Appendix E

Geology: Geotechnical Report

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PRELIMINARY FOUNDATION INVESTIGATION

Proposed Cortona Apartments

6830 Cortona Drive

City of Goleta

California

CLIENT
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INTRODUCTION

This report presents the results of a preliminary foundation investigation performed at the proposed Cortona Apartments, 6830 Cortona Drive, in the City of Goleta, California. Presently, the site is undeveloped. It is proposed to develop the site with a multi-residential complex, including a swimming pool. The development will consist of several multi-residential buildings with the driveway and parking lots surrounding the buildings. The site will be graded in order to establish proper drainage. There are no steep slopes associated with the property.

SCOPE OF WORK

It is the purpose of this investigation to classify the soil disclosed by the exploratory borings and excavations by observation and tests on selected samples. In addition, this study includes laboratory tests to evaluate soil strength, the effect of moisture variation on the soil-bearing capacity, compressibility, liquefaction, and expansiveness. Based upon this information, we will provide preliminary grading and foundation recommendations for the proposed Cortona Apartments.

The scope of this investigation does not include the analyses of the corrosive potential of the soil, previous site construction, or analyses of geologic structures and their associated features, such as faults, fractures, bedding planes, strike and dip angles, ancient landslides, potential for earth movement in undisturbed or natural soil formations sloped or level, or other sources of potential instability which relate to the geologic conditions, as these items should be addressed by a qualified Engineering Geologist.

This exploration was conducted in accordance with presently accepted geotechnical engineering procedures currently applied in the local community in order to provide the appropriate geotechnical design characteristics of the foundations soils and of the proposed fill soils in order to properly evaluate the proposed structures with respect to differential settlement based upon the anticipated soil characteristics at the time of construction.

LIMITATIONS

This Laboratory's basic assumption is that the soil borings presented herein are representative of the entire footprint of the proposed development, however, no warranty is implied. If, during the course of construction, soil conditions are encountered which vary from those presented herein, please contact this Laboratory immediately so appropriate field modifications may be expeditiously proposed.

It is your responsibility to contact our office, providing at least 48 hours of notice for grading or footing excavation observations and testing. The observation of excavations during the construction phase represents an opportunity by our firm to either confirm soil conditions estimated by the exploratory borings or to discover soil conditions which have not been addressed. When such undisclosed conditions are encountered, opinions and recommendations addressing these conditions will be rendered at that time.

This report is considered preliminary and no person should consider the recommendations or soil conditions described herein as conclusive. The recommendations and conclusions of this report are considered preliminary until all excavations have been observed during the construction phase, after which a final report will be issued stating that the grading and foundation works accomplished and installed are appropriate for the soil conditions encountered.

FIELD INVESTIGATION

The subsurface soil conditions were explored by five truck-mounted auger borings, which were drilled to depths of up to 50 feet, supplemented by three field density tests. Three Cone Penetrometer Test Soundings (CPT) were advanced to depths of up to 38 feet. The CPT soundings were performed in conformance with ASTM D-3441. The locations of the borings were selected as appropriate and representative. Representative relatively "undisturbed" tube soil samples were obtained during the drilling operation by the thin-walled sampling tube method (ASTM D-1587). Laboratory tests and analyses of representative soil samples, obtained during the drilling operation, were performed to estimate the engineering properties and determine the soil classification. The locations of the borings are shown on Plate 1. The boring log data is presented in Appendix A, "Field Investigation", while the results of the laboratory tests are provided in Appendix B, "Laboratory Tests".

The CPT soundings were accomplished by placing a cylindrical cone tipped probe into the soil deposit while simultaneously recording the resulting penetration resistance. The probe is attached to the end of a string of steel pipe segments, each 1 meter long, and pushed into the ground by means of heavy hydraulic rams, mounted inside the rear compartment of a three-axle truck. The weight of the truck provides the reaction force. Each downward stroke of the hydraulic ram pushes the string down one pipe length at a time, during which a constant penetration rate of 2 centimeters per second is maintained. A pause of a few seconds is necessary after each stroke to add a new section of pipe and raise the rams for the next downward push. An electric cable, which is strung through all of the steel segments in advance, connects the CPT probe to a computer controlled data acquisition system located inside the CPT rig.

The recorded soundings are presented graphically in Appendix C. The results of these soundings have been correlated to estimate engineering properties of the soils, including soil behavior type, Standard Penetration Test (SPT), equivalent relative density, undrained shear strength and internal angle of friction. These values accompany each graphic depiction of the soundings and are contained in Appendix C.

SOIL CONDITIONS

1. Groundwater was encountered in the exploratory borings at a depth of 20 feet in Boring Nos. 1 through 4. At Boring No. 5, the groundwater was encountered at a depth of 30 feet. It should be recognized that water table elevations, even seasonal perched water tables, might fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

2. The top 20 feet of the soil profile consists of silty sands, clayey silts and sands, becoming a saturated sand below that depth.

3. The surface soils were found to have a very low potential for expansion.

4. The top 5 feet of the surface soils were found to be compressible and sensitive to collapse when subjected to increased moisture content.

5. The soil profile at this site is judged to be stiff soil corresponding to a Site Class D as defined by Table 1613.5.2 of the California Building Code (CBC). This estimate is based on the borings which encountered the geologic formation known as the Older Alluvium which is widely regarded as a Type D soil profile since the Standard Penetration Resistance typically results in blow counts having a range of between 15 to 50.

LIQUEFACTION ANALYSIS

Liquefaction is a phenomenon which occurs in a specific soil condition when disturbed by ground motions. The specific soil condition conducive to liquefaction is loose sands and silty sands below the water table and typically within the top 50 feet of the ground surface. Ground motions are typically the result of a seismic event. Soils which have the potential to liquefy were encountered at this site between the depths of 20 to 50 feet below the present grade.

A liquefaction analysis was performed based on the evaluation method presented in Reference No. 3 (NCEER, 1997 Method). The "Liquefaction Analyses and Summary" is presented in Appendix D. The data for these analyses was a correlation between the CPT results and the probable ground motions for the site. The computation was performed utilizing the computer program "Liquefy2". The last column in the Liquefaction Analyses Summary indicates the Factor of Safety for liquefaction to occur. It should be noted the potential for liquefaction to occur is considered low to non-existent for Factors of Safety of 1.2 to 1.5. The results of the analyses for the on-site soils indicate the Liquefaction Factor of Safety to be from 0.83 and 1.08 between the depths of 24 to 26 feet.

Due to the topography of the building site, the potential mode of seismically induced settlement is anticipated to be the result of volumetric compression. An estimate of the potential settlement due to volumetric compression has been tabulated in Table A below and is based on procedures proposed by Tokimatsu & Seed, Reference No. 2. The calculation is also based on the soil profile as discovered in the CPT soundings. The CPT soundings were converted to N_1 Values in accordance with the methods referenced above.

TABLE A

Possible Settlement Due to Liquefaction

LOCATION	SOIL LAYERS DEPTH (FT) FROM	TO	STRATA THICKNESS (inches)	CORRECTED SPT $(N_1)_{60}$ VALUE	CSR_{eq}	ESTIMATED VOLUMETRIC STRAIN (percent)*	ANTICIPATED STRATA SETTLEMENT (inches)
CPT-1	24.0	26.0	66.0	16.1	0.26	1.5	1.0
						Total CPT-1	1.0

* Based upon Figure 9 in Tokimatsu & Seed (August 1987 Geotechnical Journal)

The total anticipated settlement of 1.0 inch due to volumetric compression, as shown in Table A, would probably contribute a differential settlement of 0.5 inch to the proposed structure in a seismic event. Cosmetic damage to the structures due to the settlement will require repair and the foundations may require re-leveling; however, risk to the human occupancy is extremely low to unlikely provided the recommendations given below are implemented into the design and construction.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

It is the opinion of this Laboratory the proposed grading and construction are feasible from a soil-engineering perspective provided the recommendations contained in this soil engineering report are incorporated into the design and implemented during construction.

It is the understanding of this Laboratory the proposed Cortona Apartments will be two- and/or three-story wood frame structures with concrete slab-on-grade floors. Based upon this understanding, we present the following preliminary recommendations:

GRADING

1. The area to be graded shall be cleared of surface vegetation, including roots and root structures.

2. If, during the removal and scarification process, excessive root structures are encountered, these areas shall be deep ripped in two directions to the depth of the root structure, after which the disturbed soils and the roots shall be completely removed, and the resulting cavities shall be scarified and processed to receive fill in accordance with recommendations contained in this section.

3. If, during the grading operations, previously placed undocumented fill material is encountered, this fill material shall be removed under the direction of this Laboratory prior to commencement of the filling operations.

4. The footings of the proposed structures shall be supported completely by a **uniform** thickness of compacted soil. **The structures shall not be supported over a cut/fill transition.**

5. Beneath the proposed structures and for a minimum distance of 5 feet beyond the exterior perimeters, the loose topsoil and compressible surface soils shall be removed and observed by a representative of our firm. Upon approval of excavation, the exposed ground surface shall be scarified an additional 6 to 8 inches, moistened or dried to near the optimum moisture content, and compacted to 90% of the relative compaction. We anticipate the depth of the surface soil removal to be from 60 inches below the existing grade, or 12 inches below the bottom of the footings and swimming pool foundation, whichever is deeper.

6. The removed surface soils and/or imported approved fill may then be placed in loose lifts of approximately 6 inches, thoroughly mixed, moistened or dried to near optimum moisture content, and compacted to a minimum of 90% relative compaction.

7. Rocks greater than 6 inches in size shall be removed from the soil being spread for compaction.

8. All fill slopes which are created during the grading operation shall be properly shaped to a maximum slope angle of 2 horizontal to 1 vertical, and compacted by rolling the sheepsfoot roller or similar compaction equipment over the slope face at vertical lift intervals of 30 inches or less.

9. Import soils, if required for compacted fill, shall be granular, non-expansive soils which are equal to, or superior in quality to, the on-site soils as determined by this Laboratory prior to importation of the fill material to the site. This is not referring to retaining wall backfill. See the RETAINING WALLS section of this report for retaining wall backfill requirements.

10. The compaction standard shall be the latest adoption of the ASTM D-1557 method of compaction.

11. Positive surface drainage shall direct water away from all slopes and away from the foundation system of the proposed structure.

FOUNDATIONS

1. These recommendations assume a uniform thickness of compacted soil will support the proposed footings.

2. For portions of the structure which rest upon compacted fill soil, all continuous exterior footings for one-story portions of the structure shall extend a minimum of 18 inches and all continuous interior one-story footings shall extend a minimum distance of 12 inches below compacted ground surface.

3. Footings below two-story portions of the structure shall extend 18 inches below compacted ground surface.

4. Footings below three-story portions of the structure shall extend 24 inches below compacted ground surface.

5. All footings shall contain a minimum of two No. 4 horizontal rebar placed one in the base and one in the stem of the footing. The Project Civil or Structural Engineer shall specify the foundation steel reinforcement.

6. Isolated piers may be utilized and shall extend a minimum of 18 inches below compacted ground surface for one- and two-story support and 24 inches for three-story support.

7. Concrete slab-on-grade floors shall be placed over a subgrade soil conforming to the GRADING recommendations of this report.

8. As a minimum, concrete slabs on grade shall be a full 4 inches thick and shall contain No. 3 rebar spaced 24 inches on center each way. The steel reinforcement shall be placed near the center of the slab. The slab shall be underlain with a minimum 4-inch coarse washed concrete sand layer in which a 10-mil or heavier impervious membrane is embedded at the lower quarter of the sand blanket, creating at least a 3-inch cover of sand. These concrete slab-on-grade requirements shall be modified as needed by the designers for surcharge loads, wheel loads, concentrated loads, or for moisture control. The floor covering supplier or manufacturer should be contacted for their specifications for design features which will result in a successful bond between the concrete slab and floor covering. Floor flatness and shrinkage crack control must be addressed by a competent contractor experienced in the skill of concrete placement. The owners or their agents shall inform those designing, building, and installing the concrete slab on grade and flooring of the performance and aesthetics expected.

9. Concrete slabs on grade shall be doweled into all adjacent footings using No. 3 rebar spaced 24 inches on center.

10. If footings are to be located on, adjacent to, or within 10 feet of the top of a slope, these footings shall extend to such a depth so that the horizontal distance

between the bottom outside edge of the footing and the face of the adjacent slope is a minimum distance of 10 feet.

11. This Laboratory shall be requested to inspect the footing excavation prior to placement of reinforcing steel and timber form boards.

12. Based upon compliance with the above recommendations, an allowable soil bearing value for compacted soil of 1,300 psf for 12-inch deep footings and 1,500 psf for 18-inch deep footings with a one-third increase when considering wind or seismic forces may be assumed.

13. Floor or crawl space elevations located lower than the surrounding exterior grades are recommended to be protected from moisture intrusion. Please consult the building designer for details, such as waterproofing and French drains.

RETAINING WALLS

Cantilevered - For cantilevered retaining walls, such as site walls and garden walls, which do not form part of the structure, we recommend the following:

1. The cantilevered retaining wall shall be designed assuming an active soil pressure equivalent to a fluid (E.F.P.) whose weight is 35 pcf for level backfill conditions and 52 pcf for backfill slopes, which are constructed at an angle of up to 27 degrees. These values are based on Coulomb's Equation and the following assumed backfill soil values: internal angle of friction equal to 34 degrees, cohesion equal to 0, and a total unit weight of soil equal to 125 pcf. The E.F.P. value does not include surcharge loads and is based on a free-draining condition. The free-draining condition must be created by placing the backfill specified in this section of the report.

2. Retaining walls having a retained height of 12 feet or more measured from the top of the footing may be designed using pseudostatic analyses based on the Mononobe Okabe approach. We have estimated the seismic earth pressures using the Mononobe Okabe method and assuming a horizontal ground acceleration of 0.40g (design basis acceleration from FRISKSP by Blake for 10% probability of exceedence in 50 years) and assuming drained backfill conditions. The seismic earth pressure ($\triangle P_{AE}$) resulting from seismic loads acting on retaining walls may be estimated as $\triangle P_{AE} = 19H^2$, in pounds force per lineal foot of wall, for an inverted triangular pressure distribution with the resultant force acting 0.6H above the base of the wall.

3. The bottom of the retaining wall footing shall extend a minimum distance of 24 inches below the undisturbed natural grade, or 12 inches into firm undisturbed original ground (whichever is deeper), and shall be designed assuming an allowable soil bearing value of 2,000 psf. For footings placed on slopes, the base of the toe or keyway placed at the toe shall extend to such a depth that

there exists 10 horizontal feet between the bottom of the footing and the daylight line of the adjacent slope. It should be noted the key may be placed adjacent to the downhill edge of the retaining wall footing in order to attain the recommended downhill grade footing embedment.

4. A passive soil pressure equivalent to a fluid whose weight is 350 pcf and a coefficient of friction against sliding of 0.35 may be assumed for the footing excavation described in the recommendation above.

5. The use of equipment to compact soil within the wedge of backfill defined by a 1:1 line projected up from behind the retaining wall to the surface shall be limited to handheld rammer plate compactors, such as a Wacker BS 45Y. A string line shall be placed along the top of the wall to monitor possible rotation of the wall due to the compaction surcharge. If the wall begins to bow or lean away from the backfilling operations, the compaction process shall stop and the Geotechnical Engineer shall be notified immediately such that modified compaction recommendations can be given at that time.

6. The finish covering on the face of the wall, such as stucco or paint, may be adversely affected by moisture intrusion from the backfill through the back of the wall. To prevent this, you should consider waterproofing the back of the wall and footing. All waterproofing and application of waterproofing shall be in accordance with the specifications of the product supplier.

7. Retaining wall backfill shall be a clean coarse sand or gravel wrapped in a filter fabric. The gravel shall be separated from adjacent native soil by a filter fabric, such as Mirafi 140N™. The retaining wall shall be serviced by appropriately placed weep holes or a perforated drain. This drainage feature must include at least 2 cubic feet of gravel wrapped in filter fabric. Lower quality native backfill material may be utilized outside the triangular wedge which extends upwards from the inside edge of the retaining wall and is a minimum width of 60% of the wall height at ground surface. The sand between the wall and native soil shall have a Sand Equivalent of 20 or greater and an Expansion Index equal to 0. To avoid excessive amounts of sand and gravel backfill, do not allow the excavation contractor to cut a vertical excavation 2 to 4 feet beyond the back of the retaining wall footing or stem. Cut only to the point needed to install the drainpipe and slope the excavation back as specified.

8. It is assumed that the rough grade excavation behind the retaining wall is to be cut at a temporary slope angle of 1 horizontal to 1 vertical in order to comply with Cal-OSHA safety requirements.

9. All soil backfill shall be compacted to a minimum of 90% relative compaction. It should be noted retaining walls designed assuming active soil conditions are anticipated to deflect seasonally. In addition, surface features which obtain their support from retaining wall backfill materials are anticipated to express differential movement with respect to the retaining wall as the wall may be resting

upon a thinner depth of fill or undisturbed original ground and the surface features may be resting upon a considerable thickness of compacted fill which has settlement characteristics differing from that of original ground. The differential movement between the wall and slab patio may be undesirable. In order to hide or prevent such differential movement, an alternate design may be required, such as but not limited to placing a planter between the wall and slab or connecting the slab to the wall, creating a retaining wall which is pinned at the top, not cantilevered.

Partially Restrained - For restrained or partially restrained retaining walls or cantilevered retaining walls which form a portion of the foundation system of the structure, we recommend the wall be designed as a braced wall utilizing at-rest pressures in accordance with the following recommendations:

1. The retaining wall shall be designed assuming an at-rest soil pressure equivalent to a fluid (E.F.P.) whose weight is 60 pcf for level backfill conditions and 73 pcf for backfill slopes, which are constructed at an angle of up to 27 degrees. These values are based on the same assumed conditions stated in Recommendation No. 1 under the Cantilevered section. The at-rest condition for a level backfill is based on the following equation: E.F.P.=$K_{0\gamma}$ where K_0=1-sin ϕ, γ is the total unit weight of soil, and ϕ is the internal angle of friction.

2. Retaining walls having a retained height of 12 feet or more measured from the top of the footing may be designed using pseudostatic analyses based on the Mononobe Okabe approach. We have estimated the seismic earth pressures using the Mononobe Okabe method and assuming a horizontal ground acceleration of 0.40g (design basis acceleration from FRISKSP by Blake for 10% probability of exceedence in 50 years) and assuming drained backfill conditions. The seismic earth pressure ($\triangle P_{AE}$) resulting from seismic loads acting on retaining walls may be estimated as $\triangle P_{AE} = 19H^2$, in pounds force per lineal foot of wall, for an inverted triangular pressure distribution with the resultant force acting 0.6H above the base of the wall.

3. The retaining wall footing shall conform to the FOUNDATIONS recommendations and may be designed assuming an allowable soil bearing value of 2,000 psf. For footings placed on or adjacent to slopes, the base of the toe or keyway placed at the toe shall extend to such a depth that there exists 10 horizontal feet between the bottom of the footing and the daylight line of the adjacent slope.

4. A passive soil pressure equivalent to a fluid whose weight is 350 pcf and a coefficient of friction against sliding of 0.35 may be assumed for the footing excavation described in the recommendation above.

5. The retaining wall shall be serviced by a perforated drain which is located a minimum of 12 inches below top of the adjacent interior concrete slab-on-grade floor.

6. Walls, foundations, and connections between walls and foundations forming interior finished rooms of the structure shall be waterproofed by the proper application of a moisture barrier, such as Mirafi™ M-800, followed by Miradry™. A drainage composite, such as Miradrain™, shall be placed over the Miradry™. All waterproofing products should be applied in strict conformance with the manufacturer's recommendations. The selection of a waterproofing product and the observation of proper installation will not involve Pacific Materials Laboratory. We recognize the need for waterproofing; however, it is not in our realm to know the optimum product for application to the retaining wall or to confirm proper installation.

7. It is assumed that the rough grade excavation behind the retaining wall is to be cut at a temporary slope angle of 1 horizontal to 1 vertical in order to comply with Cal-OSHA safety requirements.

8. Footings located near the retaining wall stem shall extend through any retaining wall backfill and shall be supported on the firm underlying ground surface and behind a 1 horizontal to 1 vertical line projected upward from the base of the wall. As an alternative, this footing can be designed to span across the backfill area and tie into the retaining wall for support.

9. Retaining wall backfill shall include 2 cubic feet per linear foot of wall of 3/8- to 1-inch gravel placed around a 4-inch perforated rigid PVC drainpipe. The perforations of the pipe shall be placed down at the positions of 5 and 7 o'clock. A filter fabric shall separate the gravel from the other backfill soils.

10. Retaining wall backfill above the drainpipe shall be a clean coarse sand or gravel, creating an inverted triangular wedge. Lower quality native backfill material may be utilized outside the triangular wedge which extends upwards from the outside edge of the pipe/gravel at the base of the retaining wall and is a minimum width of 60% of the wall height at ground surface. Coarse clean sand is acceptable when the Sand Equivalent is greater than 20 and the Expansion Index equals 0. To avoid excessive amounts of sand and gravel backfill, do not allow the excavation contractor to cut a vertical excavation 2 to 4 feet beyond the back of the retaining wall footing or stem. Cut only to the point needed to install the drainpipe and slope the excavation back as specified.

11. The use of equipment to compact soil within the wedge of backfill defined by a 1:1 line projected up from behind the retaining wall to the surface shall be limited to handheld rammer plate compactors, such as a Wacker BS 45Y. A string line shall be placed along the top of the wall to monitor possible rotation of the wall due to the compaction surcharge. If the wall begins to bow or lean away from the backfilling operations, the compaction process shall stop and the Geotechnical Engineer shall be notified immediately such that modified compaction recommendations can be given at that time.

12. The engineer designing the retaining wall shall address the following conditions:

    A. When a retaining wall is backfilled without a top restraint, such as a wood floor diaphragm, the stem of the retaining wall acts as a cantilever.

    B. Depending on the rigidity of the top restraint, the wall may act as a beam spanning between the top and bottom points, reversing the tension side of the stem to the front of the wall as opposed to the back as in the case of a cantilever condition.

    C. Structure members deflect when loaded. The users guide to the widely used computer program RetainPro recommends the deflection of the wall be checked because the program does not calculate deflection. Refer to Section 9 titled "Related Design Considerations" in the manual titled "Basics of Retaining Wall Design", Page 50. As an estimate, the Concrete Reinforcing Steel Institute (CRSI) manual estimates concrete reinforced stems of cantilevered retaining walls will deflect a horizontal distance at the top of the wall equal to the height of the wall divided by 240. We recommend the appropriate deflection equation and values corresponding to load, condition, and material be employed to determine the deflection corresponding to the lateral loads recommended herein such that appropriate connections, tiebacks, bracing, or construction joints can be placed within the structural design to properly account for the deflection. The total deflection may not occur during the backfilling operation, but rather sometime after the frame structure is built over and adjacent to the retaining wall.

PAVEMENT

1. Beneath the proposed parking areas, we recommend the top loose surface soils be removed, moistened or dried to or near the optimum moisture content and compacted to 90% relative compaction, the top 9 inches being compacted to 95% relative compaction where pavement will be subject to vehicle travel or parking. The subgrade area shall be check rolled in order to detect isolated soft spots. Any areas found to be yielding under the wheel loads of the equipment shall be stabilized by removal and compaction.

2. The Class 2 Aggregate Base shall be compacted to a minimum of 95% relative compaction in accordance with the ASTM D-1557 test method. Asphalt concrete shall be placed only after the Class 2 Aggregate Base has been demonstrated to be firm and unyielding.

3. Pavement sections consisting of the following dimensions are recommended, assuming Traffic Indices of 4, 5, 5.5, and 6 and an R-Value of 15:

Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
4	2.5	6.5
	3.0	5.0
5	2.5	9.5
	3.0	8.0
	3.5	6.5
	4.0	5.5
5.5	2.5	11.5
	3.5	10.0
	3.5	8.5
	4.0	7.5
	5.0	6.0
6	2.5	12.5
	3.0	11.5
	3.5	10.0
	4.0	9.0
	5.0	7.5

4. Maintenance to assist in reducing the potential for rapid deterioration of the asphalt paved areas is recommended to include surface treatment approximately six months to one year after construction and approximately three years or less from the first treatment. Pavement conditions should be reviewed at least once a year for cracks, puddling of surface water, and overall appearance. If possible, this review should be done in the fall such that cracks may be repaired which may otherwise allow moisture to pass through the pavement and weaken the subgrade.

SWIMMING POOL

1. The swimming pool may be designed for an expansive soil condition. Even though the soil samples tested were found to have zero expansion, expansive soils are widespread throughout Santa Barbara County, and the possibility of expansive soils being present at the pool warrants the use of the standard expansive soil detail which specifies more rebar.

2. The swimming pool deck shall be placed on soil which has been compacted in accordance with the GRADING recommendations starting on Page 4 of this document. The swimming pool concrete deck shall have a minimum thickness of 4 inches and contain No. 3 rebar spaced 12 inches on center each way placed near the center of the slab.

3. It is recommended to remove the soil under the pool and 5 feet beyond the pool with a grading operation. The excavation shall extend to a depth of at least 12 inches below the bottom of the floor of the swimming pool. The soil may be

replaced as compacted fill that can then be excavated to the shape of the pool. It is important that the entire bottom of the swimming pool rests on a layer of compacted fill having a uniform thickness.

4. Concrete pool decks will move differentially with respect to the pool structure. This may be due to the difference in support elevations and the different thickness of the compacted fill supporting the deck vs. the pool. A flexible deck performs best and hides the differential movement. An example of a flexible deck is individual stone pavers with grass growing between the joints. It is recommended that a flexible deck design be incorporated into the pool design.

5. The walls of the swimming pool shall be designed to resist a lateral earth load of 100 pcf.

ADJACENT LOADS

Where footings are placed at varying elevations, the effect of adjacent loads may be calculated using the widely published Formulas for Stresses in Semi-infinite Elastic Foundations or the Boussinesq figures and equations for both vertical and horizontal surcharge loads.

SETTLEMENT

It is the intent of the recommendations contained in this report to achieve angular distortions[1] of approximately 1/480. A total settlement from static loads of approximately 1 inch or less is anticipated for foundations supported on the undisturbed native soil and approximately 1% to 1.5% of the fill height is the anticipated total settlement at areas where compacted fill soil is placed in accordance with the GRADING recommendations provided in this soil engineering report. Settlement from seismic loads were discussed in the section of this report with the heading LIQUEFACTION. The soil bearing values and estimated settlements contained in this report are preliminary and may need to be modified after the foundation and grading plans are substantially complete.

CONSTRUCTION OBSERVATION

The owner or his agent shall request the Project Geotechnical Engineer to observe all excavations prior to placement of compacted soil, gravel backfill, or rebar and concrete.

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[1] Angular distortion is the ratio of the vertical differential settlement divided by the horizontal distance over which the vertical differential is measured.

PLAN REVIEW

We request the grading and foundation plans be submitted to our office for a general review to verify substantial compliance to the recommendations contained in this report.

CLOSURE

The recommendations contained herein are for the sole use of our client and are based upon this Laboratory's understanding of the project which has been described herein. If the project scope, location, or conceptual design is subsequently altered, this Laboratory shall be requested to modify, as necessary, the recommendations contained herein as is appropriate for the new development concept. If the recommendations of this report are not implemented within one year, we recommend an update and review of the contents of this report be performed by this Laboratory.

The recommendations contained herein are based upon the assumption that Pacific Materials Laboratory shall be requested to perform the testing and observation services which will be required during the grading and foundation operations in order to verify that the actual soil conditions encountered and the construction procedures are consistent with the recommendations contained herein. If this service is performed by others, only the technical correctness of the actual analytical soil tests described here is attested to by this Laboratory.

Thank you for the opportunity of providing this service. If you have any questions regarding this matter, please do not hesitate to call.

Respectfully submitted,

PACIFIC MATERIALS LABORATORY, INC.

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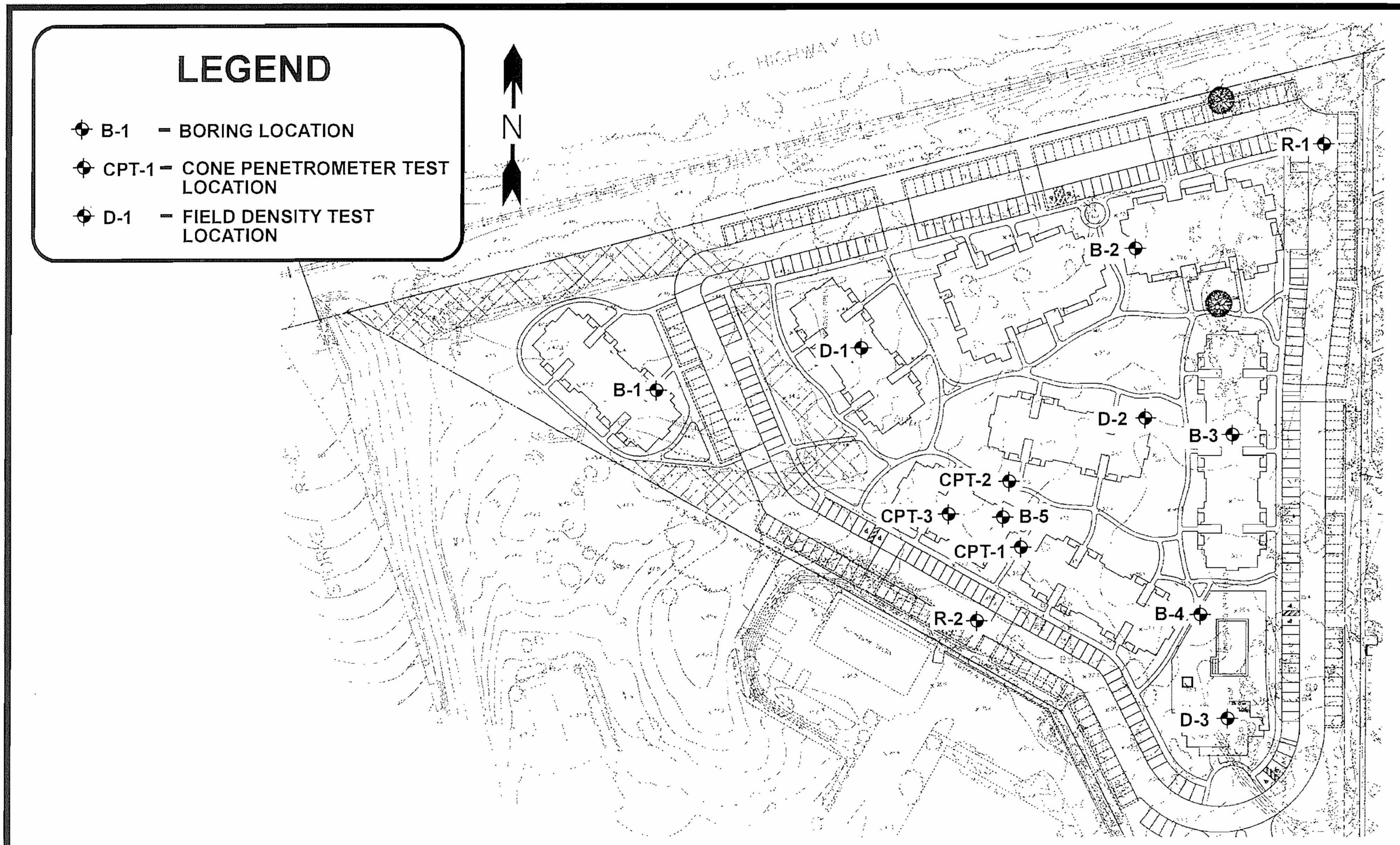


SITE PLAN

6830 Cortona Drive
Goleta, California

Pacific Materials Laboratory, Inc.

Scale: none

Plate 1
Lab No: 82939-2
File No: 09-13053-2
Date: January 28, 2009

APPENDIX A

FIELD INVESTIGATION

January 28, 2009

Lab No: 82939-2

File No: 09-13053-2

Pacific Materials Laboratory of Santa Barbara, Inc.

Lab No: **82939-2**
File No: **09-13053-2**

BORING LOG DATA

BORING NO. B-1

Field Technician: Kump

Date Drilled: 12/31/08

Blow Counts	Dry Density (pcf)	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
			0		Light brown silty SAND
		8.4			
					Brown clayey SAND, moist and dense
36	59.6	61.4	5		
					Light brown-tan fine SAND, moist and dense
>50	97.9	6.0	10		
		6.2	15		
					Brown silty clayey SAND, moist and dense
51	100.4	22.4	20		
>50	101.2	22.6	25		
			30		
			35		
			40		
			45		
			50		

LEGEND

■ - Split-Barrel Sample ASTM D-1586

NOTE: Water encountered at 20 feet

January 28, 2009

Lab No: 82939-2
File No: 09-13053-2

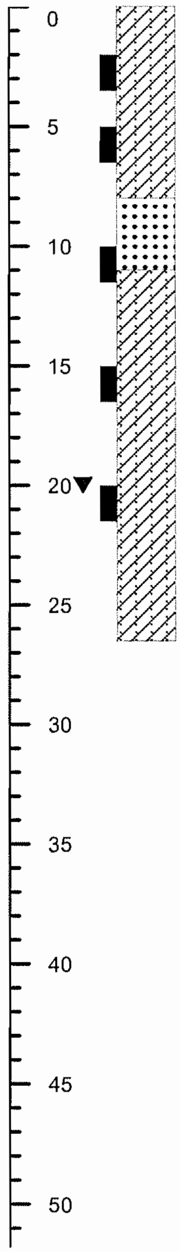
BORING LOG DATA

BORING NO. B-2

Field Technician: Kump

Date Drilled: 12/31/08

Blow Counts	Dry Density (pcf)	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
			0		Brown clayey SAND, moist and dense
		9.9			
33	92.8	10.1	5		
					Brown SAND, moist and dense
22	99.8	4.8	10		
					Brown sandy CLAY
		16.6	15		
17	109.6	19.0	20▼		Saturated and medium firm
			25		
			30		
			35		
			40		
			45		
			50		



LEGEND

■ - Split-Barrel Sample ASTM D-1586

January 28, 2009

Lab No: 82939-2
File No: 09-13053-2

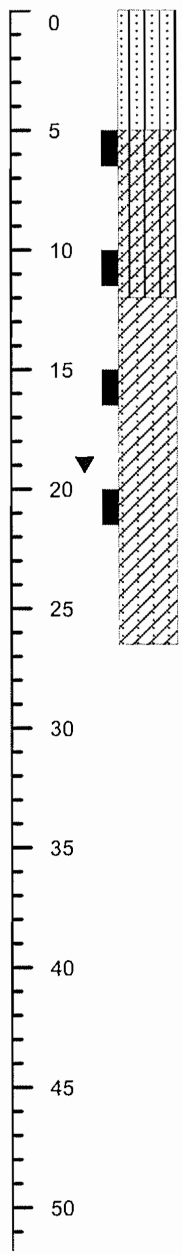
BORING LOG DATA

BORING NO. B-3

Field Technician: Kump

Date Drilled: 12/31/08

Blow Counts	Dry Density (pcf)	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
			0		Brown silty SAND, moist and medium dense
21	121.3	9.7	5		Brown clayey silty SAND, moist and medium dense
10	82.1	10.4	10		
					Dark brown sandy CLAY, moist and firm
		18.0	15		
27	116.8	14.7	20		Saturated and firm
			25		
			30		
			35		
			40		
			45		
			50		



LEGEND

- Split-Barrel Sample ASTM D-1586

Pacific Materials Laboratory of Santa Barbara, Inc.

Lab No: 82939-2
File No: 09-13053-2

BORING LOG DATA

BORING NO. B-4

Field Technician: Kump

Date Drilled: 12/31/08

Blow Counts	Dry Density (pcf)	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
			0		Brown silty SAND, moist and dense
		10.4			
19	116.1	8.8	5		
25	107.5	11.5	10		
		17.6	15		Brown sandy CLAY
35	111.6	16.8	20▼		
			25		
			30		
			35		
			40		
			45		
			50		

LEGEND

■ - Split-Barrel Sample ASTM D-1586

NOTE: Water encountered at 20 feet

Lab No: 82939-2
File No: 09-13053-2

BORING LOG DATA

BORING NO. B-5

Field Technician: Kump Date Drilled: 12/31/08

Blow Counts	Dry Density (pcf)	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
			0		Brown silty SAND, moist and dense
		7.1			
14	96.2	8.4	5		
16	105.1	11.9	10		
		9.3	15		
>50	101.5	12.5	20		Tan-yellow beach SAND, moist and dense
		6.6	25		
	113.1	15.5	30▼		Saturated and dense
		8.6	35		
		21.3	40		
			45		
		21.0	50		

LEGEND

■ - Split-Barrel Sample ASTM D-1586

NOTE: Water encountered at 30 feet

APPENDIX B

LABORATORY TESTS

January 28, 2009

Lab No: 82939-2

File No: 09-13053-2

Pacific Materials Laboratory of Santa Barbara, Inc.

MOISTURE DENSITY DETERMINATIONS (ASTM D 1557)

Maximum Density-Optimum Moisture data were determined in the laboratory from soil samples using the ASTM D-1557 Method of Compaction. The results of the Maximum Density-Optimum Moisture tests are tabulated below:

SOIL TYPE	SOIL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)
I	Brown silty clayey SAND	121.9	10.5
Curve Points: (121.3 @ 9.8) (119.3 @ 12.3) (121.5 @ 11.1)			
II	Dark brown sandy clayey SILT	119.5	11.5
Curve Points: (119.1 @ 11.0) (118.6 @ 13.0) (115.1 @ 8.8)			
III	Dark brown sandy clayey SILT	120.0	11.5
Curve Points: (119.2 @ 10.6) (119.6 @ 12.5) (116.7 @ 14.0)			

FIELD DENSITY SUMMARY (Sand Cone Method ASTM D 1556)

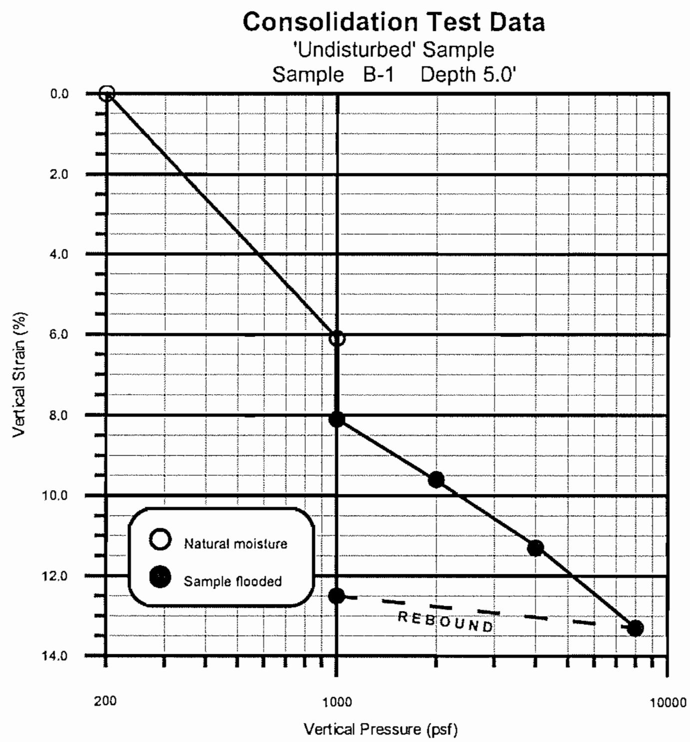
SAMPLE LOCATION	DEPTH (in.)	SOIL TYPE	FIELD MOIST. CONTENT (%)	DRY DENSITY (pcf)	% OF MAX. DRY DENSITY
D-1	12	I	12.0	97.3	79.8
D-2	24	II	8.8	101.3	84.5
D-3	18	III	10.6	102.4	85.0

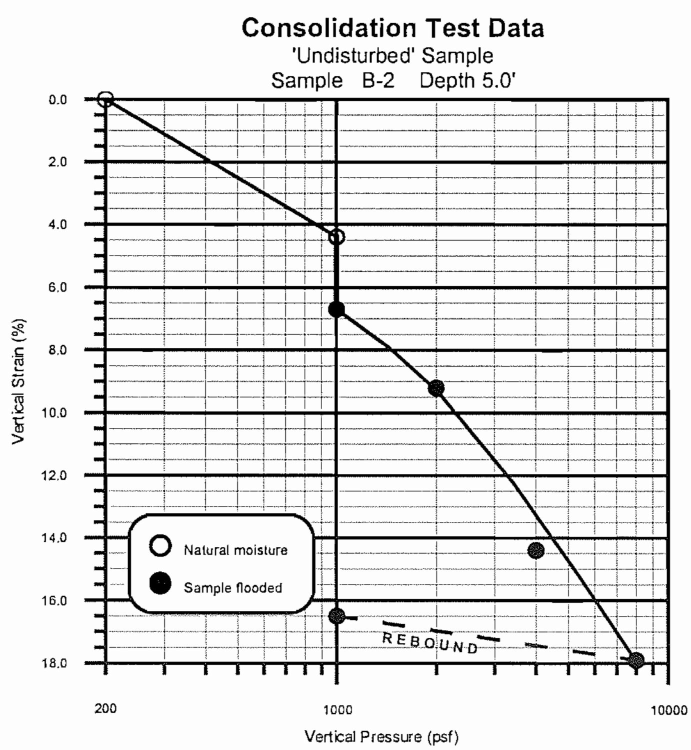
MECHANICAL ANALYSES (Values in Percent Passing ASTM D 422)

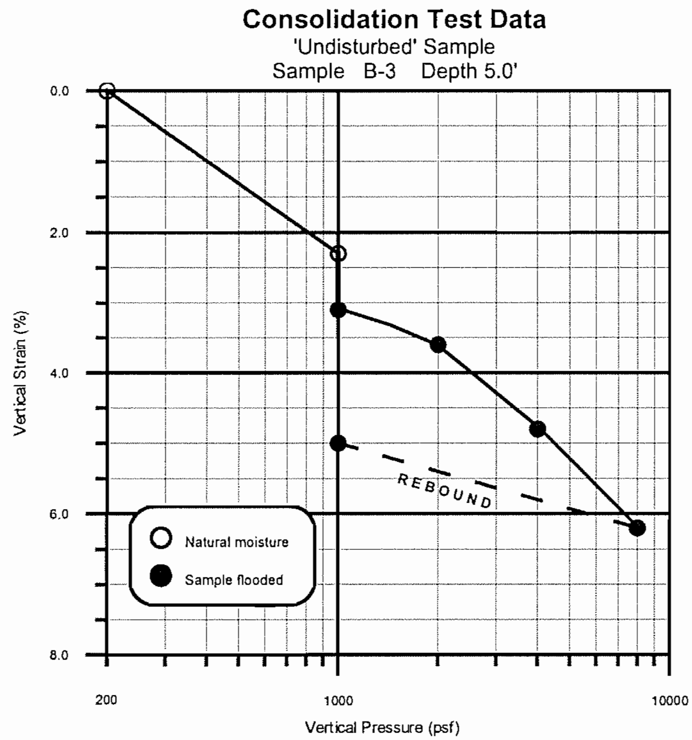
SIEVE SIZE	B-5 @ 5'	B-5 @0' to 20'	B-5 @ 20' to 50'	D-2 @ 2'	D-3 @ 1.5'
1/2 Inch	100.0	100.0	100.0	100.0	100.0
3/8 Inch	100.0	100.0	100.0	100.0	100.0
No. 4	100.0	100.0	99.9	100.0	100.0
No. 8	99.8	99.9	99.2	99.8	98.3
No. 16	99.6	99.8	96.7	99.6	96.8
No. 30	99.1	99.6	91.3	98.2	94.8
No. 50	95.1	97.3	69.7	90.6	86.3
No. 100	74.2	83.0	14.0	70.5	64.7
No. 200	47.8	54.2	8.4	54.5	46.3

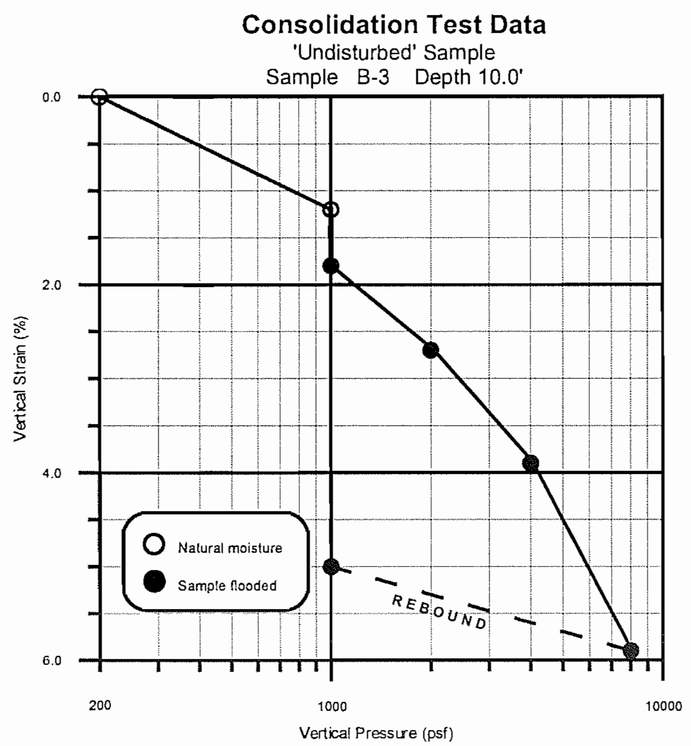
CONSOLIDATION TESTS (ASTM D 2435)

Four consolidation tests were performed on representative in-place tube soil samples in both the natural field and at increased moisture contents. The results of the consolidation tests are presented graphically below.






Consolidation Test Data
'Undisturbed' Sample
Sample B-3 Depth 5.0'
Vertical Strain (%)
0.0
2.0
4.0
6.0
8.0
REBOUND
Natural moisture
Sample flooded
200
1000
10000
Vertical Pressure (psf)


Consolidation Test Data
'Undisturbed' Sample
Sample B-3 Depth 10.0'
Vertical Strain (%)
0.0
2.0
4.0
6.0
REBOUND
Natural moisture
Sample flooded
200
1000
10000
Vertical Pressure (psf)

SAND-SILT-CLAY (By Hydrometer ASTM D 422)

SAMPLE LOCATION	DEPTH (ft.)	SAND %	SILT %	CLAY %	SOIL DESCRIPTION
B-1	5.0	60	24	16	Silty SAND
B-5	0 – 20	60	12	28	Clayey SAND
B-5	20 – 50	90	2	8	SAND
D-2	2.0	56	26	18	Silty SAND
D-3	1.5	50	30	20	Clayey SILT and SAND

EXPANSION TESTS (ASTM D 4829)

The Expansive Soil Index was determined by the present ASTM D 4829 Expansion Test Method. The results are tabulated below:

SAMPLE LOCATION	DEPTH (ft.)	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	EXPANSION INDEX	POTENTIAL FOR EXPANSION
D-2	2.0	110.9	9.6	10	Very low
D-3	1.5	107.8	10.4	15	Very low

ATTERBERG LIMITS (ASTM D 4318)

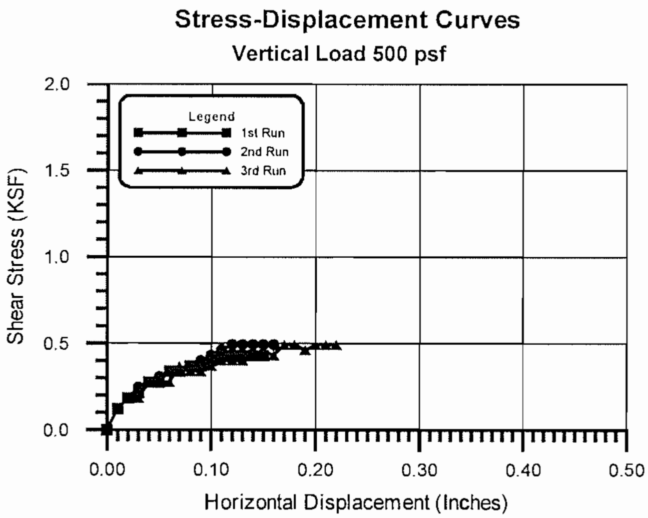
SAMPLE LOCATION	DEPTH (ft.)	SOIL TYPE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
B-5	5.0	NP	--	--	--
D-2	2.0	OL	23	26	0
D-3	1.5	SM	24	25	0

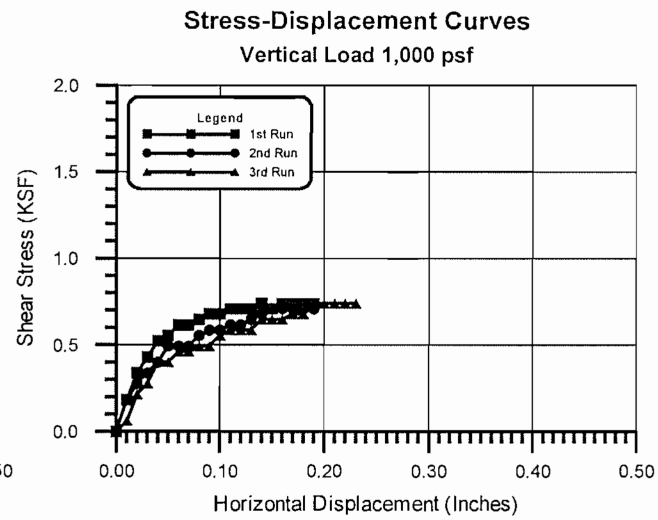
DIRECT SHEAR TEST (ASTM D 3080)

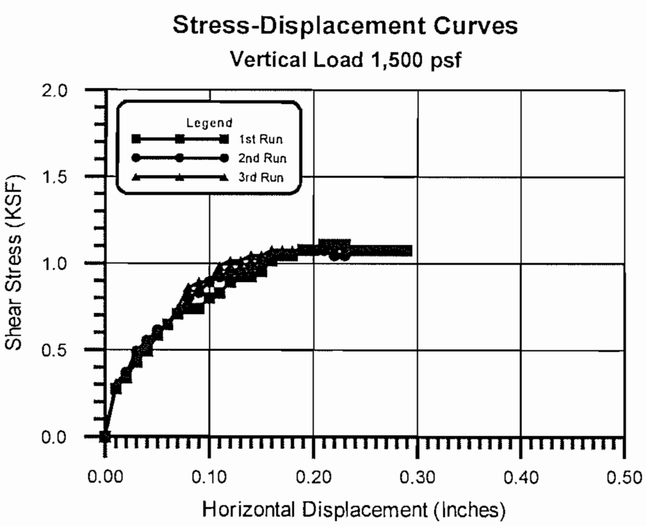
One direct shear test was performed on a representative “undisturbed” soil sample which was 2.365 inches in diameter and 1 inch thick. The test was performed under flooded conditions. The results are tabulated below:

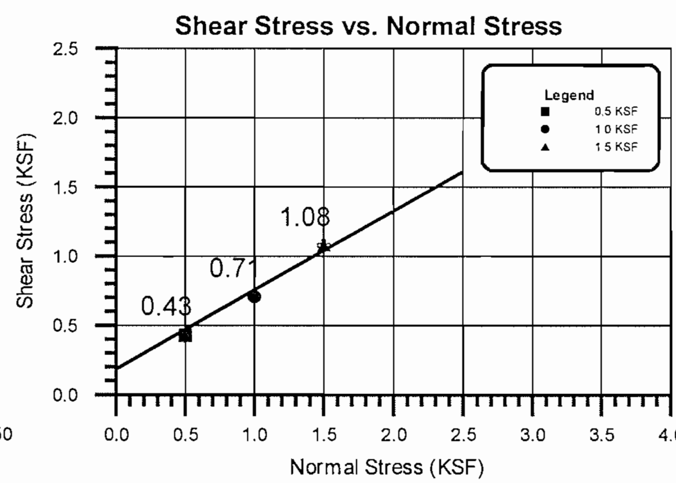
SAMPLE LOCATION	DEPTH (ft.)	INTERNAL ANGLE OF FRICTION (degrees)	COHESION (psf)
B-5	5	29	200

Sample B-5 @ 5'


Stress-Displacement Curves
Vertical Load 500 psf
Legend
1st Run
2nd Run
3rd Run
Shear Stress (KSF)
Horizontal Displacement (Inches)
2.0
1.5
1.0
0.5
0.0
0.00
0.10
0.20
0.30
0.40
0.50


Stress-Displacement Curves
Vertical Load 1,000 psf
Legend
1st Run
2nd Run
3rd Run
Shear Stress (KSF)
Horizontal Displacement (Inches)
2.0
1.5
1.0
0.5
0.0
0.00
0.10
0.20
0.30
0.40
0.50


Stress-Displacement Curves
Vertical Load 1,500 psf
Legend
1st Run
2nd Run
3rd Run
Shear Stress (KSF)
Horizontal Displacement (Inches)
2.0
1.5
1.0
0.5
0.0
0.00
0.10
0.20
0.30
0.40
0.50


Shear Stress vs. Normal Stress
Legend
0.5 KSF
1.0 KSF
1.5 KSF
1.08
0.71
0.43
Shear Stress (KSF)
Normal Stress (KSF)
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

R-VALUE DETERMINATION (ASTM D 2844)

Sample Location: R-1
Depth: Surface
Soil Description: Brown clayey SAND

ITEM	SAMPLE NO. 1	SAMPLE NO. 2	SAMPLE NO. 3
INITIAL SOIL MOISTURE (%)	17.8	18.2	20.1
COMPACTED SOIL MOISTURE (%)	17.8	20.0	22.5
DRY DENSITY (pcf)	99.2	103.1	100.5
R-Value	14.6	21.0	9.0
EXUDATION PRESSURE (psi)	581	402	233
EXPANSION PRESSURE (psf)	0	0	0

R-Value By Exudation Pressure: 15

Sample Location: R-2
Depth: Surface
Soil Description: Brown silty SAND

ITEM	SAMPLE NO. 1	SAMPLE NO. 2	SAMPLE NO. 3
INITIAL SOIL MOISTURE (%)	12.4	14.2	10.8
COMPACTED SOIL MOISTURE (%)	14.0	15.0	15.5
DRY DENSITY (pcf)	109.5	102.4	110.3
R-Value	59.8	47.0	49.0
EXUDATION PRESSURE (psi)	394	209	250
EXPANSION PRESSURE (psf)	0	0	0

R-Value By Exudation Pressure: 53

APPENDIX C

CONE PENETROMETER TESTS

January 28, 2009

Lab No: 82939-2

File No: 09-13053-2

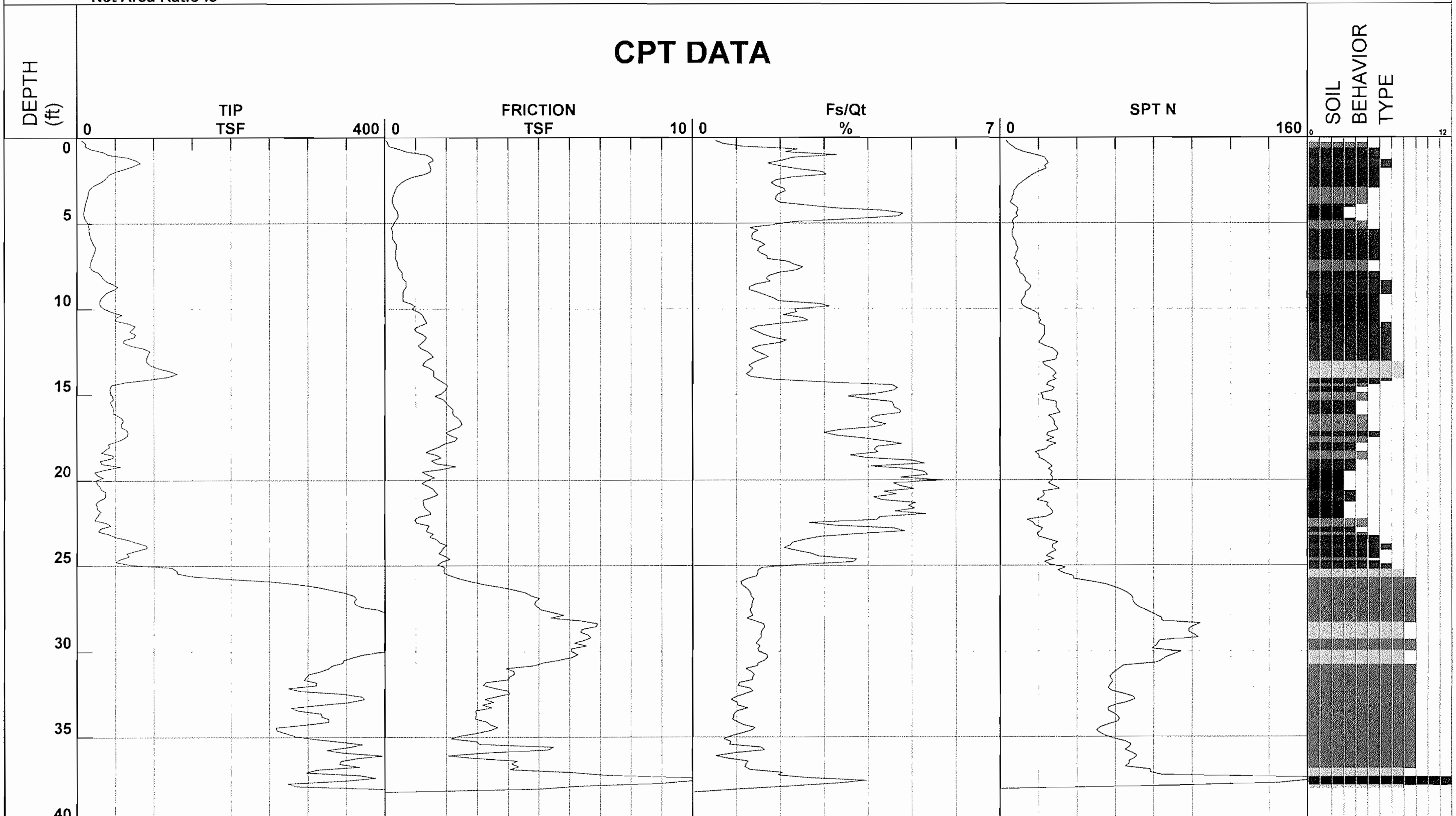
Pacific Materials Laboratory of Santa Barbara, Inc.

Pacific Materials Laboratories

Project	Cortona Drive	Operator	JV/EE	Filename	SDF(963).cpt
Job Number	Cortona Drive	Cone Number	DSG1047	GPS	
Hole Number	CPT-01	Date and Time	1/15/2009 2:27:56 PM	Maximum Depth	38.39 ft
Water Table Depth	20.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

*Soil behavior type and SPT based on data from UBC-1983

Cortona Drive

Project ID: Pacific Materials Lab
Data File: SDF(963).cpt
CPT Date: 1/15/2009 2:27:56 PM
GW During Test: 20 ft

Sounding ID: CPT-01
Project No: Cortona Drive
Cone/Rig: DSG1047

Depth ft	qc PS tsf	* qcln PS -	qlncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	* Nk -
0.33	11.1	17.8	45.6	0.1	0.0	0.7	5	silty SAND to sandy SILT	120	4.0	4	3	10	48	-	16
0.49	10.4	16.7	53.5	0.1	0.0	1.1	4	clayy SILT to silty CLAY	115	2.0	8	5	-	-	0.7	15
0.66	18.0	28.9	90.7	0.4	0.0	2.4	4	clayy SILT to silty CLAY	115	2.0	14	9	-	-	1.3	15
0.82	34.0	54.5	110.2	0.7	0.0	2.1	5	silty SAND to sandy SILT	120	4.0	14	8	47	48	-	16
0.98	41.0	65.7	151.1	1.3	0.0	3.3	4	clayy SILT to silty CLAY	115	2.0	33	20	-	-	2.9	15
1.15	65.5	105.0	161.5	1.5	0.0	2.3	5	silty SAND to sandy SILT	120	4.0	26	16	69	48	-	16
1.31	76.8	123.1	170.7	1.6	0.0	2.0	5	silty SAND to sandy SILT	120	4.0	31	19	74	48	-	16
1.48	82.1	131.7	168.5	1.4	-0.1	1.7	6	clean SAND to silty SAND	125	5.0	26	16	76	48	-	16
1.64	72.6	116.4	163.4	1.5	-0.1	2.0	5	silty SAND to sandy SILT	120	4.0	29	18	72	48	-	16
1.80	62.3	99.9	159.7	1.5	-0.3	2.4	5	silty SAND to sandy SILT	120	4.0	25	16	67	48	-	16
1.97	49.7	79.7	157.0	1.5	-0.4	3.0	5	silty SAND to sandy SILT	120	4.0	20	12	60	47	-	16
2.13	41.3	66.2	145.9	1.3	-0.4	3.0	5	silty SAND to sandy SILT	120	4.0	17	10	53	46	-	16
2.30	38.6	61.9	121.3	0.9	-0.4	2.3	5	silty SAND to sandy SILT	120	4.0	15	10	51	46	-	16
2.46	34.8	55.8	106.3	0.7	-0.4	1.9	5	silty SAND to sandy SILT	120	4.0	14	9	48	45	-	16
2.62	28.9	46.4	95.1	0.5	-0.4	1.8	5	silty SAND to sandy SILT	120	4.0	12	7	42	44	-	16
2.79	21.6	34.7	87.3	0.4	-0.4	1.9	5	silty SAND to sandy SILT	120	4.0	9	5	32	42	-	16
2.95	16.7	26.8	83.1	0.3	-0.4	2.1	4	clayy SILT to silty CLAY	115	2.0	13	8	-	-	1.2	15
3.12	14.8	23.8	-	0.3	-0.4	2.1	4	clayy SILT to silty CLAY	115	2.0	12	7	-	-	1.0	15
3.28	14.2	22.8	-	0.3	-0.4	2.0	4	clayy SILT to silty CLAY	115	2.0	11	7	-	-	1.0	15
3.45	13.2	21.1	-	0.2	-0.4	1.9	4	clayy SILT to silty CLAY	115	2.0	11	7	-	-	0.9	15
3.61	12.3	19.7	-	0.2	-0.4	1.9	4	clayy SILT to silty CLAY	115	2.0	10	6	-	-	0.9	15
3.77	11.2	17.9	-	0.2	-0.4	2.0	4	clayy SILT to silty CLAY	115	2.0	9	6	-	-	0.8	15
3.94	10.3	16.5	-	0.3	-0.4	2.6	4	clayy SILT to silty CLAY	115	2.0	8	5	-	-	0.7	15
4.10	9.7	15.5	-	0.3	-0.4	3.3	3	silty CLAY to CLAY	115	1.5	10	6	-	-	0.7	15
4.27	8.9	14.2	-	0.4	-0.4	4.5	3	silty CLAY to CLAY	115	1.5	9	6	-	-	0.6	15
4.43	8.4	13.5	-	0.4	-0.4	4.9	3	silty CLAY to CLAY	115	1.5	9	6	-	-	0.6	15
4.59	9.1	14.5	-	0.4	-0.4	4.8	3	silty CLAY to CLAY	115	1.5	10	6	-	-	0.6	15
4.76	10.2	16.4	-	0.4	-0.4	3.7	3	silty CLAY to CLAY	115	1.5	11	7	-	-	0.7	15
4.92	13.3	21.4	-	0.3	-0.4	2.3	4	clayy SILT to silty CLAY	115	2.0	11	7	-	-	0.9	15
5.09	13.9	22.4	-	0.3	-0.4	1.9	4	clayy SILT to silty CLAY	115	2.0	11	7	-	-	1.0	15
5.25	15.4	24.6	66.0	0.2	-0.4	1.3	5	silty SAND to sandy SILT	120	4.0	6	4	21	38	-	16
5.41	15.0	24.0	69.5	0.2	-0.4	1.5	5	silty SAND to sandy SILT	120	4.0	6	4	20	38	-	16
5.58	16.1	25.9	68.5	0.2	-0.3	1.4	5	silty SAND to sandy SILT	120	4.0	6	4	22	38	-	16
5.74	16.6	26.6	68.7	0.2	-0.3	1.4	5	silty SAND to sandy SILT	120	4.0	7	4	23	38	-	16
5.91	17.7	28.4	70.3	0.2	-0.3	1.4	5	silty SAND to sandy SILT	120	4.0	7	4	25	38	-	16
6.07	19.6	31.5	77.0	0.3	-0.3	1.6	5	silty SAND to sandy SILT	120	4.0	8	5	29	39	-	16
6.23	21.7	34.8	82.7	0.4	-0.2	1.7	5	silty SAND to sandy SILT	120	4.0	9	5	32	39	-	16
6.40	24.0	37.9	82.0	0.4	-0.2	1.5	5	silty SAND to sandy SILT	120	4.0	9	6	35	40	-	16
6.56	23.2	36.2	79.7	0.3	-0.2	1.5	5	silty SAND to sandy SILT	120	4.0	9	6	33	39	-	16
6.73	22.2	34.2	79.7	0.3	-0.2	1.6	5	silty SAND to sandy SILT	120	4.0	9	6	32	39	-	16
6.89	20.4	31.1	80.4	0.3	-0.2	1.7	5	silty SAND to sandy SILT	120	4.0	8	5	28	39	-	16
7.05	19.2	28.9	78.7	0.3	-0.1	1.7	5	silty SAND to sandy SILT	120	4.0	7	5	26	38	-	16
7.22	17.8	26.6	86.1	0.4	-0.1	2.2	4	clayy SILT to silty CLAY	115	2.0	13	9	-	-	1.2	15
7.38	16.9	27.1	89.4	0.4	-0.1	2.4	4	clayy SILT to silty CLAY	115	2.0	14	8	-	-	1.2	15
7.55	16.5	26.4	-	0.4	0.0	2.6	4	clayy SILT to silty CLAY	115	2.0	13	8	-	-	1.1	15
7.71	20.7	29.8	93.4	0.5	0.0	2.4	4	clayy SILT to silty CLAY	115	2.0	15	10	-	-	1.4	15
7.87	28.3	40.4	94.9	0.6	0.0	2.0	5	silty SAND to sandy SILT	120	4.0	10	7	37	40	-	16
8.04	31.3	44.2	93.2	0.5	0.0	1.8	5	silty SAND to sandy SILT	120	4.0	11	8	40	40	-	16
8.20	33.8	47.3	94.0	0.6	0.1	1.7	5	silty SAND to sandy SILT	120	4.0	12	8	42	41	-	16
8.37	38.2	52.8	101.2	0.7	0.1	1.8	5	silty SAND to sandy SILT	120	4.0	13	10	46	41	-	16
8.53	47.1	64.5	101.9	0.7	0.1	1.4	5	silty SAND to sandy SILT	120	4.0	16	12	53	42	-	16
8.69	53.0	71.9	104.1	0.7	0.1	1.3	5	silty SAND to sandy SILT	120	4.0	18	13	56	43	-	16
8.86	47.4	63.7	97.2	0.6	0.2	1.3	5	silty SAND to sandy SILT	120	4.0	16	12	52	42	-	16
9.02	38.9	51.8	93.1	0.6	0.3	1.5	5	silty SAND to sandy SILT	120	4.0	13	10	45	41	-	16
9.19	34.5	45.5	92.4	0.6	0.3	1.7	5	silty SAND to sandy SILT	120	4.0	11	9	41	40	-	16
9.35	31.1	40.6	92.5	0.6	0.3	1.9	5	silty SAND to sandy SILT	120	4.0	10	8	37	40	-	16
9.51	29.4	38.1	93.0	0.6	0.3	2.0	5	silty SAND to sandy SILT	120	4.0	10	7	35	39	-	16
9.68	28.9	37.2	112.6	0.8	0.3	3.0	4	clayy SILT to silty CLAY	115	2.0	19	14	-	-	2.0	15
9.84	30.9	39.3	119.7	1.0	0.3	3.2	4	clayy SILT to silty CLAY	115	2.0	20	15	-	-	2.2	15
10.01	37.4	47.3	110.1	0.9	0.4	2.4	5	silty SAND to sandy SILT	120	4.0	12	9	42	40	-	16
10.17	45.6	57.2	120.7	1.1	0.4	2.4	5	silty SAND to sandy SILT	120	4.0	14	11	49	41	-	16
10.34	58.2	72.3	126.3	1.2	0.4	2.1	5	silty SAND to sandy SILT	120	4.0	18	15	56	43	-	16
10.50	50.0	61.7	128.4	1.2	0.4	2.5	5	silty SAND to sandy SILT	120	4.0	15	13	51	42	-	16
10.66	49.4	60.4	130.7	1.3	0.4	2.7	5	silty SAND to sandy SILT	120	4.0	15	12	50	42	-	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Cortona Drive

Project ID: Pacific Materials Lab
Data File: SDF(963).cpt
CPT Date: 1/15/2009 2:27:56 PM
GW During Test: 20 ft

Sounding ID: CPT-01
Project No: Cortona Drive
Cone/Rig: DSG1047

Depth ft	qc PS tsf	* qcln PS -	qlncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	* Nk -
10.83	66.1	80.2	132.6	1.3	0.4	2.1	5	silty SAND to sandy SILT	120	4.0	20	17	60	43	-	16
10.99	75.3	90.8	125.8	1.1	0.5	1.5	5	silty SAND to sandy SILT	120	4.0	23	19	64	44	-	16
11.16	72.5	86.7	117.3	0.9	0.5	1.3	5	silty SAND to sandy SILT	120	4.0	22	18	62	43	-	16
11.32	68.2	81.0	116.9	1.0	0.5	1.5	5	silty SAND to sandy SILT	120	4.0	20	17	60	43	-	16
11.48	75.6	89.0	127.7	1.2	0.5	1.6	5	silty SAND to sandy SILT	120	4.0	22	19	63	44	-	16
11.65	73.9	86.4	131.3	1.3	0.5	1.8	5	silty SAND to sandy SILT	120	4.0	22	18	62	43	-	16
11.81	60.5	70.3	126.5	1.3	0.6	2.2	5	silty SAND to sandy SILT	120	4.0	18	15	55	42	-	16
11.98	59.9	69.1	121.2	1.2	0.6	2.0	5	silty SAND to sandy SILT	120	4.0	17	15	55	42	-	16
12.14	70.8	81.1	118.2	1.1	0.7	1.5	5	silty SAND to sandy SILT	120	4.0	20	18	60	43	-	16
12.30	86.8	98.7	128.8	1.2	0.7	1.4	6	clean SAND to silty SAND	125	5.0	20	17	67	44	-	16
12.47	94.5	106.8	138.7	1.4	0.7	1.4	6	clean SAND to silty SAND	125	5.0	21	19	69	44	-	16
12.63	92.4	103.6	140.6	1.5	0.7	1.6	5	silty SAND to sandy SILT	120	4.0	26	23	68	44	-	16
12.80	90.6	101.1	142.0	1.6	0.7	1.7	5	silty SAND to sandy SILT	120	4.0	25	23	67	44	-	16
12.96	89.4	99.0	134.5	1.4	0.7	1.5	5	silty SAND to sandy SILT	120	4.0	25	22	67	44	-	16
13.12	90.7	99.8	131.5	1.3	0.7	1.4	6	clean SAND to silty SAND	125	5.0	20	18	67	44	-	16
13.29	94.9	103.8	131.3	1.2	0.7	1.3	6	clean SAND to silty SAND	125	5.0	21	19	68	44	-	16
13.45	104.8	113.9	142.9	1.4	0.7	1.4	6	clean SAND to silty SAND	125	5.0	23	21	71	44	-	16
13.62	120.1	129.7	155.4	1.6	0.7	1.3	6	clean SAND to silty SAND	125	5.0	26	24	76	45	-	16
13.78	129.9	139.3	161.0	1.6	0.7	1.2	6	clean SAND to silty SAND	125	5.0	28	26	78	45	-	16
13.94	119.1	127.0	153.3	1.6	0.7	1.3	6	clean SAND to silty SAND	125	5.0	25	24	75	45	-	16
14.11	92.8	98.3	143.6	1.7	0.8	1.9	5	silty SAND to sandy SILT	120	4.0	25	23	66	44	-	16
14.27	62.3	65.6	145.2	1.9	0.8	3.0	5	silty SAND to sandy SILT	120	4.0	16	16	53	42	-	16
14.44	44.2	48.3	-	2.0	0.8	4.6	4	clayy SILT to silty CLAY	115	2.0	24	22	-	-	3.1	15
14.60	42.7	49.1	-	2.0	0.8	4.7	4	clayy SILT to silty CLAY	115	2.0	25	21	-	-	3.0	15
14.76	42.4	48.2	-	1.9	0.9	4.7	4	clayy SILT to silty CLAY	115	2.0	24	21	-	-	3.0	15
14.93	43.3	46.2	151.6	1.8	0.9	4.3	4	clayy SILT to silty CLAY	115	2.0	23	22	-	-	3.0	15
15.09	45.5	46.6	138.0	1.6	0.9	3.6	4	clayy SILT to silty CLAY	115	2.0	23	23	-	-	3.2	15
15.26	46.9	47.9	148.8	1.9	0.9	4.0	4	clayy SILT to silty CLAY	115	2.0	24	23	-	-	3.3	15
15.42	43.3	47.3	-	2.0	0.8	4.6	4	clayy SILT to silty CLAY	115	2.0	24	22	-	-	3.0	15
15.58	44.2	47.7	-	2.0	0.7	4.7	4	clayy SILT to silty CLAY	115	2.0	24	22	-	-	3.1	15
15.75	46.6	47.9	-	2.1	0.7	4.7	4	clayy SILT to silty CLAY	115	2.0	24	23	-	-	3.3	15
15.91	46.9	49.6	-	2.2	0.6	4.8	4	clayy SILT to silty CLAY	115	2.0	25	23	-	-	3.3	15
16.08	46.2	48.4	-	2.2	0.6	4.8	4	clayy SILT to silty CLAY	115	2.0	24	23	-	-	3.2	15
16.24	53.7	53.1	160.5	2.2	0.6	4.3	4	clayy SILT to silty CLAY	115	2.0	27	27	-	-	3.8	15
16.40	58.8	57.9	163.4	2.4	0.6	4.1	4	clayy SILT to silty CLAY	115	2.0	29	29	-	-	4.1	15
16.57	59.4	58.2	165.4	2.4	0.6	4.2	4	clayy SILT to silty CLAY	115	2.0	29	30	-	-	4.2	15
16.73	56.7	55.3	168.2	2.5	0.5	4.5	4	clayy SILT to silty CLAY	115	2.0	28	28	-	-	4.0	15
16.90	57.8	56.1	163.3	2.4	0.5	4.2	4	clayy SILT to silty CLAY	115	2.0	28	29	-	-	4.0	15
17.06	64.5	62.3	151.4	2.2	0.5	3.4	4	clayy SILT to silty CLAY	115	2.0	31	32	-	-	4.5	15
17.23	65.8	63.3	143.2	2.0	0.5	3.0	5	silty SAND to sandy SILT	120	4.0	16	16	52	41	-	16
17.39	64.7	61.9	149.5	2.1	0.5	3.3	4	clayy SILT to silty CLAY	115	2.0	31	32	-	-	4.5	15
17.55	60.5	57.7	159.1	2.3	0.5	3.9	4	clayy SILT to silty CLAY	115	2.0	29	30	-	-	4.2	15
17.72	52.2	49.5	159.0	2.3	0.5	4.4	4	clayy SILT to silty CLAY	115	2.0	25	26	-	-	3.6	15
17.88	40.3	38.0	-	1.9	0.5	4.9	3	silty CLAY to CLAY	115	1.5	25	27	-	-	2.8	15
18.05	42.0	39.3	-	1.8	0.5	4.3	4	clayy SILT to silty CLAY	115	2.0	20	21	-	-	2.9	15
18.21	37.1	34.4	-	1.5	0.5	4.3	4	clayy SILT to silty CLAY	115	2.0	17	19	-	-	2.6	15
18.37	31.3	28.8	-	1.3	0.5	4.4	3	silty CLAY to CLAY	115	1.5	19	21	-	-	2.2	15
18.54	46.9	43.5	135.4	1.7	0.5	3.7	4	clayy SILT to silty CLAY	115	2.0	22	23	-	-	3.3	15
18.70	46.1	41.7	-	1.8	0.5	4.0	4	clayy SILT to silty CLAY	115	2.0	21	23	-	-	3.2	15
18.87	29.9	26.8	-	1.5	0.4	5.2	3	silty CLAY to CLAY	115	1.5	18	20	-	-	2.1	15
19.03	31.6	28.1	-	1.7	0.4	5.5	3	silty CLAY to CLAY	115	1.5	19	21	-	-	2.2	15
19.19	56.6	51.6	155.8	2.3	0.4	4.1	4	clayy SILT to silty CLAY	115	2.0	26	28	-	-	4.0	15
19.36	37.0	32.4	-	1.8	0.4	5.1	3	silty CLAY to CLAY	115	1.5	22	25	-	-	2.6	15
19.52	22.8	19.7	-	1.2	0.4	5.5	3	silty CLAY to CLAY	115	1.5	13	15	-	-	1.6	15
19.69	26.1	22.5	-	1.4	0.4	5.6	3	silty CLAY to CLAY	115	1.5	15	17	-	-	1.8	15
19.85	33.7	28.7	-	1.6	0.4	4.9	3	silty CLAY to CLAY	115	1.5	19	22	-	-	2.3	15
20.01	23.9	20.3	-	1.4	0.4	6.0	3	silty CLAY to CLAY	115	1.5	14	16	-	-	1.6	15
20.18	26.0	22.0	-	1.2	0.4	4.8	3	silty CLAY to CLAY	115	1.5	15	17	-	-	1.8	15
20.34	29.5	24.9	-	1.4	0.3	4.9	3	silty CLAY to CLAY	115	1.5	17	20	-	-	2.0	15
20.51	30.9	26.0	-	1.6	0.3	5.2	3	silty CLAY to CLAY	115	1.5	17	21	-	-	2.1	15
20.67	37.0	31.0	-	1.6	0.3	4.5	3	silty CLAY to CLAY	115	1.5	21	25	-	-	2.6	15
20.83	36.8	30.8	-	1.7	0.3	4.8	3	silty CLAY to CLAY	115	1.5	21	25	-	-	2.6	15
21.00	36.2	30.1	-	1.5	0.3	4.3	3	silty CLAY to CLAY	115	1.5	20	24	-	-	2.5	15
21.16	28.5	23.6	-	1.2	0.3	4.5	3	silty CLAY to CLAY	115	1.5	16	19	-	-	2.0	15
21.33	24.3	20.1	-	1.2	0.3	5.3	3	silty CLAY to CLAY	115	1.5	13	16	-	-	1.7	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Project ID: Pacific Materials Lab
Data File: SDF(963).cpt
CPT Date: 1/15/2009 2:27:56 PM
GW During Test: 20 ft

Sounding ID: CPT-01
Project No: Cortona Drive
Cone/Rig: DSG1047

Depth ft	qc PS tsf	* qc1n PS -	q1ncs PS -	Slv Stss tsf	pore prss (psi)	Frct Ratio %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	* Nk -
21.49	25.6	21.1	-	1.3	0.3	5.2	3	silty CLAY to CLAY	115	1.5	14	17	-	-	1.8	15
21.65	25.9	21.3	-	1.3	0.3	5.3	3	silty CLAY to CLAY	115	1.5	14	17	-	-	1.8	15
21.82	31.2	25.5	-	1.4	0.3	4.8	3	silty CLAY to CLAY	115	1.5	17	21	-	-	2.2	15
21.98	27.8	22.6	-	1.5	0.3	5.6	3	silty CLAY to CLAY	115	1.5	15	19	-	-	1.9	15
22.15	25.3	20.5	-	1.1	0.2	4.5	3	silty CLAY to CLAY	115	1.5	14	17	-	-	1.7	15
22.31	22.6	18.3	-	0.9	0.2	4.5	3	silty CLAY to CLAY	115	1.5	12	15	-	-	1.5	15
22.47	38.5	33.6	105.1	1.0	0.2	2.7	4	clayy SILT to silty CLAY	115	2.0	17	19	-	-	2.7	15
22.64	43.9	35.3	-	1.4	0.2	3.4	4	clayy SILT to silty CLAY	115	2.0	18	22	-	-	3.1	15
22.80	29.9	23.9	-	1.4	0.2	4.8	3	silty CLAY to CLAY	115	1.5	16	20	-	-	2.1	15
22.97	27.9	22.2	-	1.3	0.2	5.1	3	silty CLAY to CLAY	115	1.5	15	19	-	-	1.9	15
23.13	41.0	32.6	-	1.6	0.2	3.9	4	clayy SILT to silty CLAY	115	2.0	16	21	-	-	2.8	15
23.30	49.9	43.1	120.4	1.4	0.2	3.0	4	clayy SILT to silty CLAY	115	2.0	22	25	-	-	3.5	15
23.46	65.6	56.6	126.2	1.7	0.3	2.6	5	silty SAND to sandy SILT	120	4.0	14	16	48	40	-	16
23.62	77.2	66.5	127.7	1.8	0.3	2.3	5	silty SAND to sandy SILT	120	4.0	17	19	54	41	-	16
23.79	89.9	77.3	136.0	2.0	0.3	2.3	5	silty SAND to sandy SILT	120	4.0	19	22	58	41	-	16
23.95	90.6	77.8	132.4	1.9	0.3	2.1	5	silty SAND to sandy SILT	120	4.0	19	23	59	41	-	16
24.12	75.7	64.8	129.9	1.8	0.3	2.5	5	silty SAND to sandy SILT	120	4.0	16	19	53	40	-	16
24.28	64.3	55.0	128.3	1.7	0.3	2.8	5	silty SAND to sandy SILT	120	4.0	14	16	47	40	-	16
24.44	67.5	57.6	135.3	1.9	0.3	2.9	4	clayy SILT to silty CLAY	115	2.0	29	34	-	-	4.7	15
24.61	56.5	48.2	145.1	2.1	0.4	3.8	4	clayy SILT to silty CLAY	115	2.0	24	28	-	-	3.9	15
24.77	50.0	38.3	-	1.8	0.4	3.8	4	clayy SILT to silty CLAY	115	2.0	19	25	-	-	3.5	15
24.94	71.0	60.3	125.9	1.7	0.4	2.5	5	silty SAND to sandy SILT	120	4.0	15	18	50	40	-	16
25.10	122.3	103.7	140.4	1.9	0.4	1.6	5	silty SAND to sandy SILT	120	4.0	26	31	68	43	-	16
25.26	129.2	109.3	142.3	1.9	0.5	1.5	6	clean SAND to silty SAND	125	5.0	22	26	70	43	-	16
25.43	130.1	109.8	142.9	1.9	0.5	1.5	6	clean SAND to silty SAND	125	5.0	22	26	70	43	-	16
25.59	148.7	125.4	155.6	2.1	0.5	1.5	6	clean SAND to silty SAND	125	5.0	25	30	74	44	-	16
25.76	199.0	167.4	186.4	2.4	0.5	1.2	6	clean SAND to silty SAND	125	5.0	33	40	84	45	-	16
25.92	255.2	214.3	222.4	2.8	0.6	1.1	6	clean SAND to silty SAND	125	5.0	43	51	92	46	-	16
26.08	288.9	242.2	246.1	3.2	0.6	1.1	6	clean SAND to silty SAND	125	5.0	48	58	95	47	-	16
26.25	312.4	261.3	266.1	3.7	0.6	1.2	6	clean SAND to silty SAND	125	5.0	52	62	95	47	-	16
26.41	329.7	275.3	281.9	4.2	0.7	1.3	6	clean SAND to silty SAND	125	5.0	55	66	95	47	-	16
26.58	347.7	289.7	296.3	4.6	0.8	1.3	6	clean SAND to silty SAND	125	5.0	58	70	95	47	-	16
26.74	358.7	298.3	303.9	4.7	0.8	1.3	6	clean SAND to silty SAND	125	5.0	60	72	95	47	-	16
26.90	362.4	300.9	309.5	5.0	0.9	1.4	6	clean SAND to silty SAND	125	5.0	60	72	95	47	-	16
27.07	359.7	298.1	305.9	4.9	1.0	1.4	6	clean SAND to silty SAND	125	5.0	60	72	95	47	-	16
27.23	360.9	298.5	305.4	4.8	1.1	1.3	6	clean SAND to silty SAND	125	5.0	60	72	95	47	-	16
27.40	369.7	305.2	310.8	4.9	1.4	1.3	6	clean SAND to silty SAND	125	5.0	61	74	95	47	-	16
27.56	390.2	321.6	321.9	5.1	1.5	1.3	6	clean SAND to silty SAND	125	5.0	64	78	95	48	-	16
27.72	408.6	336.1	335.7	5.4	1.7	1.3	6	clean SAND to silty SAND	125	5.0	67	82	95	48	-	16
27.89	424.9	348.9	348.7	5.8	1.8	1.4	6	clean SAND to silty SAND	125	5.0	70	85	95	48	-	16
28.05	438.5	359.4	359.4	5.4	1.9	1.2	6	clean SAND to silty SAND	125	5.0	72	88	95	48	-	16
28.22	450.8	368.7	368.4	6.4	2.1	1.4	6	clean SAND to silty SAND	125	5.0	74	90	95	48	-	16
28.38	429.9	351.1	364.6	6.9	2.3	1.6	6	clean SAND to silty SAND	125	5.0	70	86	95	48	-	16
28.54	418.8	341.3	357.6	6.8	2.2	1.6	6	clean SAND to silty SAND	125	5.0	68	84	95	48	-	16
28.71	402.3	327.3	342.9	6.4	2.2	1.6	6	clean SAND to silty SAND	125	5.0	65	80	95	48	-	16
28.87	408.2	331.5	344.9	6.3	2.1	1.6	6	clean SAND to silty SAND	125	5.0	66	82	95	48	-	16
29.04	423.3	343.2	355.1	6.6	2.1	1.6	6	clean SAND to silty SAND	125	5.0	69	85	95	48	-	16
29.20	430.3	348.2	359.5	6.7	2.1	1.6	6	clean SAND to silty SAND	125	5.0	70	86	95	48	-	16
29.36	433.0	349.7	357.0	6.4	2.1	1.5	6	clean SAND to silty SAND	125	5.0	70	87	95	48	-	16
29.53	429.2	346.1	350.6	6.1	2.1	1.4	6	clean SAND to silty SAND	125	5.0	69	86	95	48	-	16
29.69	426.8	343.6	354.2	6.5	2.2	1.5	6	clean SAND to silty SAND	125	5.0	69	85	95	48	-	16
29.86	408.1	327.9	337.8	6.0	2.1	1.5	6	clean SAND to silty SAND	125	5.0	66	82	95	48	-	16
30.02	399.5	320.4	333.2	6.1	2.0	1.5	6	clean SAND to silty SAND	125	5.0	64	80	95	47	-	16
30.19	371.6	297.5	320.8	6.3	1.8	1.7	6	clean SAND to silty SAND	125	5.0	60	74	95	47	-	16
30.35	357.1	285.5	310.3	6.1	1.7	1.7	6	clean SAND to silty SAND	125	5.0	57	71	95	47	-	16
30.51	345.5	275.7	298.8	5.6	1.6	1.6	6	clean SAND to silty SAND	125	5.0	55	69	95	47	-	16
30.68	344.5	274.4	291.6	5.1	1.5	1.5	6	clean SAND to silty SAND	125	5.0	55	69	95	47	-	16
30.84	330.6	262.9	280.4	4.9	1.5	1.5	6	clean SAND to silty SAND	125	5.0	53	66	95	46	-	16
31.01	325.8	258.6	264.8	3.9	1.4	1.2	6	clean SAND to silty SAND	125	5.0	52	65	95	46	-	16
31.17	315.9	250.4	263.2	4.2	1.4	1.3	6	clean SAND to silty SAND	125	5.0	50	63	95	46	-	16
31.33	300.8	238.0	255.4	4.2	1.4	1.4	6	clean SAND to silty SAND	125	5.0	48	60	95	46	-	16
31.50	297.6	235.0	251.3	4.0	1.3	1.4	6	clean SAND to silty SAND	125	5.0	47	60	95	46	-	16
31.66	294.5	232.2	248.6	4.0	1.3	1.4	6	clean SAND to silty SAND	125	5.0	46	59	95	46	-	16
31.83	310.6	244.5	245.5	3.3	1.2	1.1	6	clean SAND to silty SAND	125	5.0	49	62	95	46	-	16
31.99	310.2	243.8	243.3	3.2	1.2	1.0	6	clean SAND to silty SAND	125	5.0	49	62	95	46	-	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Cortona Drive

Project ID: Pacific Materials Lab
Data File: SDF(963).cpt
CPT Date: 1/15/2009 2:27:56 PM
GW During Test: 20 ft

Sounding ID: CPT-01
Project No: Cortona Drive
Cone/Rig: DSG1047

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	* Nk -
32.15	273.6	214.6	231.0	3.5	1.2	1.3	6	clean SAND to silty SAND	125	5.0	43	55	92	45	-	16
32.32	290.6	227.6	245.3	4.0	1.2	1.4	6	clean SAND to silty SAND	125	5.0	46	58	94	46	-	16
32.48	344.8	269.6	272.3	4.0	1.2	1.2	6	clean SAND to silty SAND	125	5.0	54	69	95	46	-	16
32.65	369.6	288.5	288.5	3.6	1.2	1.0	6	clean SAND to silty SAND	125	5.0	58	74	95	47	-	16
32.81	372.9	290.6	290.6	3.2	1.2	0.9	6	clean SAND to silty SAND	125	5.0	58	75	95	47	-	16
32.97	351.0	273.1	273.1	3.5	1.3	1.0	6	clean SAND to silty SAND	125	5.0	55	70	95	46	-	16
33.14	312.9	243.1	243.1	3.2	1.3	1.0	6	clean SAND to silty SAND	125	5.0	49	63	95	46	-	16
33.30	277.8	215.4	229.9	3.5	1.3	1.3	6	clean SAND to silty SAND	125	5.0	43	56	92	45	-	16
33.47	287.9	222.9	226.5	2.9	1.3	1.0	6	clean SAND to silty SAND	125	5.0	45	58	93	45	-	16
33.63	316.8	244.9	244.9	2.9	1.4	0.9	6	clean SAND to silty SAND	125	5.0	49	63	95	46	-	16
33.79	317.3	244.8	244.8	2.9	1.4	0.9	6	clean SAND to silty SAND	125	5.0	49	63	95	46	-	16
33.96	326.3	251.4	251.4	2.9	1.4	0.9	6	clean SAND to silty SAND	125	5.0	50	65	95	46	-	16
34.12	326.1	250.9	250.9	3.3	1.5	1.0	6	clean SAND to silty SAND	125	5.0	50	65	95	46	-	16
34.29	296.3	227.5	236.3	3.4	1.5	1.2	6	clean SAND to silty SAND	125	5.0	46	59	94	46	-	16
34.45	258.0	197.8	220.4	3.7	1.5	1.4	6	clean SAND to silty SAND	125	5.0	40	52	90	45	-	16
34.61	259.6	198.7	217.8	3.4	1.4	1.3	6	clean SAND to silty SAND	125	5.0	40	52	90	45	-	16
34.78	271.6	207.6	217.2	3.0	1.4	1.1	6	clean SAND to silty SAND	125	5.0	42	54	91	45	-	16
34.94	283.2	216.1	216.1	2.4	1.4	0.9	6	clean SAND to silty SAND	125	5.0	43	57	92	45	-	16
35.11	305.9	233.0	233.0	2.1	1.3	0.7	6	clean SAND to silty SAND	125	5.0	47	61	95	46	-	16
35.27	338.8	257.7	257.7	2.9	1.3	0.9	6	clean SAND to silty SAND	125	5.0	52	68	95	46	-	16
35.43	370.2	281.1	281.1	3.1	1.3	0.8	6	clean SAND to silty SAND	125	5.0	56	74	95	46	-	16
35.60	352.4	267.2	287.9	5.5	1.3	1.6	6	clean SAND to silty SAND	125	5.0	53	70	95	46	-	16
35.76	323.9	245.2	271.2	5.3	1.2	1.6	6	clean SAND to silty SAND	125	5.0	49	65	95	46	-	16
35.93	344.7	260.5	260.5	3.4	1.3	1.0	6	clean SAND to silty SAND	125	5.0	52	69	95	46	-	16
36.09	396.9	299.5	299.5	2.0	1.3	0.5	6	clean SAND to silty SAND	125	5.0	60	79	95	47	-	16
36.26	363.6	274.0	274.0	2.9	1.4	0.8	6	clean SAND to silty SAND	125	5.0	55	73	95	46	-	16
36.42	342.3	257.5	266.3	4.3	1.4	1.3	6	clean SAND to silty SAND	125	5.0	52	68	95	46	-	16
36.58	340.2	255.5	262.5	4.1	1.4	1.2	6	clean SAND to silty SAND	125	5.0	51	68	95	46	-	16
36.75	366.6	275.0	277.2	4.3	1.5	1.2	6	clean SAND to silty SAND	125	5.0	55	73	95	46	-	16
36.91	311.0	232.9	247.4	4.1	1.5	1.3	6	clean SAND to silty SAND	125	5.0	47	62	95	45	-	16
37.08	296.8	222.0	264.4	6.1	1.5	2.1	6	clean SAND to silty SAND	125	5.0	44	59	93	45	-	16
37.24	365.6	273.0	308.7	7.1	1.6	2.0	6	clean SAND to silty SAND	125	5.0	55	73	95	46	-	16
37.40	387.5	288.9	352.1	10.2	1.7	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	25.6	16
37.57	346.9	258.3	378.3	13.7	1.7	4.0	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	22.9	16
37.73	273.7	203.5	293.9	9.0	1.7	3.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.1	16
37.90	284.6	211.3	261.0	6.3	1.8	2.2	6	clean SAND to silty SAND	125	5.0	42	57	92	45	-	16
38.06	484.4	359.2	359.2	5.0	1.2	1.0	6	clean SAND to silty SAND	125	5.0	72	97	95	47	-	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

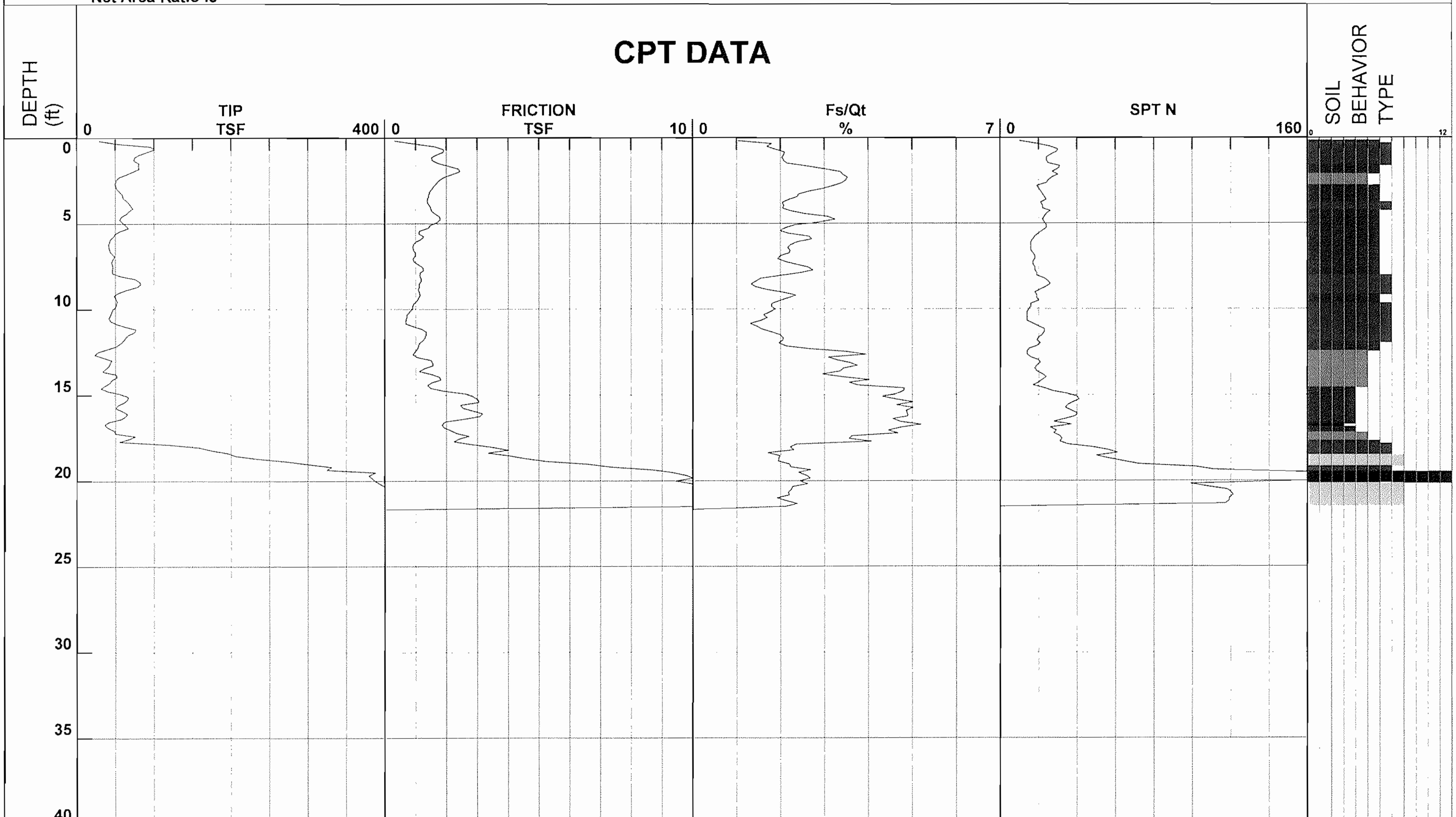
Middle Earth Geo Testing

Pacific Materials Laboratories

Project	Cortona Drive	Operator	JV/EE	Filename	SDF(964).cpt
Job Number	Cortona Drive	Cone Number	DSG1047	GPS	
Hole Number	CPT-02	Date and Time	1/15/2009 3:12:39 PM	Maximum Depth	21.82 ft
Water Table Depth	20.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

*Soil behavior type and SPT based on data from UBC-1983

Cortona Drive

Project ID: Pacific Materials Lab
Data File: SDF(964).cpt
CPT Date: 1/15/2009 3:12:39 PM
GW During Test: 20 ft

Page: 1
Sounding ID: CPT-02
Project No: Cortona Drive
Cone/Rig: DSG1047

Depth ft	qc PS tsf	* qcln PS -	qlncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	* Nk -
0.33	52.4	84.1	128.1	0.9	0.0	1.8	5	silty SAND to sandy SILT	120	4.0	21	13	61	48	-	16
0.49	95.3	152.8	187.2	1.6	0.0	1.7	6	clean SAND to silty SAND	125	5.0	31	19	81	48	-	16
0.66	100.2	160.6	200.6	1.9	0.1	1.9	6	clean SAND to silty SAND	125	5.0	32	20	83	48	-	16
0.82	90.1	144.5	192.1	1.9	0.0	2.1	5	silty SAND to sandy SILT	120	4.0	36	23	79	48	-	16
0.98	80.0	128.3	176.6	1.7	0.0	2.1	5	silty SAND to sandy SILT	120	4.0	32	20	75	48	-	16
1.15	74.3	119.2	166.8	1.5	0.0	2.0	5	silty SAND to sandy SILT	120	4.0	30	19	73	48	-	16
1.31	73.6	118.0	167.1	1.5	0.0	2.1	5	silty SAND to sandy SILT	120	4.0	30	18	72	48	-	16
1.48	79.9	128.2	178.5	1.7	-0.1	2.1	5	silty SAND to sandy SILT	120	4.0	32	20	75	48	-	16
1.64	79.4	127.3	192.0	2.0	-0.1	2.6	5	silty SAND to sandy SILT	120	4.0	32	20	75	48	-	16
1.80	80.0	128.4	206.1	2.4	-0.1	3.0	5	silty SAND to sandy SILT	120	4.0	32	20	75	48	-	16
1.97	71.9	115.3	205.6	2.4	-0.2	3.4	5	silty SAND to sandy SILT	120	4.0	29	18	72	48	-	16
2.13	63.1	101.2	192.8	2.2	-0.2	3.4	5	silty SAND to sandy SILT	120	4.0	25	16	67	48	-	16
2.30	54.4	87.3	181.3	1.9	-0.2	3.5	5	silty SAND to sandy SILT	120	4.0	22	14	63	47	-	16
2.46	50.7	81.2	173.7	1.8	-0.2	3.5	4	clayy SILT to silty CLAY	115	2.0	41	25	-	-	3.6	15
2.62	49.4	79.3	169.1	1.7	-0.2	3.4	5	silty SAND to sandy SILT	120	4.0	20	12	59	46	-	16
2.79	49.8	79.8	164.2	1.6	-0.1	3.2	5	silty SAND to sandy SILT	120	4.0	20	12	60	46	-	16
2.95	51.5	82.6	160.7	1.5	-0.1	3.0	5	silty SAND to sandy SILT	120	4.0	21	13	61	46	-	16
3.12	54.7	87.7	157.1	1.5	-0.1	2.7	5	silty SAND to sandy SILT	120	4.0	22	14	63	46	-	16
3.28	58.7	94.1	155.6	1.4	-0.1	2.4	5	silty SAND to sandy SILT	120	4.0	24	15	65	46	-	16
3.45	59.0	94.6	154.9	1.4	-0.1	2.4	5	silty SAND to sandy SILT	120	4.0	24	15	65	46	-	16
3.61	62.5	100.3	154.5	1.4	-0.1	2.2	5	silty SAND to sandy SILT	120	4.0	25	16	67	46	-	16
3.77	67.0	107.5	156.7	1.4	-0.1	2.0	5	silty SAND to sandy SILT	120	4.0	27	17	69	46	-	16
3.94	69.5	111.4	161.4	1.4	-0.1	2.1	5	silty SAND to sandy SILT	120	4.0	28	17	71	46	-	16
4.10	72.2	115.7	164.6	1.5	-0.1	2.1	5	silty SAND to sandy SILT	120	4.0	29	18	72	46	-	16
4.27	67.5	108.2	163.6	1.5	-0.1	2.2	5	silty SAND to sandy SILT	120	4.0	27	17	70	46	-	16
4.43	63.7	102.1	167.6	1.6	0.0	2.6	5	silty SAND to sandy SILT	120	4.0	26	16	68	46	-	16
4.59	57.5	92.2	173.7	1.8	0.0	3.1	5	silty SAND to sandy SILT	120	4.0	23	14	64	45	-	16
4.76	55.2	88.5	175.0	1.8	0.0	3.3	5	silty SAND to sandy SILT	120	4.0	22	14	63	45	-	16
4.92	58.8	94.3	170.3	1.7	0.0	2.9	5	silty SAND to sandy SILT	120	4.0	24	15	65	45	-	16
5.09	63.2	101.4	159.8	1.5	0.0	2.3	5	silty SAND to sandy SILT	120	4.0	25	16	67	45	-	16
5.25	66.2	106.2	157.9	1.4	0.0	2.1	5	silty SAND to sandy SILT	120	4.0	27	17	69	45	-	16
5.41	56.1	89.9	139.6	1.1	0.1	2.0	5	silty SAND to sandy SILT	120	4.0	22	14	63	45	-	16
5.58	49.5	79.3	135.8	1.1	0.1	2.2	5	silty SAND to sandy SILT	120	4.0	20	12	59	44	-	16
5.74	47.3	75.8	145.5	1.3	0.1	2.7	5	silty SAND to sandy SILT	120	4.0	19	12	58	44	-	16
5.91	43.0	68.9	140.8	1.2	0.1	2.7	5	silty SAND to sandy SILT	120	4.0	17	11	55	43	-	16
6.07	41.9	67.1	130.0	1.0	0.1	2.4	5	silty SAND to sandy SILT	120	4.0	17	10	54	43	-	16
6.23	40.6	64.5	123.7	0.9	0.1	2.3	5	silty SAND to sandy SILT	120	4.0	16	10	53	43	-	16
6.40	41.4	65.0	122.2	0.9	0.1	2.2	5	silty SAND to sandy SILT	120	4.0	16	10	53	43	-	16
6.56	42.1	65.2	123.8	0.9	0.1	2.2	5	silty SAND to sandy SILT	120	4.0	16	11	53	43	-	16
6.73	44.9	68.7	126.3	1.0	0.1	2.2	5	silty SAND to sandy SILT	120	4.0	17	11	55	43	-	16
6.89	48.5	73.3	125.1	1.0	0.1	2.0	5	silty SAND to sandy SILT	120	4.0	18	12	57	43	-	16
7.05	46.6	69.6	120.2	0.9	0.1	2.0	5	silty SAND to sandy SILT	120	4.0	17	12	55	43	-	16
7.22	44.6	65.8	121.4	0.9	0.1	2.1	5	silty SAND to sandy SILT	120	4.0	16	11	53	42	-	16
7.38	45.7	66.7	129.4	1.1	0.1	2.4	5	silty SAND to sandy SILT	120	4.0	17	11	54	43	-	16
7.55	46.2	66.6	136.2	1.2	0.1	2.6	5	silty SAND to sandy SILT	120	4.0	17	12	54	43	-	16
7.71	45.7	65.2	138.0	1.3	0.2	2.8	5	silty SAND to sandy SILT	120	4.0	16	11	53	42	-	16
7.87	46.0	65.0	130.2	1.1	0.2	2.5	5	silty SAND to sandy SILT	120	4.0	16	11	53	42	-	16
8.04	56.4	78.8	130.1	1.1	0.2	2.0	5	silty SAND to sandy SILT	120	4.0	20	14	59	43	-	16
8.20	75.1	103.9	139.2	1.2	0.2	1.6	5	silty SAND to sandy SILT	120	4.0	26	19	68	45	-	16
8.37	81.0	111.1	142.4	1.2	0.2	1.4	6	clean SAND to silty SAND	125	5.0	22	16	70	45	-	16
8.53	82.4	111.8	140.0	1.1	0.2	1.3	6	clean SAND to silty SAND	125	5.0	22	16	71	45	-	16
8.69	77.4	104.0	135.8	1.1	0.2	1.4	6	clean SAND to silty SAND	125	5.0	21	15	68	45	-	16
8.86	64.3	85.5	126.9	1.1	0.3	1.7	5	silty SAND to sandy SILT	120	4.0	21	16	62	44	-	16
9.02	53.8	71.0	125.1	1.1	0.3	2.1	5	silty SAND to sandy SILT	120	4.0	18	13	56	43	-	16
9.19	48.1	62.8	125.6	1.1	0.3	2.4	5	silty SAND to sandy SILT	120	4.0	16	12	52	42	-	16
9.35	49.7	64.3	122.2	1.1	0.2	2.2	5	silty SAND to sandy SILT	120	4.0	16	12	52	42	-	16
9.51	51.9	66.6	118.9	1.0	0.2	2.0	5	silty SAND to sandy SILT	120	4.0	17	13	54	42	-	16
9.68	51.3	65.3	112.9	0.9	0.3	1.8	5	silty SAND to sandy SILT	120	4.0	16	13	53	42	-	16
9.84	49.9	63.1	110.7	0.9	0.3	1.8	5	silty SAND to sandy SILT	120	4.0	16	12	52	42	-	16
10.01	46.5	58.3	109.0	0.9	0.3	1.9	5	silty SAND to sandy SILT	120	4.0	15	12	49	41	-	16
10.17	44.6	55.4	103.3	0.8	0.3	1.8	5	silty SAND to sandy SILT	120	4.0	14	11	47	41	-	16
10.34	43.2	53.2	97.6	0.7	0.3	1.6	5	silty SAND to sandy SILT	120	4.0	13	11	46	41	-	16
10.50	41.3	50.5	97.6	0.7	0.3	1.7	5	silty SAND to sandy SILT	120	4.0	13	10	44	41	-	16
10.66	43.0	52.2	95.0	0.7	0.3	1.6	5	silty SAND to sandy SILT	120	4.0	13	11	46	41	-	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Project ID: Pacific Materials Lab
Data File: SDF(964).cpt
CPT Date: 1/15/2009 3:12:39 PM
GW During Test: 20 ft

Sounding ID: CPT-02
Project No: Cortona Drive
Cone/Rig: DSG1047

Depth ft	qc PS tsf	* qc1n PS -	q1ncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	* Nk -
10.83	51.1	61.5	96.3	0.7	0.3	1.3	5	silty SAND to sandy SILT	120	4.0	15	13	51	42	-	16
10.99	62.9	75.1	112.0	0.9	0.3	1.5	5	silty SAND to sandy SILT	120	4.0	19	16	58	43	-	16
11.16	76.1	90.2	127.8	1.2	0.3	1.6	5	silty SAND to sandy SILT	120	4.0	23	19	64	44	-	16
11.32	74.8	88.0	132.1	1.3	0.3	1.8	5	silty SAND to sandy SILT	120	4.0	22	19	63	43	-	16
11.48	66.7	78.0	129.1	1.3	0.3	2.0	5	silty SAND to sandy SILT	120	4.0	20	17	59	43	-	16
11.65	62.8	73.0	126.8	1.3	0.3	2.1	5	silty SAND to sandy SILT	120	4.0	18	16	57	42	-	16
11.81	60.3	69.5	123.4	1.2	0.3	2.1	5	silty SAND to sandy SILT	120	4.0	17	15	55	42	-	16
11.98	56.3	64.5	116.7	1.1	0.3	2.0	5	silty SAND to sandy SILT	120	4.0	16	14	53	42	-	16
12.14	50.7	57.7	115.3	1.1	0.4	2.2	5	silty SAND to sandy SILT	120	4.0	14	13	49	41	-	16
12.30	39.9	45.0	115.7	1.0	0.4	2.7	4	clayy SILT to silty CLAY	115	2.0	23	20	-	-	2.8	15
12.47	27.8	37.1	-	1.0	0.4	3.6	4	clayy SILT to silty CLAY	115	2.0	19	14	-	-	1.9	15
12.63	22.9	30.2	-	0.9	0.4	4.1	4	clayy SILT to silty CLAY	115	2.0	15	11	-	-	1.6	15
12.80	34.0	37.7	117.6	1.0	0.4	3.2	4	clayy SILT to silty CLAY	115	2.0	19	17	-	-	2.4	15
12.96	45.2	49.8	136.0	1.5	0.4	3.3	4	clayy SILT to silty CLAY	115	2.0	25	23	-	-	3.2	15
13.12	43.0	47.1	139.3	1.5	0.4	3.6	4	clayy SILT to silty CLAY	115	2.0	24	21	-	-	3.0	15
13.29	41.3	45.0	140.3	1.5	0.3	3.8	4	clayy SILT to silty CLAY	115	2.0	22	21	-	-	2.9	15
13.45	37.3	40.4	127.9	1.3	0.3	3.5	4	clayy SILT to silty CLAY	115	2.0	20	19	-	-	2.6	15
13.62	33.1	37.5	123.1	1.1	0.3	3.4	4	clayy SILT to silty CLAY	115	2.0	19	17	-	-	2.3	15
13.78	51.0	54.5	133.2	1.5	0.3	3.0	4	clayy SILT to silty CLAY	115	2.0	27	25	-	-	3.6	15
13.94	51.5	54.8	144.9	1.8	0.3	3.5	4	clayy SILT to silty CLAY	115	2.0	27	26	-	-	3.6	15
14.11	44.8	47.4	149.5	1.8	0.3	4.1	4	clayy SILT to silty CLAY	115	2.0	24	22	-	-	3.1	15
14.27	42.4	44.6	136.0	1.5	0.2	3.6	4	clayy SILT to silty CLAY	115	2.0	22	21	-	-	3.0	15
14.44	36.4	39.7	-	1.4	0.2	3.9	4	clayy SILT to silty CLAY	115	2.0	20	18	-	-	2.5	15
14.60	30.7	35.3	-	1.5	0.2	4.9	3	silty CLAY to CLAY	115	1.5	24	20	-	-	2.1	15
14.76	40.2	45.7	-	1.9	0.2	4.9	4	clayy SILT to silty CLAY	115	2.0	23	20	-	-	2.8	15
14.93	57.0	58.7	178.0	2.6	0.2	4.7	4	clayy SILT to silty CLAY	115	2.0	29	29	-	-	4.0	15
15.09	66.2	67.8	182.2	2.9	0.2	4.4	4	clayy SILT to silty CLAY	115	2.0	34	33	-	-	4.6	15
15.26	64.7	65.9	188.3	3.0	0.2	4.7	4	clayy SILT to silty CLAY	115	2.0	33	32	-	-	4.5	15
15.42	60.8	61.6	190.7	3.0	0.2	5.1	4	clayy SILT to silty CLAY	115	2.0	31	30	-	-	4.3	15
15.58	52.8	53.2	170.6	2.4	0.2	4.7	4	clayy SILT to silty CLAY	115	2.0	27	26	-	-	3.7	15
15.75	50.0	53.4	-	2.5	0.1	5.1	4	clayy SILT to silty CLAY	115	2.0	27	25	-	-	3.5	15
15.91	58.2	58.1	182.3	2.8	0.1	4.9	4	clayy SILT to silty CLAY	115	2.0	29	29	-	-	4.1	15
16.08	64.9	64.4	191.5	3.2	0.1	5.0	4	clayy SILT to silty CLAY	115	2.0	32	32	-	-	4.5	15
16.24	62.7	62.0	188.5	3.1	0.2	5.0	4	clayy SILT to silty CLAY	115	2.0	31	31	-	-	4.4	15
16.40	56.5	55.6	172.1	2.6	0.2	4.6	4	clayy SILT to silty CLAY	115	2.0	28	28	-	-	4.0	15
16.57	41.0	41.7	-	1.9	0.2	4.8	4	clayy SILT to silty CLAY	115	2.0	21	21	-	-	2.9	15
16.73	35.5	35.7	-	1.8	0.2	5.3	3	silty CLAY to CLAY	115	1.5	24	24	-	-	2.5	15
16.90	40.1	40.0	-	1.9	0.2	4.9	3	silty CLAY to CLAY	115	1.5	27	27	-	-	2.8	15
17.06	47.7	47.1	-	2.1	0.2	4.5	4	clayy SILT to silty CLAY	115	2.0	24	24	-	-	3.3	15
17.23	49.6	48.5	-	2.3	0.2	4.8	4	clayy SILT to silty CLAY	115	2.0	24	25	-	-	3.5	15
17.39	75.3	72.0	169.2	2.7	0.2	3.7	4	clayy SILT to silty CLAY	115	2.0	36	38	-	-	5.3	15
17.55	67.6	64.3	159.2	2.4	0.2	3.6	4	clayy SILT to silty CLAY	115	2.0	32	34	-	-	4.7	15
17.72	54.7	51.9	156.5	2.2	0.1	4.1	4	clayy SILT to silty CLAY	115	2.0	26	27	-	-	3.8	15
17.88	118.8	112.1	171.5	2.8	0.1	2.4	5	silty SAND to sandy SILT	120	4.0	28	30	71	44	-	16
18.05	158.1	148.4	200.8	3.5	0.2	2.2	5	silty SAND to sandy SILT	120	4.0	37	40	80	45	-	16
18.21	173.7	162.3	216.8	4.0	0.2	2.3	5	silty SAND to sandy SILT	120	4.0	41	43	83	46	-	16
18.37	195.3	181.7	215.1	3.3	0.2	1.7	6	clean SAND to silty SAND	125	5.0	36	39	87	46	-	16
18.54	205.8	190.6	232.3	4.1	0.2	2.0	6	clean SAND to silty SAND	125	5.0	38	41	88	46	-	16
18.70	231.5	213.4	253.2	4.5	0.5	2.0	6	clean SAND to silty SAND	125	5.0	43	46	92	47	-	16
18.87	270.0	247.7	284.6	5.2	0.5	1.9	6	clean SAND to silty SAND	125	5.0	50	54	95	47	-	16
19.03	299.5	273.6	319.1	6.6	0.6	2.2	6	clean SAND to silty SAND	125	5.0	55	60	95	48	-	16
19.19	330.5	300.6	345.7	7.3	1.0	2.2	6	clean SAND to silty SAND	125	5.0	60	66	95	48	-	16
19.36	324.3	293.6	358.0	8.7	1.0	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	21.4	16
19.52	387.3	349.1	400.7	9.3	1.0	2.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	25.6	16
19.69	378.7	340.0	399.7	9.8	1.1	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	25.0	16
19.85	382.9	342.4	405.9	10.2	1.2	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	25.3	16
20.01	387.0	345.5	398.4	9.4	1.3	2.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	25.6	16
20.18	393.5	350.6	411.2	10.3	1.5	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	26.0	16
20.34	453.7	403.5	445.9	10.3	1.8	2.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	30.0	16
20.51	507.1	450.3	489.4	11.4	2.1	2.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	33.6	16
20.67	512.4	454.1	489.2	11.1	2.5	2.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	33.9	16
20.83	480.4	425.0	462.9	10.5	0.9	2.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	31.8	16
21.00	523.2	462.1	481.5	10.0	0.3	1.9	6	clean SAND to silty SAND	125	5.0	92	100	95	48	-	16
21.16	487.1	429.2	463.6	10.4	0.3	2.1	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	32.2	16
21.33	481.1	423.2	470.7	11.5	0.4	2.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	31.8	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Cortona Drive

Project ID: Pacific Materials Lab
Data File: SDF(964).cpt
CPT Date: 1/15/2009 3:12:39 PM
GW During Test: 20 ft

Sounding ID: CPT-02
Project No: Cortona Drive
Cone/Rig: DSG1047

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	* Nk -
21.49	501.2	440.1	473.2	10.6	0.9	2.1	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	33.2	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

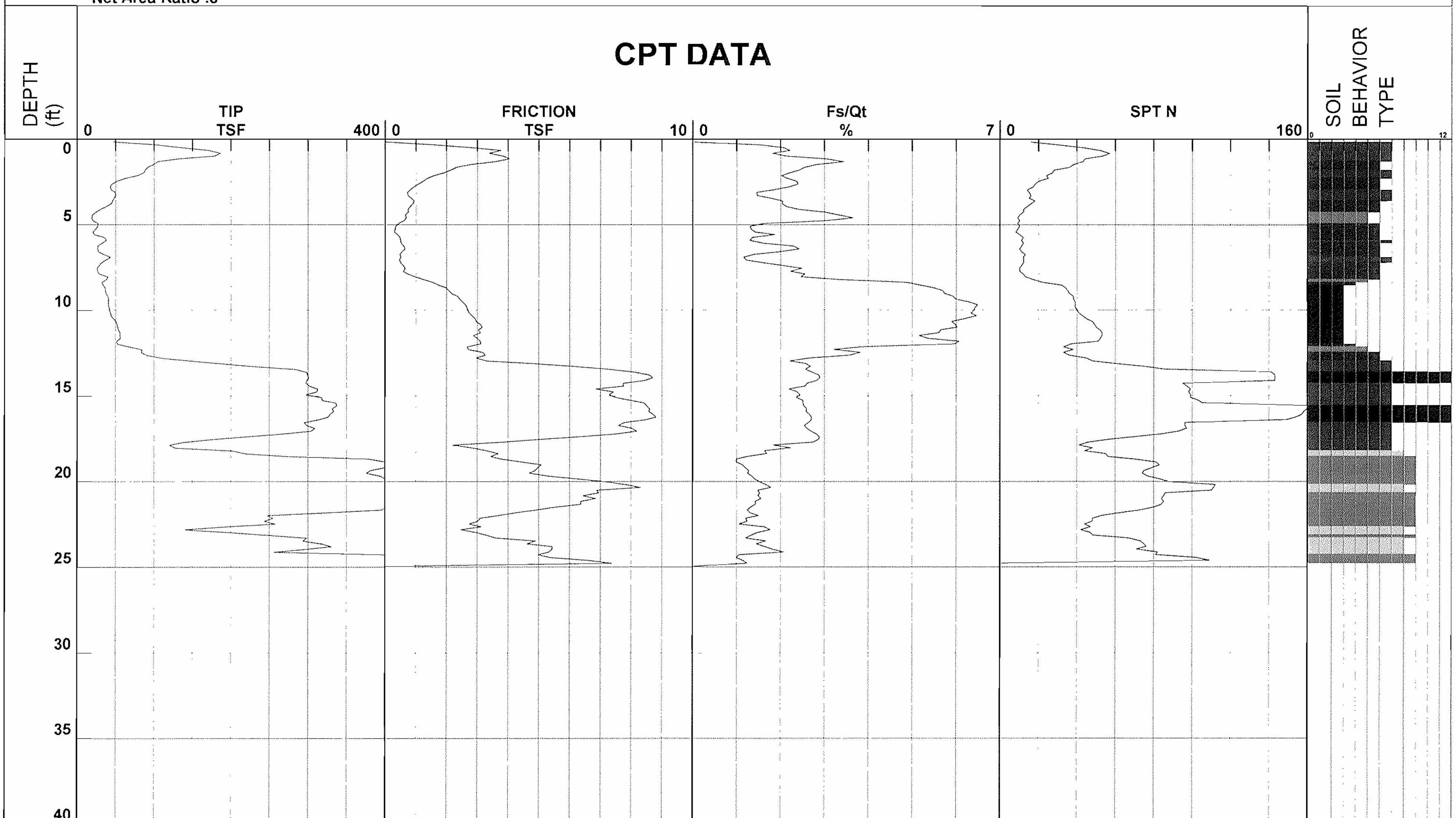
Middle Earth Geo Testing

Pacific Materials Laboratories

Project	Cortona Drive	Operator	JV/EE	Filename	SDF(965).cpt
Job Number	Cortona Drive	Cone Number	DSG1047	GPS	
Hole Number	CPT-03	Date and Time	1/15/2009 3:53:59 PM	Maximum Depth	25.10 ft
Water Table Depth	20.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

*Soil behavior type and SPT based on data from UBC-1983

Cortona Drive

Project ID: Pacific Materials Lab
Data File: SDF(965).cpt
CPT Date: 1/15/2009 3:53:59 PM
GW During Test: 20 ft

Sounding ID: CPT-03
Project No: Cortona Drive
Cone/Rig: DSG1047

. Depth ft	. qc PS tsf	* qcln PS -	. q1ncs PS -	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	* Nk -
0.33	101.9	163.4	192.0	1.6	0.0	1.5	6	clean SAND to silty SAND	125	5.0	33	20	83	48	-	16
0.49	133.8	214.5	257.4	2.8	0.0	2.1	6	clean SAND to silty SAND	125	5.0	43	27	92	48	-	16
0.66	170.2	272.9	318.3	3.8	0.0	2.2	6	clean SAND to silty SAND	125	5.0	55	34	95	48	-	16
0.82	185.6	297.6	326.0	3.4	0.0	1.8	6	clean SAND to silty SAND	125	5.0	60	37	95	48	-	16
0.98	178.1	285.6	328.1	3.8	0.0	2.2	6	clean SAND to silty SAND	125	5.0	57	36	95	48	-	16
1.15	132.7	212.8	292.0	4.0	-0.6	3.0	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	8.8	16
1.31	104.5	167.6	261.2	3.6	-0.6	3.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	6.9	16
1.48	99.1	159.0	230.4	2.8	-0.5	2.8	5	silty SAND to sandy SILT	120	4.0	40	25	82	48	-	16
1.64	91.1	146.1	208.6	2.3	-0.5	2.5	5	silty SAND to sandy SILT	120	4.0	37	23	80	48	-	16
1.80	87.9	141.0	199.7	2.1	-0.5	2.4	5	silty SAND to sandy SILT	120	4.0	35	22	78	48	-	16
1.97	86.6	138.9	190.4	1.9	-0.5	2.2	5	silty SAND to sandy SILT	120	4.0	35	22	78	48	-	16
2.13	78.1	125.3	172.2	1.6	-0.5	2.0	5	silty SAND to sandy SILT	120	4.0	31	20	74	48	-	16
2.30	63.3	101.5	154.6	1.4	-0.5	2.2	5	silty SAND to sandy SILT	120	4.0	25	16	68	48	-	16
2.46	52.0	83.4	144.3	1.2	-0.5	2.4	5	silty SAND to sandy SILT	120	4.0	21	13	61	47	-	16
2.62	45.0	72.2	134.5	1.1	-0.5	2.4	5	silty SAND to sandy SILT	120	4.0	18	11	56	46	-	16
2.79	42.4	67.9	124.8	0.9	-0.5	2.2	5	silty SAND to sandy SILT	120	4.0	17	11	54	45	-	16
2.95	44.1	70.7	117.9	0.8	-0.4	1.8	5	silty SAND to sandy SILT	120	4.0	18	11	56	45	-	16
3.12	49.2	78.9	114.3	0.7	-0.4	1.5	5	silty SAND to sandy SILT	120	4.0	20	12	59	45	-	16
3.28	49.8	79.8	115.4	0.7	-0.4	1.5	5	silty SAND to sandy SILT	120	4.0	20	12	60	45	-	16
3.45	47.8	76.7	121.3	0.8	-0.4	1.8	5	silty SAND to sandy SILT	120	4.0	19	12	58	45	-	16
3.61	45.6	73.1	125.6	0.9	-0.4	2.0	5	silty SAND to sandy SILT	120	4.0	18	11	57	45	-	16
3.77	44.2	70.9	123.7	0.9	-0.4	2.0	5	silty SAND to sandy SILT	120	4.0	18	11	56	44	-	16
3.94	37.9	60.8	117.4	0.8	-0.3	2.2	5	silty SAND to sandy SILT	120	4.0	15	9	51	43	-	16
4.10	30.4	48.7	113.1	0.7	-0.3	2.4	5	silty SAND to sandy SILT	120	4.0	12	8	43	42	-	16
4.27	24.6	39.4	116.2	0.7	-0.3	3.0	4	clayy SILT to silty CLAY	115	2.0	20	12	-	-	1.7	15
4.43	19.7	31.6	-	0.7	-0.3	3.4	4	clayy SILT to silty CLAY	115	2.0	16	10	-	-	1.4	15
4.59	18.5	29.6	-	0.7	-0.3	3.7	4	clayy SILT to silty CLAY	115	2.0	15	9	-	-	1.3	15
4.76	20.0	32.1	-	0.6	-0.3	3.1	4	clayy SILT to silty CLAY	115	2.0	16	10	-	-	1.4	15
4.92	26.6	42.6	88.3	0.4	-0.2	1.6	5	silty SAND to sandy SILT	120	4.0	11	7	39	41	-	16
5.09	26.1	41.8	79.9	0.3	-0.3	1.3	5	silty SAND to sandy SILT	120	4.0	10	7	38	41	-	16
5.25	23.8	38.1	77.5	0.3	-0.3	1.3	5	silty SAND to sandy SILT	120	4.0	10	6	35	40	-	16
5.41	20.3	32.5	75.3	0.3	-0.2	1.4	5	silty SAND to sandy SILT	120	4.0	8	5	30	39	-	16
5.58	21.5	34.5	87.3	0.4	-0.2	1.9	5	silty SAND to sandy SILT	120	4.0	9	5	32	40	-	16
5.74	34.8	55.8	92.5	0.5	-0.3	1.4	5	silty SAND to sandy SILT	120	4.0	14	9	48	42	-	16
5.91	37.7	60.5	94.9	0.5	-0.2	1.3	5	silty SAND to sandy SILT	120	4.0	15	9	50	42	-	16
6.07	32.3	51.9	95.9	0.5	-0.2	1.6	5	silty SAND to sandy SILT	120	4.0	13	8	45	41	-	16
6.23	26.6	42.3	104.5	0.6	-0.2	2.3	5	silty SAND to sandy SILT	120	4.0	11	7	39	40	-	16
6.40	26.3	41.2	106.3	0.6	-0.2	2.5	5	silty SAND to sandy SILT	120	4.0	10	7	38	40	-	16
6.56	27.5	42.6	97.2	0.5	-0.1	2.0	5	silty SAND to sandy SILT	120	4.0	11	7	39	40	-	16
6.73	34.3	52.4	90.8	0.5	-0.1	1.4	5	silty SAND to sandy SILT	120	4.0	13	9	46	41	-	16
6.89	43.3	65.5	95.2	0.5	-0.1	1.2	5	silty SAND to sandy SILT	120	4.0	16	11	53	43	-	16
7.05	37.2	55.6	88.7	0.5	-0.1	1.2	5	silty SAND to sandy SILT	120	4.0	14	9	48	42	-	16
7.22	31.1	45.9	91.5	0.5	-0.1	1.6	5	silty SAND to sandy SILT	120	4.0	11	8	41	41	-	16
7.38	28.1	41.1	98.3	0.6	0.0	2.1	5	silty SAND to sandy SILT	120	4.0	10	7	38	40	-	16
7.55	25.8	37.2	103.9	0.6	0.0	2.5	4	clayy SILT to silty CLAY	115	2.0	19	13	-	-	1.8	15
7.71	26.2	37.4	98.5	0.6	0.0	2.3	5	silty SAND to sandy SILT	120	4.0	9	7	35	39	-	16
7.87	28.6	40.4	108.7	0.7	0.0	2.6	4	clayy SILT to silty CLAY	115	2.0	20	14	-	-	2.0	15
8.04	39.4	55.2	121.1	1.0	0.0	2.5	5	silty SAND to sandy SILT	120	4.0	14	10	47	41	-	16
8.20	37.5	52.0	139.3	1.3	0.0	3.4	4	clayy SILT to silty CLAY	115	2.0	26	19	-	-	2.6	15
8.37	31.8	50.9	-	1.5	0.0	4.9	4	clayy SILT to silty CLAY	115	2.0	25	16	-	-	2.2	15
8.53	33.5	53.8	-	1.7	0.1	5.3	4	clayy SILT to silty CLAY	115	2.0	27	17	-	-	2.3	15
8.69	36.1	58.0	-	2.0	0.1	5.6	4	clayy SILT to silty CLAY	115	2.0	29	18	-	-	2.5	15
8.86	36.5	58.6	-	2.1	0.1	5.8	4	clayy SILT to silty CLAY	115	2.0	29	18	-	-	2.6	15
9.02	37.5	60.1	-	2.1	0.1	5.8	4	clayy SILT to silty CLAY	115	2.0	30	19	-	-	2.6	15
9.19	39.7	63.6	-	2.4	0.1	6.0	4	clayy SILT to silty CLAY	115	2.0	32	20	-	-	2.8	15
9.35	40.5	64.9	-	2.4	0.1	6.1	9	very stiff fine SOIL	120	2.0	32	20	53	41	-	30
9.51	40.1	64.2	-	2.5	0.1	6.4	9	very stiff fine SOIL	120	2.0	32	20	52	41	-	30
9.68	40.3	64.7	-	2.6	0.2	6.6	9	very stiff fine SOIL	120	2.0	32	20	53	41	-	30
9.84	41.3	66.2	-	2.7	0.2	6.5	9	very stiff fine SOIL	120	2.0	33	21	53	41	-	30
10.01	41.9	67.2	-	2.7	0.2	6.5	9	very stiff fine SOIL	120	2.0	34	21	54	41	-	30
10.17	43.2	69.2	-	2.7	0.2	6.4	9	very stiff fine SOIL	120	2.0	35	22	55	41	-	30
10.34	43.9	70.5	-	2.8	0.2	6.5	9	very stiff fine SOIL	120	2.0	35	22	55	41	-	30
10.50	47.2	64.5	-	2.9	0.2	6.3	9	very stiff fine SOIL	120	2.0	32	24	53	41	-	30
10.66	50.2	67.7	219.7	3.0	0.2	6.0	9	very stiff fine SOIL	120	2.0	34	25	54	42	-	30

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Cortona Drive

Project ID: Pacific Materials Lab
Data File: SDF(965).cpt
CPT Date: 1/15/2009 3:53:59 PM
GW During Test: 20 ft

Sounding ID: CPT-03
Project No: Cortona Drive
Cone/Rig: DSG1047

Depth ft	qc PS tsf	* qc1n PS -	q1ncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	* Nk -
10.83	51.9	69.3	224.0	3.1	0.2	6.1	9	very stiff fine SOIL	120	2.0	35	26	55	42	-	30
10.99	52.4	69.2	224.9	3.2	0.2	6.1	9	very stiff fine SOIL	120	2.0	35	26	55	42	-	30
11.16	53.7	64.0	207.8	3.0	0.2	5.7	4	clayy SILT to silty CLAY	115	2.0	32	27	-	-	3.8	15
11.32	55.4	65.5	209.4	3.1	0.2	5.7	4	clayy SILT to silty CLAY	115	2.0	33	28	-	-	3.9	15
11.48	55.5	65.2	198.5	2.9	0.2	5.2	4	clayy SILT to silty CLAY	115	2.0	33	28	-	-	3.9	15
11.65	55.9	65.2	203.5	3.0	0.3	5.4	4	clayy SILT to silty CLAY	115	2.0	33	28	-	-	3.9	15
11.81	51.1	64.3	-	3.1	0.3	6.1	9	very stiff fine SOIL	120	2.0	32	26	52	41	-	30
11.98	52.0	64.8	-	3.1	0.3	6.1	9	very stiff fine SOIL	120	2.0	32	26	53	41	-	30
12.14	69.5	79.4	182.7	2.7	0.3	3.9	4	clayy SILT to silty CLAY	115	2.0	40	35	-	-	4.9	15
12.30	84.2	95.6	182.1	2.7	0.3	3.2	5	silty SAND to sandy SILT	120	4.0	24	21	66	44	-	16
12.47	83.2	93.8	198.2	3.2	0.3	3.8	4	clayy SILT to silty CLAY	115	2.0	47	42	-	-	5.8	15
12.63	90.7	101.7	199.7	3.3	0.3	3.6	5	silty SAND to sandy SILT	120	4.0	25	23	68	44	-	16
12.80	111.5	124.1	192.5	3.0	0.3	2.7	5	silty SAND to sandy SILT	120	4.0	31	28	74	45	-	16
12.96	149.3	165.1	216.4	3.3	0.3	2.2	5	silty SAND to sandy SILT	120	4.0	41	37	84	46	-	16
13.12	187.3	205.9	268.3	4.8	0.3	2.6	5	silty SAND to sandy SILT	120	4.0	51	47	91	47	-	16
13.29	229.8	251.0	316.3	6.2	0.4	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.2	16
13.45	283.4	307.7	367.0	7.3	0.4	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.7	16
13.62	297.9	321.6	387.3	8.1	0.7	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.7	16
13.78	299.1	321.0	393.4	8.6	0.8	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.8	16
13.94	300.6	320.7	394.2	8.7	0.8	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.9	16
14.11	297.8	316.0	386.3	8.4	0.9	2.8	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.7	16
14.27	297.2	313.6	374.2	7.7	0.9	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.7	16
14.44	302.2	317.1	376.0	7.7	1.1	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	20.0	16
14.60	312.3	325.9	368.6	6.8	1.2	2.2	6	clean SAND to silty SAND	125	5.0	65	62	95	48	-	16
14.76	311.2	322.9	373.8	7.4	1.4	2.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	20.6	16
14.93	297.1	306.6	360.9	7.3	2.0	2.5	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.6	16
15.09	317.4	325.8	376.0	7.5	1.9	2.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	21.0	16
15.26	317.9	324.7	381.0	8.0	1.8	2.5	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	21.0	16
15.42	336.0	341.3	397.3	8.4	1.8	2.5	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	22.2	16
15.58	336.6	340.2	396.9	8.5	1.8	2.5	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	22.3	16
15.75	331.1	332.9	393.0	8.6	1.9	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	21.9	16
15.91	332.5	332.7	391.9	8.6	1.9	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	22.0	16
16.08	327.9	326.5	389.4	8.7	1.9	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	21.7	16
16.24	325.2	322.1	387.2	8.8	2.0	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	21.5	16
16.40	313.2	308.8	373.9	8.5	2.1	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	20.7	16
16.57	294.6	289.0	351.7	7.8	2.2	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.5	16
16.73	298.1	291.0	349.8	7.6	2.3	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	19.7	16
16.90	308.5	299.8	360.7	8.0	2.4	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	20.4	16
17.06	303.2	293.2	358.4	8.2	2.4	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	20.0	16
17.23	266.7	256.7	327.2	7.5	2.4	2.8	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	17.6	16
17.39	217.4	208.3	282.4	6.3	2.4	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	14.4	16
17.55	175.6	167.5	241.6	5.0	2.3	2.9	5	silty SAND to sandy SILT	120	4.0	42	44	84	46	-	16
17.72	138.5	131.5	202.6	3.8	2.3	2.8	5	silty SAND to sandy SILT	120	4.0	33	35	76	45	-	16
17.88	119.8	113.2	156.5	2.2	2.3	1.9	5	silty SAND to sandy SILT	120	4.0	28	30	71	44	-	16
18.05	127.5	119.9	174.7	2.8	2.3	2.2	5	silty SAND to sandy SILT	120	4.0	30	32	73	44	-	16
18.21	201.7	188.9	219.4	3.3	2.2	1.6	6	clean SAND to silty SAND	125	5.0	38	40	88	46	-	16
18.37	218.4	203.5	234.4	3.7	1.1	1.7	6	clean SAND to silty SAND	125	5.0	41	44	90	47	-	16
18.54	274.0	254.2	263.3	3.4	0.9	1.3	6	clean SAND to silty SAND	125	5.0	51	55	95	48	-	16
18.70	379.6	350.4	350.4	3.8	0.8	1.0	6	clean SAND to silty SAND	125	5.0	70	76	95	48	-	16
18.87	448.3	411.9	411.9	4.4	0.7	1.0	6	clean SAND to silty SAND	125	5.0	82	90	95	48	-	16
19.03	446.7	408.6	408.6	5.1	0.6	1.1	6	clean SAND to silty SAND	125	5.0	82	89	95	48	-	16
19.19	412.5	375.6	375.6	5.0	0.6	1.2	6	clean SAND to silty SAND	125	5.0	75	83	95	48	-	16
19.36	381.3	345.6	345.6	4.9	0.6	1.3	6	clean SAND to silty SAND	125	5.0	69	76	95	48	-	16
19.52	375.9	339.3	339.3	4.7	0.6	1.3	6	clean SAND to silty SAND	125	5.0	68	75	95	48	-	16
19.69	394.1	354.1	354.1	5.3	0.7	1.4	6	clean SAND to silty SAND	125	5.0	71	79	95	48	-	16
19.85	440.6	394.2	394.2	6.2	0.9	1.4	6	clean SAND to silty SAND	125	5.0	79	88	95	48	-	16
20.01	469.8	419.4	418.0	7.2	1.0	1.5	6	clean SAND to silty SAND	125	5.0	84	94	95	48	-	16
20.18	469.4	418.1	426.6	7.8	1.3	1.7	6	clean SAND to silty SAND	125	5.0	84	94	95	48	-	16
20.34	463.0	411.5	428.6	8.3	1.3	1.8	6	clean SAND to silty SAND	125	5.0	82	93	95	48	-	16
20.51	462.8	410.5	410.5	6.9	1.4	1.5	6	clean SAND to silty SAND	125	5.0	82	93	95	48	-	16
20.67	453.9	401.7	403.5	6.9	1.6	1.5	6	clean SAND to silty SAND	125	5.0	80	91	95	48	-	16
20.83	432.4	381.9	384.0	6.4	1.5	1.5	6	clean SAND to silty SAND	125	5.0	76	86	95	48	-	16
21.00	439.1	387.0	392.9	6.8	1.2	1.6	6	clean SAND to silty SAND	125	5.0	77	88	95	48	-	16
21.16	444.9	391.2	391.2	6.4	1.0	1.4	6	clean SAND to silty SAND	125	5.0	78	89	95	48	-	16
21.33	443.6	389.3	389.3	6.4	0.9	1.4	6	clean SAND to silty SAND	125	5.0	78	89	95	48	-	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Cortona Drive

Project ID: Pacific Materials Lab	Page: 3
Data File: SDF(965).cpt	Sounding ID: CPT-03
CPT Date: 1/15/2009 3:53:59 PM	Project No: Cortona Drive
GW During Test: 20 ft	Cone/Rig: DSG1047

.	.	*	.	.	.	.	*	*	.	.	*	.	*	*	.	*
. Depth ft	qc PS tsf	qcln PS -	q1ncs PS -	Slv Stss tsf	pore prss (psi)	Frct Ratio %	Mat Typ Zon	Material Behavior Description	Unit Wght pcf	Qc to N	SPT R-N1 60%	SPT R-N 60%	Rel Den %	Ftn Ang deg	Und Shr tsf	Nk -
21.49	419.9	367.7	367.7	5.5	0.8	1.3	6	clean SAND to silty SAND	125	5.0	74	84	95	48	-	16
21.65	395.9	346.0	346.0	4.9	0.7	1.2	6	clean SAND to silty SAND	125	5.0	69	79	95	48	-	16
21.82	322.1	280.9	288.9	4.2	0.2	1.3	6	clean SAND to silty SAND	125	5.0	56	64	95	48	-	16
21.98	247.2	215.1	238.7	3.7	0.1	1.5	6	clean SAND to silty SAND	125	5.0	43	49	92	46	-	16
22.15	254.3	220.9	233.0	3.1	0.1	1.2	6	clean SAND to silty SAND	125	5.0	44	51	93	47	-	16
22.31	243.1	210.8	225.5	3.0	0.1	1.3	6	clean SAND to silty SAND	125	5.0	42	49	92	46	-	16
22.47	257.4	222.7	228.0	2.7	0.1	1.1	6	clean SAND to silty SAND	125	5.0	45	51	93	47	-	16
22.64	190.4	164.3	197.0	3.1	0.1	1.7	6	clean SAND to silty SAND	125	5.0	33	38	83	45	-	16
22.80	139.0	119.8	160.4	2.5	0.1	1.8	5	silty SAND to sandy SILT	120	4.0	30	35	73	44	-	16
22.97	199.7	171.7	198.7	3.0	0.2	1.5	6	clean SAND to silty SAND	125	5.0	34	40	85	45	-	16
23.13	246.3	211.3	229.4	3.3	0.3	1.3	6	clean SAND to silty SAND	125	5.0	42	49	92	46	-	16
23.30	298.2	255.4	262.1	3.6	0.3	1.2	6	clean SAND to silty SAND	125	5.0	51	60	95	47	-	16
23.46	293.2	250.6	277.3	4.9	0.2	1.7	6	clean SAND to silty SAND	125	5.0	50	59	95	47	-	16
23.62	317.2	270.6	286.7	4.6	0.2	1.5	6	clean SAND to silty SAND	125	5.0	54	63	95	47	-	16
23.79	329.9	280.9	304.0	5.4	0.2	1.7	6	clean SAND to silty SAND	125	5.0	56	66	95	47	-	16
23.95	299.3	254.3	286.1	5.4	0.2	1.8	6	clean SAND to silty SAND	125	5.0	51	60	95	47	-	16
24.12	255.6	216.8	260.8	5.3	0.2	2.1	6	clean SAND to silty SAND	125	5.0	43	51	93	46	-	16
24.28	470.2	398.0	398.0	5.0	0.1	1.1	6	clean SAND to silty SAND	125	5.0	80	94	95	48	-	16
24.44	541.3	457.3	457.3	5.4	0.1	1.0	6	clean SAND to silty SAND	125	5.0	91	100	95	48	-	16
24.61	579.1	488.3	488.3	6.6	0.1	1.1	6	clean SAND to silty SAND	125	5.0	98	100	95	48	-	16
24.77	592.1	498.2	498.2	7.4	0.4	1.2	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

APPENDIX D

SEISMIC AND LIQUEFACTION ANALYSES

January 28, 2009

Lab No: 82939-2

File No: 09-13053-2

Pacific Materials Laboratory of Santa Barbara, Inc.

SEISMICITY AND LIQUEFACTION ANALYSES

An analysis of the seismicity and potential liquefaction of the site was performed using the computer program FRISKSP and the NCEER 1997 method to determine liquefaction potential.

FRISKSP

FRISKSP is a computer program for the probabilistic estimation of seismic hazard using faults as earthquake sources. The program uses a seismotectonic source model which uses information from nearby faults to estimate seismic hazard at a selected site. The program has been modified, updated, an enhanced from Robin McGuire's original FRISK program (McGuire 1978a) so that FRISKSP has the capability to utilize several of the more recently developed peak horizontal acceleration-attenuation relations. The computation of peak horizontal ground acceleration is based on the closest distance between the site and the ground rupture for each fault in the source model.

Each of the computations was performed using the same attenuation relationship (Campbell & Bozorgnia (1997 Rev.) Hor. – Alluvium).

GROUND MOTIONS

The probabilistic method of seismic analysis was performed using the computer program FRISKSP and the attenuation relationship of Campbell & Bozorgnia (1997 Rev.) Hor. – Alluvium. For a weighted earthquake magnitude of 7.5, the ground acceleration which would have a 10% probability of exceedence within a 50-year time period was determined to be 0.4g. An acceleration of 0.4g was used as the peak acceleration to perform the liquefaction.

LIQUEFACTION ANALYSIS

An analysis of the liquefaction potential of the soils at the site was performed using the computer program LIQUEFY2. The program uses the Seed and Others (1985) semi-empirical procedure for liquefaction analysis based on Standard Penetration Test results and grain-size data.

The input data and results of the analysis are presented on the following pages to the end of this Appendix. Soil profiles based on CPT 1, 2, and 3 were used to model soil conditions at the site.

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*                          *
*      L I Q U E F Y 2     *
*                          *
*       Version 1.50       *
*                          *
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EMPIRICAL PREDICTION OF
EARTHQUAKE-INDUCED LIQUEFACTION POTENTIAL

JOB NUMBER: 13053-2 DATE: 03-09-2009

JOB NAME: 6830 Cortona Drive, CPT-1 (Detailed Strata)

SOIL-PROFILE NAME: 6830CdC1.LDW

BORING GROUNDWATER DEPTH: 20.00 ft

CALCULATION GROUNDWATER DEPTH: 20.00 ft

DESIGN EARTHQUAKE MAGNITUDE: 7.50 Mw

SITE PEAK GROUND ACCELERATION: 0.400 g

BOREHOLE DIAMETER CORRECTION FACTOR: 1.00

SAMPLER SIZE CORRECTION FACTOR: 1.00

N60 HAMMER CORRECTION FACTOR: 1.00

MAGNITUDE SCALING FACTOR METHOD: Idriss (1997, in press)

Magnitude Scaling Factor: 1.000

rd-CORRECTION METHOD: NCEER (1997)

FIELD SPT N-VALUES ARE CORRECTED FOR THE LENGTH OF THE DRIVE RODS.

Rod Stick-Up Above Ground: 3.0 ft

CN NORMALIZATION FACTOR: 1.044 tsf

MINIMUM CN VALUE: 0.6

NCEER [1997] Method

LIQUEFACTION ANALYSIS SUMMARY

File Name: 6830CdC1.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
1	0.25	0.016	0.016	3	3.97	*	*	*	*	*	**
2	0.75	0.046	0.046	7	~	*	*	*	*	*	**
5	1.25	0.077	0.077	18	5.70	*	*	*	*	*	**
7	1.75	0.108	0.108	11	4.91	*	*	*	*	*	**
7	2.25	0.139	0.139	11	4.91	*	*	*	*	*	**
7	2.75	0.171	0.171	11	4.91	*	*	*	*	*	**
8	3.25	0.201	0.201	7	~	*	*	*	*	*	**
8	3.75	0.231	0.231	7	~	*	*	*	*	*	**
9	4.25	0.261	0.261	6	~	*	*	*	*	*	**
9	4.75	0.291	0.291	6	~	*	*	*	*	*	**
10	5.25	0.321	0.321	7	~	*	*	*	*	*	**
11	5.75	0.352	0.352	5	4.09	*	*	*	*	*	**
11	6.25	0.383	0.383	5	4.09	*	*	*	*	*	**
11	6.75	0.414	0.414	5	4.09	*	*	*	*	*	**
12	7.25	0.445	0.445	9	~	*	*	*	*	*	**
12	7.75	0.475	0.475	9	~	*	*	*	*	*	**
13	8.25	0.506	0.506	10	4.40	*	*	*	*	*	**
13	8.75	0.537	0.537	10	4.40	*	*	*	*	*	**
13	9.25	0.568	0.568	10	4.40	*	*	*	*	*	**
14	9.75	0.599	0.599	15	~	*	*	*	*	*	**
15	10.25	0.629	0.629	15	4.80	*	*	*	*	*	**
15	10.75	0.661	0.661	15	4.80	*	*	*	*	*	**
15	11.25	0.692	0.692	15	4.80	*	*	*	*	*	**
15	11.75	0.723	0.723	15	4.80	*	*	*	*	*	**
15	12.25	0.754	0.754	15	4.80	*	*	*	*	*	**
17	12.75	0.786	0.786	23	5.32	*	*	*	*	*	**
18	13.25	0.817	0.817	22	1.31	*	*	*	*	*	**
18	13.75	0.848	0.848	22	1.31	*	*	*	*	*	**
19	14.25	0.879	0.879	20	5.05	*	*	*	*	*	**
20	14.75	0.910	0.910	25	~	*	*	*	*	*	**
20	15.25	0.940	0.940	25	~	*	*	*	*	*	**
20	15.75	0.970	0.970	25	~	*	*	*	*	*	**
20	16.25	1.000	1.000	25	~	*	*	*	*	*	**
20	16.75	1.030	1.030	25	~	*	*	*	*	*	**
20	17.25	1.060	1.060	25	~	*	*	*	*	*	**
22	17.75	1.090	1.090	29	~	*	*	*	*	*	**
24	18.25	1.120	1.120	20	~	*	*	*	*	*	**
26	18.75	1.150	1.150	23	~	*	*	*	*	*	**
28	19.25	1.180	1.180	28	~	*	*	*	*	*	**
29	19.75	1.210	1.210	19	~	*	*	*	*	*	**
29	20.25	1.240	1.232	19	~	~	~	~	~	~	~~
29	20.75	1.270	1.247	19	~	~	~	~	~	~	~~
29	21.25	1.300	1.261	19	~	~	~	~	~	~	~~

File Name: 6830CdC1.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
29	21.75	1.330	1.275	19	~	~	~	~	~	~	~~
29	22.25	1.360	1.290	19	~	~	~	~	~	~	~~
30	22.75	1.390	1.304	21	~	~	~	~	~	~	~~
32	23.25	1.420	1.319	23	~	~	~	~	~	~	~~
33	23.75	1.451	1.334	19	4.93	0.880	21.4	0.225	0.945	0.267	0.84
33	24.25	1.482	1.349	19	4.93	0.880	21.4	0.225	0.943	0.269	0.83
34	24.75	1.512	1.364	29	~	~	~	~	~	~	~~
35	25.25	1.543	1.379	25	5.28	0.870	26.3	0.295	0.941	0.274	1.08
36	25.75	1.574	1.395	67	2.05	0.812	56.8	Infin	0.940	0.276	NonLiq
36	26.25	1.606	1.411	67	2.05	0.812	56.8	Infin	0.939	0.278	NonLiq
36	26.75	1.637	1.426	67	2.05	0.812	56.8	Infin	0.938	0.280	NonLiq
36	27.25	1.668	1.442	67	2.05	0.812	56.8	Infin	0.936	0.282	NonLiq
36	27.75	1.699	1.458	67	2.05	0.812	56.8	Infin	0.935	0.284	NonLiq
36	28.25	1.731	1.473	67	2.05	0.812	56.8	Infin	0.934	0.285	NonLiq
36	28.75	1.762	1.489	67	2.05	0.812	56.8	Infin	0.933	0.287	NonLiq
36	29.25	1.793	1.505	67	2.05	0.812	56.8	Infin	0.932	0.289	NonLiq
36	29.75	1.824	1.520	67	2.05	0.812	56.8	Infin	0.931	0.290	NonLiq
36	30.25	1.856	1.536	67	2.05	0.812	56.8	Infin	0.928	0.291	NonLiq
36	30.75	1.887	1.551	67	2.05	0.812	56.8	Infin	0.924	0.292	NonLiq
36	31.25	1.918	1.567	67	2.05	0.812	56.8	Infin	0.920	0.293	NonLiq
36	31.75	1.949	1.583	67	2.05	0.812	56.8	Infin	0.916	0.293	NonLiq
36	32.25	1.981	1.598	67	2.05	0.812	56.8	Infin	0.912	0.294	NonLiq
36	32.75	2.012	1.614	67	2.05	0.812	56.8	Infin	0.907	0.294	NonLiq
36	33.25	2.043	1.630	67	2.05	0.812	56.8	Infin	0.903	0.294	NonLiq
36	33.75	2.074	1.645	67	2.05	0.812	56.8	Infin	0.899	0.295	NonLiq
36	34.25	2.106	1.661	67	2.05	0.812	56.8	Infin	0.895	0.295	NonLiq
36	34.75	2.137	1.677	67	2.05	0.812	56.8	Infin	0.891	0.295	NonLiq
36	35.25	2.168	1.692	67	2.05	0.812	56.8	Infin	0.887	0.296	NonLiq
36	35.75	2.199	1.708	67	2.05	0.812	56.8	Infin	0.883	0.296	NonLiq
36	36.25	2.231	1.724	67	2.05	0.812	56.8	Infin	0.879	0.296	NonLiq
36	36.75	2.262	1.739	67	2.05	0.812	56.8	Infin	0.875	0.296	NonLiq
36	37.25	2.293	1.755	67	2.05	0.812	56.8	Infin	0.871	0.296	NonLiq
37	37.75	2.324	1.771	100	9.71	0.768	86.5	Infin	0.867	0.296	NonLiq
38	38.25	2.356	1.786	77	2.14	0.765	61.0	Infin	0.863	0.296	NonLiq

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****************************
*                          *
*      L I Q U E F Y 2     *
*                          *
*       Version 1.50       *
*                          *
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EMPIRICAL PREDICTION OF
EARTHQUAKE-INDUCED LIQUEFACTION POTENTIAL

JOB NUMBER: 13053-2 DATE: 03-09-2009

JOB NAME: 6830 Cortona Drive, CPT-1 (Simplified Strata)

SOIL-PROFILE NAME: 6830CsC1.LDW

BORING GROUNDWATER DEPTH: 20.00 ft

CALCULATION GROUNDWATER DEPTH: 20.00 ft

DESIGN EARTHQUAKE MAGNITUDE: 7.50 Mw

SITE PEAK GROUND ACCELERATION: 0.400 g

BOREHOLE DIAMETER CORRECTION FACTOR: 1.00

SAMPLER SIZE CORRECTION FACTOR: 1.00

N60 HAMMER CORRECTION FACTOR: 1.00

MAGNITUDE SCALING FACTOR METHOD: Idriss (1997, in press)

Magnitude Scaling Factor: 1.000

rd-CORRECTION METHOD: NCEER (1997)

FIELD SPT N-VALUES ARE CORRECTED FOR THE LENGTH OF THE DRIVE RODS.

Rod Stick-Up Above Ground: 3.0 ft

CN NORMALIZATION FACTOR: 1.044 tsf

MINIMUM CN VALUE: 0.6

File Name: 6830CsC1.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
1	0.25	0.016	0.016	3	3.97	*	*	*	*	*	**
2	0.75	0.046	0.046	7	~	*	*	*	*	*	**
5	1.25	0.077	0.077	13	5.10	*	*	*	*	*	**
5	1.75	0.108	0.108	13	5.10	*	*	*	*	*	**
5	2.25	0.139	0.139	13	5.10	*	*	*	*	*	**
5	2.75	0.171	0.171	13	5.10	*	*	*	*	*	**
6	3.25	0.201	0.201	7	~	*	*	*	*	*	**
6	3.75	0.231	0.231	7	~	*	*	*	*	*	**
6	4.25	0.261	0.261	7	~	*	*	*	*	*	**
6	4.75	0.291	0.291	7	~	*	*	*	*	*	**
6	5.25	0.321	0.321	7	~	*	*	*	*	*	**
7	5.75	0.352	0.352	5	4.09	*	*	*	*	*	**
7	6.25	0.383	0.383	5	4.09	*	*	*	*	*	**
7	6.75	0.414	0.414	5	4.09	*	*	*	*	*	**
8	7.25	0.445	0.445	9	~	*	*	*	*	*	**
8	7.75	0.475	0.475	9	~	*	*	*	*	*	**
9	8.25	0.506	0.506	10	4.40	*	*	*	*	*	**
9	8.75	0.537	0.537	10	4.40	*	*	*	*	*	**
9	9.25	0.568	0.568	10	4.40	*	*	*	*	*	**
10	9.75	0.599	0.599	15	~	*	*	*	*	*	**
11	10.25	0.629	0.629	18	5.00	*	*	*	*	*	**
11	10.75	0.661	0.661	18	5.00	*	*	*	*	*	**
11	11.25	0.692	0.692	18	5.00	*	*	*	*	*	**
11	11.75	0.723	0.723	18	5.00	*	*	*	*	*	**
11	12.25	0.754	0.754	18	5.00	*	*	*	*	*	**
11	12.75	0.786	0.786	18	5.00	*	*	*	*	*	**
11	13.25	0.817	0.817	18	5.00	*	*	*	*	*	**
11	13.75	0.848	0.848	18	5.00	*	*	*	*	*	**
11	14.25	0.879	0.879	18	5.00	*	*	*	*	*	**
12	14.75	0.910	0.910	25	~	*	*	*	*	*	**
12	15.25	0.940	0.940	25	~	*	*	*	*	*	**
12	15.75	0.970	0.970	25	~	*	*	*	*	*	**
12	16.25	1.000	1.000	25	~	*	*	*	*	*	**
12	16.75	1.030	1.030	25	~	*	*	*	*	*	**
12	17.25	1.060	1.060	25	~	*	*	*	*	*	**
14	17.75	1.090	1.090	21	~	*	*	*	*	*	**
14	18.25	1.120	1.120	21	~	*	*	*	*	*	**
14	18.75	1.150	1.150	21	~	*	*	*	*	*	**
14	19.25	1.180	1.180	21	~	*	*	*	*	*	**
14	19.75	1.210	1.210	21	~	*	*	*	*	*	**
14	20.25	1.240	1.232	21	~	~	~	~	~	~	~~
14	20.75	1.270	1.247	21	~	~	~	~	~	~	~~
14	21.25	1.300	1.261	21	~	~	~	~	~	~	~~

File Name: 6830CsC1.OUT

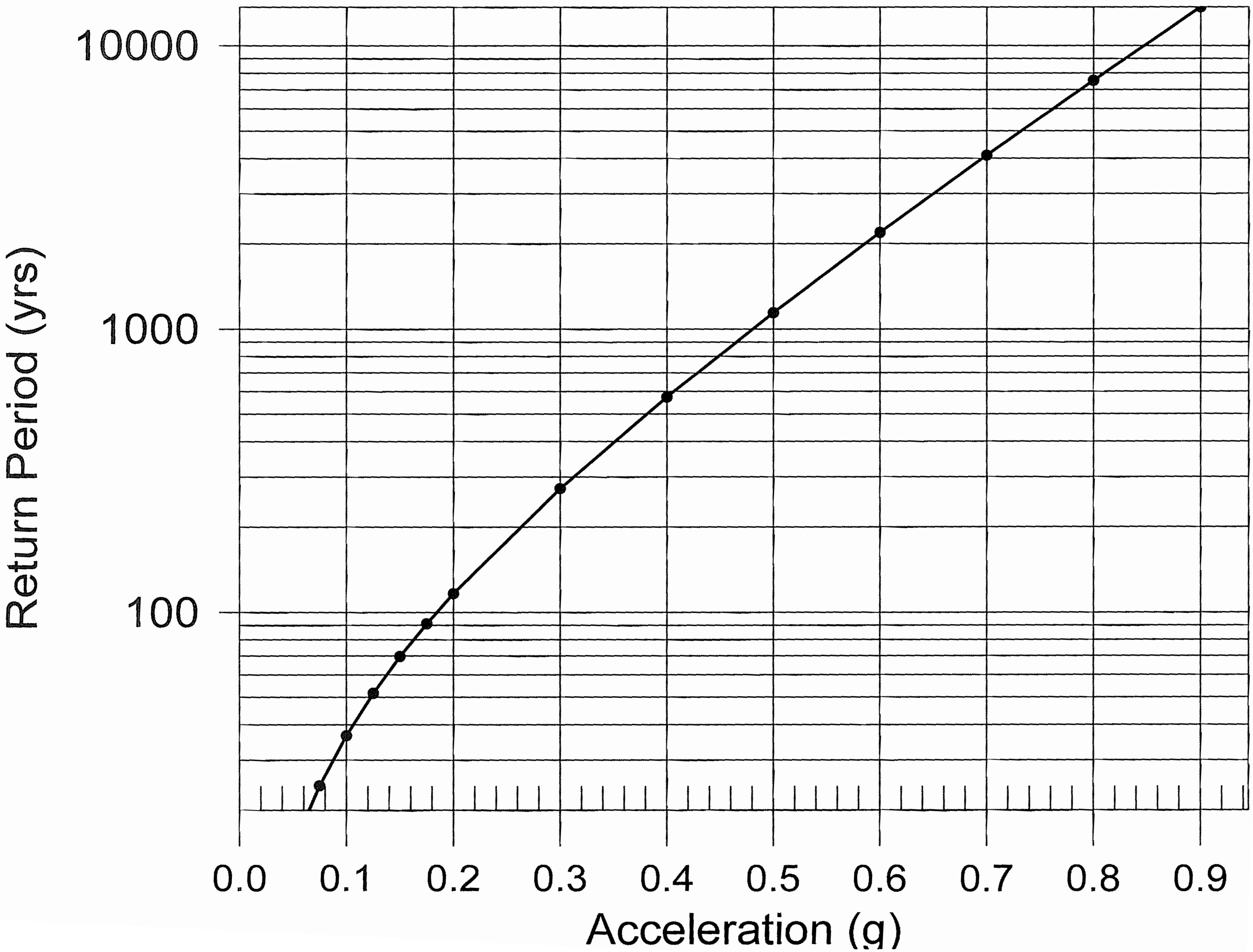
SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
14	21.75	1.330	1.275	21	~	~	~	~	~	~	~~
14	22.25	1.360	1.290	21	~	~	~	~	~	~	~~
14	22.75	1.390	1.304	21	~	~	~	~	~	~	~~
14	23.25	1.420	1.319	21	~	~	~	~	~	~	~~
15	23.75	1.451	1.334	19	4.93	0.880	21.4	0.225	0.945	0.267	0.84
15	24.25	1.482	1.349	19	4.93	0.880	21.4	0.225	0.943	0.269	0.83
16	24.75	1.512	1.364	29	~	~	~	~	~	~	~~
17	25.25	1.543	1.379	68	2.06	0.812	57.1	Infin	0.941	0.274	NonLiq
17	25.75	1.574	1.395	68	2.06	0.812	57.1	Infin	0.940	0.276	NonLiq
17	26.25	1.606	1.411	68	2.06	0.812	57.1	Infin	0.939	0.278	NonLiq
17	26.75	1.637	1.426	68	2.06	0.812	57.1	Infin	0.938	0.280	NonLiq
17	27.25	1.668	1.442	68	2.06	0.812	57.1	Infin	0.936	0.282	NonLiq
17	27.75	1.699	1.458	68	2.06	0.812	57.1	Infin	0.935	0.284	NonLiq
17	28.25	1.731	1.473	68	2.06	0.812	57.1	Infin	0.934	0.285	NonLiq
17	28.75	1.762	1.489	68	2.06	0.812	57.1	Infin	0.933	0.287	NonLiq
17	29.25	1.793	1.505	68	2.06	0.812	57.1	Infin	0.932	0.289	NonLiq
17	29.75	1.824	1.520	68	2.06	0.812	57.1	Infin	0.931	0.290	NonLiq
17	30.25	1.856	1.536	68	2.06	0.812	57.1	Infin	0.928	0.291	NonLiq
17	30.75	1.887	1.551	68	2.06	0.812	57.1	Infin	0.924	0.292	NonLiq
17	31.25	1.918	1.567	68	2.06	0.812	57.1	Infin	0.920	0.293	NonLiq
17	31.75	1.949	1.583	68	2.06	0.812	57.1	Infin	0.916	0.293	NonLiq
17	32.25	1.981	1.598	68	2.06	0.812	57.1	Infin	0.912	0.294	NonLiq
17	32.75	2.012	1.614	68	2.06	0.812	57.1	Infin	0.907	0.294	NonLiq
17	33.25	2.043	1.630	68	2.06	0.812	57.1	Infin	0.903	0.294	NonLiq
17	33.75	2.074	1.645	68	2.06	0.812	57.1	Infin	0.899	0.295	NonLiq
17	34.25	2.106	1.661	68	2.06	0.812	57.1	Infin	0.895	0.295	NonLiq
17	34.75	2.137	1.677	68	2.06	0.812	57.1	Infin	0.891	0.295	NonLiq
17	35.25	2.168	1.692	68	2.06	0.812	57.1	Infin	0.887	0.296	NonLiq
17	35.75	2.199	1.708	68	2.06	0.812	57.1	Infin	0.883	0.296	NonLiq
17	36.25	2.231	1.724	68	2.06	0.812	57.1	Infin	0.879	0.296	NonLiq
17	36.75	2.262	1.739	68	2.06	0.812	57.1	Infin	0.875	0.296	NonLiq
17	37.25	2.293	1.755	68	2.06	0.812	57.1	Infin	0.871	0.296	NonLiq
17	37.75	2.324	1.771	68	2.06	0.812	57.1	Infin	0.867	0.296	NonLiq
17	38.25	2.356	1.786	68	2.06	0.812	57.1	Infin	0.863	0.296	NonLiq

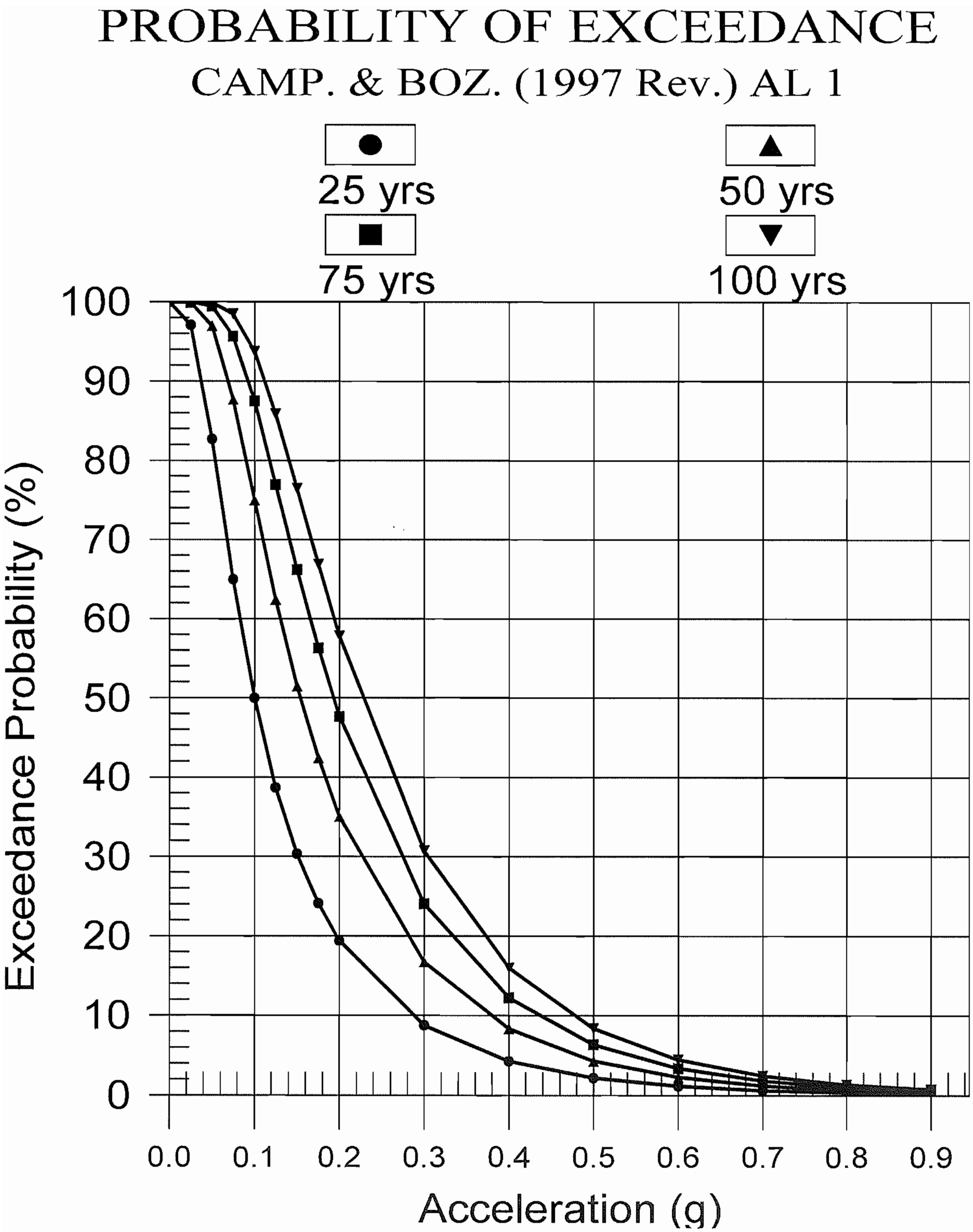
```
****************************************
*                                      *
*        FRISKSP - IBM-PC VERSION      *
*                                      *
*  Modified from *FRISK* (McGuire 1978)  *
*   To Perform Probabilistic Earthquake  *
*  Hazard Analyses Using Multiple Forms  *
* of Ground-Motion-Attenuation Relations *
*                                      *
*   Modifications by:  Thomas F. Blake   *
*              - 1988-2000 -           *
*                                      *
*              VERSION 4.00            *
*            (Visual Fortran)          *
****************************************
```

```
 TITLE: 6830 Cortona Drive

 IPR_FILE
  0

 IPLOT
  0

 SITE CONDITION
  0.00

 BASEMENT     DEPTH (km)
  5.00

 RHGA FACTOR     RHGA DIST (km)
     1.000            0.000

 NFLT  NSITE   NPROB   NATT     LCD
 30      1       2       6       1

PROBLEM DATA:

 CAMP. & BOZ. (1997 Rev.) AL 1    AMPLITUDES:
     15         0.025    0.050    0.075    0.100    0.125    0.150    0.175
0.200    0.300    0.400
                0.500    0.600    0.700    0.800    0.900

     MAGNITUDE WEIGHTING FACTORS:     MWF:   1    MWF MAGNITUDE:     7.50

 CAMP. & BOZ. (1997 Rev.) AL 2    AMPLITUDES:
     15         0.025    0.050    0.075    0.100    0.125    0.150    0.175
0.200    0.300    0.400
                0.500    0.600    0.700    0.800    0.900

     MAGNITUDE WEIGHTING FACTORS:     MWF:   1    MWF MAGNITUDE:     7.50

 RISKS SPECIFIED:
   5     0.013900  0.010000  0.005000  0.002105  0.001000

 SITE COORDINATES:
  1    -119.8685   34.4335
```

RETURN PERIOD vs. ACCELERATION

CAMP. & BOZ. (1997 Rev.) AL 1




PROBABILITY OF EXCEEDANCE
CAMP. & BOZ. (1997 Rev.) AL 1
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Acceleration (g)

PRELIMINARY SOIL ENGINEERING AND GEOLOGIC HAZARDS EVALUATION
8.82 ACRE BERMANT PARCEL

Cortona Drive
Goleta, California
January 23, 1998

HOOVER & ASSOCIATES, INC.

HOOVER & ASSOCIATES, INC. Geologists • Hydrologists

800 GARDEN STREET, SUITE L • SANTA BARBARA, CALIFORNIA 93101 • (805) 965-3045 – FAX (805) 966-5661

January 23, 1998

Bermant Development Company
5383 Hollister Ave #150
Santa Barbara CA 93111

Attn: Mr. Tom Carey

Subject: Soil Engineering and
Geologic Hazards Evaluation
Proposed Commercial Development
8 acre parcel/Cortona Drive
(APN 73-140-16)
Goleta, California

Gentlemen:

INTRODUCTION

This report presents our findings, conclusions and recommendations concerning soil and geologic conditions at the 8.82-acre property (APN 73-140-16) located on Cortona Drive, in Goleta, California (see Plate 1 - Location Map). It is our understanding that this site is to be developed as commercial light industrial or office space in a manner similar to the Poliquin Kellogg Design Group conceptual development plan, dated January 8, 1998 that you provided us. The Poliquin Kellogg plan shows the footprint of 6 one and two story structures 13,100 square feet to 45,010 square feet in size, spaced around a smaller shower/bathroom structure located near the center of the site. It is our understanding that there is no site grading plan available at the present time.

The general purpose of our investigation was to provide a preliminary geologic hazards and soil engineering evaluation of the site, identify adverse soil conditions and geologic hazards that may affect the location and design of the proposed building footprints shown on the Poliquin Kellogg plan, and to provide sufficient information so that the applicant and project engineer can avoid adverse soil or geologic conditions that may be identified during our investigation. Additional investigations may be required for areas with special problems after specific building plans are formulated, including grading, structural load and foundation design.

Our investigation has been conducted in accordance with our proposal dated November 12, 1997, pertinent provisions of "Desired Contents of Geologic Reports submitted to Santa Barbara County," and with California Division of Mines and Geology Guideline #44, "Recommended Guidelines for Preparing Engineering Geologic Reports".

Scope of Services

The scope of services provided during the course of this investigation included:

- Review of pertinent, available geotechnical reports and maps (see Previous Work and references).
- Field mapping of geologic rock units and geologic structures.
- Analysis of aerial photographs for geologic hazards (primarily faults).
- Subsurface exploration utilizing continuous flight drilled auger.
- Logging of the exploratory borings including collection of representative soil materials from the boreholes.

- Laboratory testing of representative soil samples obtained during the subsurface exploration.
- Geologic and soil engineering analysis of field and laboratory data.
- Preparation of a summary report presenting our findings, conclusions, and recommendations.

PREVIOUS WORK

We know of now previous site-specific geologic or soil engineering studies of the subject site. Any report(s) that may have been performed for the adjacent Joslyn facility were not made available to us.

It is our understanding that some grading was performed at the site in 1994 to 1995 by Caltrans as part of the expansion of the Storke Road overpass. An expanded fill slope was constructed adjacent to and a short distance across the western boundary of the property, as shown on Plate 2 - Geologic Map (located in the pocket following the text). The fill slope affects a very small portion of the site and does not overlie the area proposed for development. Caltrans also used the property to temporarily stockpile fill soils and construction materials and equipment during the same period. At the end of Caltrans' work, reportedly less than 50 cubic yards of fill material remained from the stockpile and that material was spread out near the southern end of the site (Mike Mortensen, personal communication). Some areas of remnant fill material were noted and mapped as "Qaf" as shown on Plate 2.

SITE CONDITIONS

Historic Land Use

The site was historically used for farmworker housing and agricultural operations, including an orchard and row crops maintained by the Bishop Ranch. The housing and the plantings were removed prior to the mid 1960's, when urbanization of the area began. The southern portion of the site was the northern fringe of the Goleta Slough prior to development of the western Goleta Valley. There are no structures currently on the property.

A small area of palm and pine trees exists near the eastern boundary of the property. Most of the remaining vegetation consists of low grasses and small shrubs.

Topography

The majority of this site can be generally characterized as nearly flat, sloping between 3% and 1%. The steepest slope is a 50% (2:1) slope of limited extent located near the southern property boundary, and the previously mentioned 2:1 (horizontal to vertical) Caltrans fill slope that is part of the Storke Road overpass located in the northwest corner of the property (see Plate 2). The portion of the site that is intended to be developed is generally comprised of slopes less than 5%.

Drainage

Surface water runoff at this site is generally to the south and east via sheet flow. Flooding and flood control measures are to be calculated by the project engineer and are not part of this report.

Ground Water

In late 1997, ground water was found in borings at depths of 15 to over 21.5 feet below land surface. Please see Plate 2 for the location of the soil borings; the boring logs are located in the Appendix.

The deeper aquifers underlying this site comprise a portion of the West Sub-Basin of the Goleta Groundwater Basin, which is utilized by municipal and private pumpers. Groundwater was encountered in the soil borings at elevations 15 to 20 feet higher than the groundwater elevations measured in monitoring wells on adjacent parcels (Joslyn), indicating perched groundwater and a confined or semi-confined groundwater aquifer at this time.

GEOLOGY

Regional Setting

The project site overlies a sedimentary sequence of unconsolidated Pliocene through Holocene-age alluvial deposits comprising younger and older alluvium and the Santa Barbara Formation. The underlying alluvial sequence is bounded on the north by the foothills of the Santa Ynez Mountains, a portion of the Transverse Range Province. The underlying basin is bounded on the south by the More Ranch Fault and smaller northwest and east-west trending faults. Please see Plate 3 - Regional Fault Map and Plate 4 - Geologic Cross-Section. Some investigators believe that the More Ranch Fault is active, but it has not been designated as a special studies zone by the state, and no data has been found to demonstrate that the More Ranch is seismically active. The nearest active fault is the North Channel Slope fault located offshore four miles to the south of the site. The nearest Alquist-Priolo Studies zone is over 20 miles southeast of this site onshore on the Pitas Point quadrangle (Pitas Point/Red Mountain faults).

Site Geology: Lithology

Three geologic units are exposed on the surface of the property. The areal extent of each unit is shown on Plate 2 - Geologic Map. The relationship between the rock units is best seen on Plate 4 - Geologic Cross-Section, including an older fourth unit underlying the Quaternary deposits. From oldest to youngest, these rock units are described below:

Santa Barbara Formation (Qsb)

Data from nearsite wells indicates the Plio-Pleistocence age Santa Barbara Formation underlies the entire site from a depth of 50 to 400 feet (approximate). The Santa Barbara Formation is of marine origin and is composed of unconsolidated sand, silt, and clay.

Older Alluvium(Qoa)

The surface deposits in the west portion of the site are inferred to be part of a diverse unit called older alluvium. The older alluvium is comprised of upper Pleistocene-age stream alluvium and slough deposits that, in appearance and lithology, are very similar to recent alluvium. The older alluvium at this site varies from a brown sand to a sandy clay. The older alluvium overlies the Santa Barbara Formation and is probably less than 50 feet thick at this site.

Younger Alluvium (Qal)

The eastern portions of the site are underlain by younger alluvium and slough deposits (Plate 2). The composition of the alluvium varies from a black to dark brown sandy clay and clayey sand to a brown sand. The younger alluvium is similar in appearance to the older alluvium and is primarily differentiated by the density of the materials as measured by blow counts of the soil sampler tool. The alluvium appears to be about 30 feet thick where encountered in B-11, where it overlies the older alluvium and the Santa Barbara Formation.

Artificial fill (Qaf)

Fill soils at this site were reportedly derived from materials imported for the Caltrans Storke Road project. Please see Plate 2 for mapped approximate locations of artificial fill. The stability of the fill slope constructed by Caltrans adjacent to Storke Road has not been determined as part of this investigation since it is located primarily offsite. A separate area of artificial fill appears to be mounded near the northern and southwestern property lines.

Site Geology: Structure

Quaternary and upper Tertiary-age units have been deposited on flat or gently dipping erosion surfaces of the older Tertiary-age rock units as shown on Plate 4-Geologic Cross-Section. Structure within the older alluvium and alluvium consist of horizontal lying beds, although stratification is often indistinct within these units.

East-west trending faults were suspected to exist by previous investigations (Upson, 1951; Herron, 1974) under or near the site on the basis of extrapolated information. The location of the nearby fault mapped by Upson is shown on Plate 3 of this report. Its suspected location is over 1/8 mile north of the subject 8-acre Bermant parcel. In-house data supports the existence of a subsurface feature demonstrating vertical offset, with the south side of the suspected fault displaced upward relative to the north side ("south side up" feature), in the area of Upson's fault. Upson's map does not, however, indicate the displacement of Pleistocene-age or younger material, therefore, if this fault exists, it may be inactive.

Herron's data is based on an interpretation of oil well logs, including the nearby Texaco "Bishop A1" and "A3" logs. Although Herron's cross section C-C' shows subsurface faulting beneath or adjacent to the Bermant site, his two fault features do not demonstrate offset of materials younger than Miocene-age. Herron's surface fault map does not show faults on or near the Bermant site.

The Santa Barbara County Seismic Safety Element (Moore and Taber, 1974) recognizes Upson's fault as a possible extension of the Las Varas Fault, however the map contained in that document does not indicate the existence of the suspected fault any closer than 1/8 mile north of the site. Subsequent editions of the county seismic safety element (1979 and 1993, draft) provide no new data on the suspected extension of the Las Varas Fault or the fault(s) theorized by Herron.

In addition to the previous investigations discussed above, previous studies conducted by this office (Hoover & Associates, 1982 and 1996) were reviewed for any evidence indicating that a fault may exist on the site.

No data were found to support the existence of an active, or potentially active faults that present a surface rupture hazard on the site.

INVESTIGATION

Analysis of Aerial Photographs

Prior to and during the geologic field investigation we analyzed aerial photographs from surveys flown in 1972 and 1995 by Pacific Western Aerial Surveys for the purpose of investigating the presence of faults mapped by Herron and Upson (op cit). The specific photos examined were PW - 55010-66, -67, and -95 through -98 from January 17, 1995, and PW - SB1 - 28, -29, -31, and -33 from November 2, 1972.

Magnified and stereoscopic evaluation of the photos revealed no distinctive fault related landforms or features on the project site. An attempt was made to trace an extension of the branch of the Eagle Fault ("Las Varas Fault") which offsets Tertiary sediments as mapped approximately 4 miles west of the subject site (Dibblee, 1966). No fault features associated with Dibblee's Eagle Fault branch or Herron's fault(s) were evident on or near the subject site in the photos.

Subsurface Exploration

In order to collect subsurface data and samples for laboratory analysis, seven borings (B-1 to B-6 and B-11) were drilled and sampled to depths ranging from 20 to 30 feet. Boring logs are located in the Appendix. The approximate locations of the borings are shown on Plate 2 - Geologic Map. The borings were advanced using an 8-inch diameter, hollow-stem continuous flight auger.

The subsurface exploration was supervised by a California Certified Engineering Geologist. Bulk and relatively undisturbed samples were obtained for laboratory testing. The soils were classified visually according to the Unified Soil Classification System.

Classifications are shown on the boring logs included in the Appendix. The site is generally characterized by interbedded sands and clays.

Laboratory Testing

Laboratory testing was performed on representative bulk and relatively undisturbed samples obtained from the test borings. The following tests were performed:

* Dry Density and Moisture Content (ASTM: D2216)
* Consolidation (ASTM: D2435)
* Expansion (ASTM:D 4829)
* No. 200 Sieve (ASTM:D 1140)
* Atterberg Limits (ASTM:D 4318)
* Maximum Dry Density/Optimum Moisture Content (ASTM:D 1557-91)
* Direct Shear (ASTM:D 3080)
* R-Value (Cal-Trans 301-F)

Results of the laboratory tests are included in the appendix.

POTENTIAL GEOLOGIC HAZARDS

Faulting

Potentially active faults are those that have moved during the last 2.5 million years but not during the last 10,000 years, while **active** faults show evidence of movement within the last 10,000 years. The County's land use policy is to preclude building over either of these two types of faults, although only active faults are considered by the State of California for setback of human occupied structures (Alquist-Priolo Special Studies Zone Act of 1972).

Neither active or potentially active faults were mapped at this site by previous investigations (Upson, 1951; Dibblee, 1966;). No faults were found at this site by Hoover & Associates during the course of this study. It is therefore our opinion that there is no significant hazard related to fault rupture at this site.

Ground Shaking

Severe ground shaking during earthquakes is a hazard endemic to most of California. Several earthquakes of Richter magnitude 6 (or larger) have been recorded in the Goleta area in recent historic times. The largest earthquake to affect this site was probably the Santa Barbara earthquake in 1925. That earthquake, which occurred prior to instrumentation for seismic events, probably caused site shaking on the order of 0.3g at this site (Hoover & Associates 1978 and Staal, Gardner, & Dunne 1986). Future seismic events could produce ground accelerations on the order of .37g to .53g in the general vicinity of the site (Hoover & Associates 1982, 1996 and Staal, Gardner, & Dunne 1986). Ground acceleration of that magnitude would probably be related to an active offshore fault. The most common design parameter for the types of private commercial structures proposed at this site is a seismic event that has a 50% likelihood of occurrence within 50 years. That event would yield a .37g ground acceleration at this site.

Liquefaction

Liquefaction is the loss of shear strength in loose, saturated, granular soils caused by severe ground shaking during an earthquake. Low lying alluvial areas where ground water is present near the ground surface are typically susceptible to liquefaction (sand boils, etc.). At this site, the liquefaction appears unlikely due to the clayey nature of the near-surface soils.

Artificial Fill

The major areas of unengineered artificial fill are shown on Plate 2 - Geologic Map. There may be other areas of unengineered fill not shown on Plate 2. Furthermore, test pits excavated as part of an archaeological investigation of the site have not been mapped on Plate 2, but it is our understanding that their location was surveyed by the archeologist. In addition to the mapped areas of unengineered fill, any unengineered fills found by subsequent investigation will require removal and replacement as compacted fill if structural improvements are planned over the fill.

Expansive Soils

Expansive clay soils are present. Recommendations to mitigate this geologic hazard are included in subsequent sections of this report. Following grading, additional expansion testing should be performed to determine the expansion potential of the soils at finished grade.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our soils and geologic hazards evaluation, we conclude that the proposed development of the project site is feasible with regard to geotechnical aspects, provided the following conclusions and recommendations are incorporated into the project plans and specifications.

Once grading and structural plans are prepared, they should be reviewed by the geotechnical consultant and any necessary additional geotechnical exploration performed to confirm anticipated conditions and provide additional recommendations as necessary.

Faults

No faults were found at this site. No recommendations are required.

Seismic Shaking

The hazard associated with seismic shaking will occur throughout the property. The areas underlain by alluvium will be more susceptible to earthquake induced soil failure (see Liquefaction and Settlement below). There is nothing particular to this site that will result in seismic shaking more severe than at most other sites in the county with the exception noted above. Structures should be built to withstand peak ground accelerations of .37g to .52g. The most common design parameter for these types of commercial structures is a 50% likelihood of occurrence in 50 years which yields a peak ground acceleration of .37g. That event has a recurrence interval of 129 years.

Liquefaction

Liquefaction is considered unlikely. No recommendations are required.

Artificial Fill

Existing artificial Fill will be removed and replaced. Refer to grading and earthwork recommendations.

Expansive Hazards

Refer to foundation and slab recommendation for mitigation of this geologic hazard.

Other Hazards

Other geologic hazards such as high groundwater, landslides, volcanism, tsunamis, etc. have been evaluated and found not to exist.

Slope Stability

Cut and fill slopes should be constructed at 2:1 (horizontal to vertical) or flatter.

Grading and Earthwork

Site grading should be performed in accordance with the following recommendations:

1. Observation

Continuous observation by the geotechnical team (soil engineer and engineering geologist) during grading is essential to confirm conditions anticipated by the preliminary investigation and to provide data to adjust designs to actual conditions revealed by grading.

2. Clearing and Grubbing

Prior to grading, vegetation and miscellaneous debris should be cleared and removed from the site. Holes resulting from the removal of buried obstructions, which extend below finished site grades, should be replaced with compacted fill. In the event that abandoned cesspools, septic tanks or storage tanks are discovered during the excavation of the site, they should be removed and backfilled in accordance with local regulations. Existing utility lines should be removed and capped in accordance with the local requirements.

3. Treatment of Surface Soils

Prior to the placement of fill and/or construction of improvements, all artificial fill and loose/disturbed near surface soils should be removed to down to firm natural ground. We anticipate soil removals of from 1 to 2 feet over the entire site. The actual depth and extent of removals should be determined by the geotechnical consultant during grading.

4. Scarification

All areas to receive fill should, after the required excavations have been made, be scarified to a minimum depth of 6 to 8 inches, brought to near optimum moisture content and compacted to at least 90 percent relative compaction. (ASTM: D1557-91).

5. Compacted Fill

Fill soils should be compacted by mechanical means in uniform horizontal lifts of 6 to 8 inches in thickness. All fill should be compacted to a minimum relative compaction of 90 percent based upon ASTM:D 1557-91. The on-site materials are suitable for use as compacted fill, provided rock fragments over 6 inches in dimension and other perishable or unsuitable materials are excluded from the fill. All grading and compaction should be observed and tested by the Geotechnical Engineer..

6. Over-excavation of Building Pads

Transition building pads where buildings will partially be underlain by compacted fill and partially by bedrock or native ground may require over-excavation of the cut portion to eliminate the transition and reduce possible differential settlement. This determination should be made by the geotechnical consultant on a pad by pad basis during grading.

7. Foundation and Slab Recommendations

Foundation and slab recommendations should be provided on a building-by-building basis following grading and when final building loads and locations have been determined. The following recommendations are provided for preliminary design purposes and assume that soils with a medium to high expansion potential will be exposed at finish site grades.

Footings founded in bedrock firm native ground or compacted fill may be designed for a dead plus live load bearing value of 2000 pounds per square foot for continuous footings and 2250 pounds per square foot for spread footings. These values may be increased by one-third for wind and seismic loads. A lateral bearing value of 250 pounds per square foot per foot of depth and a coefficient of friction between concrete and soil of 0.3 may be assumed. These values assume that footings will be poured neat against foundations soils.

Footings should have a minimum width of 15 inches and extend to a minimum depth of 24 inches below lowest adjacent finished grade. A 24 inch deep continuous footing or grade beam should be placed around the perimeter of structures as a moisture barrier. Reinforcing steel consisting of a minimum of four No. 5 bars, two placed near the top and two near the bottom, is recommended in continuous footings/grade beams. All footing/grade beam excavations should be observed by the geotechnical consultant prior to the placement of reinforcing steel to verify that the footings/grade beams are founded in competent bearing materials.

Floor slabs may be supported on bedrock or compacted fill soils. Slabs should be at least 5-1/2 inches thick with minimum reinforcing consisting of No. 4 bars placed at 18 inches on center (two directions) and placed on chairs so that the reinforcing steel is in the center of the slab. Slabs should be underlain by a 4-inch layer of clean sand. Slab subgrade soils should be thoroughly moistened prior to pouring concrete. If moisture sensitive floor coverings are planned, post-construction measures may be necessary to ensure that moisture vapor emission through the floor slab is compatible with the desired floor covering.

8. Retaining Walls

Retaining walls free to rotate (cantilevered walls) should be designed for an active pressure of 50 pounds per cubic foot, equivalent fluid pressure, assuming level backfill consisting of on-site soils. Walls restrained from movement at the top should be designed for an additional uniform soils pressure of 8xH pounds per square foot where H is the height of the wall in feet. Any additional surcharge pressures behind the wall should be added to these values. Retaining wall footings should be designed in accordance with the previous building foundation recommendations. Retaining walls should be provided with adequate drainage to prevent buildup of hydrostatic pressure and should be adequately waterproofed.

9. Trench and Retaining Wall Backfill

All trench and retaining wall backfill should be compacted to at least 90 percent relative compaction and tested by the Geotechnical Engineer.

10. Concrete Flatwork

The concrete slab-on-grade patio areas or walkways should be at least 4-inches thick (actual) and reinforced with No. 3 bars placed at 18-inches on center (two directions) and placed on chairs so that the reinforcement is in the center of the slab. Slab subgrade should be thoroughly moistened prior to placement of concrete. Contraction joints should be provided at 8 feet spacings (maximum).

11. Pavements

Based on an R-value of 15 and an assumed traffic index of 5.5, the following pavement section may be utilized for preliminary design purposes:

3 inches of asphalt concrete over 10 inches
of class 2 aggregate base.

The pavement subgrade should be compacted to 90% and the aggregate base to 95% relative compaction.

12. Site Drainage

The following recommendations are intended to minimize the potential adverse effects of water on the structures and appurtenances.

a) Consideration should be given to providing the structures with roof gutters and down-spouts connected to tight line discharge systems.

b) Al site drainage should be directed away from structures.

c) No landscaping should be allowed against foundations. Moisture accumulation or watering adjacent to foundations can result in deterioration of wood/stucco and may effect footing performance.

d) Irrigated areas should not be over-watered. Irrigation should be limited to that required to maintain the vegetation. Additionally, automatic systems should be seasonally adjusted to minimize over-saturation potential particularly in the winter (rainy) season.

e) All slope, yard, and roof drains should be periodically checked to verify they are not blocked and flow properly. This may be accomplished either visually or, in the case of subsurface drains, placing a hose at the inlet and checking the outlet for flow.

Grading and Foundation Plan Review

Grading and foundation plans should be reviewed by the geotechnical consultant to confirm conformance with the recommendations presented herein and to modify the recommendations as necessary.

* * * * *

This opportunity to be of service is sincerely appreciated. If we can be of further assistance on this project, please contact us.

Sincerely,
HOOVER & ASSOCIATES, INC.

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Geotechnical Engineer
State of California, #397

MFH/SC/MDH/
bermrl.doc

Enclosures:
Plates (4)
Appendices

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File 676-002

Portions of the U.S.G.S. "Dos Pueblos" and "Goleta" 7.5' Quadrangles

PROJECT LOCATION MAP
BERMANT DEVELOPMENT CORPORATION
8.82 ACRE PARCEL/CORTONA DRIVE
APN 73-140-16
GOLETA, CALIFORNIA

N

SCALE IN FEET

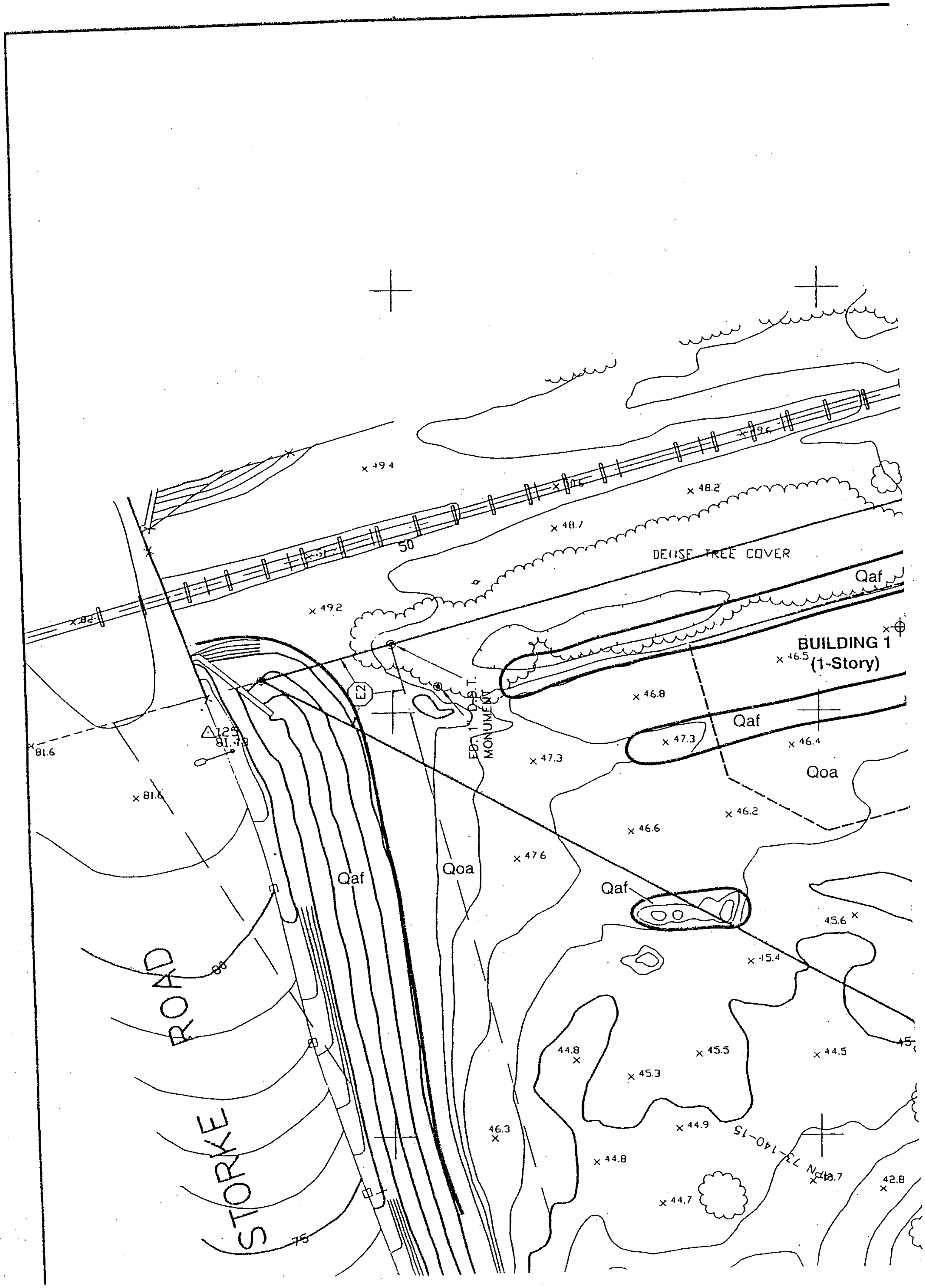
0 2000 4000

HOOVER & ASSOCIATES, INC.
Geologists • Hydrologists

Date 1-16-98

By DAS

Plate 1



DENSE TREE COVER
BUILDING 1
(1-Story)
Qaf
Qoa
STORKE ROAD
FD. 1" D.B.T. MONUMENT
E2
N 73-140-15
50
75
x 49.4
x 48.2
x 48.7
x 49.2
x 46.5
x 46.8
x 47.3
x 46.4
x 46.2
x 46.6
x 47.6
x 45.6
x 45.4
x 44.8
x 45.5
x 44.5
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x 44.9
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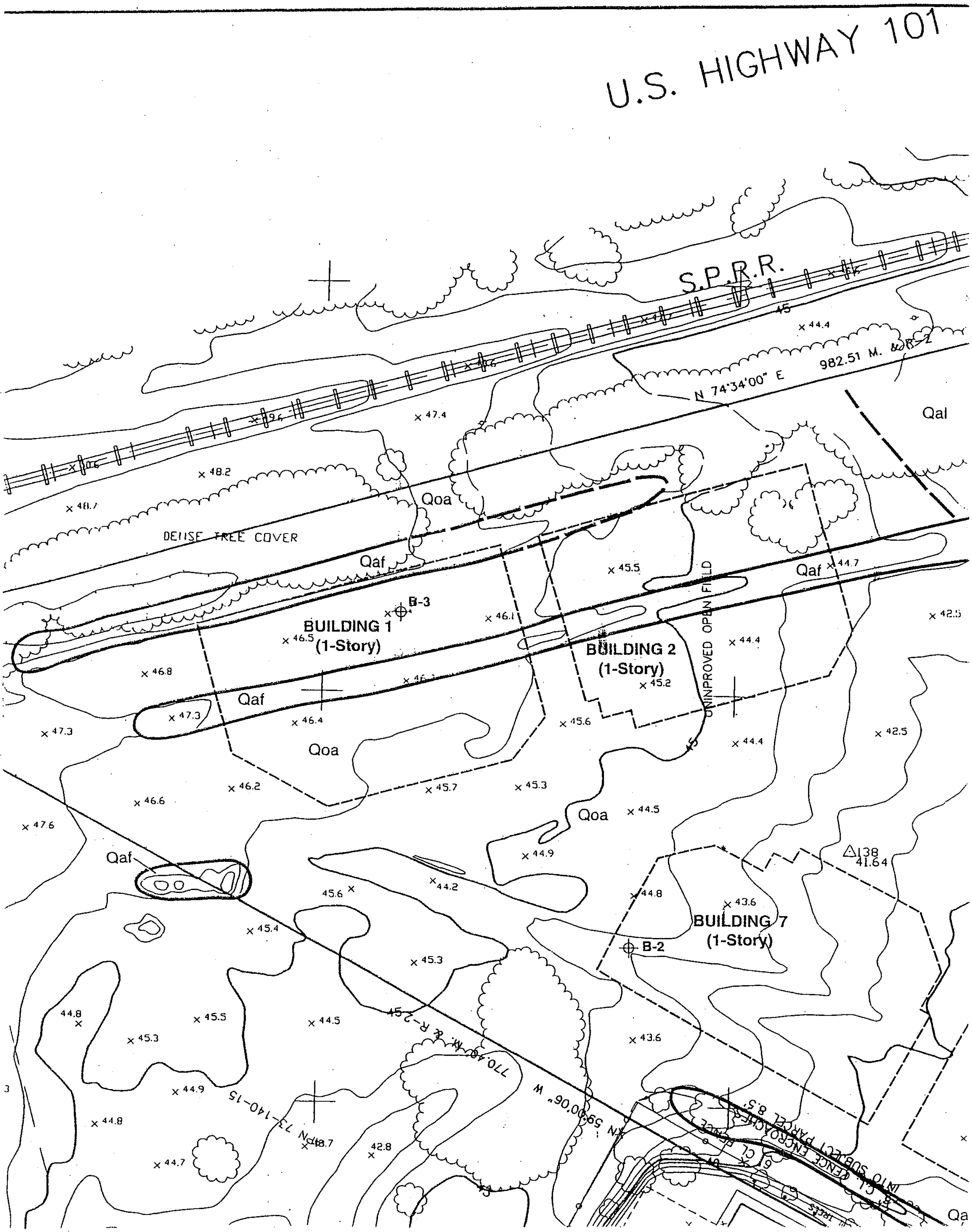
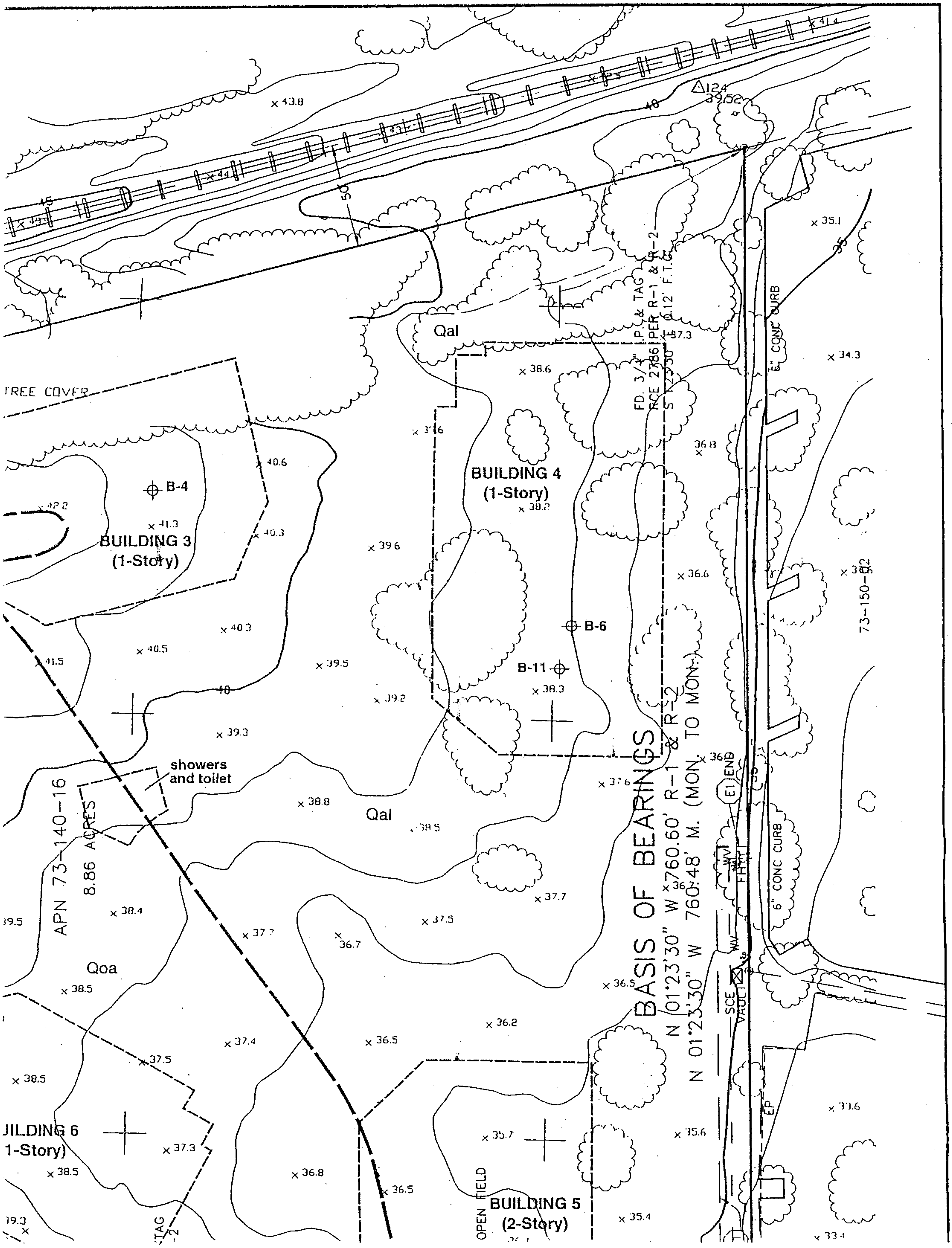
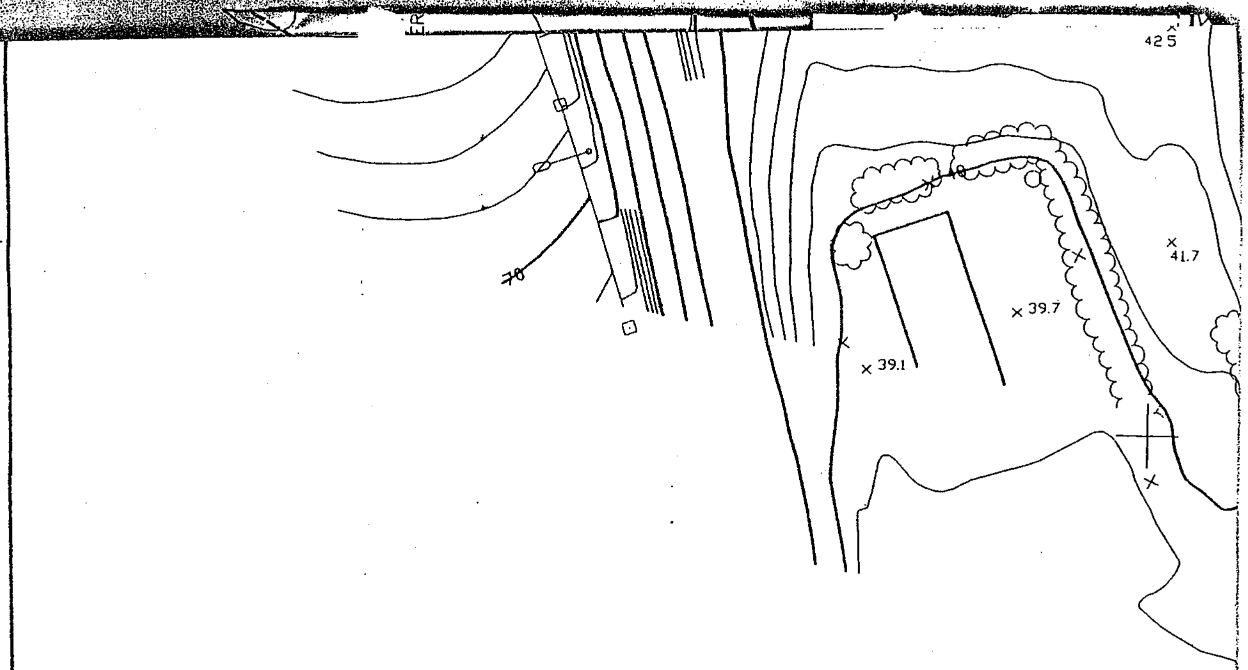
x 44.8
x 43.7
x 42.8
x 44.7
x 81.6
81.6



U.S. HIGHWAY 101
S.P.R.R.
N 74°34'00" E
982.51 M. & R-2
Qal
Qoa
Qaf
DENSE TREE COVER
BUILDING 1
(1-Story)
B-3
BUILDING 2
(1-Story)
UNIMPROVED OPEN FIELD
BUILDING 7
(1-Story)
B-2
Qaf
Qoa
N 59°00'06" W
770.40 M. & R-2
APN 73-140-15
Qa



TREE COVER
BUILDING 3
(1-Story)
B-4
BUILDING 4
(1-Story)
B-6
B-11
Qal
Qal
Qoa
showers
and toilet
APN 73-140-16
8.86 ACRES
BASIS OF BEARINGS
N 01°23'30" W 760.60' R-1 & R-2
N 01°23'30" W 760.48' M. (MON. TO MON.)
6" CONC CURB
6" CONC CURB
OPEN FIELD
BUILDING 5
(2-Story)
(1-Story)



LEGEND

EXPLANATION

AGE

Quaternary
- Holocene
  - Qaf — artificial fill
  - Qal — alluvium
- Pleistocene
  - Qoa — older alluvium

SYMBOLS

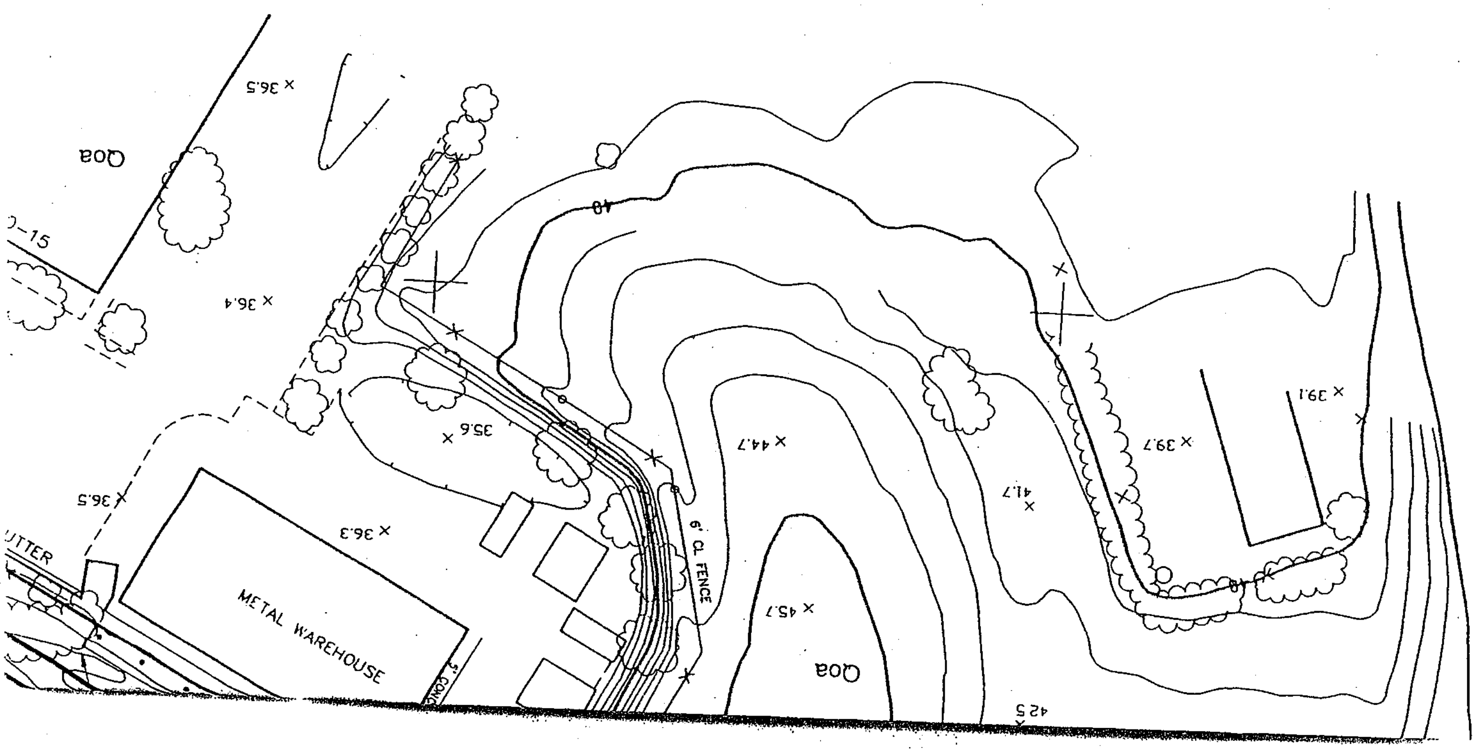
- formation contact; dashed where approximate; queried where questionable
- Proposed Building Footprint per P-K Design Group (1/8/98)
- Soil Boring Location

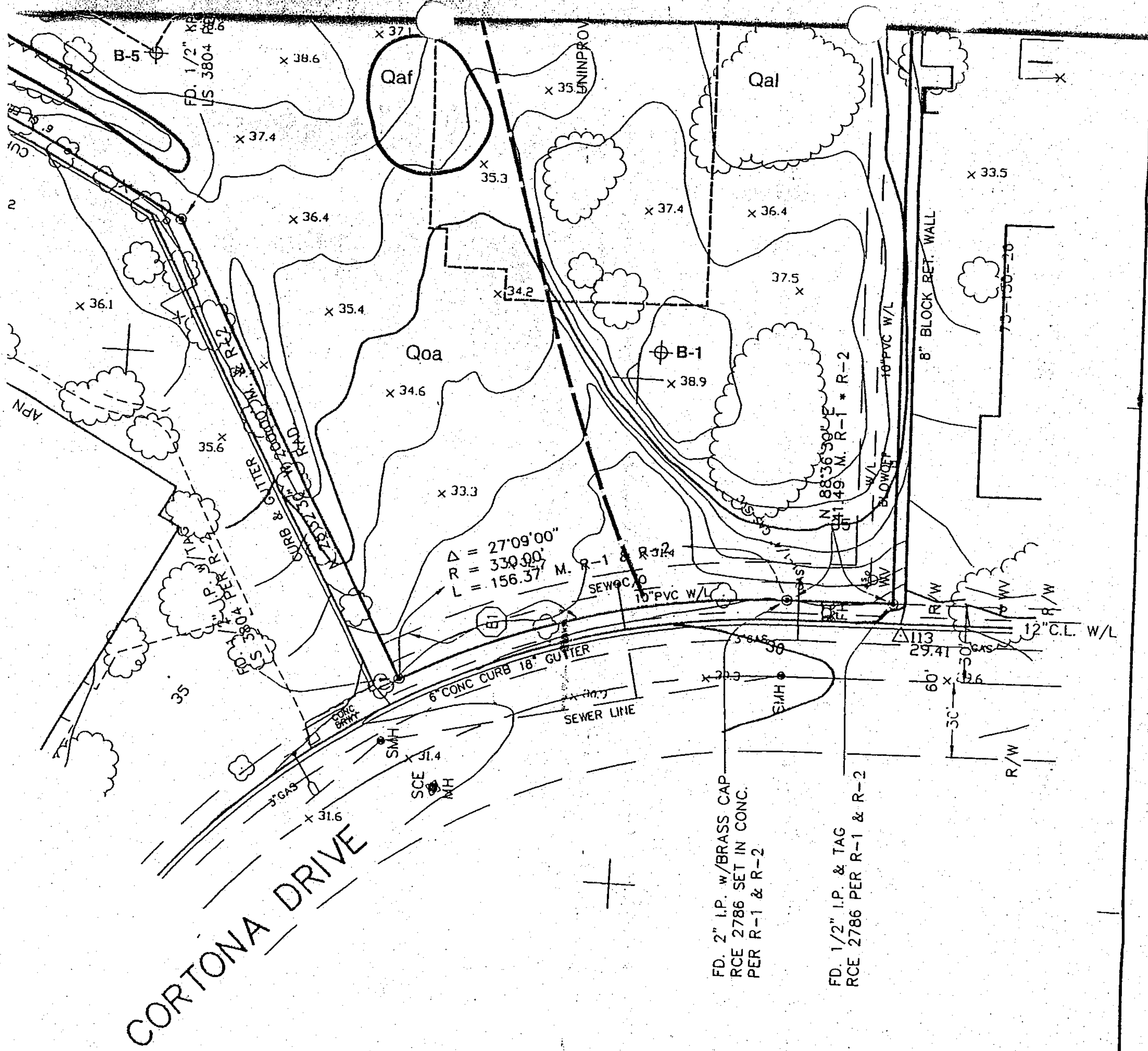
N

SCALE IN FEET

0 40 80 120

basemap: Waters Land Surveying, December, 1997 from aerial photography dated November 18, 1997 (Golden State Aerial Surveys).


Qoa
36.5
36.4
35.6
36.3
METAL WAREHOUSE
6' CL FENCE
40
44.7
45.7
41.7
39.7
39.1
Qoa
Qoa



GEOLOGIC MAP
BERMANT DEVELOPMENT COMPANY
APN 73-140-16
8.82 ACRE PARCEL
CORTONA DRIVE
GOLETA, CALIFORNIA

HOOVER & ASSOCIATES, INC.
Geologists • Hydrologists

Plate 2

APPENDIX

Boring Logs
Soil Laboratory Results

LEGEND SHEET FOR BORING LOGS

BORING LOG SYMBOLS

- 2 1/2" Split Spoon Sample
- First Water Encountered
- Measured Water Level
- Contact between Soils; may be gradational or inferred

MONITORING WELL SYMBOLS

- Concrete Seal
- Bentonite Seal
- Lapis #3
- Native Backfill
- Slotted Section of Casing

LITHOLOGIES

CLAY	SILTY CLAY	SANDY CLAY
SILT; SANDY SILT; SILTY SAND	CLAYEY SILTY SAND	
SAND	PEBBLES	FILL
COBBLES/ BOULDERS	BEDROCK	ASPHALT/ CONCRETE

HOOVER & ASSOCIATES, INC.
Geologists • Hydrologists • Soil Engineers

BORING LOG

Bermant/8-Acre Site
Goleta, California
Date: 12/16/97
Time Started/Finished: 08:30/10:20 hrs.
Sampling Method: 2.5" CA Modified
Rig Type: CME-75
Drilling Contractor: S&G Laboratories

BORING NO.: B-1
Logged By: P. Martyniuk
Casing Size & Type: N/A
Elevation: 38' MSL
Boring Location: SE property/Building 5

DEPTH (FEET)	SAMPLE NO. & LOG	PID (ppm)	BLOWS PER FOOT	WELL DETAILS	H_2O	USCS/ LITHO	SOIL DESCRIPTION AND NOTES
0	B-1B @ 0.5'						
	B-1 @ 2.5'		18			SM	Sandy silt; dark brown; moist; firm; occasional subangular gravel.
	B-1 @ 4.5'		14				
5	B-1B @ 6'					SM	Sandy silt; dark brown.
	B-1 @ 6.5'		28				
							Silty sand; light brown; dry-moist; moderately dense; firm-hard.
							Silty fine sand; brown; moist; firm.
10	B-1 @ 11.5'		14				Silty sand; brown; moist; firm; grass-like root holes.
						SM	
15	B-1 @ 16.5'		21				As above with some clay.
20	B-1 @ 21.5'		18		∇	ML	Silty clay; brown; moist; firm; dense; some roots.
					∇		Silty fine-medium sand; very moist; firm; some roots.
25	B-1 @ 26.5'		13			SM	Silty sand; saturated; firm.
30	SPT		10				Silty sand; saturated; firm.

EOB – 30 feet.
Sampled to 31.5 feet.
Ground water as noted.
Backfilled with native soil.

USCS determination by lab:
0 - 11.5' CL
11.5'-31.5' SC

HOOVER & ASSOCIATES, INC.
Geologists · Hydrologists

File 687-002
Date 1-17-98
By DAS

BORING LOG

Sheet 1 of 1

Bermant/8-Acre Site
Goleta, California
Date: 12/16/97
Time Started/Finished: 11:26/13:40 hrs.
Sampling Method: 2.5" CA Modified
Rig Type: CME-75
Drilling Contractor: S&G Laboratories

BORING NO.: B-2
Logged By: P. Martyniuk
Casing Size & Type: N/A
Elevation: 43' MSL
Boring Location: West central/Building 7

DEPTH (FEET)	SAMPLE NO. & LOG	PID (ppm)	BLOWS PER FOOT	WELL DETAILS	H_2O	USCS/ LITHO	SOIL DESCRIPTION AND NOTES
0	B-2B @ 1' No ring sample; sampler frozen		56			SP	Sand; tan; some silt; dry; moderately firm.
	B-2B@ 3.5' B-2 @ 4.5'		34			SM	Silty sand; brown; moist; firm; moderately dense.
5	B-2 @ 6.5'		51			SM	Silty sand; brown; dry-moist; very firm; dense.
10	B-2 @ 11.5'		40			SM	As above.
15	B-2 @ 16.5'		79			SP	Sand; tan; dry; firm.
20	B-2 @ 21.5'		40/50+			SP	Sand; fine; tan; dry; firm.
25							EOB – 20 feet. Sampled to 21.5 feet. No ground water encountered. Backfilled with native soil.
30							USCS determination by lab: 0 -6.5' CL; 6.5' -11.5' SC; 11.5' - 21.5' SP
35							
40							
45							

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Geologists • Hydrologists

File 687-002
Date 1-17-98
By DAS

BORING LOG

Bermant/8-Acre Site
Goleta, California
Date: 12/16/97
Time Started/Finished: 13:50/14:55 hrs.
Sampling Method: 2.5" CA Modified
Rig Type: CME-75
Drilling Contractor: S&G Laboratories

BORING NO.: B-3
Logged By: P. Martyniuk
Casing Size & Type: N/A
Elevation: 46' MSL
Boring Location: Northern portion of property/Building 1

DEPTH (FEET)	SAMPLE NO. & LOG	PID (ppm)	BLOWS PER FOOT	WELL DETAILS	H_2O	USCS/ LITHO	SOIL DESCRIPTION AND NOTES
0	B-3B @ 0.5'						
	B-3 @ 2.5'		18			ML	Silty clay; brown; very moist; firm.
	B-3 @ 4.5'		24			CL	Sandy clay; brown; very moist; firm.
						SM	Silty sand; brown; moist; firm.
5	B-3 @ 6.5'		30			SW	Sand with some silt; tan; dry-moist; semi-firm.
10	B-3 @ 11.5'		56			SM	Silty sand; light brown; moist; semi-firm.
15	B-3 @ 16.5'		79		▽	SM	Silty sand; light tan; dry-moist; semi-firm.
20	B-3 @ 21.5'		13			SM	Silty sand; mottled brown; saturated.
25							EOB – 20 feet. Sampled to 21.5 feet. No ground water found when checked late in the day (caving?). Backfilled with native soil.
30							USCS determination by lab: 0 -6.5' CL; 6.5' -11.5' SC; 11.5' - 21.5' SP
35							
40							
45							

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File 687-002
Date 1-17-98
By DAS

File 687-002

BORING LOG

Sheet 1 of 1

Bermant/8-Acre Site
Goleta, California
Date: 12/16/97
Time Started/Finished: 16:20/17:20 hrs.
Sampling Method: 2.5" CA Modified
Rig Type: CME-75
Drilling Contractor: S&G Laboratories

BORING NO.: B-5
Logged By: P. Martyniuk
Casing Size & Type: N/A
Elevation: 38' MSL
Boring Location: Building 6/southern property area

DEPTH (FEET)	SAMPLE NO. & LOG	PID (ppm)	BLOWS PER FOOT	WELL DETAILS	H_2O	USCS/ LITHO	SOIL DESCRIPTION AND NOTES
0	B-5B @ 0.5'						
	B-5 @ 2.5'		33			SM	Silty sand; dark brown; moist; firm.
	B-5 @ 4.5'		17			SM	Silty sand; brown; moist; semi-firm; root holes.
5	B-5 @ 6.5'		24			ML	Sandy silt; brown; moist; semi-firm.
10	B-5 @ 11.5'		20			SM	Silty sand; brown; moist; firm.
15	B-5 @ 16.5'		28			SC	Clayey sand; dark brown; moist; firm.
20	B-5 @ 21.5'		26			SM	Silty sand; brown; most; firm.
25							EOB – 20 feet. Sampled to 21.5 feet. No ground water encountered. Backfilled with native soil.
30							
35							
40							
45							

USCS determination by lab:
0 - 6.5' SC
6.5' - 11.5' SP
11.5' - 16.5'CL
16.5' - 21.5' SC

Date 1-17-98
By DAS

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BORING LOG

Bermant/8-Acre Site
Goleta, California
Date: 12/17/97
Time Started/Finished: 07:45/09:00 hrs.
Sampling Method: 2.5" CA Modified
Rig Type: CME-75
Drilling Contractor: S&G Laboratories

BORING NO.: B-6
Logged By: P. Martyniuk
Casing Size & Type: N/A
Elevation: 38' MSL
Boring Location: East property/Building 4

DEPTH (FEET)	SAMPLE NO. & LOG	PID (ppm)	BLOWS PER FOOT	WELL DETAILS	H_2O	USCS/ LITHO	SOIL DESCRIPTION AND NOTES
0	B-6B @ 0.5'						
	B-6 @ 1.5'		22			SC	Clayey sand and silt; dark brown; very moist; soft.
	B-6B @ 3.5'						
	B-6 @ 4.5'		13			SC	Clayey sand; dark brown; moist-very moist; moderately firm.
5	B-6 @ 6.5'		27				
						ML	Clayey silt with fine sand; brown; moist; firm-very firm.
10	B-6 @ 11.5'		14			SC	Sandy clay brown; moist.
15	NR		14		▽		
20	B-6 @ 21.5'		12			SC	Fine sandy clay; brown; saturated.
25							EOB – 20 feet. Sampled to 21.5 feet. Ground water as noted. Backfilled with native soil.
30							USCS determination by lab: 0-6.5' CL 6.5'-15' SC 15'-21.5' CL
35							
40							
45							

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By DAS Date 1-17-98

BORING LOG

Bermant/8-Acre Site
Goleta, California
Date: 12/16/97
Time Started/Finished: 15:05/15:55 hrs.
Sampling Method: 2.5" CA Modified
Rig Type: CME-75
Drilling Contractor: S&G Laboratories

BORING NO.: B-4
Logged By: P. Martyniuk
Casing Size & Type: N/A
Elevation: 41' MSL
Boring Location: Building 3/northern Property

DEPTH (FEET)	SAMPLE NO. & LOG	PID (ppm)	BLOWS PER FOOT	WELL DETAILS	H_2O	USCS/ LITHO	SOIL DESCRIPTION AND NOTES
0	B-4B @ 0.5'						
	B-4 @ 2.5'		7			ML	Sandy clay; dark brown; very moist; moderately firm.
	B-4B @ 3.5'		11				
5	B-4 @ 4.5'					ML	As above.
	B-4 @ 6.5'		14			SC	Clayey sand; dark brown; moist; firm.
10	B-4 @ 11.5'		12			SC	As above.
15	B-4 @ 16.5'		7		▽	ML	Sandy clay; dark brown; moist-very moist; moderately firm.
					▽		
20	NR		8				No sample recovered, too wet.
							EOB – 20 feet. Ground water as noted. Backfilled with native soil.
25							USCS determination by lab: 0 - 16.5' CL
30							
35							
40							
45							

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File 687-002
Date 1-17-98
By DAS

File 687-002

BORING LOG

Bermant/8-Acre Site
Goleta, California
Date: 12/30/97
Time Started/Finished: 11:50/12:35 hrs.
Sampling Method: 2.5" CA Modified
Rig Type: CME-75
Drilling Contractor: S&G Laboratories

BORING NO.: B-11
Logged By: P. Martyniuk
Casing Size & Type: N/A
Elevation: 38' MSL
Boring Location: 21' south of B-6/east property

DEPTH (FEET)	SAMPLE NO. & LOG	PID (ppm)	BLOWS PER FOOT	WELL DETAILS	H_2O	USCS/ LITHO	SOIL DESCRIPTION AND NOTES
0							
	⧄		5			SC	Clayey sand; dark brown; moist; soft.
	⧄		4			SC	Clayey sand; brown; moist; moderately firm.
5	⧄		6			SC	As above.
10	⧄		8				
						SM	Sand; some silt; light brown; moist;; moderately firm.
15	⧄		3		▽		No recovery.
20	⧄		5			SC	Clayey sand; light brown; most; moderately firm. (catcher used)
						CL	Sandy clay; brown; moist-very moist; moderately firm.
25	⧄		9		▽	CL	As above; very moist.
30	⧄		19			SC	Clayey sand; brown; very moist; very dense.
							EOB – 30 feet. Ground water as noted. Backfilled with native soil.
35							
40							
45							

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By DAS Date 1-17-98

SUMMARY OF MOISTURE/DENSITY RELATIONSHIPS

Boring	Depth (ft.)	West Density (pcf)	Dry Density (pcf)	Moisture Content (%)	Saturation
B-1	2.5	121.1	110.4	9.7	50
B-1	4.5	113.4	102.3	10.9	45
B-1	6.5	98.1	87.8	11.7	34
B-1	11.5	123.7	111.4	11.0	58
B-1	16.5	128.2	111.4	15.0	79
B-1	21.5	128.2	107.5	19.3	92
B-1	26.5	130.2	112.3	16.0	86
B-2	4.5	129.3	112.3	15.2	82
B-2	6.5	132.7	115.1	15.3	89
B-2	11.5	114.1	101.1	12.9	52
B-2	16.5	105.8	101.3	4.5	18
B-2	21.5	96.2	91.7	4.9	16
B-3	2.5	121.1	100.5	20.4	81
B-3	4.5	123.6	105.9	16.7	76
B-3	6.5	128.0	111.5	14.8	78
B-3	11.5	129.8	118.1	9.9	63
B-3	16.5	104.7	99.8	4.9	19
B-3	21.5	110.8	81.2	36.5	92
B-4	2.5	120.9	100.5	20.3	81
B-4	4.5	124.0	103.6	19.7	85
B-4	6.5	125.8	111.1	13.3	70
B-4	11.5	125.5	108.1	16.1	78
B-4	16.5	128.2	104.9	22.2	99
B-5	2.5	119.0	109.1	9.1	45
B-5	4.5	98.1	92.1	6.6	21
B-5	6.5	107.4	100.7	6.7	27
B-5	11.5	114.4	106.6	7.3	34
B-5	16.5	129.4	111.2	16.4	86
B-5	21.5	133.3	115.3	15.6	91
B-6	1.5	89.2	76.5	16.6	37
B-6	4.5	126.2	106.3	18.8	87
B-6	6.5	120.8	108.0	11.9	57
B-6	11.5	125.0	108.4	15.4	75
B-6	21.5			22.1	

Assumes specific gravity of 2.70

ATTERBERG LIMITS
(ASTM: D4318)

Sample Location	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS
B-40 @ 0.5'	38	23	15	CL

EXPANSION INDEX

Sample Location	Initial Moisture (%)	Compacted Dry Density (pcf)	Final Moisture (%)	Expansion Index	Expansion Potential
B-4 @ 0.5'	13.1	103.0	24.8	44	Low
B-2 @ 0.5'	10.3	110.5	25.4	124	High

SUMMARY OF MAXIMUM DENSITY/OPTIMUM MOISTURE CONTENT DETERMINATIONS
(ASTM 1557-91A)

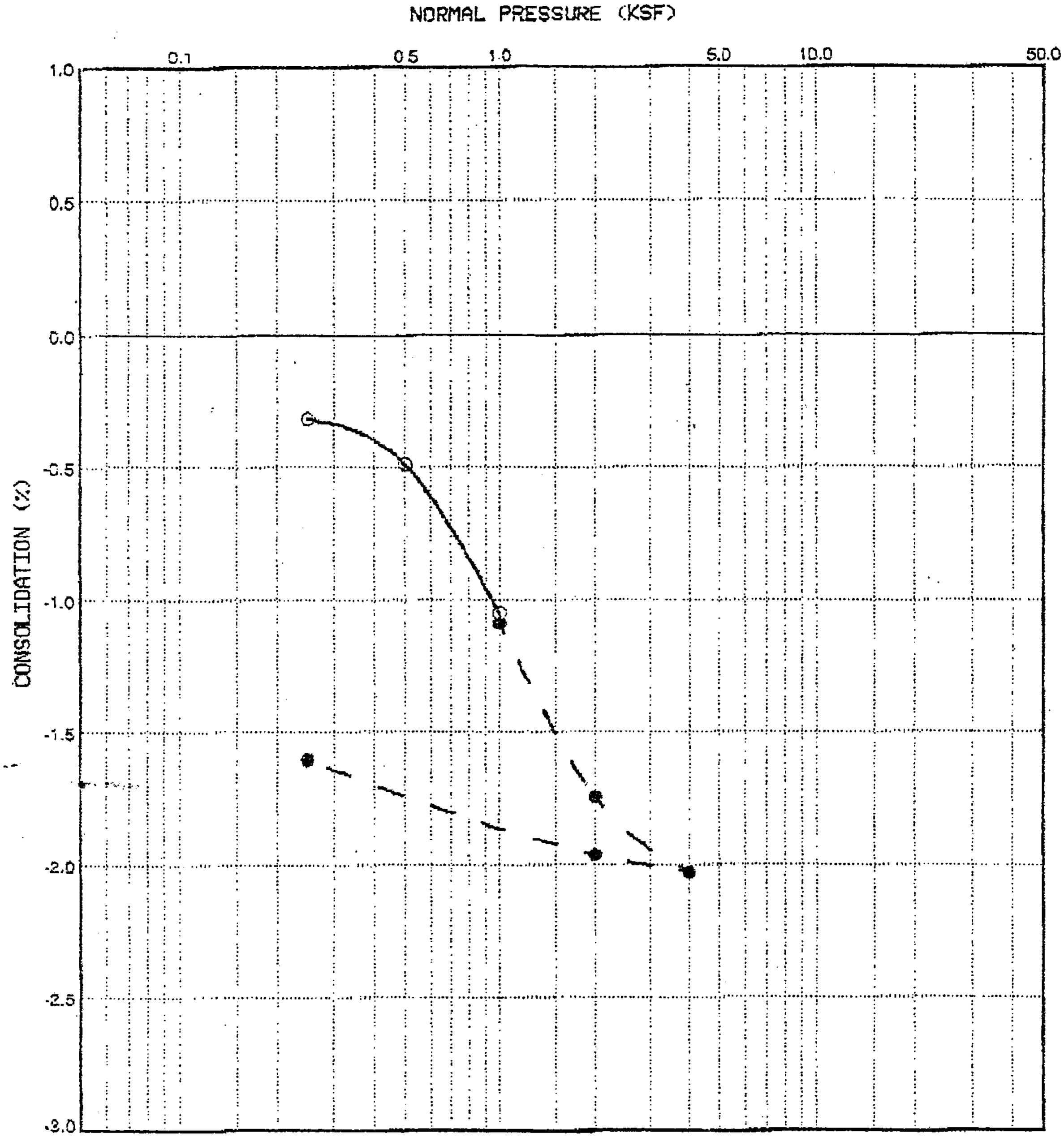
Sample Location	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-4 @ 0.5'	Dark brown sandy clay	114.5	14.5

No. 200 Sieve (ASTM: D 1140)			
Sample Location	% Passing #4 Sieve	% Passing #40 Sieve	% Passing #200 Sieve
B-1 @ 11.5'	100	88.3	62.2
B-1 @ 16.5'	100	96.4	51.2
B-1 @ 26.5'	100	92.5	42.5
B-4 @ 0.5'	98.7	93.7	61.1

R-Value (Caltrans 301-F)	
Sample Location	R-Value
B-1 @ 0.5'	29
B-3 @ 0.5'	15

DIRECT SHEAR (ASTM: D 3080)		
Sample Location	Angle of Internal Friction (°)	Cohesion (psf)
B-4 @ 0.5'	25	100

Note: Undisturbed, saturated, drained



SYMBOL	SAMPLE LOCATION	NORMAL PRESSURE AT SATURATION (KSF)	CON.(-) / EXP.(+) AT SATURATION (%)	MOISTURE (%) BEFORE	AFTER
○ ●	B-4 at 11.5	1.000	-0.04	19.5	19.7

CONSOLIDATION TEST RESULTS

HOOVER & ASSOCIATES, INC.
GEOLOGISTS-HYDROLOGISTS-SOIL ENGINEERS

Bermant Project

PROJECT NO.	FIGURE NO.

Portions of the U.S.G.S. "Dos Pueblos" and "Goleta" 7.5' Quadrangles

REGIONAL FAULT MAP

in the vicinity of the

8.82 ACRE BERMANT DEVELOPMENT PARCEL GOLETA, CALIFORNIA

SCALE IN FEET

0 2000 4000

SYMBOLS

Fault; dashed where approximate or questionable

A — A' Line of Geologic Cross-Section

• Oil or Water Well Location

N

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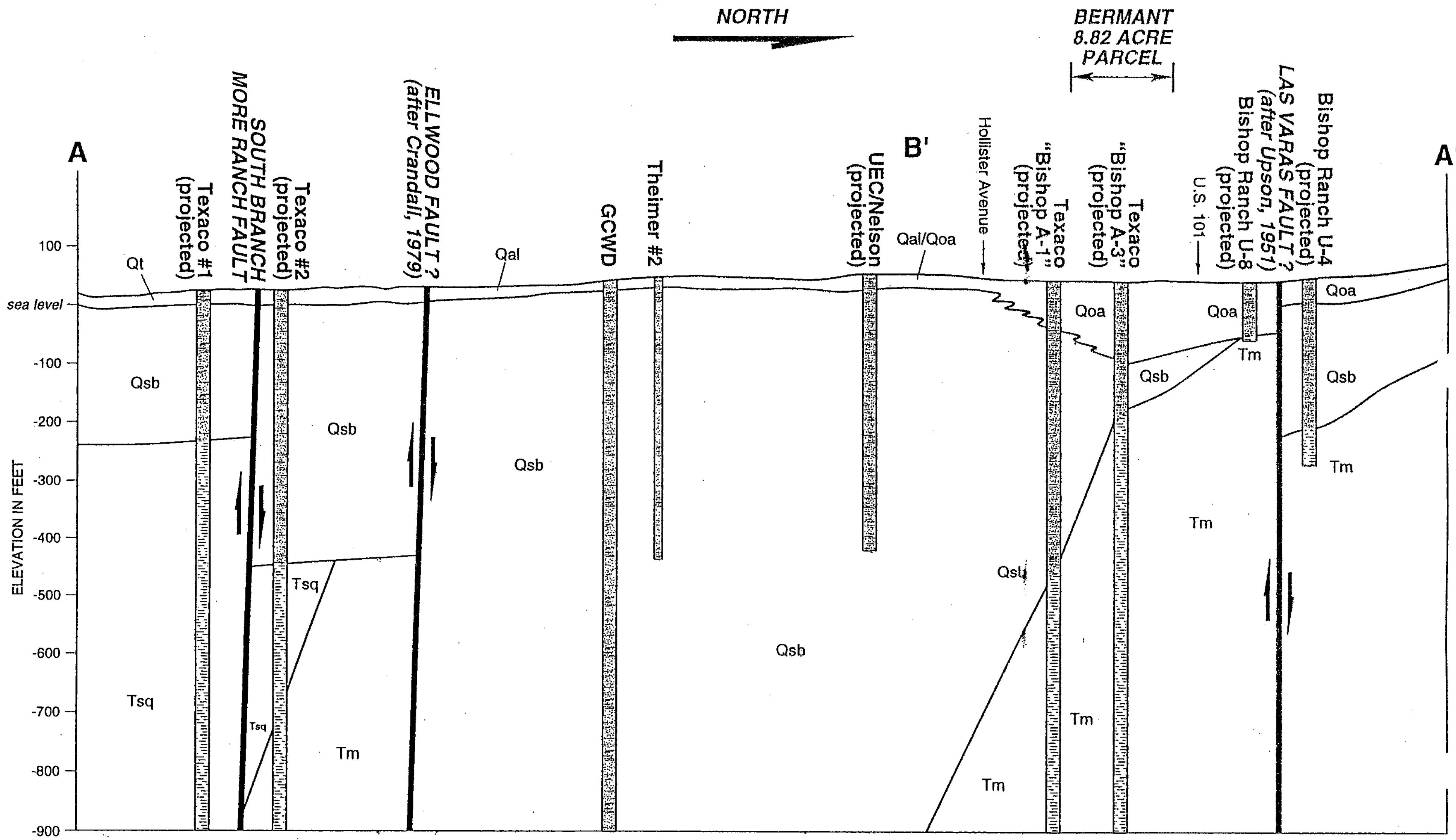
Date 1-16-98

By DAS

Plate 3

By DAS Date 1-16-98 File 687-002



EXPLANATION

AGE

Quaternary

- Qal Alluvium
- Qoa Older Alluvium
- Qt Terrace Deposits
- Qsb Santa Barbara formation

Tertiary ?

- Tsq Sisquoc formation
- Tm Monterey formation

GEOLOGIC CROSS-SECTION A – A'

BERMANT DEVELOPMENT COMPANY

8.82 ACRE SITE/CORTONA DRIVE

HORIZONTAL SCALE IN FEET

0 1000 2000

VERTICAL EXAGGERATION = 4X

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