No.	1	2	3	4	Average
Initial					
Dry Density, pcf	102.0	99.0	101.4	100.1	100.6
Moisture Content, %	9.5	9.5	9.5	9.5	9.5
Saturation, %	40	37	39	38	39
At Test					
Moisture Content, %	21.8	25.1	23.3	23.2	23.4
Saturation, %	92	98	97	93	95
Normal Stress, kg/cm^2	0.24	0.47	0.71	0.94	
Peak Stress, kg/cm^2	0.30	0.58	0.60	0.90	
Ultimate Stress, kg/cm^2	0.27	0.58	0.60	0.84	



SHEAR vs. NORMAL STRESS DIAGRAM



Capco Analytical Services Incorporated (CAS)
1536 Eastman Avenue, Suite B
Ventura, CA. 93003
(805) 644-1095

Prepared For: Earth Systems
1731-A Walter St. Ste A
Ventura, CA 93003

June 25, 2002

ATTENTION: Todd

Laboratory No: 021287
Date Received: 17-JUN-02
Project: S.B. Zoo Foxes & Condors
(VT-22603-09)

Job No: B05541
Sampled By: Client
ID: See Below

RESULTS

On June 17, 2002, one (1) sample was received for analysis by Capco Analytical Services Inc. The sample was identified and assigned the lab number listed below. This report consists of 2 pages excluding the cover letter, and the Chain of Custody.

SAMPLE DESCRIPTION	CAS LAB NUMBER
2 @ 0-5 & 5 @ 5-7 MIX	02128701

Dan A. Farah, Ph.D.
Director - Analytical Operations

CAPCO Analytical Services, Inc.

Capco Analytical Services INC. (CAS)
1536 Eastman Avenue, Suite B
Ventura CA 93003
(805) 644-1095

Client: Earth Systems
Sample ID: 2 @ 0-5 & 5 @ 5-7 Mix
Date Received: 06/17/02
Date Sampled: N/A

Sample Matrix: Soil
CAS LAB NO: 02128701

WET CHEMISTRY ANALYSIS SUMMARY

COMPOUND	RESULT	UNITS	DF	PQL	METHOD	ANALYZED
*Chloride	240	mg/Kg	1	10	300.0M	06/17/02
pH	6.4	S.U.	1	---	9045	06/17/02
*Resistivity	1470	ohms-cm	1	3	CA test 424	06/17/02
*Sulfate	120	mg/Kg	1	10	300.0M	06/17/02

*Sample was analyzed on a 1:3 soil/water extract. Results were reported based on the original soil sample weight.
PQL: Practical Quantitation Limit
BQL: Below Practical Quantitation Limit

Principal Analyst

CAPCO Analytical Services, Inc.

Capco Analytical Services INC. (CAS)
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Client: Earth Systems
Sample ID: Method Blank

Sample Matrix: MB for Solid
CAS LAB NO: 021287-MB

WET CHEMISTRY ANALYSIS SUMMARY

COMPOUND	RESULT	UNITS	DF	PQL	METHOD	ANALYZED
Chloride	BQL	mg/Kg	1	10	300.0M	06/17/02
Sulfate	BQL	mg/Kg	1	10	300.0M	06/17/02

PQL: Practical Quantitation Limit
BQL: Below Practical Quantitation Limit

Principal Analyst

CAPCO Analytical Services, Inc.