Appendix F: Geotechnical Investigations

F.1 - Feasibility Level Geotechnical Investigation, Sleger and Martin Properties, GeoSoils, Inc., June 18, 2003

FEASIBILITY LEVEL GEOTECHNICAL INVESTIGATION
±80-ACRE PARCELS
10241 AND 10129 EDISON AVENUE
(SLEGER AND MARTIN PROPERTIES)
ONTARIO AREA, SAN BERNARDINO COUNTY, CALIFORNIA

FOR

HILLCREST HOMES
c/o C.L. WILLIAMS GROUP, LLC
525 SHADOW OAKS
IRVINE, CALIFORNIA 92618

W.O. 3914-A-SC JUNE 18, 2003

GeoSoils, Inc.

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June 18, 2003

W.O. 3914-A-SC

Hillcrest Homes
c/o **C.L. Williams Group, LLC**
525 Shadow Oaks
Irvine, California 92618

Attention: Mr. Brett Williams

Subject: Feasibility Level Geotechnical Investigation, ±80-Acre Parcels, 10241 and 10129 Edison Avenue (Sleger and Martin Properties), Ontario Area, San Bernardino County, California

Dear Mr. Williams:

In accordance with your request and authorization, this report presents the results of our feasibility level geotechnical investigation of the subject site. The purpose of the study was to evaluate the onsite soils and geologic conditions and their effects on the proposed development from a geotechnical point of view. In particular, the primary purpose of our study was to evaluate subsurface conditions with respect to proposed development of the site, and provide; potential remedial removal depths, current groundwater conditions, liquefaction evaluation, etc., based on current standards of practice. A secondary purpose of this study was to provide preliminary geotechnical foundation design parameters, and general earthwork and grading guidelines, in light of site geotechnical conditions.

EXECUTIVE SUMMARY

Based on our review of data (Appendix A), field exploration, laboratory testing, and geologic and engineering analyses, the proposed project site appears suitable for residential development, from a geotechnical viewpoint, provided the recommendations presented in the text of this report are implemented. The primary developmental considerations are summarized below:

- Removal of any manure, artificial fill, colluvium/topsoil deposits, and near surface weathered Quaternary fan deposits (Pleistocene-age alluvial fans) will be necessary prior to fill placement. Approximate depths of removals are outlined in the conclusions and recommendations section of this report. For preliminary planning purposes, these depths are estimated to be on the order of ±4 to ±9 feet, with an average of approximately ±6 feet across the site (excluding stockpiled materials).

- Based on our subsurface investigation and field reconnaissance mapping, abundant amounts of manure and organic matter exist and/or are stockpiled and/or were spread across localized areas of the site. It is the standard of the industry that after removal of such materials that the remaining surficial spoils may be properly mixed with existing soils to a maximum 1 percent concentration by weight, for fill. However, based on our experience, testing on other nearby parcels, and visual observations, it appears that the existing surficial soils already contain in excess of 1 percent organic matter. The excessive manure and organic matter, approximately ±1 to 6+ feet in thickness (stockpiles and berms), should be removed and exported offsite. In addition, removals of soils contaminated with excess organic materials may also be necessary. Observation, and if deemed necessary, testing by representatives of GSI, should be conducted to verify the organic materials have been properly removed from areas proposed for settlement sensitive improvements. In addition, based on previous land use (dairy), methane studies will likely be required by the County.

- Based on laboratory testing, for preliminary planing purposes, the expansion potential of the onsite soils is considered very low. However, soils with a low to medium expansive potential may not be precluded from occurring onsite. Preliminary foundation recommendations for conventional and post-tension design are provided herein.

- Typical samples of the site materials have been analyzed for soluble sulfate/corrosion potential. Based on testing, the use of sulfate resistant concrete is not anticipated at this time. However, based on the test results, the onsite soils are mildly alkaline and are considered corrosive to severely corrosive to ferrous metals in a saturated state. Accordingly, consideration should be given to consulting with a corrosion engineer to provide specific recommendations.

- In general and based upon the available data to date, groundwater is not expected to be a factor in the development of the site. However, due to the nature of the site materials, seepage may be encountered throughout the site along with seasonal perched water, and also may be encountered in "daylighted" bedding, sandy lenses, or fracture systems within the Quaternary fan deposits. Therefore, subdrainage systems for the control of localized groundwater seepage should be anticipated, both during and after grading and development.

- Our review indicates no known active faults are crossing the site, and the site is not within an Alquist-Priolo Earthquake Fault Zone, nor is it within a liquefaction zone established by the County of San Bernardino or State of California.

- Adverse geologic features that would preclude project feasibility (e.g., evidence of paleo-liquefaction, etc.) were not encountered.

- The recommendations presented in this report should be incorporated into the planning, design, and construction considerations of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

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FEASIBILITY LEVEL GEOTECHNICAL INVESTIGATION
±80-ACRE PARCELS
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SCOPE OF SERVICES

The scope of our services has included the following:

1. Review of available soils and geologic data for the site area, including any previous geotechnical reports in the subject area (Appendix A).

2. Geologic site reconnaissance and geologic mapping of significant geologic structures and surficial deposits (Plate 1).

3. Subsurface exploration consisting of six hollow stem auger borings and 24 test pits, advanced into onsite geologic units, for geotechnical logging and sampling (Appendix B).

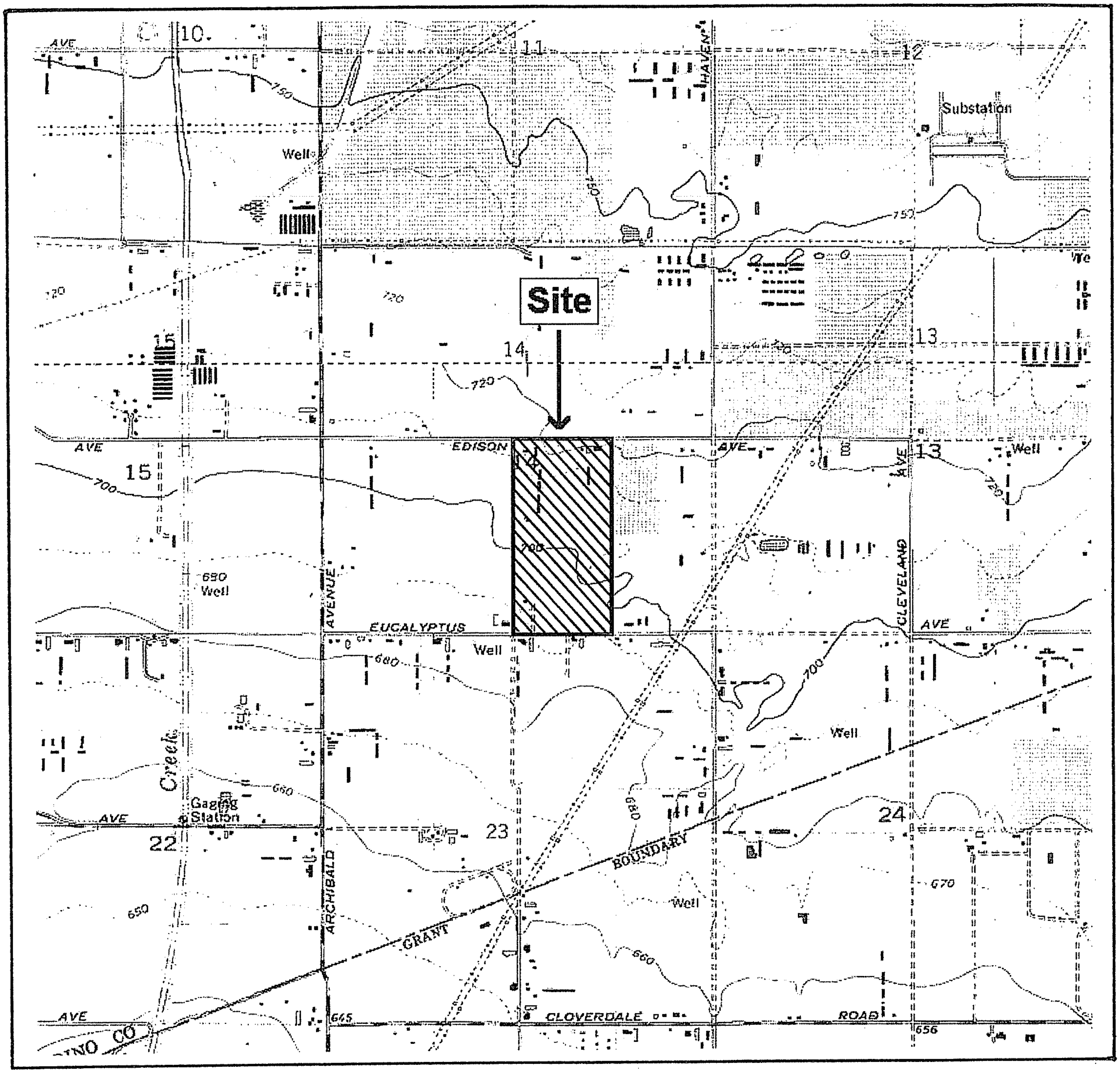
4. General areal seismicity evaluation (Appendix C).

5. Pertinent laboratory testing of representative soil samples collected during our subsurface exploration program. Testing included in-situ moisture and density, maximum density testing, shear, soluble sulfate, corrosion analysis, and expansion index testing of the materials encountered during our field studies. Results of our laboratory testing are provided in Appendix D.

6. Appropriate engineering and geologic analyses of data collected, and preparation of this report and accompaniments.

SITE DESCRIPTION

The two rectangular shaped parcels are located at 10241 and 10129 Edison Avenue, in the Ontario Area, San Bernardino County, California (see Figure 1, Site Location Map). The site is relatively flat lying and is located at elevations ranging between ±688 feet mean sea level (MSL) to ±720 feet MSL, and is currently being utilized for agricultural/diary purposes. Several residential homes, two diaries with associated barns and cattle pens, are located along Edison Avenue. Several barn/storm water holding ponds are also located along Eucalyptus Avenue on the southern portion of the site. Two active wells and one abandoned well are located onsite. Overall, site drainage is generally toward the south-southwest by sheetflow, however drainage is variable in localized areas depending on the relief.



Base Map: USGS, 7.5 minute, Guasti and Corona North Quadrangles, 1981. Topographic base USGS 1933 and 1967, photorevised 1981.

0 2000 4000

Scale Feet

GSI GeoSoils, Inc.

W.O.

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SITE LOCATION MAP

Figure 1

PROPOSED DEVELOPMENT

It is our understanding that typical cut and fill grading techniques would be utilized to prepare the site for residential development, with associated infrastructure and underground utilities. It is assumed that the residential buildings would be one- and/or two-story structures, utilizing typical wood-frame construction with slabs-on-grade and continuous footings and/or post tensioned foundations. Building loads are assumed to be typical for this type of relatively light construction. Sewage disposal is to be accommodated by tying into the regional municipal system. The need for import soils is unknown.

FIELD STUDIES

Field studies conducted during our evaluation of the property for this investigation consisted of geologic reconnaissance mapping, excavation of six hollow stem exploratory borings, and 24 test pits throughout the site, for evaluation of near-surface soil and geologic conditions. Field exploration was performed on April 8, 9, and 18, 2003. The test pits and borings were logged by staff from our firm who collected representative bulk and undisturbed soil samples for appropriate laboratory testing. The logs of the test pits and borings are presented in Appendix B. Approximate locations of the exploratory test pits and borings are presented on Plate 1 (Geotechnical Map).

GEOLOGY

Regional Geologic Setting

The property is located within the Perris Block portion of a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. The Peninsular Range is characterized by steep, elongated ranges and valleys that trend northwesterly. This province is typified by plutonic and metamorphic rocks (bedrock) which comprise the majority of the mountain masses, with relatively thin volcanic and sedimentary deposits discontinuously overlying the bedrock, and with Plio/Pleistocene-aged to older Quaternary-aged alluvial fan deposits filling in the valleys and younger alluvium filling in the incised drainages. The alluvial deposits are derived from the water borne deposition of the products of weathering and erosion of the bedrock.

General Site Geology

As mapped by Cox and Morton (1978a, 1978b) surficial deposits consist of "eolian wind-blown sands." Based on our field mapping, subsurface investigation, and our familiarity with other nearby sites, these mapped surficial deposits mantle the underlying Quaternary fan deposits (Pleistocene-age fans). The eolian sands/soils onsite range between ±3 and ±9 feet in thickness (see Appendix B). The underlying alluvial fan deposits are generally flat lying, appear to be undeformed, and are regionally distinguished from Holocene deposits by the presence of pedogenic soils that regionally have a poorly, to well-developed textural B horizon. The fan deposits also tend to be better consolidated and slightly less permeable than Holocene sediments, due to advanced sediment compaction and redistribution of binding agents such as clay, and calcium carbonate. The alluvial fan deposits (Pleistocene-age fans) are also readily identified by an abrupt change in blow count near the geologic contact, and the presence of Stage II carbonate veins and veinlets which effervesce violently with the application of a weak acidic solution, additionally corroborating their late Pleistocene-age. These underlying late Pleistocene-age alluvial fan deposits are preserved as dissected remnants of old distal alluvial fans and as terrace deposits situated tens of feet above modern stream courses. In localized areas of the site, undocumented fill, manure, colluvium/topsoil, and "eolian sands" mantle the Quaternary fan deposits. As used in this report, the term colluvium refers to undifferentiated surficial deposits, excluding the manure and artificial fill.

SITE GEOLOGIC UNITS

The geologic units encountered during our investigation within the project site consist of undocumented artificial fill, colluvium/topsoil, "eolian sands," and Quaternary fan deposits (Pleistocene-age fans). These units are described, from youngest to oldest, as follows:

Artificial Fill - Undocumented (Not Mapped)

Locally observed in many locations across the site, were areas of undocumented artificial fill, and stockpiled "manure and organic matter." The undocumented fill, manure and organic matter, locally up to ±1 to 6+ feet in thickness (stockpiles), have been placed during dairy operations. Due to the potentially compressible nature of these soils/materials, they are considered unsuitable for support of structures and/or improvements in their existing state. Clean fill materials may be reused for compacted fills provided that the organic materials have been removed from the site and they have been approved by the geotechnical engineer prior to placement. Manure and other organic materials will be need to be removed from the site, prior to grading, should settlement sensitive improvements be proposed within their influence.

Colluvium/Topsoil - (Not Mapped)

Colluvium/topsoil was observed in our subsurface investigation locally mantling the "eolian sands" and Quaternary fan deposits throughout the site. These soils were generally observed to be approximately ±2 feet in thickness. The colluvium/topsoil was generally observed to be medium brown silty sands. The colluvium/topsoil was generally non-uniform, dry, and loose. These soils typically have a very low to low expansion potential; however, some clayey factions have a medium expansion potential. Due to the potentially compressible nature of these soils, they are considered unsuitable for support of structures and/or improvements in their existing state. Therefore, these soils will be need to be removed and recompacted, if not removed during planned excavation, should settlement sensitive improvements be proposed within their influence.

Quaternary Eolian Sand (Map Symbol - Qws)

Based on our subsurface investigation, and as mapped by Cox and Morton (1978a, 1978b), "eolian wind-blow sands" surficially mantle the site. Onsite these deposits range between ±3 and ±9 feet in thickness. The eolian deposits generally consist of light, to medium, to grayish brown, to gray, sands, silty sands, and localized silt-rich zones. Based on the low density and potentially compressible nature of the deposits, they are considered unsuitable for support of structures and/or improvements in their existing state. Therefore, these soils will be need to be removed and recompacted, if not removed during planned excavation, should settlement sensitive improvements be proposed within their influence.

Quaternary Fan Deposits [Pleistocene-age Alluvial Fans]- (Map Symbol - Qf)

Quaternary alluvial fan deposits were encountered underlying the artificial fill, colluvial, and eolian deposits onsite. These sediments were generally observed to be various shades of gray, yellow, olive, and orange (oxidized) brown, silts, silty sands, clayey sands, and fine-to coarse-grained sands. The fan deposits also contained Stage II carbonate veins and veinlets near the stratigraphic top of the formation. The sediments generally varied from dry to wet, to locally saturated, and generally ranged from medium dense/medium stiff to very dense/very stiff with depth. As encountered onsite, the fan deposits typically have a low expansion potential. However, medium expansive soils may not be precluded from occurring onsite, and should be anticipated. Due to the potential for settlement, near surface weathered fan deposits should be removed and/or processed prior to compacted fill placement, should settlement sensitive improvements be proposed within their influence.

FAULTING AND REGIONAL SEISMICITY

The site is situated in Southern California, which is in an area of active faulting. The nearby Chino - Cental Avenue (Elsinore) fault zone (design fault for the site) is considered active and is included within Alquist-Priolo Earthquake Fault Zone. Our review indicates that there are no known active faults crossing the site, and the site is not within an Alquist-Priolo Earthquake Fault Zone.

The following table lists the major faults and fault zones in southern California that could have a significant effect on the site should they experience activity.

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE MILES (KM)
Chino - Central Avenue (Elsinore)	7.1 (11.4)
Clamshell - Sawpit	24.7 (39.7)
Cleghorn	23.0 (37.0)
Compton Thrust	27.0 (43.4)
Cucamonga	13.8 (22.2)
Elsinore - Glen Ivy	10.3 (16.6)
Elsinore - Temecula	27.8 (44.7)
Elysian Park Thrust	17.4 (28.0)
Helendale - South Lockhard	47.9 (77.1)
Hollywood	38.4 (61.8)
Newport-Inglewood - (L.A. Basin)	32.7 (52.7)
Newport-Inglewood - (Offshore)	33.7 (54.3)
North Frontal Fault Zone (East)	47.7 (76.7)
North Frontal Fault Zone (West)	27.9 (44.9)
Palos Verdes	42.3 (68.0)
Pinto Mountain	49.5 (79.7)
Raymond	27.5 (44.2)
San Andreas (1857 Rupture)	22.2 (35.7)
San Andreas (Mojave)	22.2 (35.7)
San Andreas (San Bernardino)	20.6 (33.1)
San Andreas (Southern)	20.6 (33.1)
San Gabriel	45.9 (73.8)
San Jacinto - Anza	42.0 (67.6)
San Jacinto - San Bernardino	15.1 (24.3)
San Jacinto - San Jacinto Valley	19.9 (32.1)
San Jose	11.0 (17.7)
Santa Monica	48.0 (77.3)
Sierra Madre	13.7 (22.1)
Sierra Madre (San Fernando)	46.2 (74.3)
Verdugo	33.3 (53.6)
Whittier	10.3 (16.5)

The acceleration-attenuation relations of Bozorgnia, Campbell, and Niazi (1999), and Campbell and Bozorgnia (1997) have been incorporated into EQFAULT (Blake, 1989). For this study, peak horizontal ground accelerations anticipated at the site were determined based on the random mean and random mean plus 1 - sigma attenuation curves developed by Campbell (1993), and Campbell and Bozorgnia (1994). These acceleration-attenuation relations have been incorporated in EQFAULT, a computer program by Thomas F. Blake (1989), which performs deterministic seismic hazard analyses using up to 150 digitized California faults as earthquake sources. The program estimates the closest distance between each fault and a user-specified file. If a fault is found to be within a user-selected radius, the program estimates peak horizontal ground acceleration that may occur at the site from the upper bound ("maximum credible") earthquake on that fault. Site acceleration (g) is computed by any of the 19 user-selected acceleration-attenuation relations that are contained in EQFAULT. Based on the above, peak horizontal ground accelerations from an upper bound event may be on the order of 0.39g to 0.64g.

Historical site seismicity was evaluated with the acceleration-attenuation relations of Bozorgnia, Campbell, and Niazi (1999), and the computer program EQSEARCH (Blake, 1989, updated to 2002). This program performs a search of historical earthquake records for magnitude 5.0 to 9.0 seismic events within a 100-mile radius, between the years 1800 to December 2002. Based on the selected acceleration-attenuation relationship, a peak horizontal ground acceleration is estimated, which may have effected the site during the specific event listed. Based on the available data and the attenuation relationship used, the estimated maximum repeatable peak site acceleration during the period 1800 through December, 2002 was 0.87g. In addition, site specific probability of exceeding various peak horizontal ground accelerations and a seismic recurrence curve are also estimated/generated from the historical data.

A probabilistic seismic hazards analysis was performed using FRISKSP (Blake, 1995) which models earthquake sources as three-dimensional planes and evaluates the site specific probabilities of exceedance for given peak acceleration levels or pseudo-relative velocity levels. Based on a review of these data, and considering the relative seismic activity of the southern California region, a peak horizontal ground acceleration of 0.46g was calculated. This value was chosen as it corresponds to a 10 percent probability of exceedance in 50 years (or a 475-year return period).

The possibility of ground shaking at the site may be considered similar to the southern California region as a whole. The relationship of the site location to these major mapped faults is indicated on the California Fault Map (Figure 2).

Lineament Analysis

In order to identify possible unmapped faults, identify possible fissures, and to evaluate topographic expressions of nearby published fault and lineament traces, a lineament analysis was performed. As indicated previously, stereoscopic "false-color" infrared aerial photographs (United State Department of Agriculture, 1980) at a scale of approximately 1:40,000 were utilized in our lineament analysis. Lineaments are classified according to their development as strong, moderate, or weak. A strong lineament is a well defined feature that can be continuously traced several hundred feet to a few thousand feet. A

CALIFORNIA FAULT MAP

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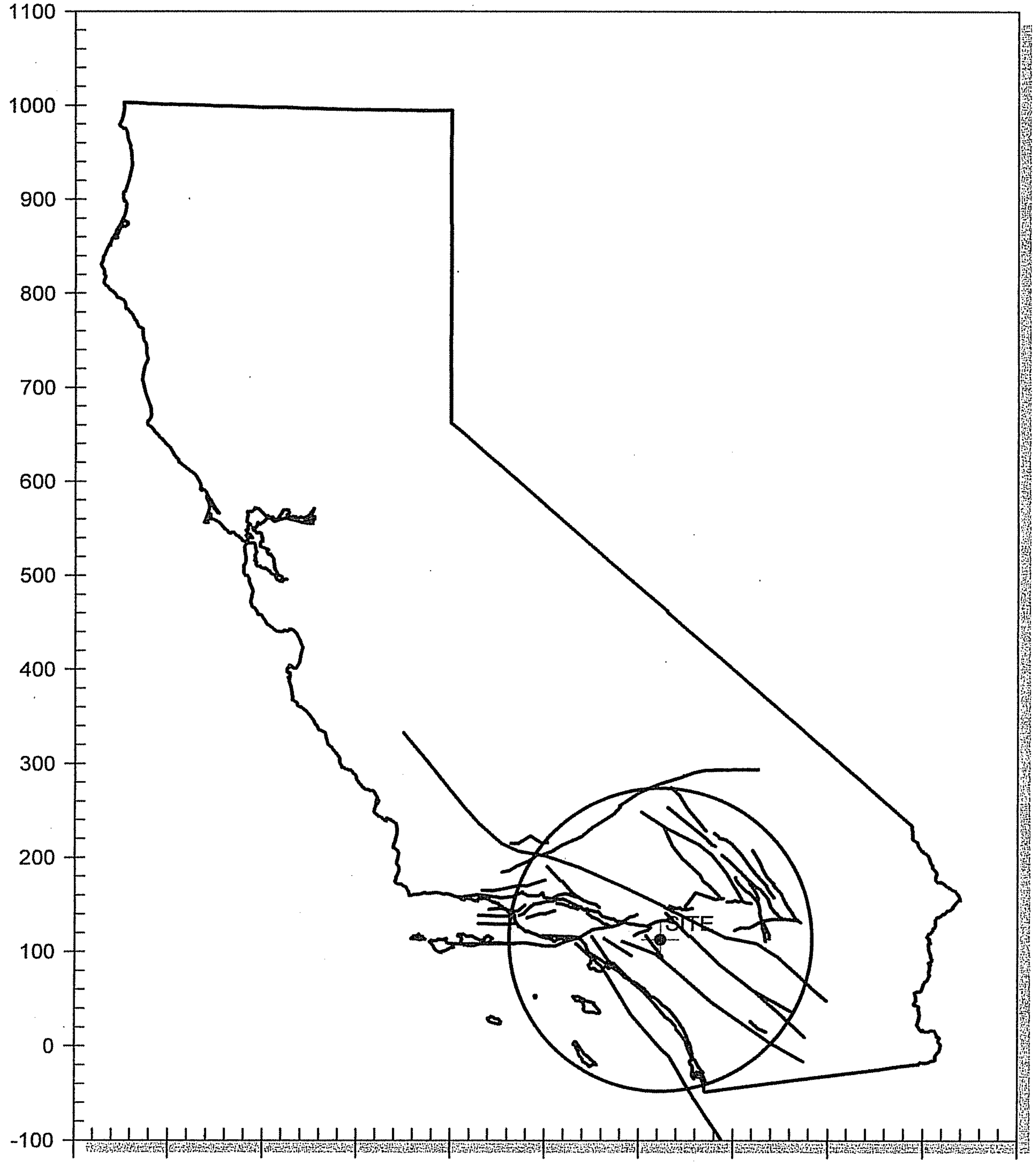


Figure 2

moderate lineament is less well defined, somewhat discontinuous, and can be traced for only a few hundred feet. A weak lineament is discontinuous, poorly defined, and can be traced for a few hundred feet or less. No lineaments were observed transecting the site based on the aerial photographs reviewed for this study.

Seismic Shaking Parameters

Based on the site conditions, Chapter 16 of the Uniform Building Code (UBC, International Conference of Building Officials [ICBO], 1997), the following seismic parameters are provided.

Seismic zone (per Figure 16-2*)	4
Seismic zone factor Z (per Table 16-I*)	0.40
Soil Profile Types (per Table 16-J*)	S_D
Seismic Coefficient C_a (per Table 16-Q*)	0.44 N_a
Seismic Coefficient C_v (per Table 16-R*)	0.64 N_v
Near Source factor N_a (per Table 16-S*)	1.0
Near Source factor N_v (per Table 16-T*)	1.1
Distance to Seismic Source (Chino - Central Ave.)	7.1 mi. (11.4 km)
Seismic Source Type (per Table 16-U*)	B
Upper Bound Earthquake (Chino - Central Ave.)	M_W 6.7
* Figure and table references from Chapter 16 of the Uniform Building Code (1997).	

SUBSURFACE WATER

Free subsurface water was not encountered in any of the thirty subsurface excavations completed during this study. These observations reflect site conditions at the time of our investigation and do not preclude changes in local groundwater conditions in the future from heavy irrigation, precipitation, or other factors not obvious at the time of our field work. Based on the California Department of Water Resources (CDWR), water data library (see Appendix A), historic high groundwater levels in other wells in the general site area are reported to be in excess of 100+ feet below the ground surface. Groundwater may occur in the Quaternary fan deposits (Pleistocene-age fans), or along fractures and/or bedding due to migration from adjacent drainage areas and development and/or during and after periods of above normal or heavy precipitation. Thus, perched groundwater conditions may occur in the future, and should be anticipated. Additional discussions of groundwater are presented within the conclusions section of this report.

LIQUEFACTION POTENTIAL

Seismically-induced liquefaction is a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in soils. The soils may thereby acquire a high degree of mobility, and lead to lateral movement, sliding, sand boils, consolidation and settlement of loose sediments, and other damaging deformations. This phenomenon occurs only below the water table; but after liquefaction has developed, it can propagate upward into overlying, non-saturated soil as excess pore water dissipates. Typically, liquefaction has a relatively low potential at depths greater than 45 feet and is virtually unknown below a depth of 60 feet.

The condition of liquefaction has two principal effects. One is the consolidation of loose sediments with resultant settlement of the ground surface. The other effect is lateral sliding. Significant permanent lateral movement generally occurs only when there is significant differential loading, such as fill on natural ground slopes. Liquefaction susceptibility is related to numerous factors and the following conditions should be present for liquefaction to occur: 1) sediments must be relatively young in age and not have developed a large amount of cementation; 2) sediments generally consist of medium to fine grained, relatively cohesionless sands; 3) the sediments must have low relative density; 4) free groundwater must be present in the sediment; and 5) the site must experience a seismic event of a sufficient duration and magnitude, to induce straining of soil particles.

It should be noted that throughout our site observations, and subsurface investigation, there was no evidence of upward-directed hydraulic force that was suddenly applied, and was of short duration, nor were there any features commonly caused by seismically induced liquefaction, such as dikes, sills, vented sediments, lateral spreads, or soft-sediment deformation. In addition, mottled soils were not noted during our subsurface investigation, which also indicates the absence of high groundwater levels historically. These features would be expected if the site area had been subject to liquefaction in the past (Obermeier, 1996). Inasmuch as the future performance of the site with respect to liquefaction should be similar to the past, excluding the effects of urbanization (irrigation), GSI concludes that the site generally has not been subject to liquefaction in the geologic past, regardless of the depth of the localized water table.

After rough grading operations, two to three of these five conditions will not have the potential to affect the site, and the entire site is underlain at depth by relatively dense Pleistocene-age alluvial fan deposits. As indicated previously, all potentially liquefiable eolian sands/soils, in areas proposed for development, will be mitigated by complete remedial removals. Our evaluation and general liquefaction screening process (pursuant to Special Publication 117) indicates that the potential for liquefaction and associated adverse effects within the site is low, even with a future rise in groundwater levels.

SUBSIDENCE

Areal subsidence generally occurs at the transition/contact between materials of substantially different engineering properties. Thus, the only potential for this condition exists between the basement bedrock and alluvial fan deposits. Based on the available data, bedrock underlies the alluvial fan deposits at great depth; therefore, this potential is considered low. Our review of available stereoscopic aerial photographs (USDA, 1980) showed no features generally associated with areal subsidence (i.e., radially-directed drainages flowing into a depression(s), linearity of depressions associated with mountain fronts, etc.). Ground fissures are generally associated with excessive groundwater withdrawal and associated subsidence, or active faulting. Our review did not reveal any information that active faulting or excessive groundwater withdrawal, or ground fissures, in the specific site vicinity, is occurring at this time. Therefore, the potential for areal subsidence or ground fissures is considered low. However, groundwater levels may change in the future as a result of groundwater withdrawal/pumping, climatic change, or irrigation.

OTHER GEOLOGIC HAZARDS

Mass wasting refers to the various processes by which earth materials are moved down slope in response to the force of gravity. Since the site is relatively flat lying, the potential for mass wasting is considered very low. Indications of deep-seated landsliding, slope creep, or significant surficial failures on the site were not observed during our site investigations, and should not affect the site, provided our recommendations for development are implemented.

LABORATORY TESTING

Classification

Soils were classified visually according to the Unified Soils Classification System. The soil classifications are shown on the test pit and boring logs, Appendix B; and the laboratory test results are presented in Appendix D.

Moisture Density

The field moisture contents and dry unit weights were determined for undisturbed ring samples for the soils encountered in the exploratory test pits and borings. The dry unit weight was determined in pounds per cubic foot and the field moisture content was determined as a percentage of the dry unit weight. The results of these tests are shown on the test pit and boring logs (Appendix B).

Laboratory Standard

The maximum density and optimum moisture content was determined for the major soil types encountered in the exploratory test pits and borings. The laboratory standard used was ASTM D-1557. The moisture-density relationship obtained for the site soils are shown below:

SOIL TYPE	LOCATION & DEPTH (ft.)	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
Silty SAND, Grayish brown	TP -1 @ 6'-7'	117.0	15.0
Sandy SILT, Grayish brown	TP-19 @ 3-4'	110.0	17.0

Expansion Potential

Expansion Index (EI) testing was performed on a representative sample of site earth materials in general accordance with Table 18-I-B of the UBC. Test results of between 8 and 1 indicate that site soils are anticipated to be generally very low in expansive potential (EI from 0 to 20). Variations may occur, including soils exhibiting expansion potentials from low to medium (EI from 21 to 90), additional EI testing should be performed during future development to verify conditions encountered during our preliminary subsurface investigations.

Soluble Sulfates/Corrosion

Typical samples of the site materials were analyzed for soluble sulfates, pH, and resistivity. The soluble sulfate and corrosion potential results are shown as follows:

LOCATION AND DEPTH (FT.)	SOLUBLE SULFATES PERCENTAGE BY WEIGHT	pH	RESISTIVITY (OHMS-CM)
TP-2 @ 6'- 7'	ND*	7.7	520
TP-19 @ 3'- 4'	0.0048	7.7	1,700

* Non-Detect

For preliminary planning purposes, based upon the soluble sulfate test results and the latest edition of the UBC, the soluble sulfate content is categorized as negligible (0.00-0.10 Water-Soluble Sulfate in Soil, percentage by weight) and sulfate-resistant concrete should not be necessary. Additionally, a modified cement to water ratio and modified concrete compressive strength should not be necessary.

Based on the results of the resistivity and pH testing, the onsite soils are considered to be mildly alkaline (a pH of 7.4 to 7.8 is considered mildly alkaline) and are considered to be corrosive to severely corrosive toward ferrous metals in a saturated state (1,000 to 2,000 is considered corrosive, below 1,000 ohm-cm is considered severely corrosive). Based on the laboratory test results obtained, consideration should be given to consulting with a corrosion engineer to provide specific recommendations.

Although the site soils are categorized as being corrosive to severely corrosive to ferrous metals, no exposure conditions stated in Table 19-A-2 of the UBC are found within the subject site. It is our understanding that ferrous metals embedded in properly poured and formed Type I, II, or V concrete should be adequately protected from these conditions. Additionally, as stated above, the soluble sulfate content on the subject lots is considered negligible.

Shear Testing

Shear testing was performed in a direct shear machine of the strain-control type. The rate of deformation is approximately 0.05 inches per minute. The sample was sheared under varying confining loads in order to determine that coulomb shear strength parameters, angle of internal friction and cohesion. The tests were performed on natural ring sample of the Quaternary fan deposits. The shear testing results are presented in Appendix D.

Consolidation Testing

Consolidation tests were performed on selected undisturbed ring samples obtained during our subsurface investigations. Testing was performed in general accordance with ASTM Test Method D-2435-90. Test results are presented in Appendix D.

Particle - Size Analysis

An evaluation was performed on selected representative soil samples in general accordance with ASTM Test Methods D-2487 and with ASTM D-422. Particle size analyses were performed on selected samples from our exploratory test pits and borings. The grain-size distribution curves are presented in Appendix D. These test results were utilized in evaluating the potential for liquefaction and utilized for soil classifications in accordance with the Unified Soil Classification System.

PRELIMINARY EARTHWORK FACTORS

Preliminary earthwork factors (shrinkage and bulking) for the subject property have been estimated based upon our field and laboratory testing, visual site observations, and experience in the site area. It is apparent that shrinkage would vary with depth and with areal extent over the site based on previous site use. Variables include vegetation, weed control, discing, and previous filling or exploring. However, all these factors are difficult to define in a three-dimensional fashion.

Therefore, the information presented below represents average shrinkage/bulking values:

Artificial fill	15% to 20% shrinkage
Topsoil/Colluvium	15% to 20% shrinkage
Weathered Quaternary Fans	5% to 10% shrinkage
Quaternary Fan Deposits (Pleistocene-age fans)	0% to 7% shrinkage

An additional shrinkage factor item would include the removal of root systems of individual large plants or trees. These plants and trees vary in size but, when pulled, they may generally result in a loss of ½ to 1½ cubic yards, to locally greater than 3 cubic yards of volume, respectively. The above facts indicate that earthwork balance for the site would be difficult to define and flexibility in design is essential to achieve a balanced end product. Subsidence due to equipment loadings (dynamic compaction) may be on the order of 0.15 to 0.2 feet, but will depend on haul routes, etc.

CONCLUSIONS AND RECOMMENDATIONS

Based on our field exploration, laboratory testing, and our engineering and geologic analyses, it is our opinion that the project site appears suited for the proposed residential use from a soils engineering and geologic viewpoint. The recommendations presented below should be incorporated in the design, grading, and construction considerations.

General

1. Soils engineering and compaction testing services should be provided during grading operations to assist the contractor in removing unsuitable soils and in his effort to compact the fill.

2. Geologic observations should be performed during grading to verify and/or further evaluate geologic conditions. Although unlikely, if adverse geologic structures are encountered during grading operations, supplemental recommendations and earthwork may be warranted.

3. Based on our subsurface investigation and field reconnaissance mapping, abundant amounts of manure and organic matter exist and/or are stockpiled and/or were spread across localized areas of the site. It is the standard of the industry that after removal of such materials that remaining surficial spoils may be properly mixed with existing soils to a <u>maximum</u> 1 percent concentration by weight, for fill. However, based on our experience, testing on other nearby parcels, and visual observations, it appears that the existing surficial soils already contain in excess of 1 percent organic matter. The excessive manure and organic matter, approximately ±1 to

6+ feet in thickness (stockpiles and berms), should be removed and exported offsite. In addition, removals of soils contaminated with excess organic materials may also be necessary. Observation, and if deemed necessary, testing by representatives of GSI, should be conducted to verify the organic materials have been properly removed from areas proposed for settlement sensitive improvements. In addition, based on previous land use (dairy), methane studies will likely be required by the County.

4. Based on laboratory testing, for preliminary planing purposes, the expansion potential of the onsite soils is considered very low. However, soils with a low to medium expansive potential may not be precluded from occurring onsite. Preliminary foundation recommendations for conventional and post-tension design are provided herein.

5. Typical samples of the site materials have been analyzed for soluble sulfate/corrosion potential. Based on testing, the use of sulfate resistant concrete is not anticipated at this time. However, based on the test results, the onsite soils are mildly alkaline and are considered corrosive to severely corrosive to ferrous metals in a saturated state. Accordingly, consideration should be given to consulting with a corrosion engineer to provide specific recommendations.

6. In general and based upon the available data to date, groundwater is not expected to be a factor in the development of the site. However, due to the nature of the site materials, seepage may be encountered throughout the site along with seasonal perched water, and also may be encountered in "daylighted" bedding, sandy lenses, or fracture systems within the Quaternary fan deposits. Therefore, subdrainage systems for the control of localized groundwater seepage should be anticipated, both during and after grading and development.

7. Based upon our field explorations the sedimentary soils throughout the site should be relatively easily rippable to the proposed depths.

8. Due to the noncohesive nature of some of the onsite materials, some caving and sloughing may be anticipated to be a factor in subsurface excavations and trenching. Therefore, current local and state/federal safety ordinances for subsurface trenching should be enforced.

9. General Earthwork and Grading Guidelines are provided at the end of this report as Appendix E. Specific recommendations are provided below.

Demolition/Grubbing

1. Any existing surface/subsurface structures, manure, major vegetation, tree remains, and any miscellaneous organic matter and debris should be removed from the areas of proposed grading.

2. The project soils engineer should be notified of any previous foundation, irrigation lines, cesspools, septic tanks, leach fields, wells, or other subsurface structures that are uncovered during the recommended removals, so that appropriate remedial recommendations can be provided.

3. Cavities or loose soils (including all previous exploratory test pits and borings, as practical) remaining after demolition and site clearance should be cleaned out, observed by the soils engineer, processed, and replaced with fill that has been moisture conditioned to at least optimum moisture content and compacted to at least 90 percent of the laboratory standard, if not removed by proposed cuts.

Treatment of Existing Ground

1. All undocumented artificial fill, colluvium/topsoil, eolian sands/soils, and near-surface weathered Quaternary fan deposits should be removed to competent alluvial fan deposits not significantly susceptible to hydroconsolidation (i.e., greater than or equal to 85 percent saturation, and/or greater than or equal to 105 pcf for in-place native materials), if not removed by proposed excavation within areas proposed for settlement-sensitive improvements. Thicknesses of colluvium/topsoil, eolian sands/soils, and weathered Quaternary fan deposits (Pleistocene-age fans) are discussed in earlier sections of this report. Variations from the previously discussed remedial removal thicknesses (±4 to ±9 feet, with an average of ±6 feet across a majority of the site [excluding stockpiles]) should be anticipated. Actual depths of removals will be evaluated in the field during grading by the soil engineer.

2. Where planned cuts are equal to or greater than the recommended removal depth, the area should be additionally overexcavated to at least two (2) feet below any foundations, the subgrade observed and tested by the geotechnical consultant, then the upper 12 inches should be scarified, brought to at least optimum moisture content, and recompacted to a minimum relative compaction of 90 percent of the laboratory standard.

3. Where the planned cuts are less than the recommended removal depth, the additional removals to attain the recommended removal should be accomplished, and overexcavated, as discussed above. The exposed removal surface should be scarified to a depth of 12 inches, moisture conditioned (if necessary), and then compacted prior to fill placement to finish pad grade.

4. Existing colluvium/topsoil, clean artificial fill, eolian sands/soils, and the Quaternary fan deposits, etc., may be reused as compacted fill provided that major concentrations of manure, vegetation, and miscellaneous debris are removed prior to fill placement.

5. Localized deeper removal may be necessary due to buried drainage channel meanders or dry porous materials. The project soils engineer/geologist should observe all removal areas during the grading.

Fill Placement

1. Fill materials should be brought to at least optimum moisture, placed in thin 6- to 8-inch lifts and mechanically compacted to obtain a minimum relative compaction of 90 percent of the laboratory standard.

2. Fill materials should be cleansed of major vegetation and debris prior to placement.

3. Any oversized rock materials greater than 12 inches in diameter should be placed under the observation of the soils engineer, and not placed within 10 feet of finish grade.

4. Any import materials should be observed and determined suitable by the soils engineer prior to placement on the site. Foundation designs may be altered if import materials have greater sulfate/expansion values than the onsite materials encountered in this investigation.

Slope Considerations and Slope Design

Based on our slope stability evaluation and experience on nearby projects, proposed cut and fill slopes constructed using onsite materials, to the heights proposed, should be grossly and surficially stable provided the recommendations contained herein are implemented during site development.

All slopes should be designed and constructed in accordance with the minimum requirements of the UBC, and/or County, and the recommendations in the General Earthwork and Grading Guidelines section of this report (Appendix E), and the following:

1. Fill slopes should be designed and constructed at a 2:1 (horizontal to vertical) gradient or flatter and should not exceed about 15 feet in height. Fill slopes should be properly built and compacted to a minimum relative compaction of 90 percent throughout, including the slope surfaces. Guidelines for slope construction are presented in Appendix E.

2. Cut slopes should be designed at gradients of 2:1 (h:v) or flatter and should not exceed about 15 feet in height. While stabilization of such slopes is not anticipated, locally adverse geologic conditions (i.e., daylighted joints/fractures, severely weathered fan deposits, or sandy lenses) may be encountered which may require remedial grading, stabilization, or laying back of the slope to an angle flatter than the adverse geologic condition.

3. Local areas of highly to severely weathered fan deposits may be present. Should these materials be exposed in cut slopes, the potential for long term maintenance or possible slope failure exists. Evaluation of cut slopes during grading would be necessary in order to identify any areas of severely weathered materials or non-cohesive sands. Should any of these materials be exposed during construction, the soils engineer/geologist, would assess the magnitude and extent of the materials and their potential affect on long-term maintenance or possible slope failures. Recommendations would then be made at the time of the field inspection.

4. Loose rock debris and fines remaining on the face of the cut slopes should be removed during grading. This can be accomplished by high pressure water washing or by hand scaling, as warranted.

5. Where loose materials are exposed on the cut slopes, the project's engineering geologist would require that the slope be cleaned as described above prior to making their final inspection. Final approval of the cut slope can only be made subsequent to the slope being fully cut and cleaned.

Transition and Overexcavation Areas

In order to reduce the potential for differential settlements between cut and fill materials, materials of differing expansion potentials, or dense Quaternary fan deposits, the entire cut portion of cut/fill transitions should be overexcavated to a minimum depth of 2 feet below any foundations (typically three [3] feet from finish grade), or to a maximum ratio of fill thickness of 3:1 (maximum to minimum), and replaced with compacted fill. The overexcavation should be performed to a minimum of five (5) feet outside the building footprint, or a 1:1 (horizontal to vertical) downward projection from proposed foundations, whichever is greater.

PRELIMINARY RECOMMENDATIONS - FOUNDATIONS

General

The foundation design and construction recommendations are based on laboratory testing and engineering analysis of onsite earth materials. Recommendations for conventional foundation systems as well as post-tensioned systems are provided in the following sections. Conventional foundations may be utilized for soils with expansion indices (EI) of less than 90 (i.e., very low to medium classification). The foundation systems may be used to support the proposed structures, provided they are founded in competent bearing material. The proposed foundation systems should be designed and constructed in accordance with the guidelines contained in the UBC and the and the differential settlement and angular distortion discussed previously and herein.

Conventional Foundation Design

1. Conventional spread and continuous footings may be used to support the proposed residential structures provided they are founded entirely in properly compacted fill.

2. Analyses indicate that an allowable bearing value of 1,500 pounds per square foot may be used for design of footings which maintain a minimum width of 12 inches (continuous) and 24 inches square (isolated), and a minimum depth of at least 12 inches into the properly compacted fill. The bearing value may be increased by one-third for seismic or other temporary loads. This value may be increased by 200 pounds per square foot for each additional 12 inches in depth, to a maximum of 2,500 pounds per square foot.

3. For lateral sliding resistance, a 0.35 coefficient of friction may be utilized for a concrete to soil contact when multiplied by the dead load.

4. Passive earth pressure may be computed as an equivalent fluid having a density of 250 pounds per cubic foot with a maximum earth pressure of 2,500 pounds per square foot.

5. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

6. All footings should maintain a minimum 7-foot horizontal distance between the base of the footing and any adjacent descending slope, and minimally comply with the guidelines depicted on Figure No. 18-I-1 of the UBC (ICBO, 1997).

FOUNDATION CONSTRUCTION

The following foundation construction recommendations are presented as a minimum criteria from a soils engineering standpoint. Onsite soils will likely vary from very low to low (EI 0 to 50). However, medium expansive soils cannot be precluded from occurring onsite. Final foundation design will be based upon which earth material is exposed at finished grades, as verified by testing, during or shortly after site grading.

Accordingly, the following foundation construction recommendations are for soils in the top 3 feet of finish grade which will have a very low to medium expansion potential, for planning and design considerations. Recommendations by the project's design-structural engineer or architect, which may exceed the soils engineer's recommendations, should take precedence over the following minimum requirements. Final foundation design will be provided based on the expansion potential of the near surface soils encountered during grading.

Expansion Classification - Very Low to low (El 0 to 50)

1. Conventional continuous footings should be founded at a minimum depth of 12 inches below the lowest adjacent ground surface for one-story floor loads and 18 inches below the lowest adjacent ground surface for two-story floor loads. Interior footings may be founded at a depth of 12 inches below the lowest adjacent ground surface.

   Footings for one-story floor loads should have a minimum width of 12 inches, and footings for two-story floor loads should have a minimum width of 15 inches. All footings should have one No. 4 reinforcing bar placed at the top and one No. 4 reinforcing bar placed at the bottom of the footing. Isolated interior or exterior footings should be founded at a minimum depth of 24 inches below the lowest adjacent ground surface.

2. A grade beam, reinforced as above, and at least 12 inches square, should be provided across the garage entrances. The base of the reinforced grade beam should be at the same elevation as the adjoining footings.

3. Concrete slabs in residential and garage areas should be a minimum of 4 inches thick, and underlain with a vapor barrier consisting of a minimum of 6-mil, polyvinyl-chloride membrane with all laps sealed. This membrane should be covered with a minimum of 2 inches of sand to aid in uniform curing of the concrete.

4. Concrete slabs, including garage slabs, should be reinforced with No. 3 reinforcement bars placed on 18-inch centers, in two horizontally perpendicular directions (i.e., long axis and short axis). All slab reinforcement should be supported to ensure proper mid-slab height positioning during placement of the concrete. "Hooking" of reinforcement is not an acceptable method of positioning.

5. Garage slabs should be poured separately from the residence footings and be quartered with expansion joints or saw cuts. A positive separation from the footings should be maintained with expansion joint material to permit relative movement.

6. The residential and garage slabs should have a minimum thickness of 4 inches, and the slab subgrade should be free of loose and uncompacted material prior to placing concrete.

7. Presaturation is not necessary for these soil conditions; however, the moisture content of the subgrade soils should be equal to or greater than optimum moisture to a depth of 12 inches below the adjacent ground grade in the slab areas, and verified by this office within 72 hours of the vapor barrier placement.

8. Soils generated from footing excavations to be used onsite should be compacted to a minimum relative compaction 90 percent of the laboratory standard, whether it is to be placed inside the foundation perimeter or in the yard/right-of-way areas. This

material must not alter positive drainage patterns that direct drainage away from the structural areas and toward the street.

9. Foundations near the top of slope should be deepened to conform to the latest edition of the UBC (ICBO, 1997) and provide a minimum 7-foot horizontal distance from the slope face. Rigid block wall designs located along the top of slope should be reviewed by a soils engineer.

10. As an alternative, an engineered post-tension foundation system may be used. Recommendations for post-tensioned slab design are provided in following sections.

Expansion Classification - Medium (EI 51 to 90)

1. Conventional continuous footings should be founded at a minimum depth of 18 inches below the lowest adjacent ground surface for one- or two-story floor loads. Interior footings may be founded at a depth of 12 inches below the lowest adjacent ground surface.

   Footings for one-story floor loads should have a minimum width of 12 inches, and footings for two-story floor loads should have a minimum width of 15 inches. All footings should be reinforced with a minimum of two No. 4 reinforcing bars at the top and two No. 4 reinforcing bars at the bottom. Isolated footings are not recommended.

2. A grade beam, reinforced as above, and at least 12 inches square, should be provided across the garage entrances. The base of the reinforced grade beam should be at the same elevation as the adjoining footings.

3. Concrete slabs in residential and garage areas should be a minimum of 4 inches thick, and underlain by a vapor barrier consisting of a minimum of 6-mil, polyvinyl-chloride membrane with all laps sealed. Two inches of the sand base should be placed over and under the membrane (total of 4 inches) to aid in uniform curing of the concrete.

4. Concrete slabs, including garage areas, should be reinforced with No. 4 reinforcement bars placed on 18-inch centers, in two horizontally perpendicular directions (i.e., long axis and short axis). All slab reinforcement should be supported to ensure proper mid-slab height positioning during placement of the concrete. "Hooking" of reinforcement is not an acceptable method of positioning.

5. Garage slabs should be poured separately from the residence footings and be quartered with expansion joints or saw cuts. A positive separation from the footings should be maintained with expansion joint material to permit relative movement.

6. The residential and garage slabs should have a minimum thickness of 4 inches, and the slab subgrade should be free of loose and uncompacted material prior to placing concrete.

7. Presaturation of slab areas is recommended for these soil conditions. The moisture content of each slab area should be 120 percent or greater above optimum and verified by the soil engineer to a depth of 18 inches below adjacent ground grade in the slab areas, within 72 hours of the vapor barrier placement.

8. Soils generated from footing excavations to be used onsite should be compacted to a minimum relative compaction 90 percent of the laboratory standard, whether it is to be placed inside the foundation perimeter or in the yard/right-of-way areas. This material must not alter positive drainage patterns that direct drainage away from the structural areas and toward the street.

9. Foundations near the top of slope should be deepened to conform to the latest edition of the UBC (ICBO, 1997) and provide a minimum 7-foot horizontal distance from the slope face. Rigid block wall designs located along the top of slope should be reviewed by a soils engineer.

10. As an alternative, an engineered post-tension foundation system may be used. Exterior footings for the post-tension foundation should be founded at a minimum depth of 18 inches below the adjacent ground surface. Prior to pouring of the post-tension foundation system, the subgrade materials should be premoistened to 120 percent or greater above optimum moisture content to a depth of 18 inches. In addition, the vapor barrier, as described previously, should be sandwiched by two 2-inch thick layers of sand (SE>30). Engineering parameters for post-tension design are provided in the following section.

PRELIMINARY POST-TENSIONED SLAB DESIGN

It is GSI's opinion that conventional slab design may not accommodate potential foundation movement that the underlying soils would impart from potentially expansive soils. Foundations should be designed to accommodate the differential settlement and angular distortion values provided herein. The recommendations presented below should be followed in addition to those contained in the previous sections. The information and recommendations presented in this section are not meant to supersede design by a registered structural engineer or civil engineer familiar with post-tensioned slab design or corrosion engineering consultant. Upon request, GSI could provide additional data/consultation regarding soil parameters as related to post-tensioned slab design.

From a soil expansion/shrinkage standpoint, a fairly common contributing factor to distress of structures using post-tensioned slabs is a significant fluctuation in the moisture content of soils underlying the perimeter of the slab, compared to the center, causing a "dishing" or "arching" of the slabs. To mitigate this possible phenomenon, a combination of soil presaturation and construction of a perimeter "cut off" wall grade beam should be employed.

Perimeter foundations should be a minimum of 12 or 18 inches deep for very low to low, or medium expansive soils, respectively. The walls should be a minimum of 12 inches in thickness. In moisture sensitive slab areas, a vapor barrier should be utilized and be of sufficient thickness to provide a durable separation of foundation from soils (6 mils. thick). The vapor barrier should be sealed to provide a continuous water-proof barrier under the entire slab. The vapor barrier should be sandwiched by two 2-inch thick layers of sand (SE>30).

Specific soil presaturation is not required; however, the moisture content of the subgrade soils should be at or above the soils' optimum moisture content to a depth of 24 inches below grade.

Post-tensioned slabs should be designed in accordance with the recommendations of the Post-Tensioning Institute Method. Based on review of laboratory data for the onsite materials, the average soil modulus subgrade reaction K, to be used for design, is 100 pounds per cubic inch. This is equivalent to a <u>surface</u> bearing value of 1,000 pounds per square foot.

Post-Tensioning Institute Method

Post-tensioned slabs should have sufficient stiffness to resist excessive bending due to non-uniform swell and shrinkage of subgrade soils. The differential movement can occur at the corner, edge, or center of slab. The potential for differential uplift can be evaluated using the 1997 Uniform Building Code Section 1816, based on design specifications of the Post-Tensioning Institute. The following table presents suggested minimum coefficients to be used in the Post-Tensioning Institute design method.

Thornthwaite Moisture Index	-20 inches/year
Correction Factor for Irrigation	20 inches/year
Depth to Constant Soil Suction	7 feet
Constant soil Suction (pf)	3.6

The coefficients are considered minimums and may not be adequate to represent worst case conditions such as adverse drainage and/or improper landscaping and maintenance. The above parameters are applicable provided structures have gutters and downspouts and positive drainage is maintained away from structures. Therefore, it is important that information regarding drainage, site maintenance, settlements, and effects of expansive soils be passed on to future owners.

Based on the above parameters, the following values were obtained from figures or tables of the 1997 Uniform Building Code Section 1816. The values may not be appropriate to account for possible differential settlement of the slab due to other factors. If a stiffer slab is desired, higher values of y_m may be warranted.

EXPANSION INDEX OF SOIL SUBGRADE (per UBC)	VERY LOW TO LOW EXPANSION POTENTIAL (EI = 0-50)	MEDIUM EXPANSION POTENTIAL (EI =51-90)
e_m center lift	5.0 feet	5.5 feet
e_m edge lift	3.5 feet	4.0 feet
Y_m center lift	1.70 inches	2.7 inches
Y_m edge lift	0.55 inches	0.75 inches

Deepened footings/edges around the slab perimeter must be used to minimize non-uniform surface moisture migration (from an outside source) beneath the slab. The bottom of the deepened footing/edge should be designed to resist tension, using cable or reinforcement per the structural engineer. Other applicable recommendations presented previous sections should be adhered to during the design and construction phase of the project.

Preliminary Foundation Settlements

In addition to designing slab systems (PT or other) for the soil conditions described herein, the estimated settlement and angular distortion values that an individual structure could be subjected to should be evaluated by a structural engineer. The levels of angular distortion were evaluated on a 40-foot length assumed as minimum dimension of buildings; if, from a structural standpoint, a decreased or increased length over which the tilt is assumed to occur is justified, this change should be incorporated into the design. The structures should be evaluated and designed for the combination of the soil parameters presented above, and the estimated total settlement, differential settlement and angular distortions provided herein. These estimated values are based on proposed depths of compacted fill and estimated settlements of the underlying alluvial fan deposits.

The footings and/or slabs should be designed to accommodate a total settlement of up to 1½ inches and a differential settlement of ¾-inch (i.e., at least ¾-inch in a 40-foot span).

Any post-construction settlement of the fill should be readily mitigated by conventional or post-tension design, provided the design parameters presented herein are utilized in design of foundation systems. In addition to the above, the structural engineer should also consider estimated settlements due to short duration seismic loading and applicable load combinations, as required by the County and/or the UBC (ICBO, 1997).

Slope Setback Considerations for Footings

Footings should maintain a horizontal distance, X, between any adjacent descending slope face and the bottom outer edge of the footing. The horizontal distance, X, may be calculated by using X = h/2, where h is the height of the slope. X should not be less than 7 feet, nor need not be greater than 80 feet. X may be maintained by deepening the footings.

CONVENTIONAL RETAINING WALLS

The design parameters provided below assume that very low expansive soils are used to backfill any retaining walls. If expansive soils are used to backfill the proposed walls, increased active and at-rest earth pressures will need to be utilized for retaining wall design.

Building walls, below grade, should be water-proofed or damp-proofed, depending on the degree of moisture protection desired. The foundation system for the proposed retaining walls should be designed in accordance with the recommendations presented in Conventional Foundation Design section of this report. Design parameters for specialty walls (i.e., crib, keystone, etc.), can be provided upon request, based on their intended use, and site specific conditions.

Restrained Walls

Any proposed retaining walls that will be restrained prior to placing and compacting backfill material or that have re-entrant or male corners, should be designed for an at-rest equivalent fluid pressure of 65 pcf, plus any applicable surcharge loading. For areas of male or re-entrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner.

Cantilevered Walls

The recommendations presented below are for proposed cantilevered retaining walls up to 15 feet high. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material.

These do not include other superimposed loading conditions such as traffic, structures, seismic events or adverse geologic conditions.

SURFACE SLOPE OF RETAINED MATERIAL HORIZONTAL TO VERTICAL	EQUIVALENT FLUID WEIGHT P.C.F. (Select Backfill)
Level	42
2 to 1	55

Wall Backfill and Drainage

The above criteria assumes that very low expansive granular soils are used as backfill, and that hydrostatic pressures are not allowed to build up behind the wall. Positive drainage must be provided behind all retaining walls in the form of perforated pipe placed within gravel wrapped in geofabric and outlets. A backdrain system is considered necessary for retaining walls that are 2 feet or greater in height. For retaining walls up to 5 feet in height (typical rear yard retaining walls) backdrains should consist of a 4-inch diameter perforated PVC or ABS pipe encased in either Class 2 permeable filter material or ½- to ¾-inch gravel wrapped in approved filter fabric (Mirafi 140 or equivalent). The filter material should extend a minimum of 1 horizontal foot behind the base of the walls and upward at least 1 foot. Outlets should consist of a 4-inch diameter solid PVC or ABS pipe spaced no more than 100± feet apart. The use of weep holes in walls higher than 2 feet should not be considered. The surface of the backfill should be sealed by pavement or the top 18 inches compacted with relatively impermeable soil. Proper surface drainage should also be provided. Consideration should be given to applying a water-proof membrane to all retaining structures. The use of a waterstop should be considered for all concrete and masonry joints.

Footing Excavation Observation

All footing excavations for walls and appurtenant structures should be observed by the geotechnical consultant to evaluate the anticipated near surface conditions prior to the placement of steel or concrete. Based on the conditions encountered during the observations of the footing excavation, supplemental recommendations may be offered, as appropriate.

Transition Conditions - Retaining Walls

Should any proposed retaining walls be situated upon cut-fill transitions, two options may be employed: 1) Increase the amount of reinforcing steel and wall detailing (i.e., expansion joints or crack control joints) such that an angular distortion of 1/360 for a distance of 2H on either side of the transition is accommodated, or; 2) overexcavate the cut portion of the foundation materials to a minimum depth of 3 feet and replace with fill compacted to 90 percent relative compaction.

DEVELOPMENT CRITERIA

Graded Slope Maintenance and Planting

Water has been shown to weaken the inherent strength of all earth materials. Slope stability is significantly reduced by overly wet conditions. Positive surface drainage, away from graded slopes, should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Over-watering should be avoided as it can adversely affect site improvements. Graded slopes constructed within and utilizing onsite materials would be erosive. Eroded debris may be minimized and surficial slope stability enhanced by establishing and maintaining a suitable vegetation cover soon after construction. Plants selected for landscaping should be light weight, deep rooted types that require little water and are capable of surviving the prevailing climate. Plant species other than that outlined above are not recommended, and, if utilized, will increase the potential for perched groundwater conditions. Compaction to the face of fill slopes would tend to minimize short-term erosion until vegetation is established. The above information regarding watering practices and plant selection should be provided to each individual homeowner in writing.

Site Improvements

Recommendations for exterior concrete flatwork design and construction can be provided upon request. If, in the future, any additional improvements are planned for the site, recommendations concerning the geological or geotechnical aspects of design and construction of said improvements could be provided upon request. This office should be notified in advance of any fill placement, grading of the site, or trench backfilling after rough grading has been completed. This includes any grading, utility trench, and retaining wall backfills.

Footing Trench Excavation

All footing excavations should be observed by a representative of this firm subsequent to trenching and prior to concrete form and reinforcement placement. The purpose of the observations is to verify that the excavations are made into the recommended bearing material, and to the minimum widths and depths recommended for construction. If loose or compressible materials are exposed within the footing excavation, a deeper footing or removal and recompaction of the subgrade materials would be recommended at that time. Footing trench spoil and any excess soils generated from utility trench excavations should be compacted to a minimum relative compaction of 90 percent if not removed from the site.

Trenching

Considering the nature of the onsite soils, it should be anticipated that caving or sloughing could be a factor in subsurface excavations and trenching. Shoring or excavating the trench walls at the angle of repose (typically 25 to 45 degrees) may be necessary and should be anticipated. All excavations should be observed by one of our representatives and minimally conform to CAL-OSHA and local safety codes.

Drainage

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond and/or seep into the ground. Pad drainage should be directed toward the street or other approved area(s). Although not a geotechnical requirement, consideration can be given to the utilization of roof gutters, down spouts, or other appropriate means to control roof drainage. Down spouts, or drainage devices, should outlet a minimum of 5 feet from structures or into a subsurface drainage system. Areas of seepage may develop due to irrigation or heavy rainfall and should be anticipated. Minimizing irrigation will lessen this potential. If areas of seepage develop, recommendations for minimizing this effect could be provided upon request.

Subsurface and Surface Water

Subsurface and surface water, as indicated previously, are not anticipated to affect site development, provided that the recommendations contained in this report are incorporated into final design and construction and that prudent surface and subsurface drainage practices are incorporated into the construction plans. Perched groundwater conditions, along zones of contrasting permeabilities, should not be precluded from occurring in the future due to site irrigation, poor drainage conditions, or damaged utilities. Should perched groundwater conditions develop, this office could assess the affected area(s) and provide the appropriate recommendations to mitigate the observed groundwater conditions. The groundwater conditions observed and opinions generated were those at the time of rough grading. Conditions may change with the introduction of irrigation, rainfall, or other factors that were not obvious during rough grading. Consideration should be given to using a thickened edge (18 inches) on the up-gradient portions of sidewalks, where utility trenches are located. Alternatively, the utility trench could be slurried to within 6 inches of finish grade at that location. Another alternative would be to utilize a subdrainage system with cutoff walls behind the sidewalk. Details may be provided upon request.

Landscape Maintenance

Only the amount of irrigation necessary to sustain plant life should be provided. Over watering the landscape areas could adversely affect proposed site improvements. We would recommend that any proposed open-bottom planters adjacent to proposed structures be eliminated for a minimum distance of 10 feet. As an alternative, closed-bottom type planters could be utilized. An outlet placed in the bottom of the planter could be installed to direct drainage away from structures or any exterior concrete flatwork. The slope areas should be planted with deep rooting, drought resistant vegetation. Consideration should be given to the type of vegetation chosen and their potential effect upon surface improvements (i.e., some trees will have an effect on concrete flatwork with their extensive root systems). From a geotechnical standpoint, leaching is not recommended for establishing landscaping. If the surface soils are processed for the purpose of adding amendments, they should be recompacted to 90 percent minimum relative compaction.

Utility Trench Backfill

1. All interior utility trench backfill should be brought to at least 2 percent above optimum moisture content and then compacted to obtain a minimum relative compaction of 90 percent of the laboratory standard. As an alternative for shallow (12 inches to 18 inches) under-slab trenches, sand having a sand equivalent value of 30 or greater may be utilized and jetted or flooded into place. Observation, probing and testing should be provided to verify the desired results.

2. Exterior trenches adjacent to, and within areas extending below a 1:1 plane projected from the outside bottom edge of the footing, and all trenches beneath hardscape features and in slopes, should be compacted to at least 90 percent of the laboratory standard. Sand backfill, unless excavated from the trench, should not be used in these backfill areas. Compaction testing and observations, along with probing, should be accomplished to verify the desired results.

3. All trench excavations should conform to CAL-OSHA and local safety codes.

Appurtenant Structures

Plans for construction of any proposed appurtenant structures such as pool, retaining walls, spas, gazebos, decks, etc. should be reviewed by a soils engineer/geologist.

SUMMARY OF RECOMMENDATIONS REGARDING GEOTECHNICAL OBSERVATION AND TESTING

We recommend that observation and/or testing be performed by GSI at each of the following construction stages:

- During grading/recertification.

- After excavation of building footings, retaining wall footings, and free standing walls footings, prior to the placement of reinforcing steel or concrete.

- During retaining wall subdrain installation, prior to backfill placement.

- During placement of backfill for area drain, interior plumbing, utility line trenches, and retaining wall backfill.

- After presoaking/presaturation of building pads and other flatwork subgrade, prior to the placement of reinforcing steel or concrete.

- During slope construction/repair.
- When any unusual soil conditions are encountered during any construction operations, subsequent to the issuance of this report.

- During any homeowner improvements, such as flatwork, walls, spas, pools, etc.

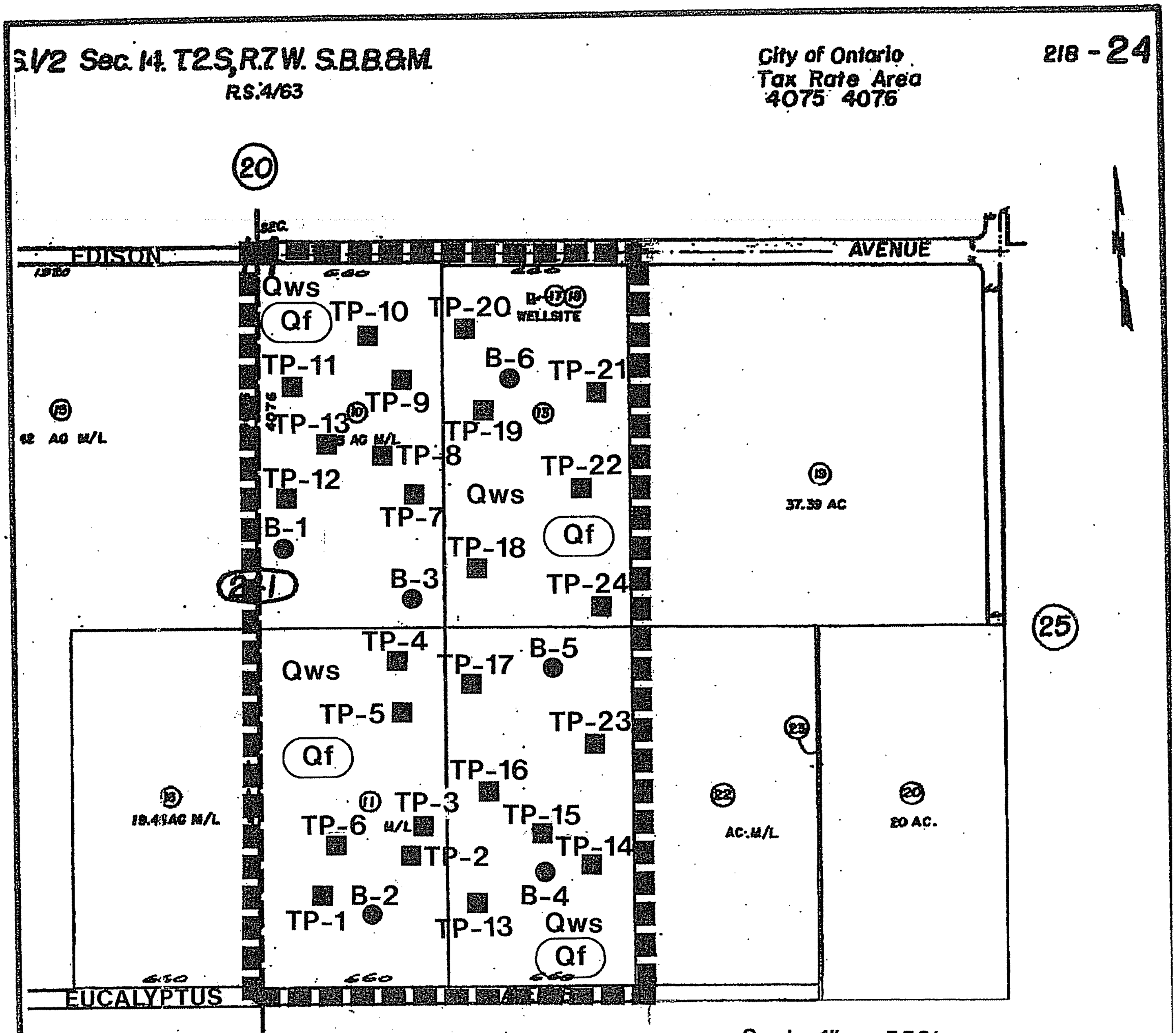
PLAN REVIEW

Because no improvement plans were available at the time of this feasibility investigation, it is imperative that rough grading, final foundation, wall, and site improvement plans be submitted to this office for review and comment, as they become available, to minimize any misunderstandings between the plans provided and the recommendations presented herein. In addition, foundation excavations and earthwork construction performed on the site should be observed and tested by this office. If conditions are found to differ substantially from those stated, appropriate recommendations would be offered at that time.

INVESTIGATION LIMITATIONS

The materials encountered on the project site and utilized in our laboratory are believed representative of the total area; however, soil materials may vary in characteristics between test pits and borings. Inasmuch as our investigation is based upon the site materials observed, selective laboratory testing, and engineering analyses, the recommendations are professional opinions. It is possible that variations in the soil conditions could exist beyond the points explored in this investigation. Also, changes in groundwater conditions could occur at some time in the near future due to variations in temperature, regional rainfall, and other factors.

These opinions have been derived in accordance with current standards of practice, and no warranty is expressed or implied. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, their inaction, or work that was performed without the benefit of GSI's observation and testing services. In addition, this report may be subject to review by the controlling authorities.



LEGEND

Scale 1" = ±550'

Qws	Quaternary Eolian wind-blown sands
Qf	Quaternary fan deposits, circled where buried
■■■	Area under the purview of this report
B-6 ●	Approximate location of exploratory boring
TP-24 ■	Approximate location of exploratory test pit

Assessor's Map
Book 218 Page 24
San Bernardino County

GeoSoils, Inc.

GEOTECHNICAL MAP

Plate 1

DATE 6/03 W. O. NO. 3914-A-SC

Geotechnical • Geologic • Environmental

FORM 89/22

<u>APPENDIX A</u>

REFERENCES

APPENDIX A

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APPENDIX B

TEST PITS AND BORING LOGS

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-1	0 - 2'	SM				**COLLUVIUM/TOPSOIL:** Silty SAND, medium brown, dry, loose; abundant roots and rootlets.
	2' - 6'	SM/SP	Ring 2' Ring 4' Ring 6'	6.8 14.2 20.6	9.6 92.2 97.5	**EOLIAN SAND:** Silty SAND and SAND, light brown, dry, loose.
	6' - 8'	ML				**QUATERNARY FAN DEPOSITS:** SILT, gray, damp, stiff.
						Total Depth: 8' No groundwater encountered Backfilled 4/8/03
TP-2	0 - 4'	SM/PT	Bulk 3' - 4'			**ARTIFICIAL FILL - UNDOCUMENTED:** Silty SAND w/manure and organic matter, medium brown, dry, loose.
	4' - 6'	SP/SM				**EOLIAN SAND**: SAND and Silty SAND, light brown, dry, loose.
	6' - 7'	ML	Bulk 6' - 7'			**QUATERNARY FAN DEPOSITS:** Clayey SILT, gray, moist, stiff to very stiff.
						Total Depth: 7' No groundwater encountered Backfilled 4/8/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-3	0 - 1'	PT				<u>**MANURE AND ORGANIC MATTER:**</u> Dark brown to black, damp to wet, loose.
	1' - 6'	SM/ML				<u>**EOLIAN SAND:**</u> Silty SAND and SILT, light brown, damp, loose to soft.
	6' - 8'	ML				<u>**QUATERNARY FAN DEPOSITS:**</u> SILT and Clayey SILT, grayish brown, damp to moist, stiff.
						Total Depth: 8' No groundwater encountered Backfilled 4/8/03
TP-4	0 - 1'	PT				<u>**MANURE AND ORGANIC MATTER:**</u> Dark brown to black, damp to wet, loose.
	1' - 4'	ML				<u>**EOLIAN SAND:**</u> SILT, gray, very soft to medium stiff.
	4' - 7'	SM				<u>**QUATERNARY FAN DEPOSITS:**</u> Silty SAND, gray, moist, dense; minor to moderate stage II calcium carbonate veins and veinlets.
						Total Depth: 7' No groundwater encountered Backfilled 4/8/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-5	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 4½'	SM				**EOLIAN SAND:** Silty SAND, gray, dry, loose.
	4½' - 6'	ML/CL				**QUATERNARY FAN DEPOSITS:** SILT and Silty CLAY, grayish brown, damp to moist, stiff to very stiff, medium dense to dense.
						Total Depth: 6' No groundwater encountered Backfilled 4/8/03
TP-6	0 - 1½'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1½' - 7'	SM	Ring 2' Ring 5'	4.7 12.9	99.0 102.1	**EOLIAN SAND:** Silty SAND, medium to grayish brown, dry, loose.
	7' - 9'	SM/ML				**QUATERNARY FAN DEPOSITS:** Silty SAND and SILT, medium brown, damp, dense to stiff.
						Total Depth: 9' No groundwater encountered Backfilled 4/8/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-7	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 6'	SM				**EOLIAN SAND:** Silty SAND, brown, damp, loose.
	6' - 8'	SM				**QUATERNARY FAN DEPOSITS:** Silty SAND, grayish brown, damp, medium dense to dense.
						Total Depth: 8' No groundwater encountered Backfilled 4/8/03
TP-8	0 - 1½'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1½' - 7'	SM				**EOLIAN SAND:** Silty SAND, light brown, dry, loose; porous.
	7' - 9'	ML/SM				**QUATERNARY FAN DEPOSITS:** SILT and Silty SAND, olive brown, damp to moist, very stiff to dense.
						Total Depth: 9' No groundwater encountered Backfilled 4/8/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-9	0 - 6"	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	6" - 5'	SP/SM				**EOLIAN SAND:** SAND and Silty SAND, light brown, dry, loose; abundant rootlets.
	5' - 8'	ML/SM				**QUATERNARY FAN DEPOSITS:** SILT and Silty SAND, medium brown, damp, medium stiff to medium dense.
						Total Depth: 8' No groundwater encountered Backfilled 4/8/03
TP-10	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 8'	SP/SM				**EOLIAN SAND:** SAND and Silty SAND, gray, damp, loose to medium dense.
	8' - 10'	ML				**QUATERNARY FAN DEPOSITS:** SILT, yellowish brown, damp, stiff.
						Total Depth: 10' No groundwater encountered Backfilled 4/8/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-11	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 5'	SM/SP				**EOLIAN SAND:** Silty SAND and SAND, light to medium brown, dry, loose.
	5' - 7'	SM				**QUATERNARY FAN DEPOSITS:** Silty SAND, yellowish brown, damp, loose.
						Total Depth: 7' No groundwater encountered Backfilled 4/8/03
TP-12	0 - 1½'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1½' - 3'	SM				**EOLIAN SAND:** Silty SAND, medium to light brown, damp, loose to medium dense with depth.
	3' - 6'	ML				**QUATERNARY FAN DEPOSITS:** SILT, gray, moist, stiff.
						Total Depth: 6' No groundwater encountered Backfilled 4/8/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-13	0 - 10"	PT				**<u>MANURE AND ORGANIC MATTER:</u>** Dark brown to black, damp to wet, loose.
	10" - 5½'	SP/SM	Ring 1' Ring 3'	4.2 8.3	99.8 94.8	**<u>EOLIAN SAND:</u>** SAND and Silty SAND, medium brown, dry, loose.
	5½' - 10'	ML				**<u>QUATERNARY FAN DEPOSITS:</u>** Clayey SILT, gray, damp to moist, stiff; minor stage II carbonates.
						Total Depth: 10' No groundwater encountered Backfilled 4/8/03
TP-14	0 - 1'	PT				**<u>MANURE AND ORGANIC MATTER:</u>** Dark brown to black, damp to wet, loose.
	1' - 6'	SM				**<u>EOLIAN SAND:</u>** Silty SAND, light brown, dry, loose.
	6' - 8'	SM				**<u>QUATERNARY FAN DEPOSITS:</u>** Silty SAND, dark gray, damp to moist, medium dense to dense.
						Total Depth: 8' No groundwater encountered Backfilled 4/8/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-15	0 - 1½'	GM				**ARTIFICIAL FILL - UNDOCUMENTED:** Silty SAND w/gravel, light brown, dry, loose.
	1½' - 8'	SP/SM				**EOLIAN SAND:** SAND and Silty SAND, light brown, dry, loose.
	8' - 12'	ML				**QUATERNARY FAN DEPOSITS:** SILT, gray, moist, stiff.
						Total Depth: 12' No groundwater encountered Backfilled 4/8/03
TP-16	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 6'	SP/SM				**EOLIAN SAND:** SAND and Silty SAND, light brown, damp to moist, loose to medium dense; porous, abundant rootlets.
	6' - 7'	ML/SM				**QUATERNARY FAN DEPOSITS:** SILT and Silty SAND, grayish brown, damp, medium stiff to medium dense with depth.
						Total Depth: 7' No groundwater encountered Backfilled 4/9/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-17	0 - 10"	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	10" - 7'	SW				**EOLIAN SAND:** SAND, light brown, damp, loose.
	7' - 11'	ML				**QUATERNARY FAN DEPOSITS:** SILT and Clayey SILT, grayish brown, damp, stiff.
						Total Depth: 11' No groundwater encountered Backfilled 4/9/03
TP-18	0 - 2'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	2' - 7'	SM/SW				**EOLIAN SAND:** Silty SAND and SAND, gray, damp, loose.
	7' - 9'	SM				**QUATERNARY FAN DEPOSITS:** Silty SAND, dark gray, damp to moist, dense.
						Total Depth: 9' No groundwater encountered Backfilled 4/9/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-19	0 - 2'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	2' - 6'	SM	Bulk 3' - 4'			**EOLIAN SAND:** Silty SAND, light brown, dry, loose.
	6' - 8'	SM	Bulk 6' - 7'			**QUATERNARY FAN DEPOSITS:** Silty SAND, light gray, dry, dense.
						Total Depth: 8' No groundwater encountered Backfilled 4/9/03
TP-20	0 - 1½'	PT	Ring 2'			**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1½' - 6'	SM/SW	Ring 2' Ring 4'	5.5 3.4	105.2 102.5	**EOLIAN SAND:** Silty SAND and SAND, light brown, dry, loose.
	6' - 10'	ML/SM				**QUATERNARY FAN DEPOSITS:** SILT and Silty SAND, yellowish brown, damp, medium stiff to medium dense.
						Total Depth: 10' No groundwater encountered Backfilled 4/9/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-21	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 6'	SW/SM				**EOLIAN SAND:** SAND and Silty SAND, grayish brown, damp, loose.
	6' - 8'	ML				**QUATERNARY FAN DEPOSITS:** SILT, yellowish brown, damp, medium stiff to stiff with depth.
						Total Depth: 8' No groundwater encountered Backfilled 4/9/03
TP-22	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 4'	SM				**EOLIAN SAND:** Silty SAND, light gray, damp, loose.
	4' - 8'	ML/SM				**QUATERNARY FAN DEPOSITS:** SILT and Silty SAND, yellowish brown, damp, medium stiff to medium dense.
						Total Depth: 8' No groundwater encountered Backfilled 4/9/03

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-23	0 - 8"	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	8" - 6'	SP/SM				**EOLIAN SAND:** SAND and Silty SAND, grayish brown, damp, loose to medium dense.
	6' - 10'	ML				**QUATERNARY FAN DEPOSITS:** SILT, yellowish brown, damp, medium stiff to stiff with depth.
						Total Depth: 10' No groundwater encountered Backfilled 4/9/03
TP-24	0 - 1'	PT				**MANURE AND ORGANIC MATTER:** Dark brown to black, damp to wet, loose.
	1' - 7'	SM/SW				**EOLIAN SAND:** Silty SAND and SAND, medium brown, damp, loose.
	7' - 9'	ML/SM				**QUATERNARY FAN DEPOSITS:** SILT and Silty SAND, yellowish brown, damp to moist, medium stiff to medium dense.
						Total Depth: 9' No groundwater encountered Backfilled 4/9/03

BORING LOG

GeoSoils, Inc.

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-1 *SHEET* 1 *OF* 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

∇ *Groundwater*

Depth (ft.)	Sample: Bulk	Sample: Undis-turbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
				SM/ML				**EOLIAN SAND:** @ 0' SILTY SAND and SILT, grayish brown, damp, loose.
5		▨	40/ 50-5"	ML	116.0	18.4	100.0	**QUATERNARY FAN DEPOSITS:** @ 5' CLAYEY SILT, gray, saturated, hard.
10		▨	39	SP/SM	107.5	2.0	10.0	@ 10' SAND and SILTY SAND, grayish brown, dry, dense.
15		▩	31	SW		2.5		@ 15' SAND, grayish brown, dry, dense; minor gravel. @ 17' Minor gravel.
20		▨	70	GW	131.8	2.0	20.0	@ 20' SANDY GRAVEL, gray, dry, dense.
25		▨	20	ML/SM		14.7		@ 25' CLAYEY SILT and SILTY SAND, medium brown, damp, very stiff to medium dense.

BORING LOG

GeoSoils, Inc.

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-1 *SHEET* 2 *OF* 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

∇ *Groundwater*

Depth (ft.)	Sample: Bulk	Sample: Undis-turbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
		▨	38	ML	109.4	16.1	83.0	@ 30' CLAYEY SILT, yellowish brown, wet, very stiff.
35		▩	17			17.5		@ 35' SILT and CLAYEY SILT, medium brown, damp, very stiff.
40		▨	49	SC	116.1	16.1	100.0	@ 40' CLAYEY SAND, orange brown, saturated, dense; oxidized in areas.
45		▩	26	ML/SM		14.6		@ 45' SILT and SILTY SAND, medium to orange brown, dry, very stiff to medium dense.
50		▨	41/ 50-5"	ML	119.1	14.2	97.0	@ 50' CLAYEY SILT, yellowish to orange brown, saturated, hard.
								Total Depth = 51' No Groundwater/Caving Encountered Backfilled 4-18-03
55								

BORING LOG

GeoSoils, Inc.

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-2 *SHEET* 1 *OF* 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

∇ *Groundwater*

Depth (ft.)	Sample: Bulk	Sample: Undis-turbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
				SM				**EOLIAN SAND:** @ 0' SILTY SAND, brown, damp, loose; abundant manure and organic matter.
		▨	8	SC	108.4	16.0	81.0	@ 3' CLAYEY SAND, grayish brown, wet, loose.
5								
		▨	24	SM	118.4	7.7	51.0	**QUATERNARY FAN DEPOSITS:** @ 7' SILTY SAND, gray, moist, medium dense.
10								
		▩	40	SP		4.1		@ 12' SAND, grayish brown, dry, dense; minor gravel, fine to coarse grained, poorly sorted.
15								
		▨	36/ 50-4½"		118.4	3.8	26.0	@ 17' SAND, grayish brown, damp, very dense; poorly sorted, minor pebbles and gravel.
20								
		▩	41			2.1		@ 22' SAND, gray, damp, dense; minor gravel.
25								
		▨	47/ 50-4"	GW	124.5	5.0	40.0	@ 27' SANDY GRAVEL, gray, damp, very dense.

BORING LOG

GeoSoils, Inc.

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-2 *SHEET* 2 *OF* 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

▽ *Groundwater*

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)		Description of Material
		▩	9	ML		23.6			@ 32' CLAYEY SILT, yellowish brown, saturated, stiff.
35									
		▨	49	SC	114.4	16.5	98.0	▨	@ 37' CLAYEY SAND, yellowish brown, saturated, dense.
									Total Depth = 38' No Groundwater/Caving Encountered Backfilled 4-18-03
40									
45									
50									
55									

BORING LOG

GeoSoils, Inc.

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-3 *SHEET* 1 *OF* 1

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

▽ *Groundwater*

Depth (ft.)	Sample			USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
	Bulk	Undis-turbed	Blows/ft.					
				SM				**EOLIAN SAND:** @ 0' SILTY SAND, gray, dry, loose; abundant organic matter near surface.
5		▨	20	ML	109.7	16.5	86.0	**QUATERNARY FAN DEPOSITS:** @ 5' CLAYEY SILT, gray, wet, very stiff; stage II carbonate veins and veinlets.
10		▩	7			11.2		@ 10' CLAYEY SILT, grayish brown, wet, medium stiff.
15		▨	45	SM	112.7	11.0	62.0	@ 15' SILTY SAND, yellowish brown, moist, dense.
20		▩	15	ML		20.7		@ 20' SILT, yellowish brown, wet, stiff.
25								Total Depth = 21½' No Groundwater/Caving Encountered Backfilled 4-18-03

GeoSoils, Inc.

BORING LOG

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-4 SHEET 1 OF 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ Standard Penetration Test

▨ Undisturbed, Ring Sample

⊽ Groundwater

Depth (ft.)	Sample: Bulk	Sample: Undis-turbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
				SM				**ARTIFICIAL FILL (UNDOCUMENTED):** @ 0' SILTY SAND w/GRAVEL, gray, dry, loose.
5		▩	7	SM		4.3		**EOLIAN SAND:** @ 1½' SILTY SAND, brown, dry, loose. @ 3' SILTY SAND, drown, dry, loose.
10		▨	21	ML	113.6	5.0	29.0	**QUATERNARY FAN DEPOSITS:** @ 6' Density Change. @ 7' SILT, yellowish brown, damp, very stiff.
15		▩	13	SM		6.1		@ 12' SILTY SAND, medium brown, damp, medium dense.
20		▨	43	ML	102.2	11.0	47.0	@ 17' CLAYEY SILT, orange brown, damp, hard.
25		▩	27	SP		3.9		@ 22' SAND, grayish brown, dry, medium dense.
		▨	20/ 50-5½"	SM	122.8	10.8	82.6	@ 27' SILTY SAND, yellowish brown, wet, dense.

GeoSoils, Inc.

BORING LOG

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-4 *SHEET* 2 *OF* 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

∇ *Groundwater*

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)		Description of Material
		▩	27	ML		15.8			@ 32' CLAYEY SILT, medium to yellowish brown, wet, very stiff.
									Total Depth = 33½' No Groundwater/Caving Encountered Backfilled 4-18-03
35									
40									
45									
50									
55									

GeoSoils, Inc.

BORING LOG

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-5 *SHEET* 1 *OF* 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

∇ *Groundwater*

Depth (ft.)	Sample			USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
	Bulk	Undis-turbed	Blows/ft.					
				SM				**EOLIAN SAND:** @ 0' SILTY SAND w/GRAVEL, grayish brown, damp, loose.
5		▨	14	ML	114.7	14.0	83.7	@ 5' CLAYEY SILT, yellowish brown, wet, stiff.
				SM				**QUATERNARY FAN DEPOSITS:** @ 7' Density Change.
10		▩	19					@ 10' No Recovery, rock in sampler.
15		▨	34		118.4	10.2	68.1	@ 15' SILTY SAND, yellowish brown, moist, medium dense.
20		▩	18	SW		6.0		@ 20' SAND, grayish to orange brown, moist, medium dense; oxidized in areas, fine grained.
25		▨	54	ML	118.5	11.5	76.9	@ 25' SILT, yellowish brown, wet, hard.

BORING LOG

GeoSoils, Inc.

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-5 SHEET 2 OF 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ Standard Penetration Test

▨ Undisturbed, Ring Sample

▽ Groundwater

Depth (ft.)	Sample: Bulk	Sample: Undis-turbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
		▩	25	ML		14.0		@ 30' CLAYEY SILT, yellowish brown, wet, very stiff.
								Total Depth = 31½' No Groundwater/Caving Encountered Backfilled 4-18-03
35								
40								
45								
50								
55								

GeoSoils, Inc.

BORING LOG

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-6 SHEET 1 OF 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

∇ *Groundwater*

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
				SM				**EOLIAN SAND:** @ 0' SILTY SAND, gray, damp, loose.
5		▨	17		99.9	2.9	11.6	@ 4' SILTY SAND, medium brown, dry, medium dense.
		▩	6	SM/ML		3.8		@ 7' SILTY SAND and SILT, medium brown, dry, loose to medium stiff.
10				ML				**QUATERNARY FAN DEPOSITS:** @ 9' Density Change.
		▨	63		115.0	15.5	93.7	@ 12' CLAYEY SILT, gray, wet, hard; minor cementation, stage II carbonates.
15								
		▩	14			9.1		@ 17' SILT, gray, moist, stiff.
20								
		▨	29	ML/SM	92.4	9.6	32.1	@ 22' SILT and SILTY SAND, gray to orange brown (oxidized), damp, very stiff to medium dense.
25								
		▩	24	SP		2.5		@ 27' SAND, gray, dry, medium dense.

GeoSoils, Inc.

BORING LOG

W.O. 3914-A-SC

PROJECT: HILLCREST HOMES
±80 Acres, Ontario

BORING B-6 *SHEET* 2 *OF* 2

DATE EXCAVATED 4-18-03

SAMPLE METHOD: CALIFORNIA SAMPLER 140 LB. WEIGHT, 30 IN. DROP

▩ *Standard Penetration Test*

▨ *Undisturbed, Ring Sample*

$\underline{\nabla}$ *Groundwater*

Depth (ft.)	Sample: Bulk	Sample: Undis-turbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)		**Description of Material**
		▨	97	SM	110.8	4.6	24.7		@ 32' SILTY SAND, orange brown, dry, very dense; oxidized in areas.
									Total Depth = 33' No Groundwater/Caving Encountered Backfilled 4-18-03
35									
40									
45									
50									
55									

APPENDIX C

EQFAULT DATA

MAXIMUM EARTHQUAKES

Hillcrest Homes

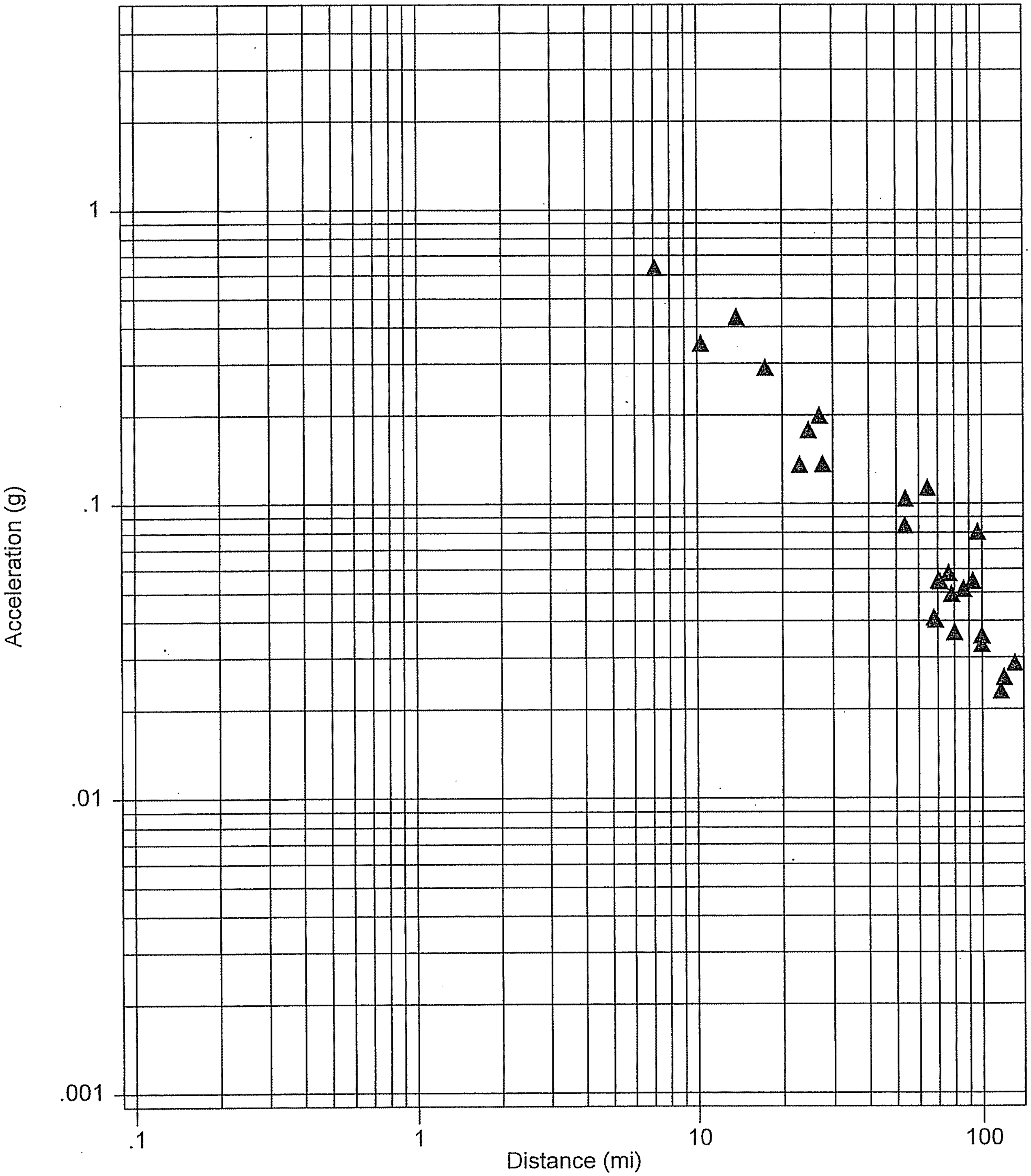
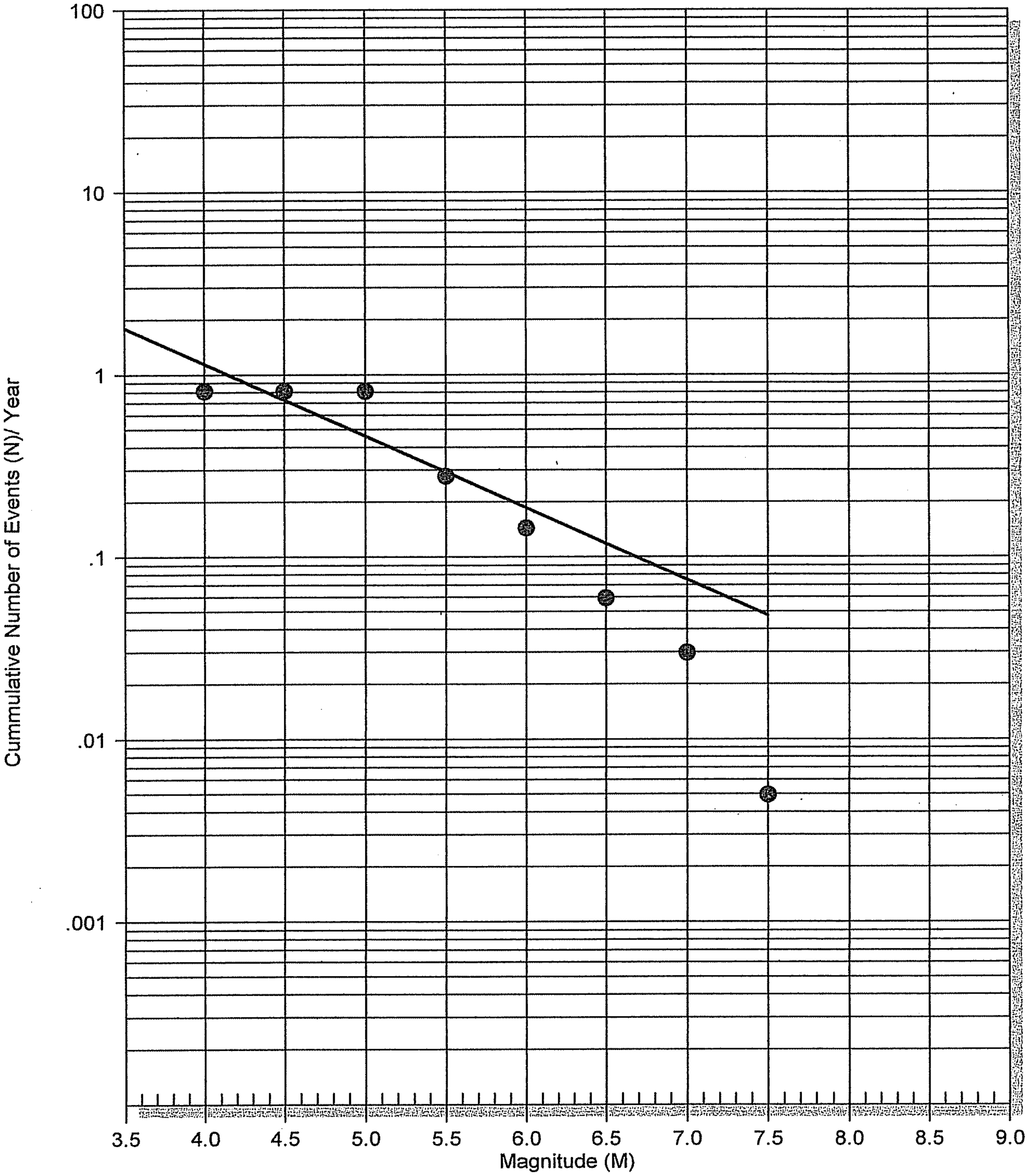


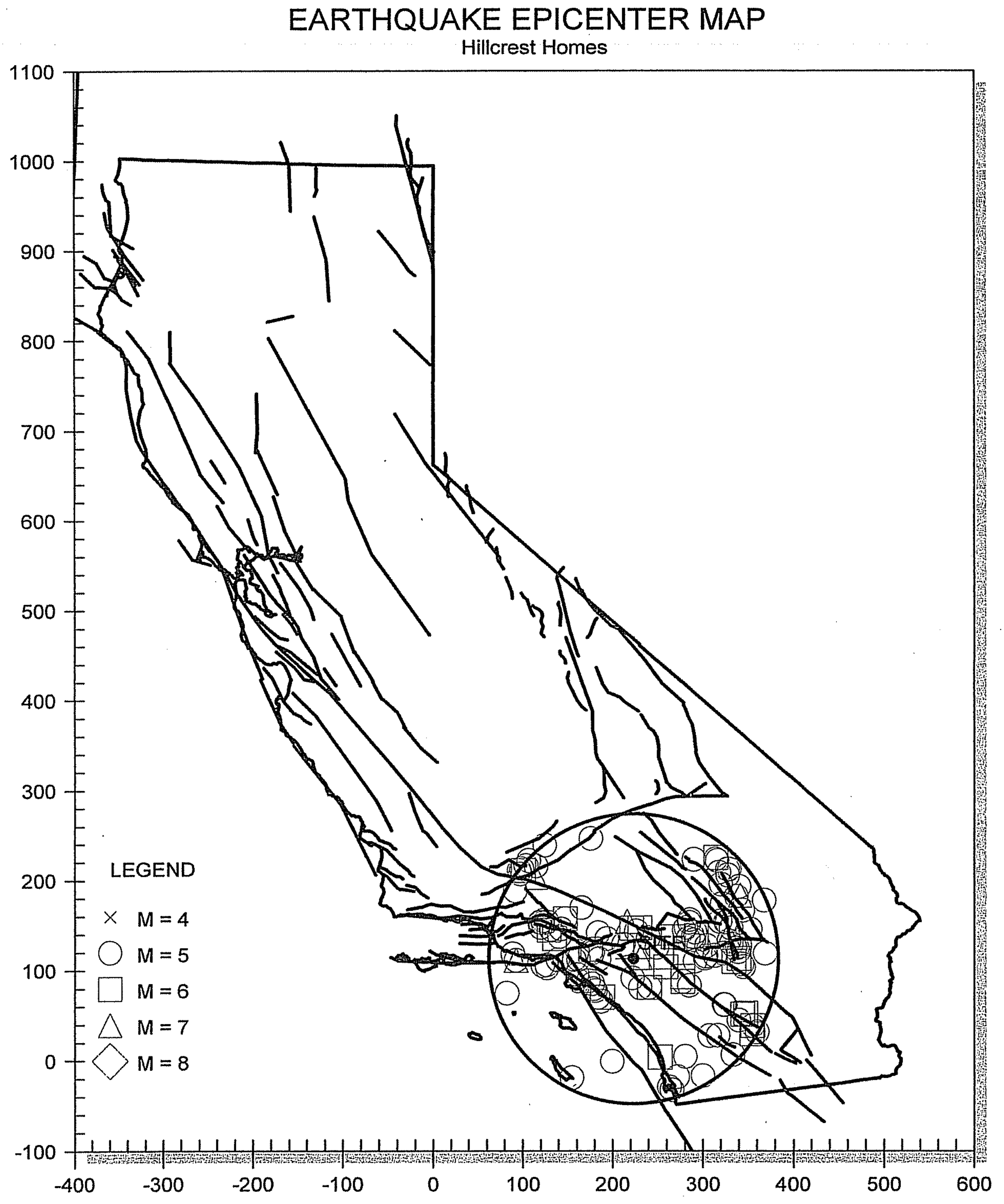
Figure C-1



EARTHQUAKE RECURRENCE CURVE

Hillcrest Homes

Figure C-2



EARTHQUAKE EPICENTER MAP
Hillcrest Homes
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
-400
-300
-200
-100
0
100
200
300
400
500
600
LEGEND
× M = 4
○ M = 5
□ M = 6
△ M = 7
◇ M = 8

Figure C-3

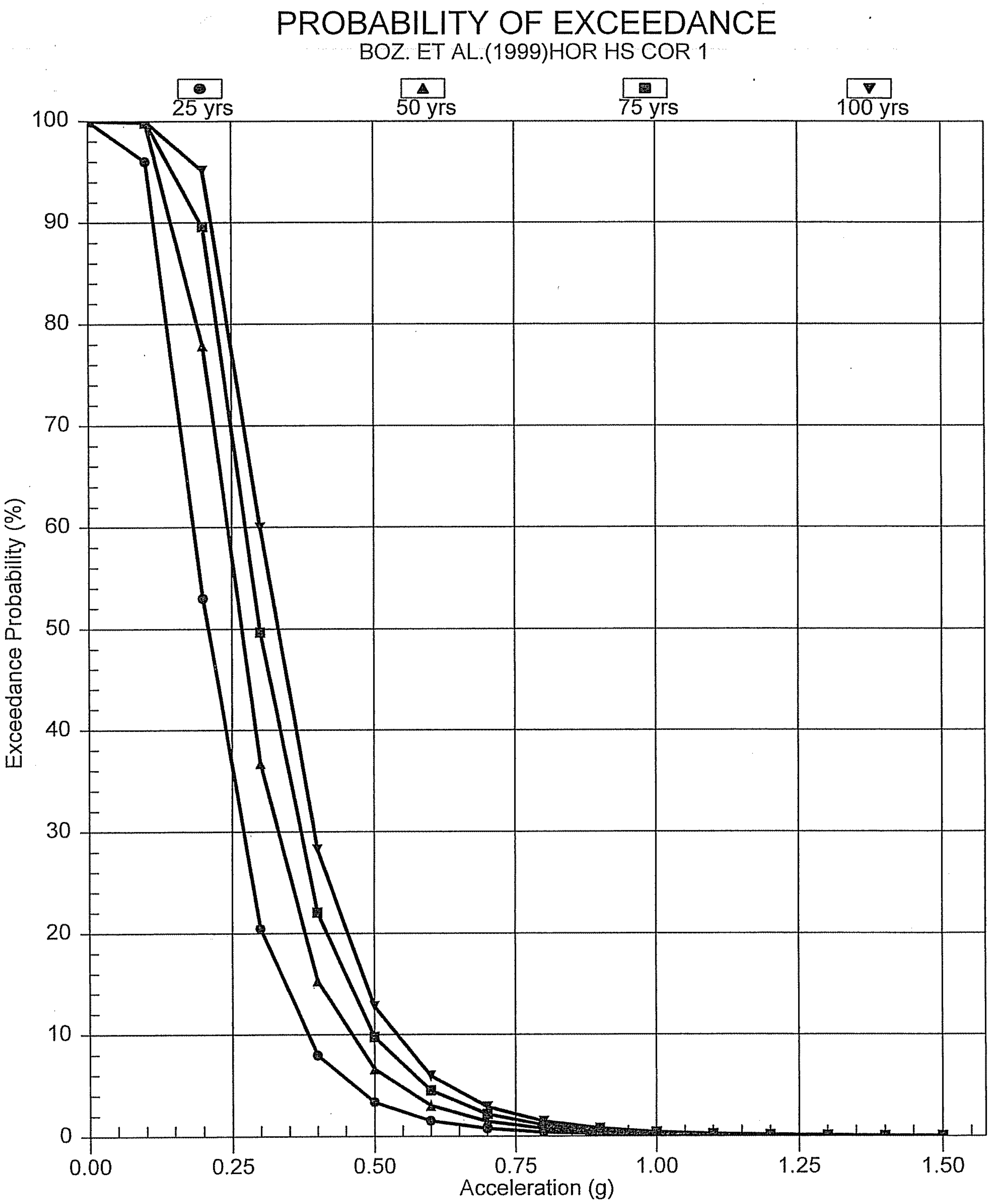

PROBABILITY OF EXCEEDANCE
BOZ. ET AL.(1999)HOR HS COR 1
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
0
10
20
30
40
50
60
70
80
90
100
Acceleration (g)
0.00
0.25
0.50
0.75
1.00
1.25
1.50

Figure C-4

RETURN PERIOD vs. ACCELERATION

BOZ. ET AL.(1999)HOR HS COR 1

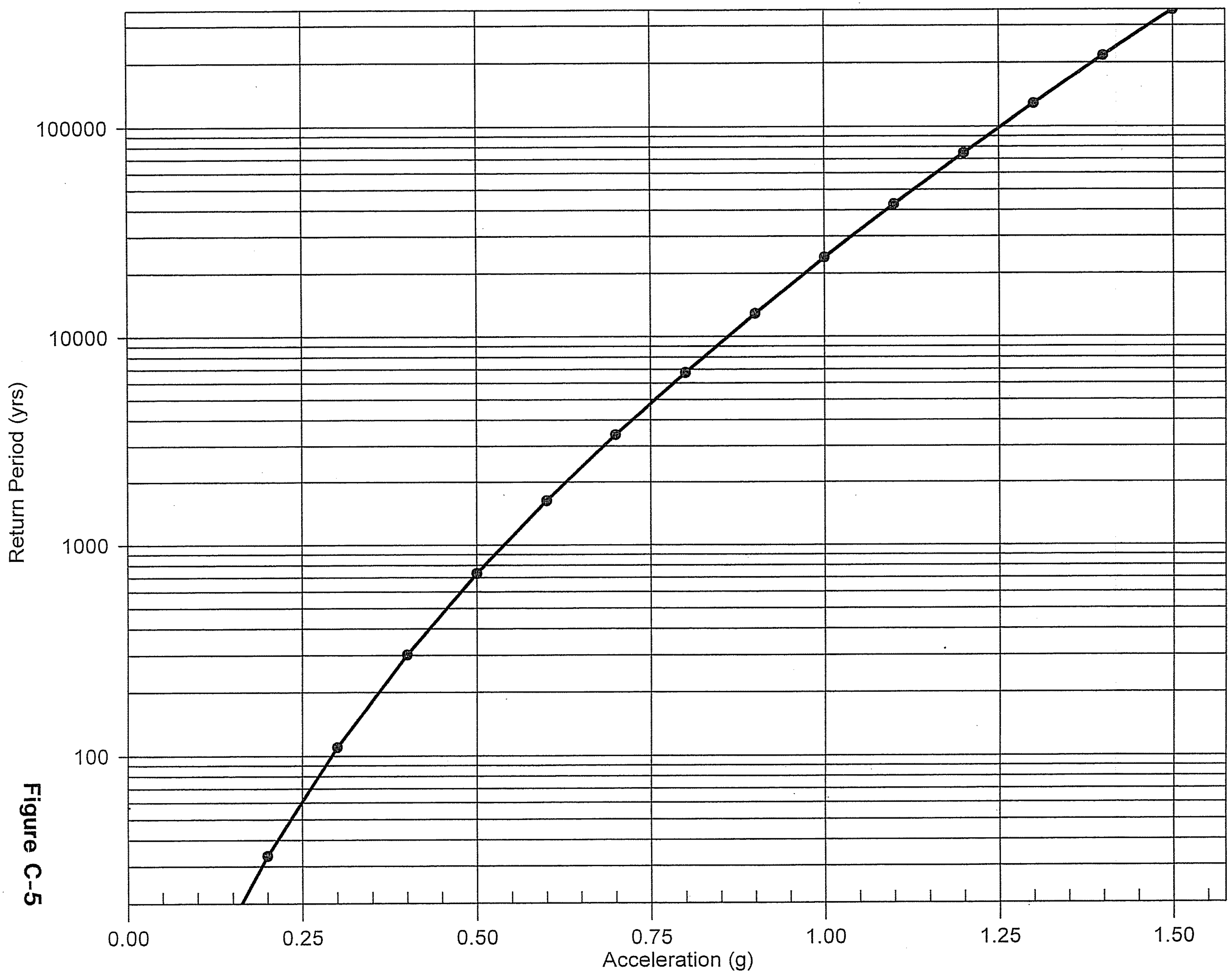
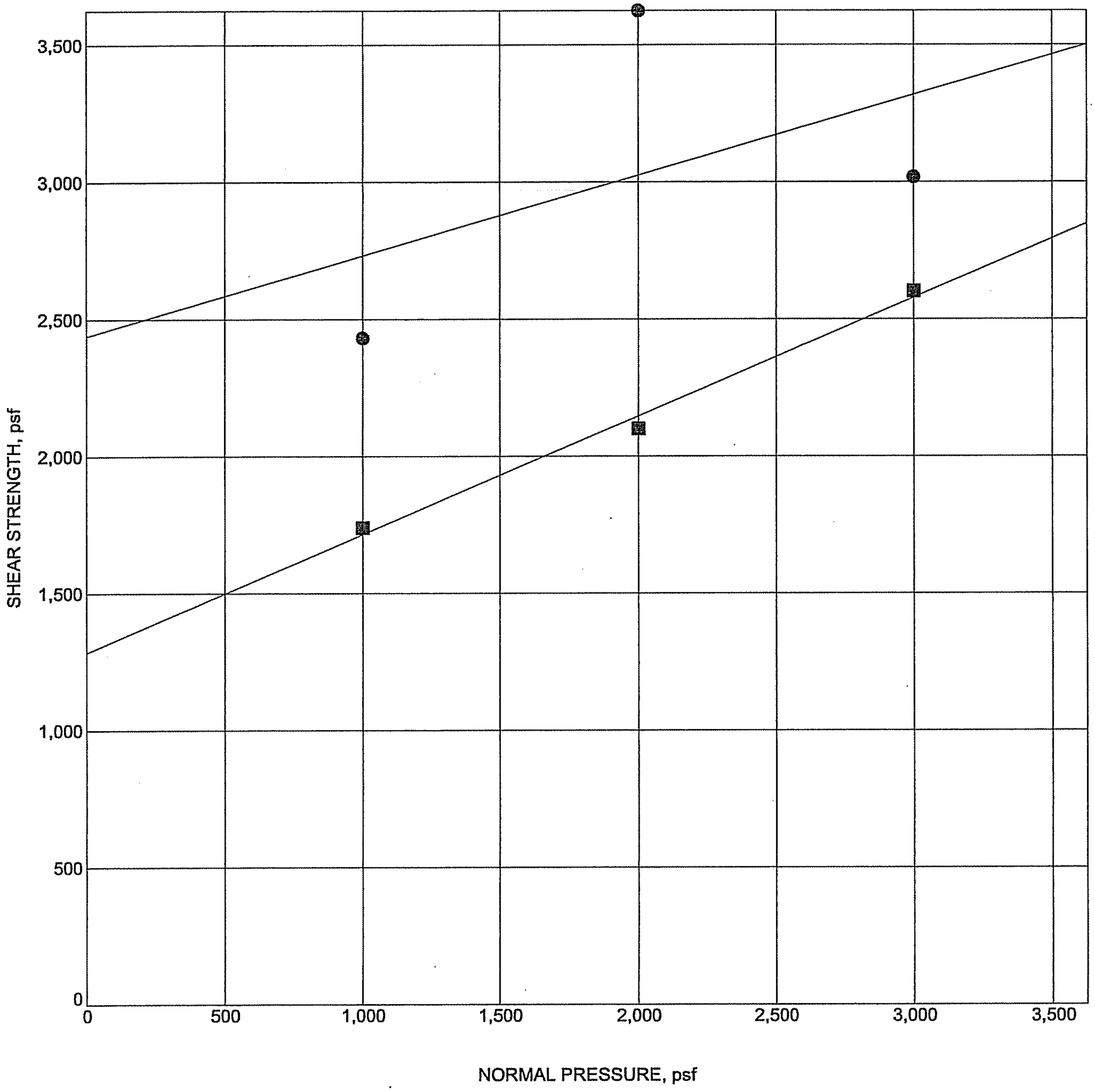


Figure C-5

APPENDIX D

LABORATORY TEST RESULTS



	Sample	Depth/El.	Primary/Residual Shear	Sample Type	γ_d	MC%	*c*	ϕ
●	B-1	5.0	Primary Shear	Undisturbed	120.6	14.0	2439	16
■	B-1	5.0	Residual Shear	Undisturbed	120.6	14.0	1284	23

Note: Sample Innundated prior to testing

GeoSoils, Inc.
5741 Palmer Way
Carlsbad, CA 92008
Telephone: (760) 438-3155
Fax: (760) 931-0915

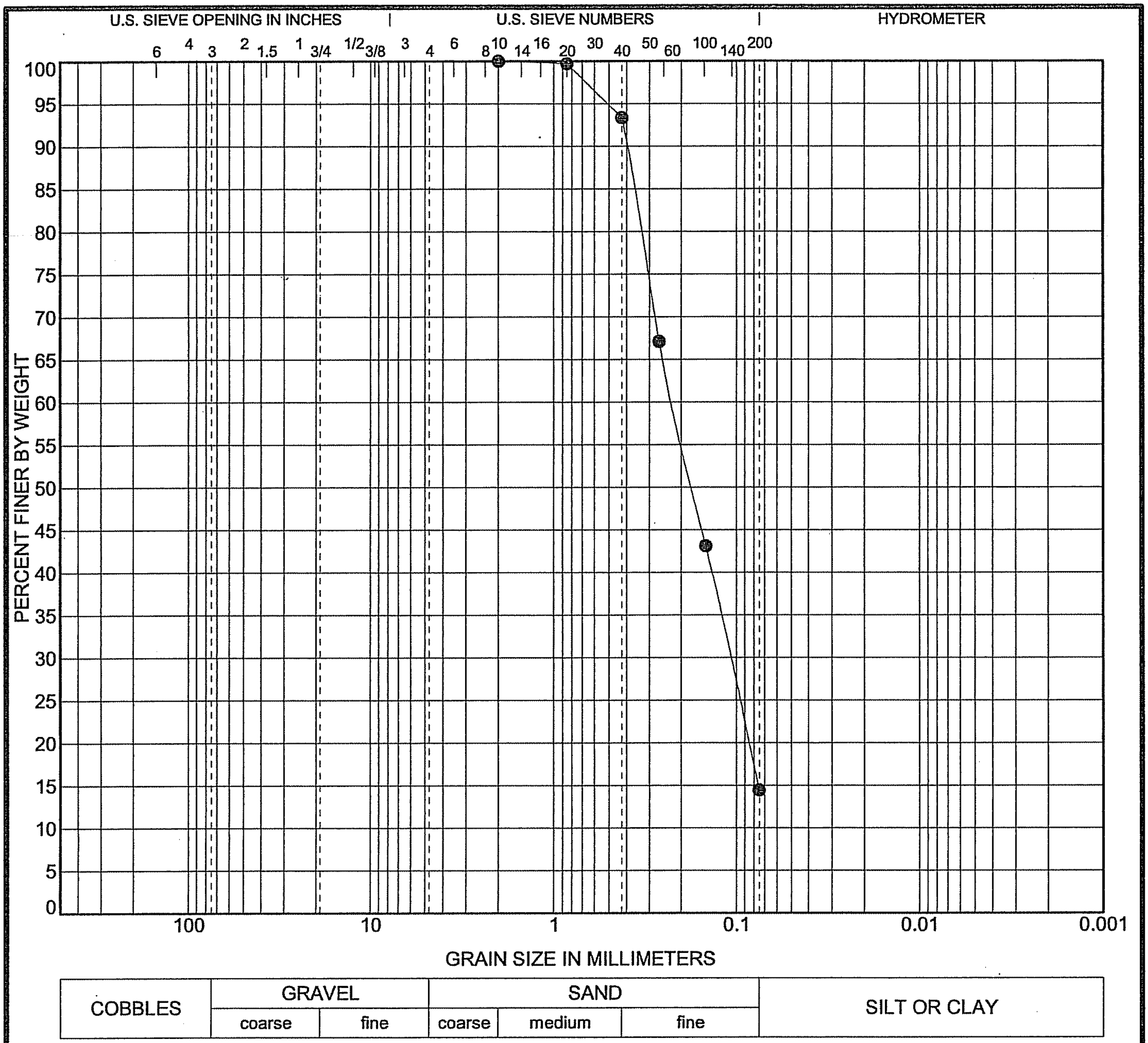
DIRECT SHEAR TEST

Project: HILLCREST HOMES

Number: 3914-A-SC

Date: June 2003

Plate: D - 1



	Sample	Depth	Classification	LL	PL	PI	Cc	Cu
●	B-6	7.0	Silty Sand					

	Sample	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6	7.0	2	0.223	0.108		0.0	85.5	14.5	

US GRAIN SIZE 3914.GPJ US LAB.GDT 6/20/03

GeoSoils, Inc.
5741 Palmer Way
Carlsbad, CA 92008
Telephone: (760) 438-3155
Fax: (760) 931-0915

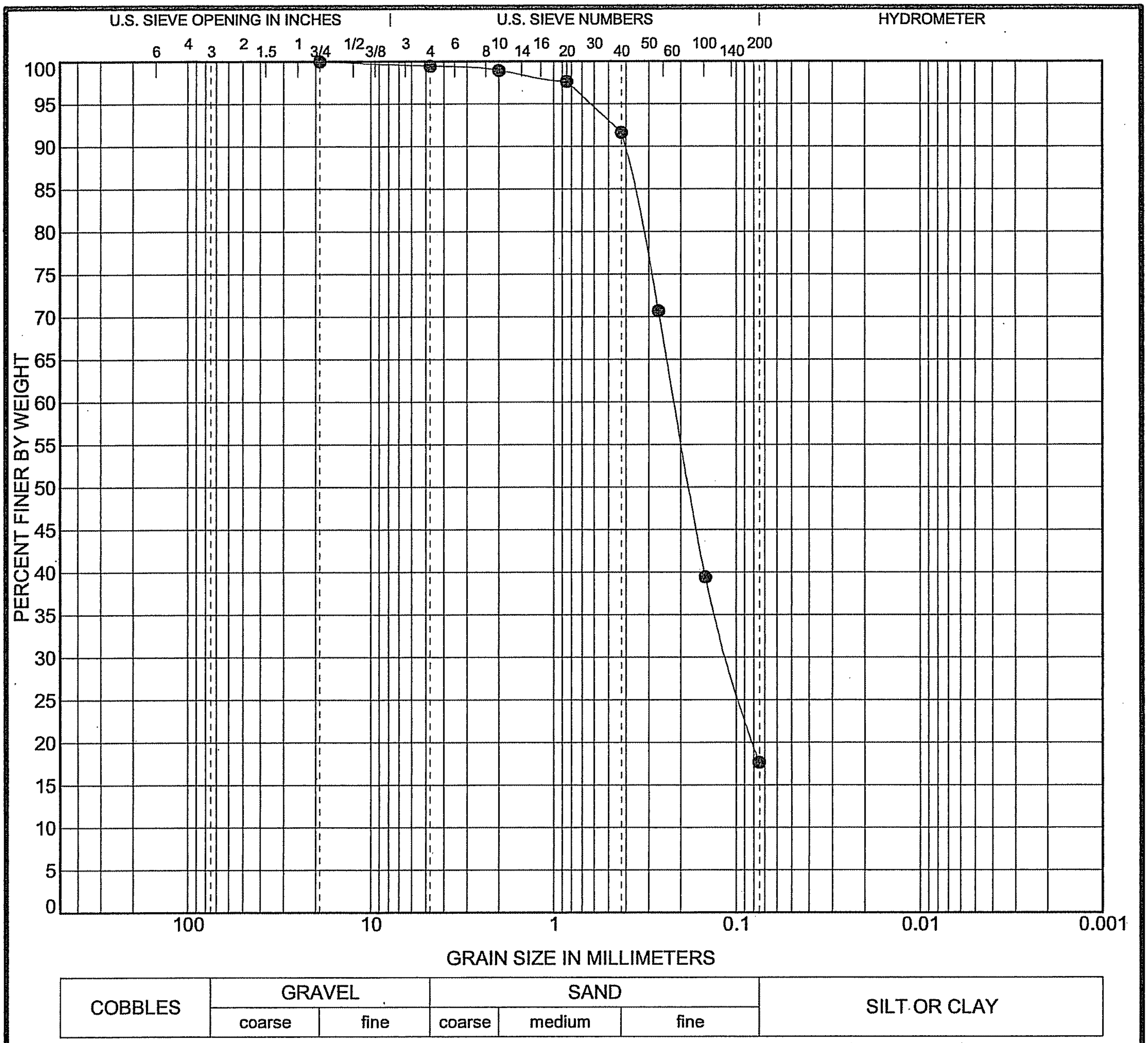
GRAIN SIZE DISTRIBUTION

Project: HILLCREST HOMES

Number: 3914-A-SC

Date: June 2003

Plate: D - 2



	Sample	Depth	Classification	LL	PL	PI	Cc	Cu
●	TP-15	4.0						

	Sample	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-15	4.0	19	0.217	0.11		0.6	81.8	17.6	

US GRAIN SIZE 3914.GPJ US LAB.GDT 6/20/03

GeoSoils, Inc.
5741 Palmer Way
Carlsbad, CA 92008
Telephone: (760) 438-3155
Fax: (760) 931-0915

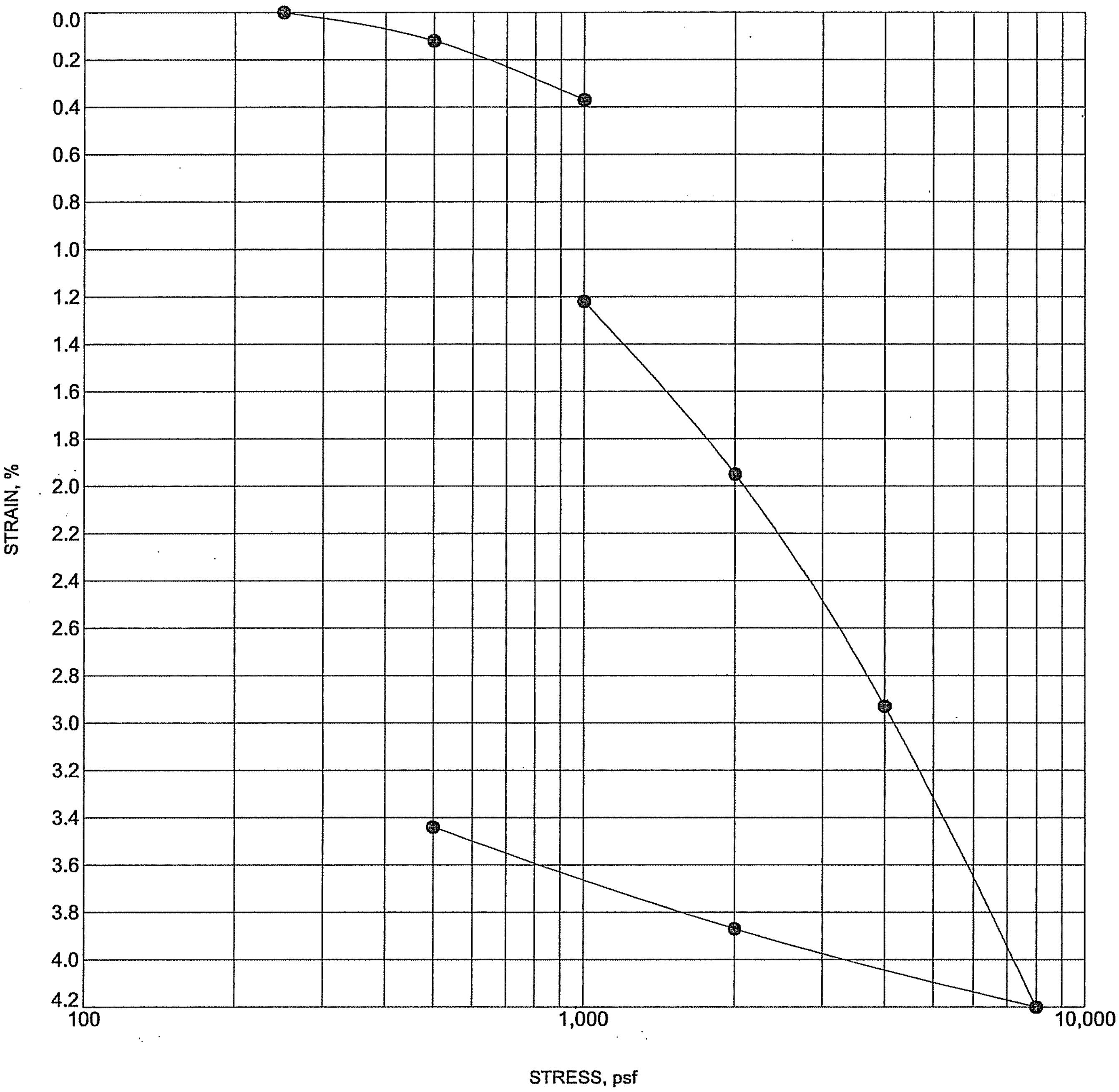
GRAIN SIZE DISTRIBUTION

Project: HILLCREST HOMES

Number: 3914-A-SC

Date: June 2003

Plate: D - 3



	Sample	Depth/El.	Visual Classification	γ_d Initial	MC Initial	MC Final	H20
●	B-4	7.0	Silty Sand	118.9	5.0	12.2	1000

GeoSoils, Inc.
5741 Palmer Way
Carlsbad, CA 92008
Telephone: (760) 438-3155
Fax: (760) 931-0915

CONSOLIDATION TEST

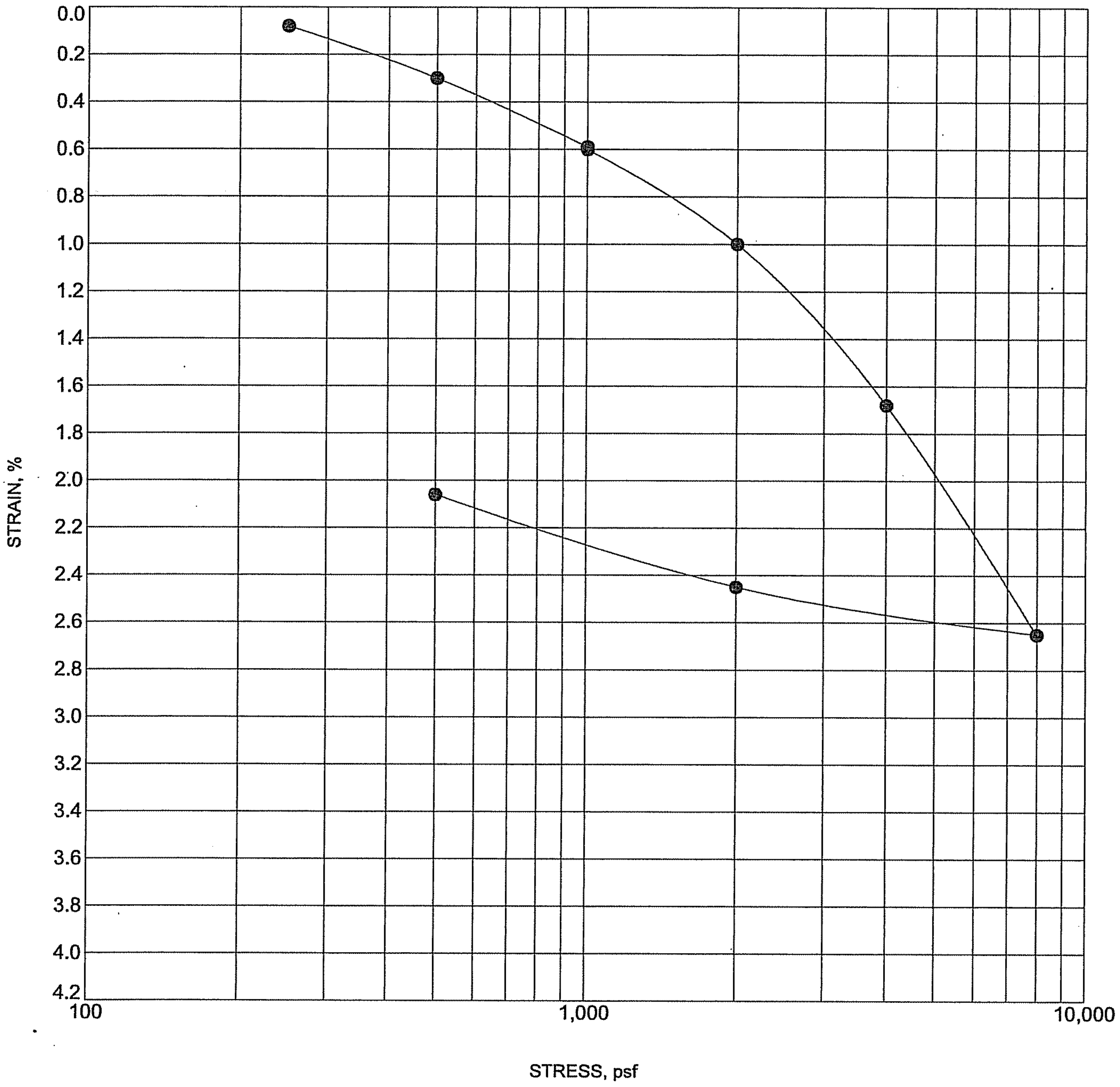
Project: HILLCREST HOMES

Number: 3914-A-SC

Date: June 2003

Plate: D - 4

US CONSOL STRAIN 3914.GPJ US LAB.GDT 6/20/03



	Sample	Depth/El.	Visual Classification	γ_d Initial	MC Initial	MC Final	H20
●	B-5	5.0	Sandy Silt	114.8	14.0	16.3	1000

GeoSoils, Inc.
5741 Palmer Way
Carlsbad, CA 92008
Telephone: (760) 438-3155
Fax: (760) 931-0915

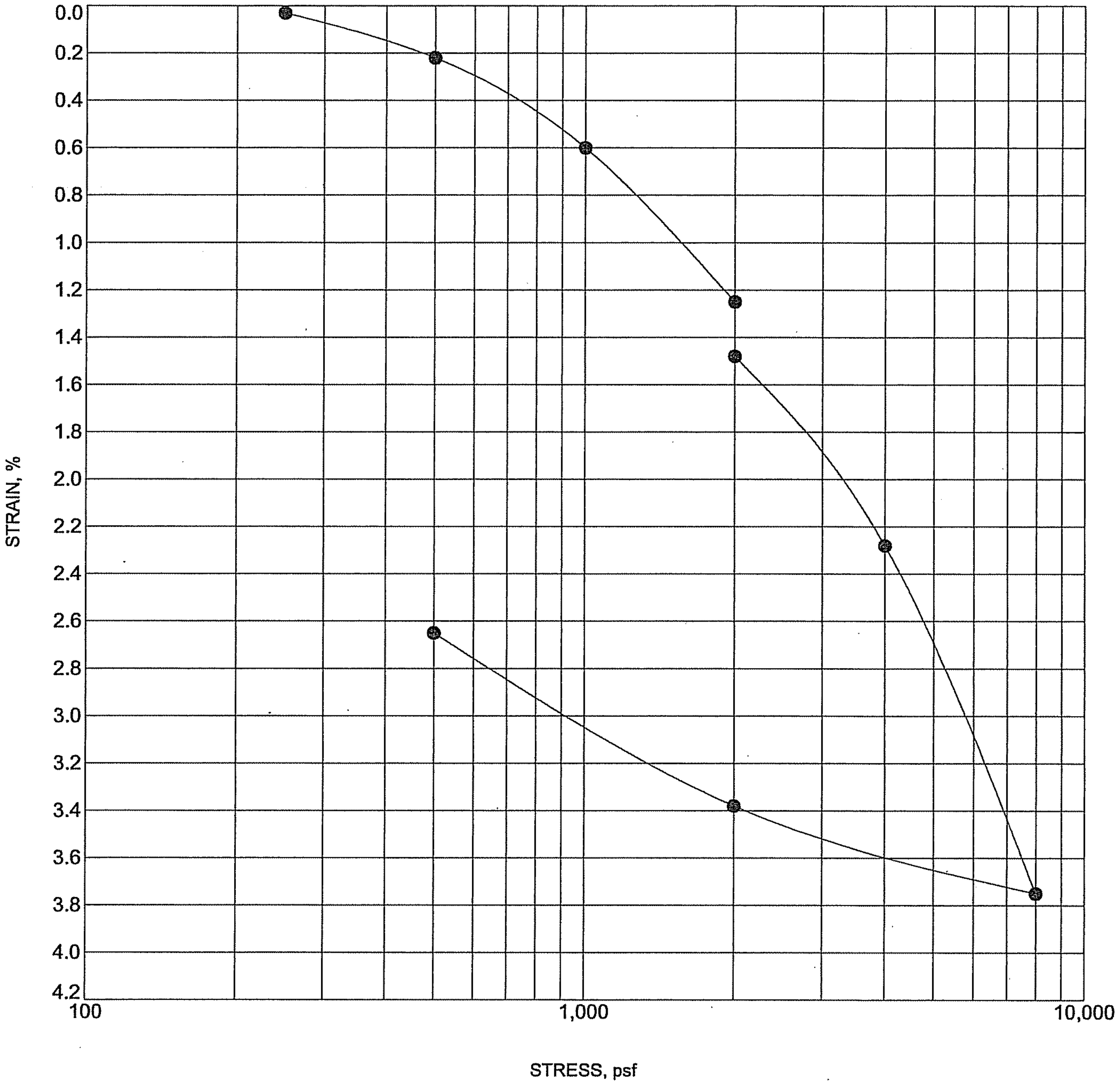
CONSOLIDATION TEST

Project: HILLCREST HOMES

Number: 3914-A-SC

Date: June 2003

Plate: D - 5



	Sample	Depth/El.	Visual Classification	γ_d Initial	MC Initial	MC Final	H20
●	B-6	12.0	Sandy Clay	115.2	15.5	16.7	2000

GeoSoils, Inc.
5741 Palmer Way
Carlsbad, CA 92008
Telephone: (760) 438-3155
Fax: (760) 931-0915

CONSOLIDATION TEST

Project: HILLCREST HOMES

Number: 3914-A-SC

Date: June 2003

Plate: D - 6

M. J. Schiff & Associates, Inc.

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

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

Table 1 - Laboratory Tests on Soil Samples

Hillcrest
Your #3914-A-SC, MJS&A #03-0486LAB
28-Apr-03

Sample ID			TP-2 @ 6-7	TP-19 @ 6-7
Resistivity		**Units**		
as-received		ohm-cm	1,500	81,000
saturated		ohm-cm	520	1,700
pH			7.7	7.7
Electrical Conductivity		mS/cm	0.80	0.17
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	212	36
magnesium	Mg^{2+}	mg/kg	78	85
sodium	Na^{1+}	mg/kg	304	ND
Anions				
carbonate	CO_3^{2-}	mg/kg	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	296	82
chloride	Cl^{1-}	mg/kg	900	30
sulfate	SO_4^{2-}	mg/kg	ND	48
Other Tests				
ammonium	NH_4^{1+}	mg/kg	na	na
nitrate	NO_3^{1-}	mg/kg	na	na
sulfide	S^{2-}	qual	na	na
Redox		mv	na	na

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

APPENDIX E

GENERAL EARTHWORK AND GRADING GUIDELINES

GENERAL EARTHWORK AND GRADING GUIDELINES

General

These guidelines present general procedures and requirements for earthwork and grading as shown on the approved grading plans, including preparation of areas to filled, placement of fill, installation of subdrains and excavations. The recommendations contained in the geotechnical report are part of the earthwork and grading guidelines and would supersede the provisions contained hereafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations which could supersede these guidelines or the recommendations contained in the geotechnical report.

The contractor is responsible for the satisfactory completion of all earthwork in accordance with provisions of the project plans and specifications. The project soil engineer and engineering geologist (geotechnical consultant) or their representatives should provide observation and testing services, and geotechnical consultation during the duration of the project.

EARTHWORK OBSERVATIONS AND TESTING

Geotechnical Consultant

Prior to the commencement of grading, a qualified geotechnical consultant (soil engineer and engineering geologist) should be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report, the approved grading plans, and applicable grading codes and ordinances.

The geotechnical consultant should provide testing and observation so that determination may be made that the work is being accomplished as specified. It is the responsibility of the contractor to assist the consultants and keep them apprised of anticipated work schedules and changes, so that they may schedule their personnel accordingly.

All clean-outs, prepared ground to receive fill, key excavations, and subdrains should be observed and documented by the project engineering geologist and/or soil engineer prior to placing and fill. It is the contractors's responsibility to notify the engineering geologist and soil engineer when such areas are ready for observation.

Laboratory and Field Tests

Maximum dry density tests to determine the degree of compaction should be performed in accordance with American Standard Testing Materials test method ASTM designation D-1557-78. Random field compaction tests should be performed in accordance with test method ASTM designation D-1556-82, D-2937 or D-2922 and D-3017, at intervals of approximately 2 feet of fill height or every 100 cubic yards of fill placed. These criteria would vary depending on the soil conditions and the size of the project. The location and frequency of testing would be at the discretion of the geotechnical consultant.

Contractor's Responsibility

All clearing, site preparation, and earthwork performed on the project should be conducted by the contractor, with observation by geotechnical consultants and staged approval by the governing agencies, as applicable. It is the contractor's responsibility to prepare the ground surface to receive the fill, to the satisfaction of the soil engineer, and to place, spread, moisture condition, mix and compact the fill in accordance with the recommendations of the soil engineer. The contractor should also remove all major non-earth material considered unsatisfactory by the soil engineer.

It is the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the earthwork in accordance with applicable grading guidelines, codes or agency ordinances, and approved grading plans. Sufficient watering apparatus and compaction equipment should be provided by the contractor with due consideration for the fill material, rate of placement, and climatic conditions. If, in the opinion of the geotechnical consultant, unsatisfactory conditions such as questionable weather, excessive oversized rock, or deleterious material, insufficient support equipment, etc., are resulting in a quality of work that is not acceptable, the consultant will inform the contractor, and the contractor is expected to rectify the conditions, and if necessary, stop work until conditions are satisfactory.

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

SITE PREPARATION

All major vegetation, including brush, trees, thick grasses, organic debris, and other deleterious material should be removed and disposed of off-site. These removals must be concluded prior to placing fill. Existing fill, soil, alluvium, colluvium, or rock materials determined by the soil engineer or engineering geologist as being unsuitable in-place should be removed prior to fill placement. Depending upon the soil conditions, these materials may be reused as compacted fills. Any materials incorporated as part of the compacted fills should be approved by the soil engineer.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, or other structures not located prior to grading are to be removed or treated in a manner recommended by the soil engineer. Soft, dry, spongy, highly fractured, or otherwise unsuitable ground extending to such a depth that surface processing cannot adequately improve the condition should be overexcavated down to firm ground and approved by the soil engineer before compaction and filling operations continue. Overexcavated and processed soils which have been properly mixed and moisture conditioned should be re-compacted to the minimum relative compaction as specified in these guidelines.

Existing ground which is determined to be satisfactory for support of the fills should be scarified to a minimum depth of 6 inches or as directed by the soil engineer. After the scarified ground is brought to optimum moisture content or greater and mixed, the materials should be compacted as specified herein. If the scarified zone is grater that 6 inches in depth, it may be necessary to remove the excess and place the material in lifts restricted to about 6 inches in compacted thickness.

Existing ground which is not satisfactory to support compacted fill should be overexcavated as required in the geotechnical report or by the on-site soils engineer and/or engineering geologist. Scarification, disc harrowing, or other acceptable form of mixing should continue until the soils are broken down and free of large lumps or clods, until the working surface is reasonably uniform and free from ruts, hollow, hummocks, or other uneven features which would inhibit compaction as described previously.

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical), the ground should be stepped or benched. The lowest bench, which will act as a key, should be a minimum of 15 feet wide and should be at least 2 feet deep into firm material, and approved by the soil engineer and/or engineering geologist. In fill over cut slope conditions, the recommended minimum width of the lowest bench or key is also 15 feet with the key founded on firm material, as designated by the Geotechnical Consultant. As a general rule, unless specifically recommended otherwise by the Soil Engineer, the minimum width of fill keys should be approximately equal to ½ the height of the slope.

Standard benching is generally 4 feet (minimum) vertically, exposing firm, acceptable material. Benching may be used to remove unsuitable materials, although it is understood that the vertical height of the bench may exceed 4 feet. Pre-stripping may be considered for unsuitable materials in excess of 4 feet in thickness.

All areas to receive fill, including processed areas, removal areas, and the toe of fill benches should be observed and approved by the soil engineer and/or engineering geologist prior to placement of fill. Fills may then be properly placed and compacted until design grades (elevations) are attained.

COMPACTED FILLS

Any earth materials imported or excavated on the property may be utilized in the fill provided that each material has been determined to be suitable by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. All unsuitable materials should be removed from the fill as directed by the soil engineer. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated by the consultant as unsuitable and may require blending with other soils to serve as a satisfactory fill material.

Fill materials derived from benching operations should be dispersed throughout the fill area and blended with other bedrock derived material. Benching operations should not result in the benched material being placed only within a single equipment width away from the fill/bedrock contact.

Oversized materials defined as rock or other irreducible materials with a maximum dimension greater than 12 inches should not be buried or placed in fills unless the location of materials and disposal methods are specifically approved by the soil engineer. Oversized material should be taken off-site or placed in accordance with recommendations of the soil engineer in areas designated as suitable for rock disposal. Oversized material should not be placed within 10 feet vertically of finish grade (elevation) or within 20 feet horizontally of slope faces.

To facilitate future trenching, rock should not be placed within the range of foundation excavations, future utilities, or underground construction unless specifically approved by the soil engineer and/or the developers representative.

If import material is required for grading, representative samples of the materials to be utilized as compacted fill should be analyzed in the laboratory by the soil engineer to determine its physical properties. If any material other than that previously tested is encountered during grading, an appropriate analysis of this material should be conducted by the soil engineer as soon as possible.

Approved fill material should be placed in areas prepared to receive fill in near horizontal layers that when compacted should not exceed 6 inches in thickness. The soil engineer may approve thick lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer should be spread evenly and blended to attain uniformity of material and moisture suitable for compaction.

Fill layers at a moisture content less than optimum should be watered and mixed, and wet fill layers should be aerated by scarification or should be blended with drier material. Moisture condition, blending, and mixing of the fill layer should continue until the fill materials have a uniform moisture content at or above optimum moisture.

After each layer has been evenly spread, moisture conditioned and mixed, it should be uniformly compacted to a minimum of 90 percent of maximum density as determined by ASTM test designation, D-1557-78, or as otherwise recommended by the soil engineer. Compaction equipment should be adequately sized and should be specifically designed for soil compaction or of proven reliability to efficiently achieve the specified degree of compaction.

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

Compaction of slopes should be accomplished by over-building a minimum of 3 feet horizontally, and subsequently trimming back to the design slope configuration. Testing shall be performed as the fill is elevated to evaluate compaction as the fill core is being developed. Special efforts may be necessary to attain the specified compaction in the fill slope zone. Final slope shaping should be performed by trimming and removing loose materials with appropriate equipment. A final determination of fill slope compaction should be based on observation and/or testing of the finished slope face. Where compacted fill slopes are designed steeper than 2:1 (horizontal to vertical), specific material types, a higher minimum relative compaction, and special grading procedures, may be recommended.

If an alternative to over-building and cutting back the compacted fill slopes is selected, then special effort should be made to achieve the required compaction in the outer 10 feet of each lift of fill by undertaking the following:

1. An extra piece of equipment consisting of a heavy short shanked sheepsfoot should be used to roll (horizontal) parallel to the slopes continuously as fill is placed. The sheepsfoot roller should also be used to roll perpendicular to the slopes, and extend out over the slope to provide adequate compaction to the face of the slope.

2. Loose fill should not be spilled out over the face of the slope as each lift is compacted. Any loose fill spilled over a previously completed slope face should be trimmed off or be subject to re-rolling.

3. Field compaction tests will be made in the outer (horizontal) 2 to 8 feet of the slope at appropriate vertical intervals, subsequent to compaction operations.

4. After completion of the slope, the slope face should be shaped with a small tractor and then re-rolled with a sheepsfoot to achieve compaction to near the slope face. Subsequent to testing to verify compaction, the slopes should be grid-rolled to achieve compaction to the slope face. Final testing should be used to confirm compaction after grid rolling.

5. Where testing indicates less than adequate compaction, the contractor will be responsible to rip, water, mix and re-compact the slope material as necessary to achieve compaction. Additional testing should be performed to verify compaction.

6. Erosion control and drainage devices should be designed by the project civil engineer in compliance with ordinances of the controlling governmental agencies, and/or in accordance with the recommendation of the soil engineer or engineering geologist.

SUBDRAIN INSTALLATION

Subdrains should be installed in approved ground in accordance with the approximate alignment and details indicated by the geotechnical consultant. Subdrain locations or materials should not be changed or modified without approval of the geotechnical consultant. The soil engineer and/or engineering geologist may recommend and direct changes in subdrain line, grade and drain material in the field, pending exposed conditions. The location of constructed subdrains should be recorded by the project civil engineer.

EXCAVATIONS

Excavations and cut slopes should be examined during grading by the engineering geologist. If directed by the engineering geologist, further excavations or overexcavation and re-filling of cut areas should be performed and/or remedial grading of cut slopes should be performed. When fill over cut slopes are to be graded, unless otherwise approved, the cut portion of the slope should be observed by the engineering geologist prior to placement of materials for construction of the fill portion of the slope.

The engineering geologist should observe all cut slopes and should be notified by the contractor when cut slopes are started. If, during the course of grading, unforeseen adverse or potential adverse geologic conditions are encountered, the engineering geologist and soil engineer should investigate, evaluate and make recommendations to treat these problems. The need for cut slope buttressing or stabilizing should be based on in-grading evaluation by the engineering geologist, whether anticipated or not.

Unless otherwise specified in soil and geological reports, no cut slopes should be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies. Additionally, short-term stability of temporary cut slopes is the contractors responsibility.

Erosion control and drainage devices should be designed by the project civil engineer and should be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the soil engineer or engineering geologist.

COMPLETION

Observation, testing and consultation by the geotechnical consultant should be conducted during the grading operations in order to state an opinion that all cut and filled areas are graded in accordance with the approved project specifications.

After completion of grading and after the soil engineer and engineering geologist have finished their observations of the work, final reports should be submitted subject to review by the controlling governmental agencies. No further excavation or filling should be undertaken without prior notification of the soil engineer and/or engineering geologist.

All finished cut and fill slopes should be protected from erosion and/or be planted in accordance with the project specifications and/or as recommended by a landscape architect. Such protection and/or planning should be undertaken as soon as practical after completion of grading.

JOB SAFETY

General

At GeoSoils, Inc. (GSI) getting the job done safely is of primary concern. The following is the company's safety considerations for use by all employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading and construction projects. GSI recognizes that construction activities will vary on each site and that site safety is the prime responsibility of the contractor; however, everyone must be safety conscious and responsible at all times. To achieve our goal of avoiding accidents, cooperation between the client, the contractor and GSI personnel must be maintained.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of field personnel on grading and construction projects:

Safety Meetings: GSI field personnel are directed to attend contractors regularly scheduled and documented safety meetings.

Safety Vests: Safety vests are provided for and are to be worn by GSI personnel at all times when they are working in the field.

Safety Flags: Two safety flags are provided to GSI field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

Flashing Lights: All vehicles stationary in the grading area shall use rotating or flashing amber beacon, or strobe lights, on the vehicle during all field testing. While operating a vehicle in the grading area, the emergency flasher on the vehicle shall be activated.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. A primary concern should be the technicians's safety. Efforts will be made to coordinate locations with the grading contractors authorized representative, and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative (dump man, operator, supervisor, grade checker, etc.) should direct excavation of the pit and safety during the test period. Of paramount concern should be the soil technicians safety and obtaining enough tests to represent the fill.

Test pits should be excavated so that the spoil pile is placed away form oncoming traffic, whenever possible. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates the fill be maintained in a driveable condition. Alternatively, the contractor may wish to park a piece of equipment in front of the test holes, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits. No grading equipment should enter this zone during the testing procedure. The zone should extend approximately 50 feet outward from the center of the test pit. This zone is established for safety and to avoid excessive ground vibration which typically decreased test results.

When taking slope tests the technician should park the vehicle directly above or below the test location. If this is not possible, a prominent flag should be placed at the top of the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g., 50 feet) away from the slope during this testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location, well away from the equipment traffic pattern. The contractor should inform our personnel of all changes to haul roads, cut and fill areas or other factors that may affect site access and site safety.

In the event that the technicians safety is jeopardized or compromised as a result of the contractors failure to comply with any of the above, the technician is required, by company policy, to immediately withdraw and notify his/her supervisor. The grading contractors representative will eventually be contacted in an effort to effect a solution. However, in the interim, no further testing will be performed until the situation is rectified. Any fill place can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor brings this to his/her attention and notify this office. Effective communication and coordination between the contractors representative and the soils technician is strongly encouraged in order to implement the above safety plan.

Trench and Vertical Excavation

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed.

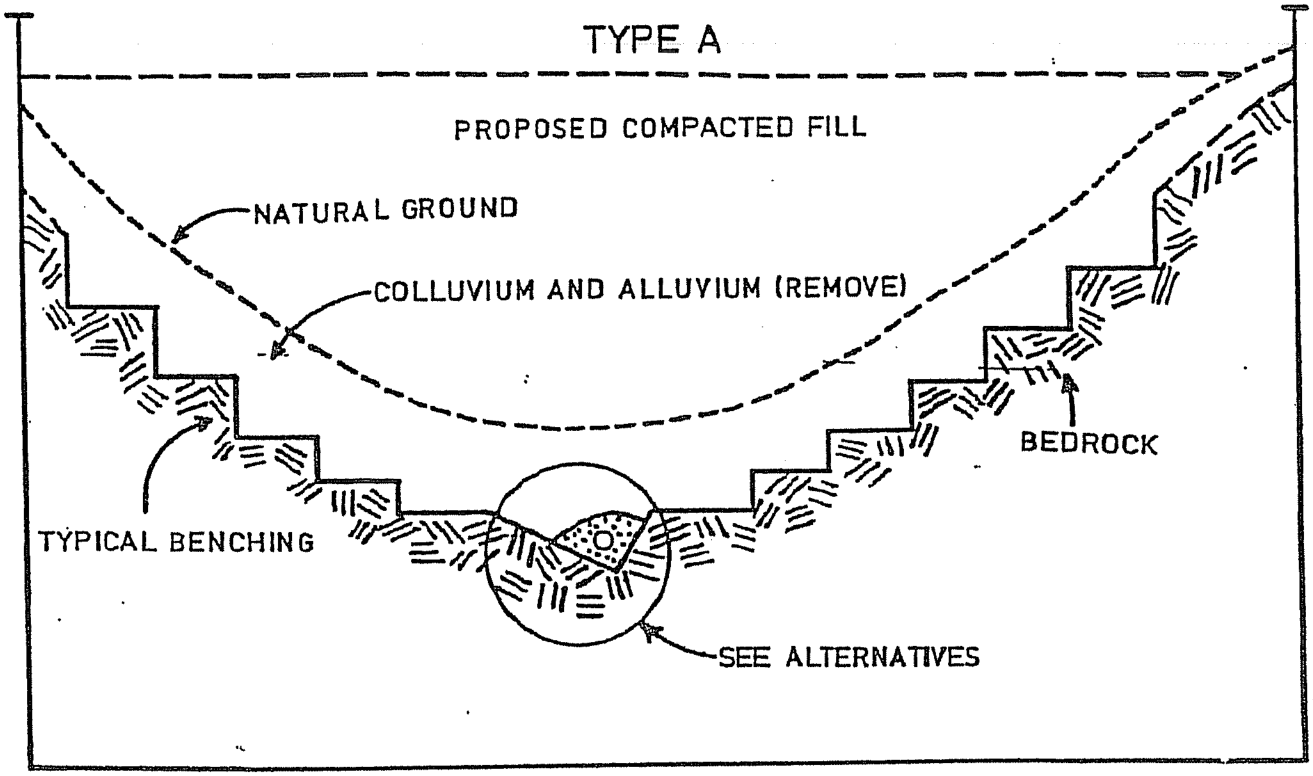
Our personnel are directed not to enter any excavation or vertical cut which: 1) is 5 feet or deeper unless shored or laid back; 2) displays any evidence of instability, has any loose rock or other debris which could fall into the trench; or 3) displays any other evidence of any unsafe conditions regardless of depth.

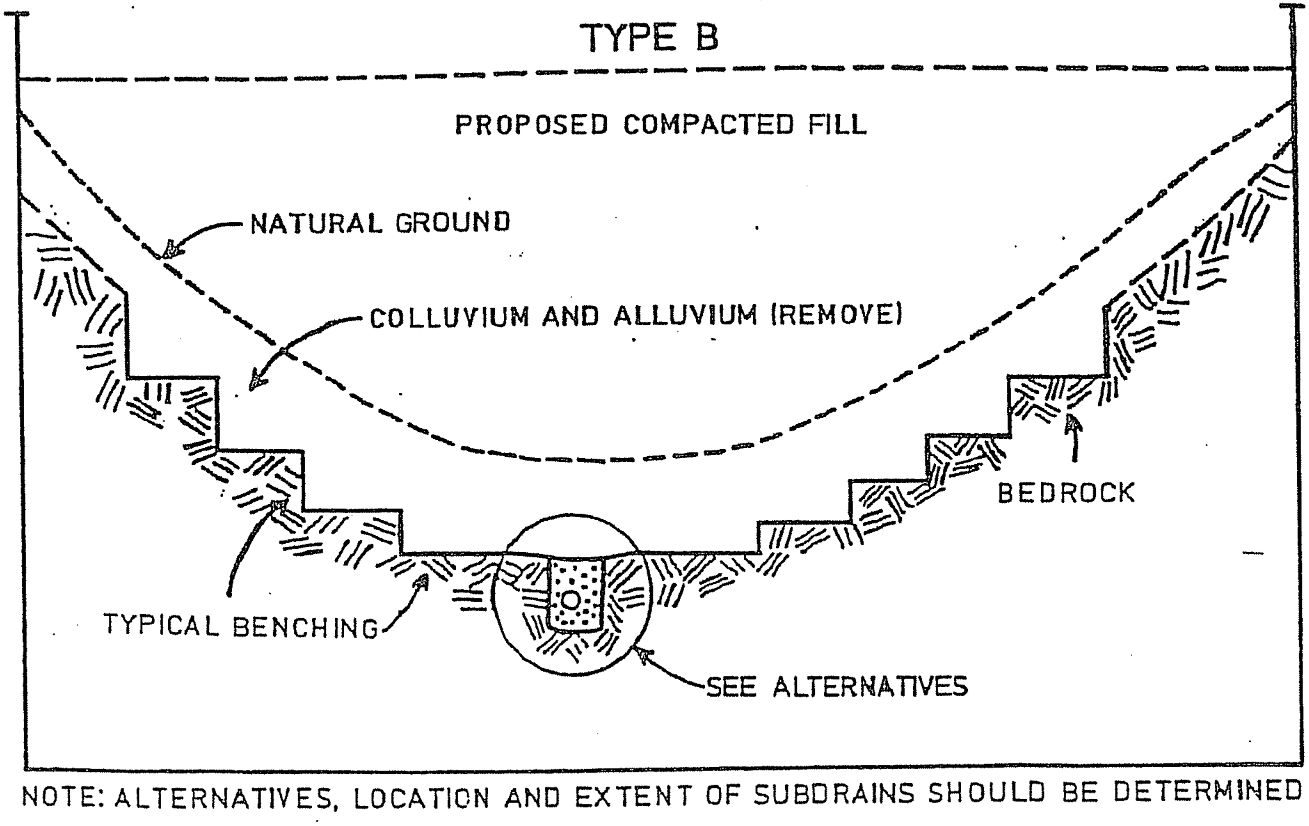
All trench excavations or vertical cuts in excess of 5 feet deep, which any person enters, should be shored or laid back. Trench access should be provided in accordance with CAL-OSHA and/or state and local standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraw and notify his/her supervisor. The contractors representative will eventually be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons could be subject to reprocessing and/or removal.

If GSI personnel become aware of anyone working beneath an unsafe trench wall or vertical excavation, we have a legal obligation to put the contractor and owner/developer on notice to immediately correct the situation. If corrective steps are not taken, GSI then has an obligation to notify CAL-OSHA and/or the proper authorities.

CANYON SUBDRAIN DETAIL



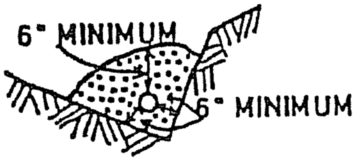


NOTE: ALTERNATIVES, LOCATION AND EXTENT OF SUBDRAINS SHOULD BE DETERMINED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST DURING GRADING.

PLATE EG—1

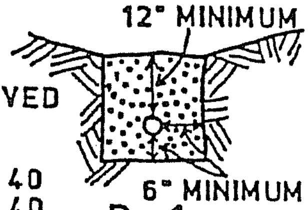
CANYON SUBDRAIN ALTERNATE DETAILS

ALTERNATE 1: PERFORATED PIPE AND FILTER MATERIAL



A—1

FILTER MATERIAL: MINIMUM VOLUME OF 9 FT.^{3}
/LINEAR FT. 6" Ø ABS OR PVC PIPE OR APPROVED
SUBSTITUTE WITH MINIMUM 8 (1/4" Ø) PERFS.
LINEAR FT. IN BOTTOM HALF OF PIPE.
ASTM D2751, SDR 35 OR ASTM D1527, SCHD. 40
ASTM D3034, SDR 35 OR ASTM D1785, SCHD. 40
FOR CONTINUOUS RUN IN EXCESS OF 500 FT.
USE 8" Ø PIPE

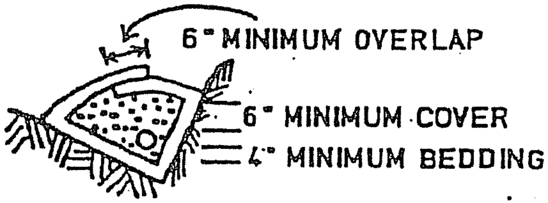


B—1

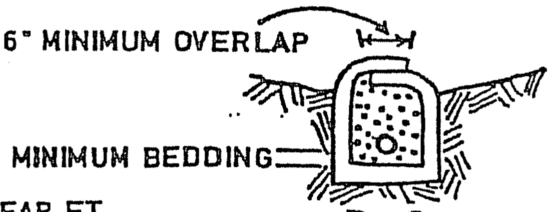
FILTER MATERIAL

SIEVE SIZE	PERCENT PASSING
1 INCH	100
3/4 INCH	90—100
3/8 INCH	40—100
NO. 4	25—40
NO. 8	18—33
NO. 30	5—15
NO. 50	0—7
NO. 200	0—3

ALTERNATE 2: PERFORATED PIPE, GRAVEL AND FILTER FABRIC



A—2



B—2

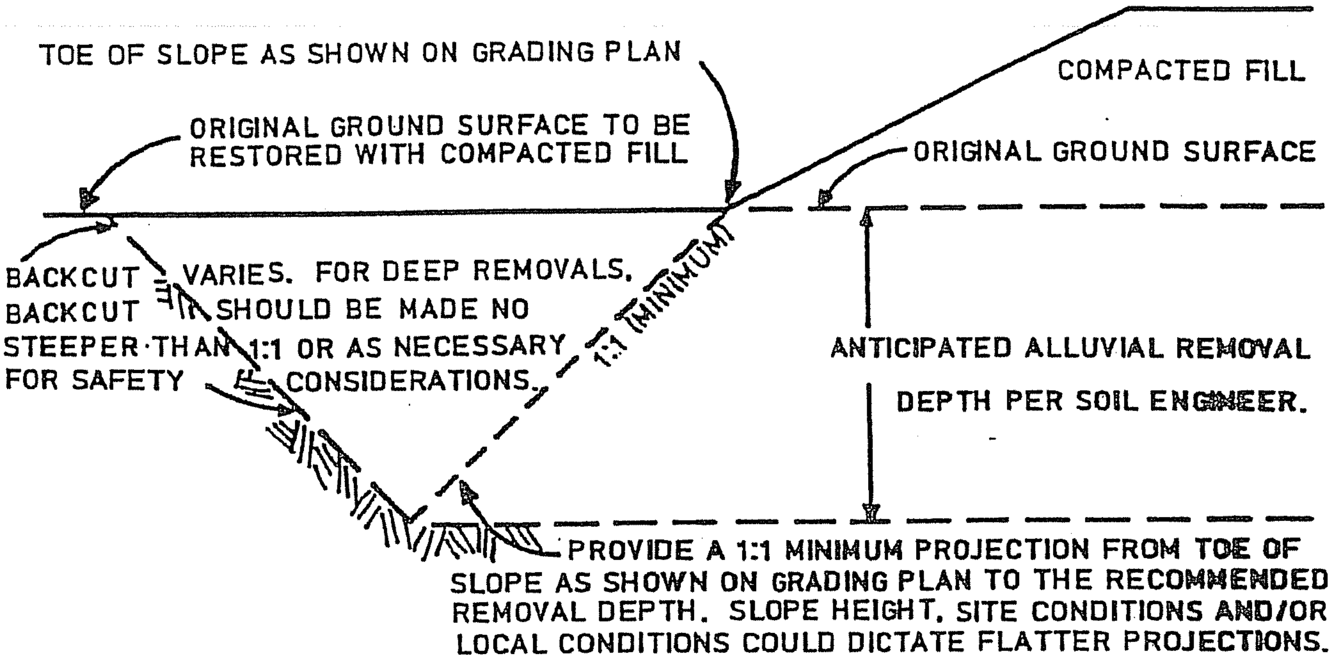
GRAVEL MATERIAL 9 FT^3/LINEAR FT.

PERFORATED PIPE: SEE ALTERNATE 1

GRAVEL: CLEAN 3/4 INCH ROCK OR APPROVED SUBSTITUTE

FILTER FABRIC: MIRAFI 140 OR APPROVED SUBSTITUTE

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON



BACKCUT VARIES. FOR DEEP REMOVALS, BACKCUT SHOULD BE MADE NO STEEPER THAN 1:1 OR AS NECESSARY FOR SAFETY CONSIDERATIONS.

PROVIDE A 1:1 MINIMUM PROJECTION FROM TOE OF SLOPE AS SHOWN ON GRADING PLAN TO THE RECOMMENDED REMOVAL DEPTH. SLOPE HEIGHT, SITE CONDITIONS AND/OR LOCAL CONDITIONS COULD DICTATE FLATTER PROJECTIONS.

REMOVAL ADJACENT TO EXISTING FILL

ADJOINING CANYON FILL

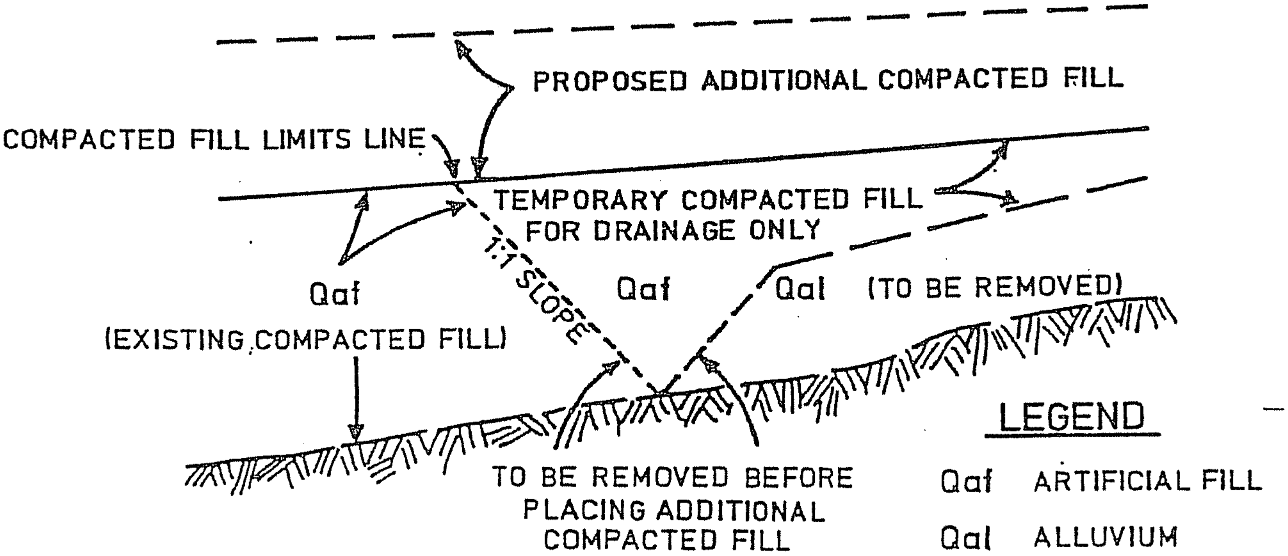


PLATE EG—3

TYPICAL STABILIZATION / BUTTRESS FILL DETAIL

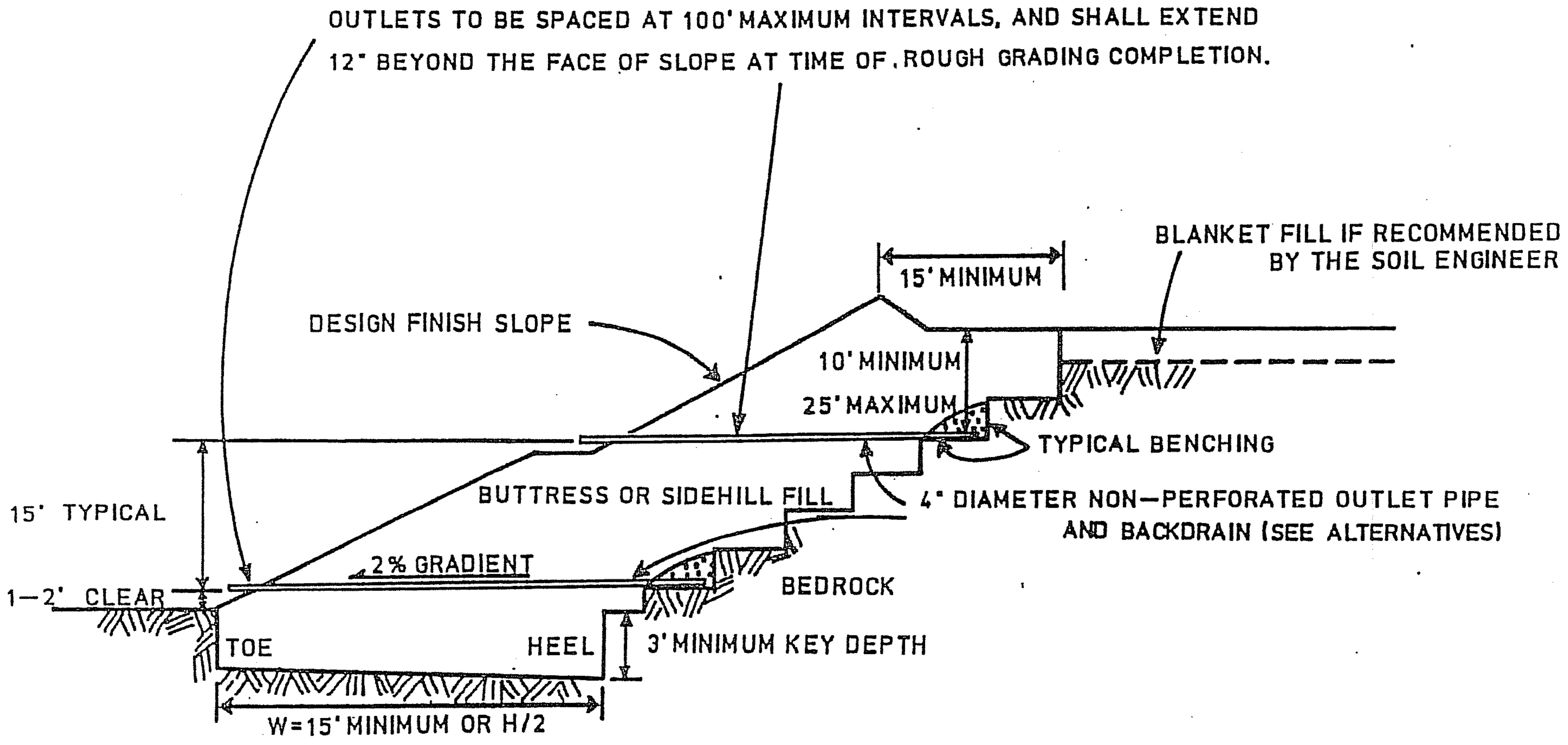
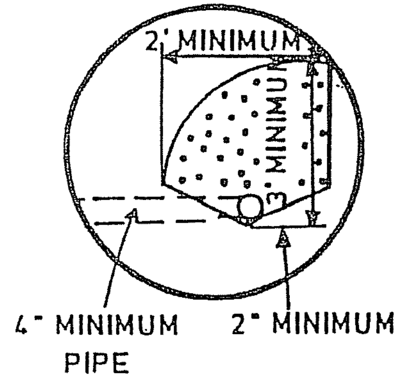
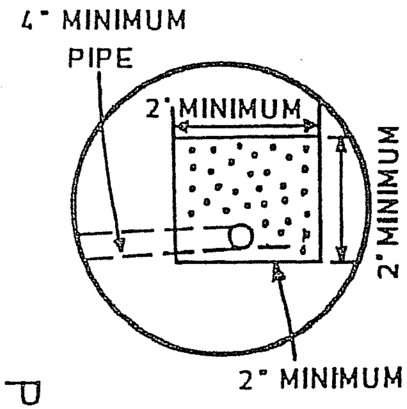


PLATE EG—4

TYPICAL STABILIZATION / BUTTRESS SUBDRAIN DETAIL





<u>FILTER MATERIAL:</u> MINIMUM OF FIVE FT^3/LINEAR FT OF PIPE OR FOUR FT^3/LINEAR FT OF PIPE WHEN PLACED IN SQUARE CUT TRENCH.

<u>ALTERNATIVE IN LIEU OF FILTER MATERIAL</u>: GRAVEL MAY BE ENCASED IN APPROVED FILTER FABRIC. FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12" ON ALL JOINTS.

<u>MINIMUM 4" DIAMETER PIPE:</u> ABS—ASTM D—2751, SDR 35 OR ASTM D—1527 SCHEDULE 40 PVC—ASTM D—3034, SDR 35 OR ASTM D—1785 SCHEDULE 40 WITH A CRUSHING STRENGTH OF 1,000 POUNDS MINIMUM, AND A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS OF BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2% TO OUTLET PIPE. OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW.

NOTE: 1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON—SITE SOIL.

2. BACKDRAINS AND LATERAL DRAINS SHALL BE LOCATED AT ELEVATION OF EVERY BENCH DRAIN. FIRST DRAIN LOCATED AT ELEVATION JUST ABOVE LOWER LOT GRADE. ADDITIONAL DRAINS MAY BE REQUIRED AT THE DISCRETION OF THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST.

<u>FILTER MATERIAL</u> SHALL BE OF THE FOLLOWING SPECIFICATION OR AN APPROVED EQUIVALENT:

SIEVE SIZE	PERCENT PASSING
1 INCH	100
3/4 INCH	90—100
3/8 INCH	40—100
NO. 4	25—40
NO. 8	18—33
NO. 30	5—15
NO. 50	0—7
NO. 200	0—3

<u>GRAVEL</u> SHALL BE OF THE FOLLOWING SPECIFICATION OR AN APPROVED EQUIVALENT:

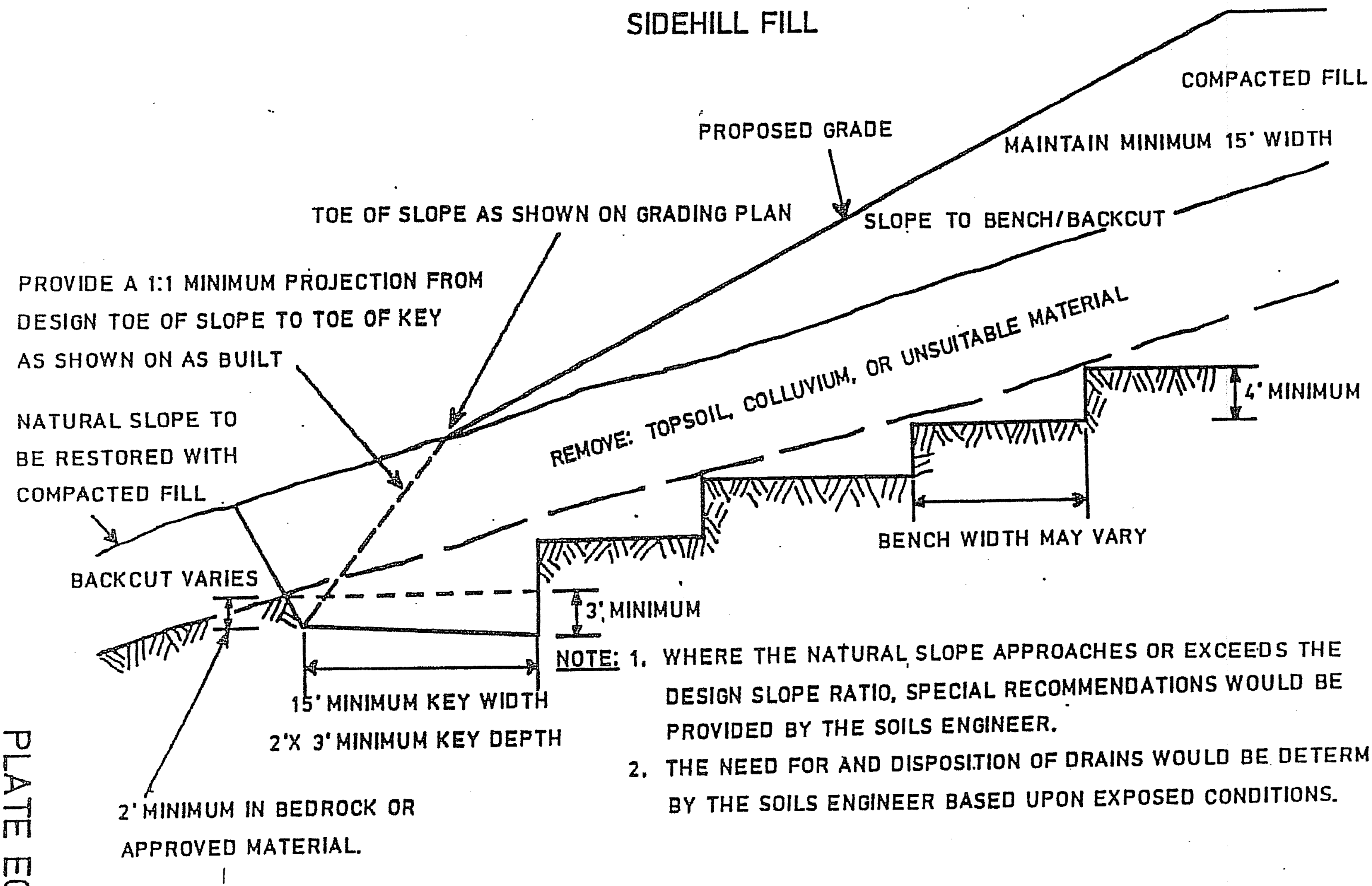
SIEVE SIZE	PERCENT PASSING
1 1/2 INCH	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT: MINIMUM OF 5

PLATE EG—5

FILL OVER NATURAL DETAIL

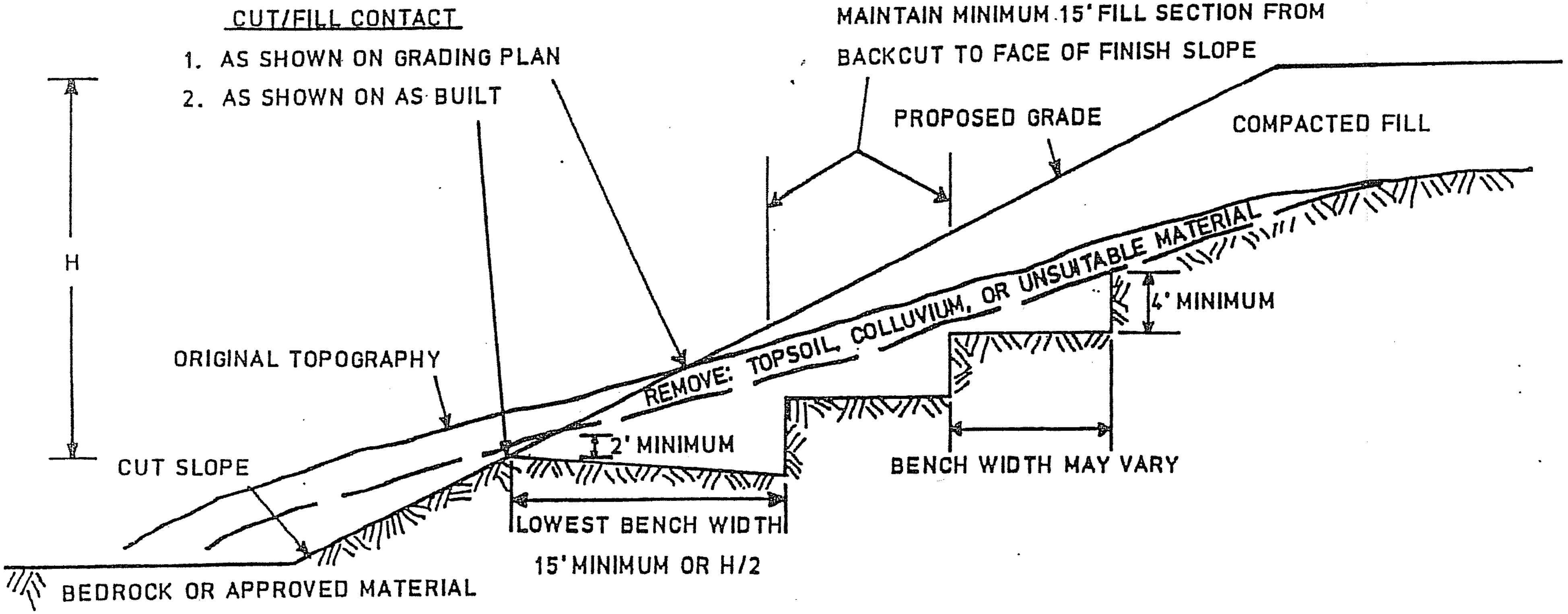
SIDEHILL FILL



NOTE: 1. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WOULD BE PROVIDED BY THE SOILS ENGINEER.

2. THE NEED FOR AND DISPOSITION OF DRAINS WOULD BE DETERMINED BY THE SOILS ENGINEER BASED UPON EXPOSED CONDITIONS.

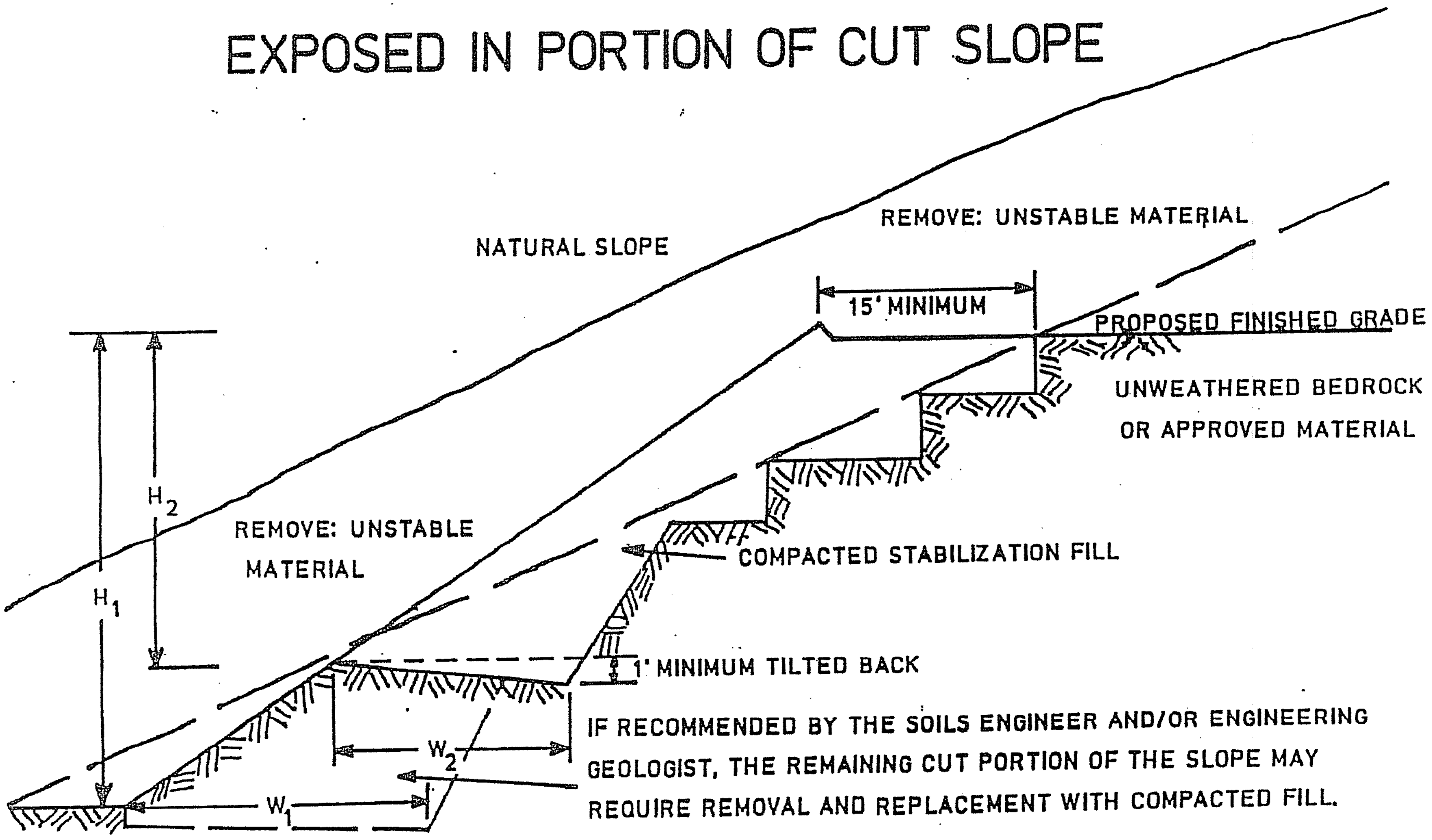
FILL OVER CUT DETAIL



NOTE: THE CUT PORTION OF THE SLOPE SHOULD BE EXCAVATED AND EVALUATED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST PRIOR TO CONSTRUCTING THE FILL PORTION.

PLATE EG—7

STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE

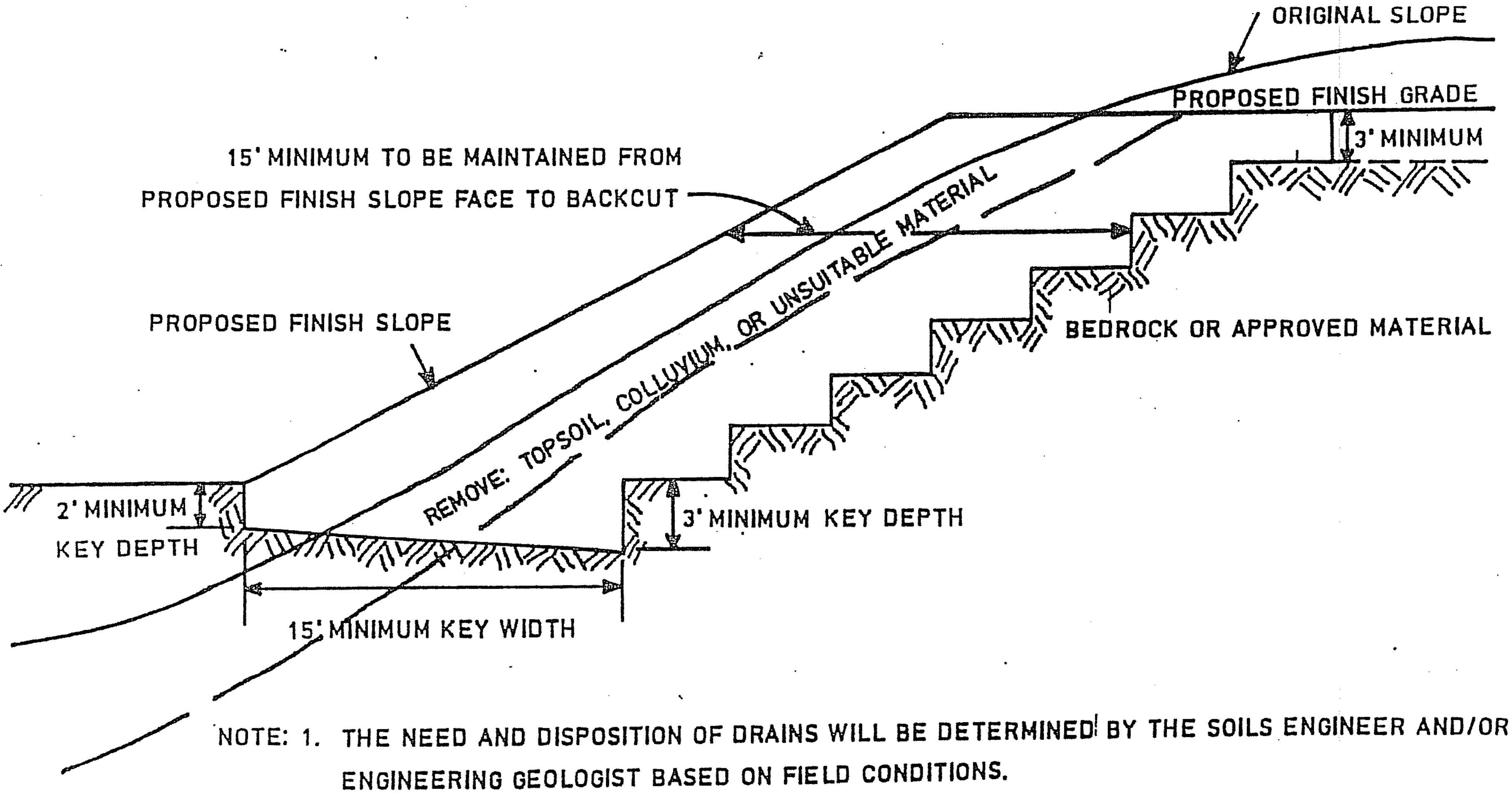


IF RECOMMENDED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST, THE REMAINING CUT PORTION OF THE SLOPE MAY REQUIRE REMOVAL AND REPLACEMENT WITH COMPACTED FILL.

NOTE: 1. SUBDRAINS ARE NOT REQUIRED UNLESS SPECIFIED BY SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST,

2. "W₁" SHALL BE EQUIPMENT WIDTH (15') FOR SLOPE HEIGHTS LESS THAN 25 FEET. FOR SLOPES GREATER THAN 25 FEET "W" SHALL BE DETERMINED BY THE PROJECT SOILS ENGINEER AND /OR ENGINEERING GEOLOGIST. AT NO TIME SHALL "W" BE LESS THAN H/2.

SKIN FILL OF NATURAL GROUND

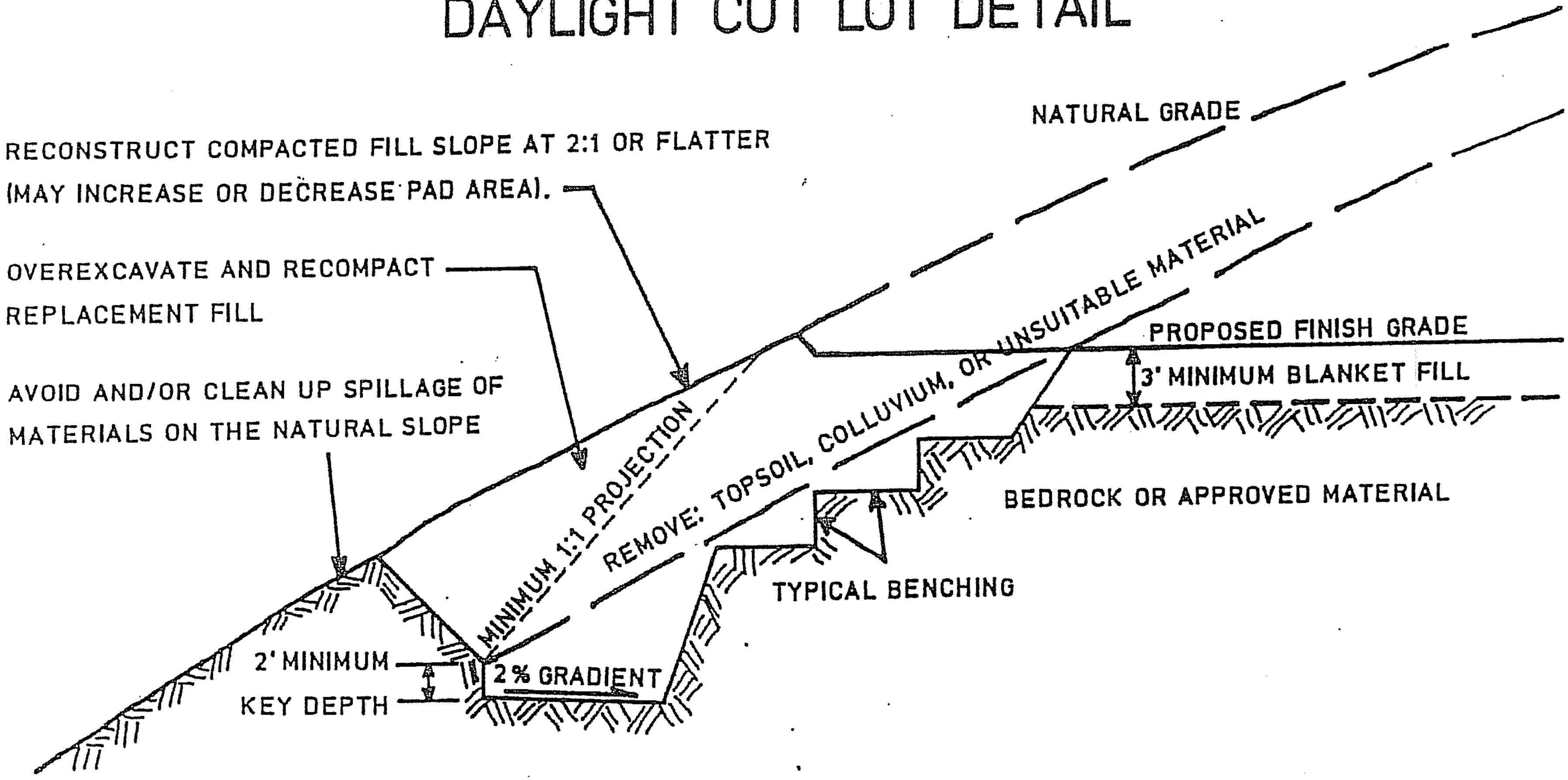


NOTE: 1. THE NEED AND DISPOSITION OF DRAINS WILL BE DETERMINED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST BASED ON FIELD CONDITIONS.

2. PAD OVEREXCAVATION AND RECOMPACTION SHOULD BE PERFORMED IF DETERMINED TO BE NECESSARY BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST.

PLATE EG—9

DAYLIGHT CUT LOT DETAIL



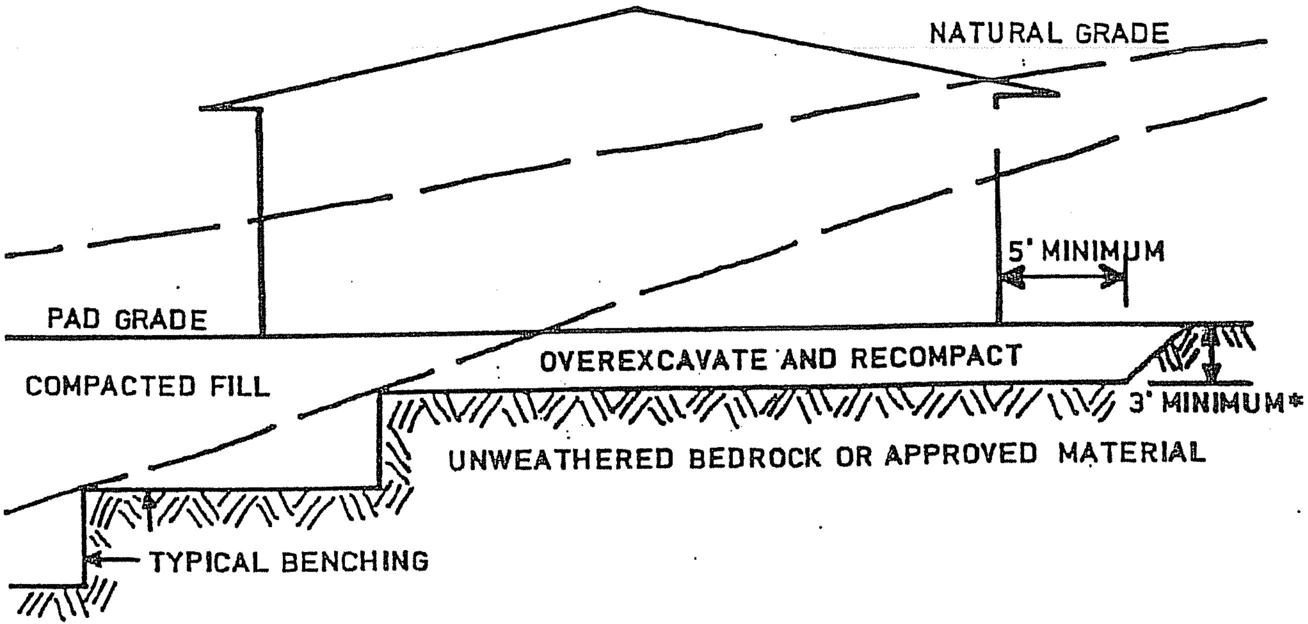
NOTE: 1. SUBDRAIN AND KEY WIDTH REQUIREMENTS WILL BE DETERMINED BASED ON EXPOSED SUBSURFACE CONDITIONS AND THICKNESS OF OVERBURDEN.

2. PAD OVER EXCAVATION AND RECOMPACTION SHOULD BE PERFORMED IF DETERMINED NECESSARY BY THE SOILS ENGINEER AND/OR THE ENGINEERING GEOLOGIST.

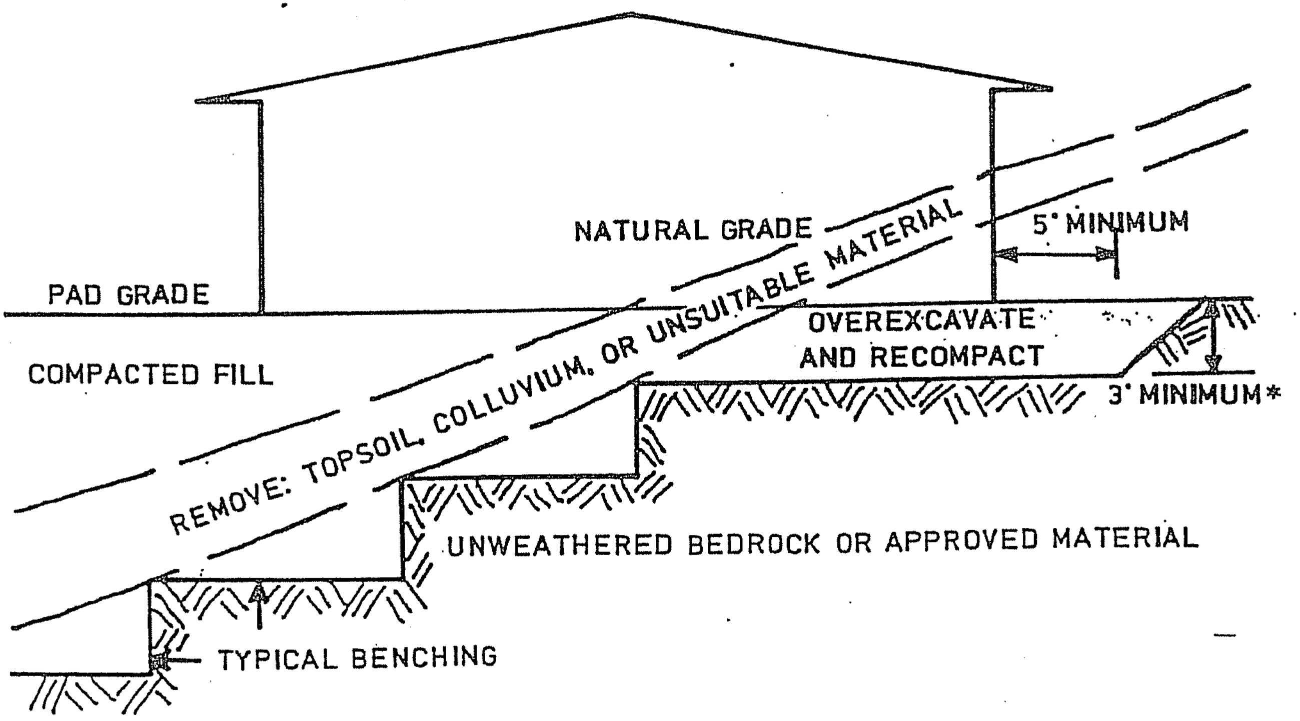
PLATE EG—10

TRANSITION LOT DETAIL

CUT LOT (MATERIAL TYPE TRANSITION)

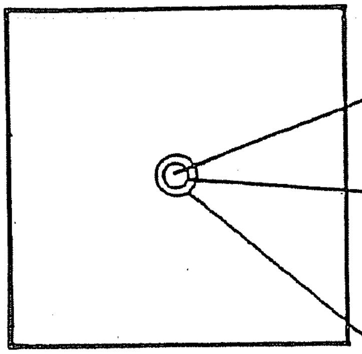


CUT—FILL LOT (DAYLIGHT TRANSITION)



NOTE: * DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST IN STEEP CUT—FILL TRANSITION AREAS.

SETTLEMENT PLATE AND RISER DETAIL

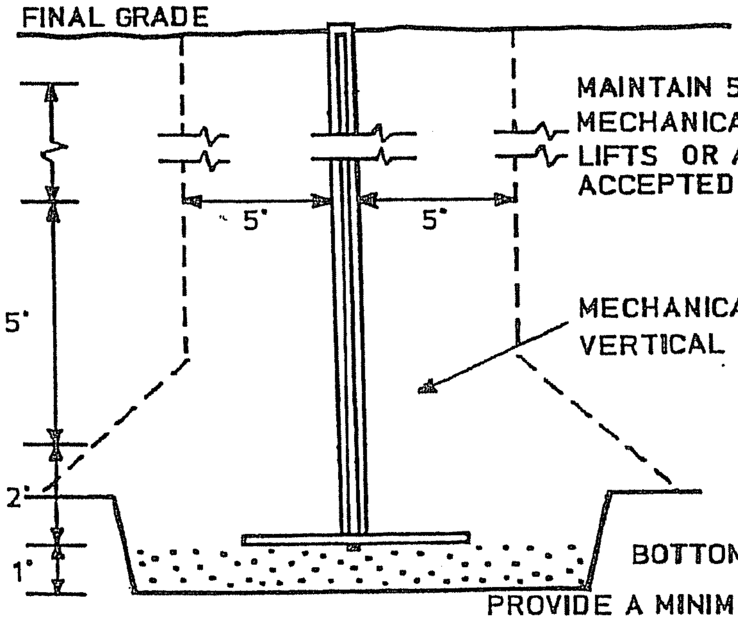


2'X 2'X 1/4" STEEL PLATE

STANDARD 3/4" PIPE NIPPLE WELDED TO TOP OF PLATE.

3/4" X 5' GALVANIZED PIPE, STANDARD PIPE THREADS TOP AND BOTTOM. EXTENSIONS THREADED ON BOTH ENDS AND ADDED IN 5' INCREMENTS.

3 INCH SCHEDULE 40 PVC PIPE SLEEVE, ADD IN 5' INCREMENTS WITH GLUE JOINTS.



MAINTAIN 5' CLEARANCE OF HEAVY EQUIPMENT. MECHANICALLY HAND COMPACT IN 2' VERTICAL LIFTS OR ALTERNATIVE SUITABLE TO AND ACCEPTED BY THE SOILS ENGINEER.

MECHANICALLY HAND COMPACT THE INITIAL 5' VERTICAL WITHIN A 5' RADIUS OF PLATE BASE.

BOTTOM OF CLEANOUT

PROVIDE A MINIMUM 1' BEDDING OF COMPACTED SAND

NOTE:

1. LOCATIONS OF SETTLEMENT PLATES SHOULD BE CLEARLY MARKED AND READILY VISIBLE (RED FLAGGED) TO EQUIPMENT OPERATORS.
2. CONTRACTOR SHOULD MAINTAIN CLEARANCE OF A 5' RADIUS OF PLATE BASE AND WITHIN 5' (VERTICAL) FOR HEAVY EQUIPMENT. FILL WITHIN CLEARANCE AREA SHOULD BE HAND COMPACTED TO PROJECT SPECIFICATIONS OR COMPACTED BY ALTERNATIVE APPROVED BY THE SOILS ENGINEER.
3. AFTER 5' (VERTICAL) OF FILL IS IN PLACE, CONTRACTOR SHOULD MAINTAIN A 5' RADIUS EQUIPMENT CLEARANCE FROM RISER.
4. PLACE AND MECHANICALLY HAND COMPACT INITIAL 2' OF FILL PRIOR TO ESTABLISHING THE INITIAL READING.
5. IN THE EVENT OF DAMAGE TO THE SETTLEMENT PLATE OR EXTENSION RESULTING FROM EQUIPMENT OPERATING WITHIN THE SPECIFIED CLEARANCE AREA, CONTRACTOR SHOULD IMMEDIATELY NOTIFY THE SOILS ENGINEER AND SHOULD BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
6. AN ALTERNATE DESIGN AND METHOD OF INSTALLATION MAY BE PROVIDED AT THE DISCRETION OF THE SOILS ENGINEER.

TYPICAL SURFACE SETTLEMENT MONUMENT

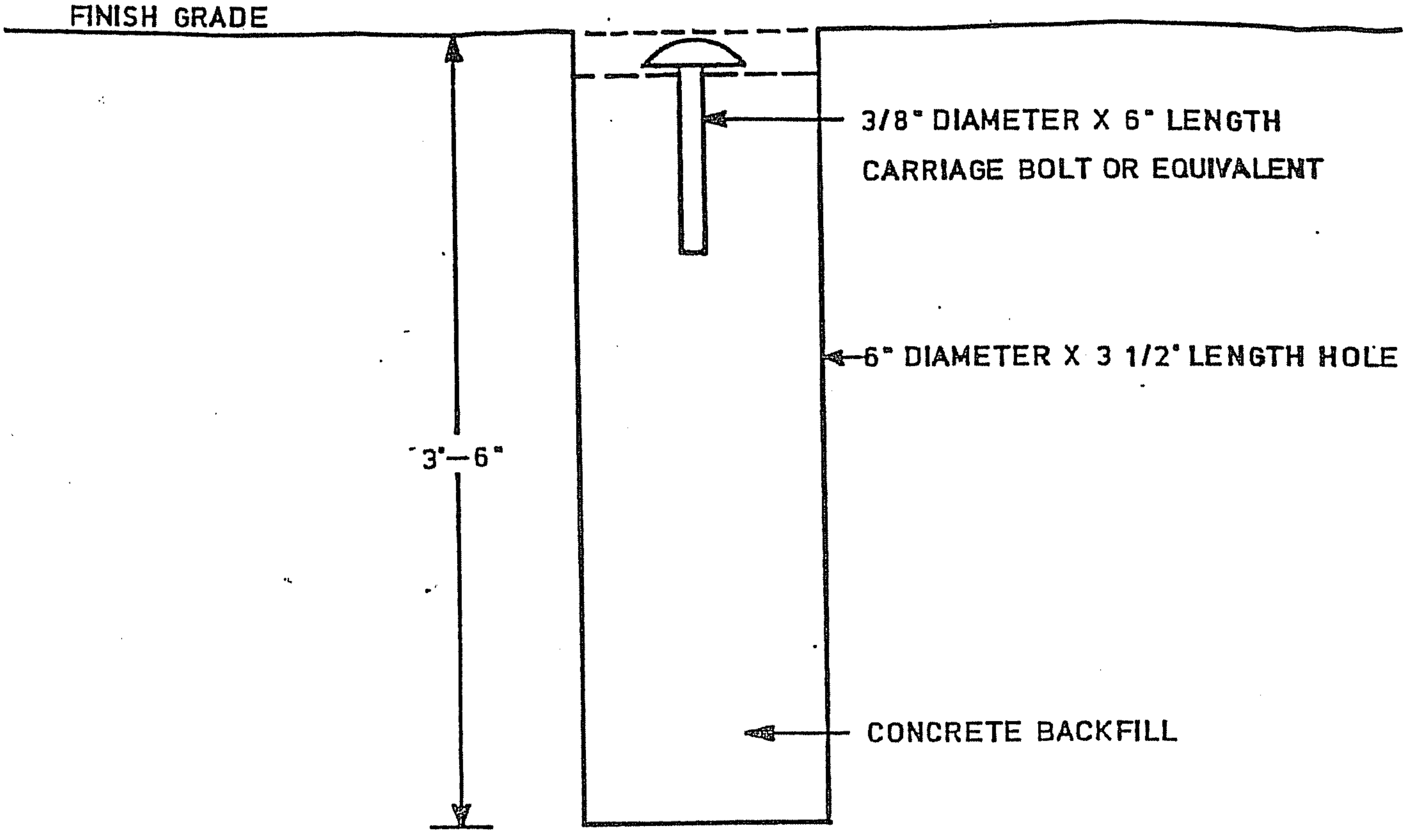
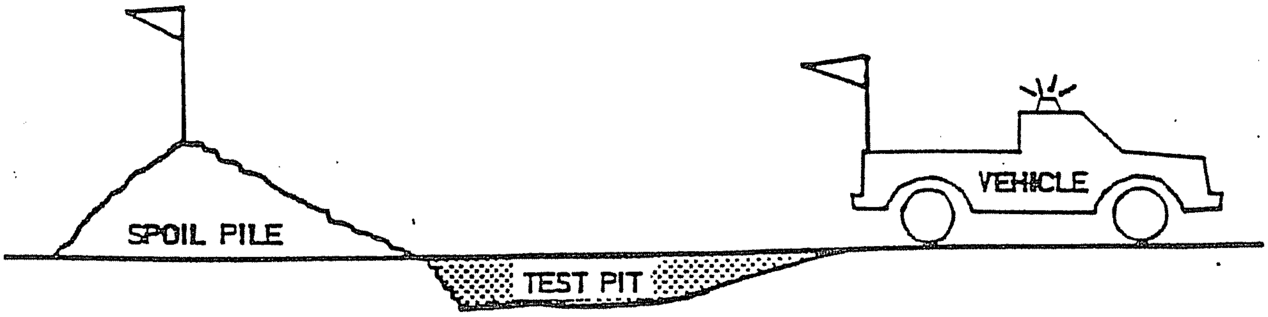


PLATE EG-15

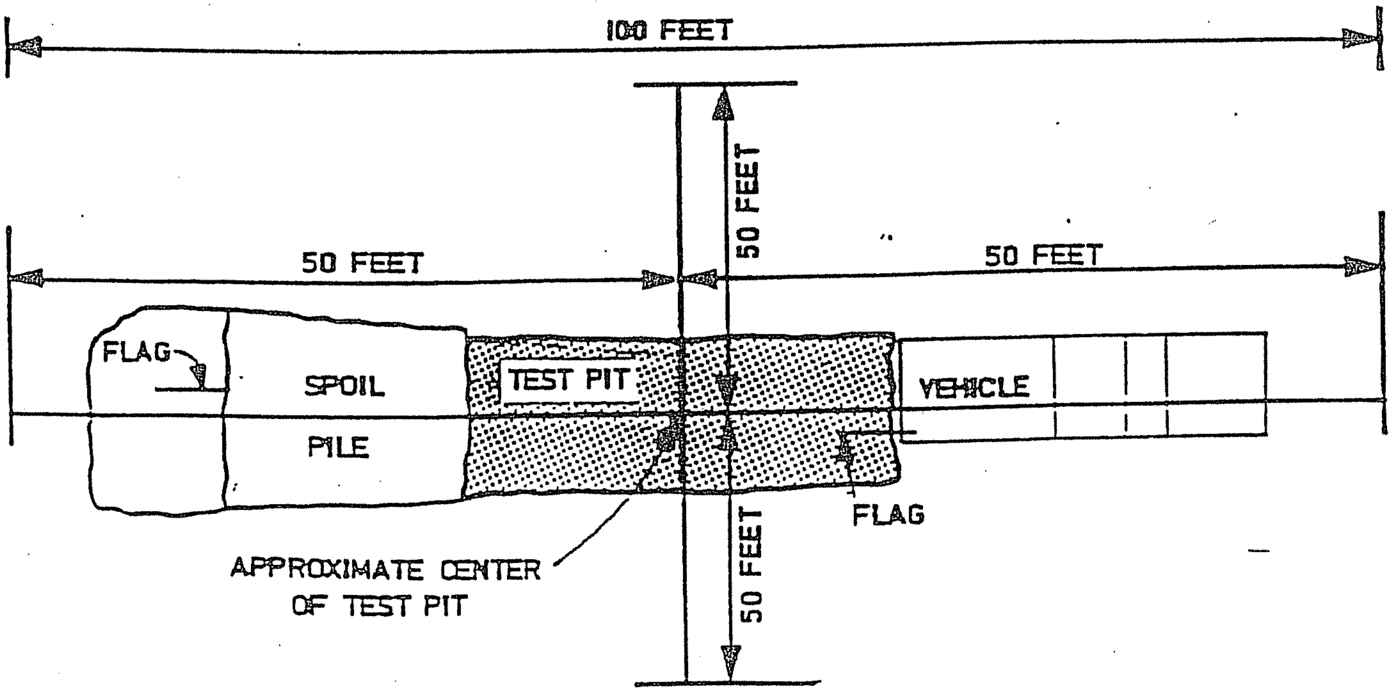
TEST PIT SAFETY DIAGRAM

SIDE VIEW



(NOT TO SCALE)

TOP VIEW

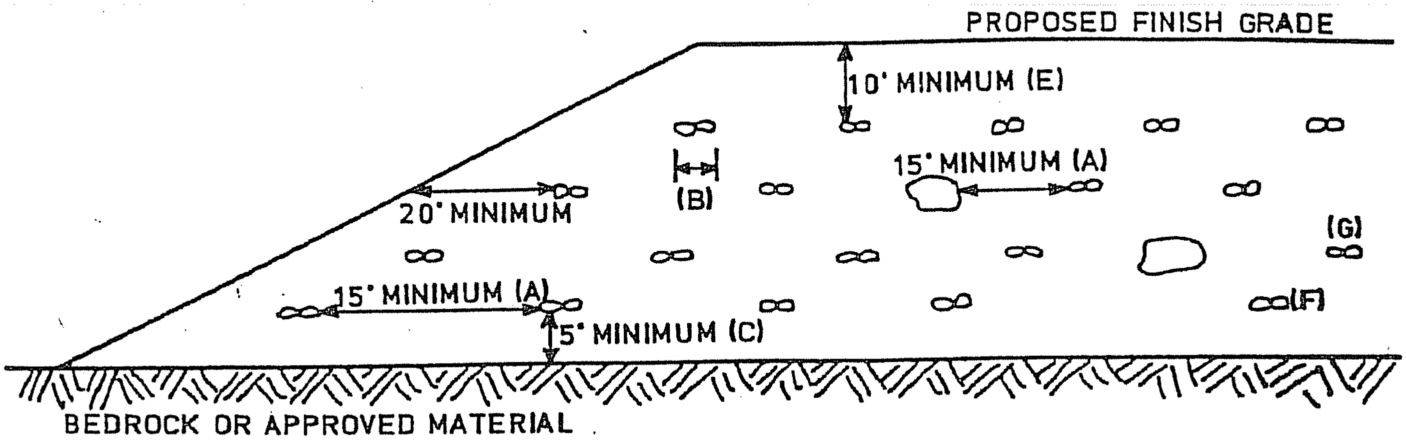


(NOT TO SCALE)

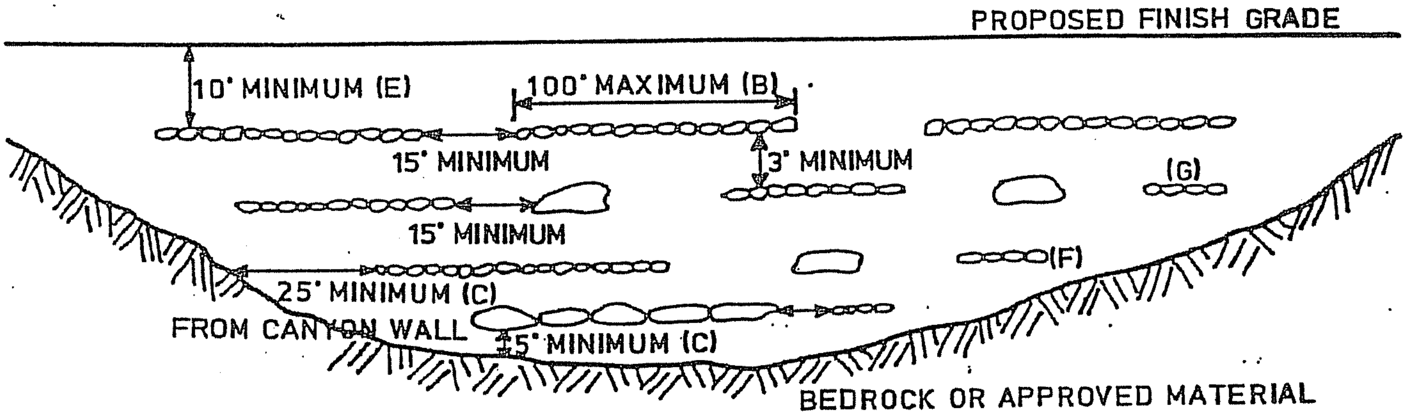
PLATE EG—16

OVERSIZE ROCK DISPOSAL

VIEW NORMAL TO SLOPE FACE



VIEW PARALLEL TO SLOPE FACE



NOTE: (A) ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.

(B) HEIGHT AND WIDTH MAY VARY DEPENDING ON ROCK SIZE AND TYPE OF EQUIPMENT. LENGTH OF WINDROW SHALL BE NO GREATER THAN 100' MAXIMUM.

(C) IF APPROVED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST, WINDROWS MAY BE PLACED DIRECTLY ON COMPETENT MATERIAL OR BEDROCK PROVIDED ADEQUATE SPACE IS AVAILABLE FOR COMPACTION.

(D) ORIENTATION OF WINDROWS MAY VARY BUT SHOULD BE AS RECOMMENDED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST. STAGGERING OF WINDROWS IS NOT NECESSARY UNLESS RECOMMENDED.

(E) CLEAR AREA FOR UTILITY TRENCHES, FOUNDATIONS AND SWIMMING POOLS.

(F) ALL FILL OVER AND AROUND ROCK WINDROW SHALL BE COMPACTED TO 90% RELATIVE COMPACTION OR AS RECOMMENDED.

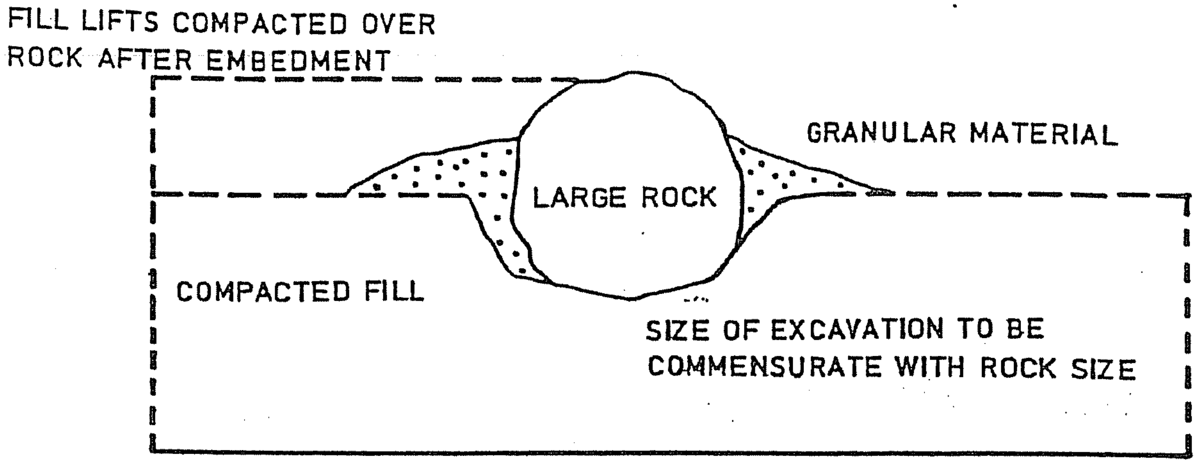
(G) AFTER FILL BETWEEN WINDROWS IS PLACED AND COMPACTED WITH THE LIFT OF FILL COVERING WINDROW, WINDROW SHOULD BE PROOF ROLLED WITH A D-9 DOZER OR EQUIVALENT.

VIEWS ARE DIAGRAMMATIC ONLY. ROCK SHOULD NOT TOUCH AND VOIDS SHOULD BE COMPLETELY FILLED IN.

PLATE RD—1

ROCK DISPOSAL PITS

VIEWS ARE DIAGRAMMATIC ONLY. ROCK SHOULD NOT TOUCH AND VOIDS SHOULD BE COMPLETELY FILLED IN.



ROCK DISPOSAL LAYERS

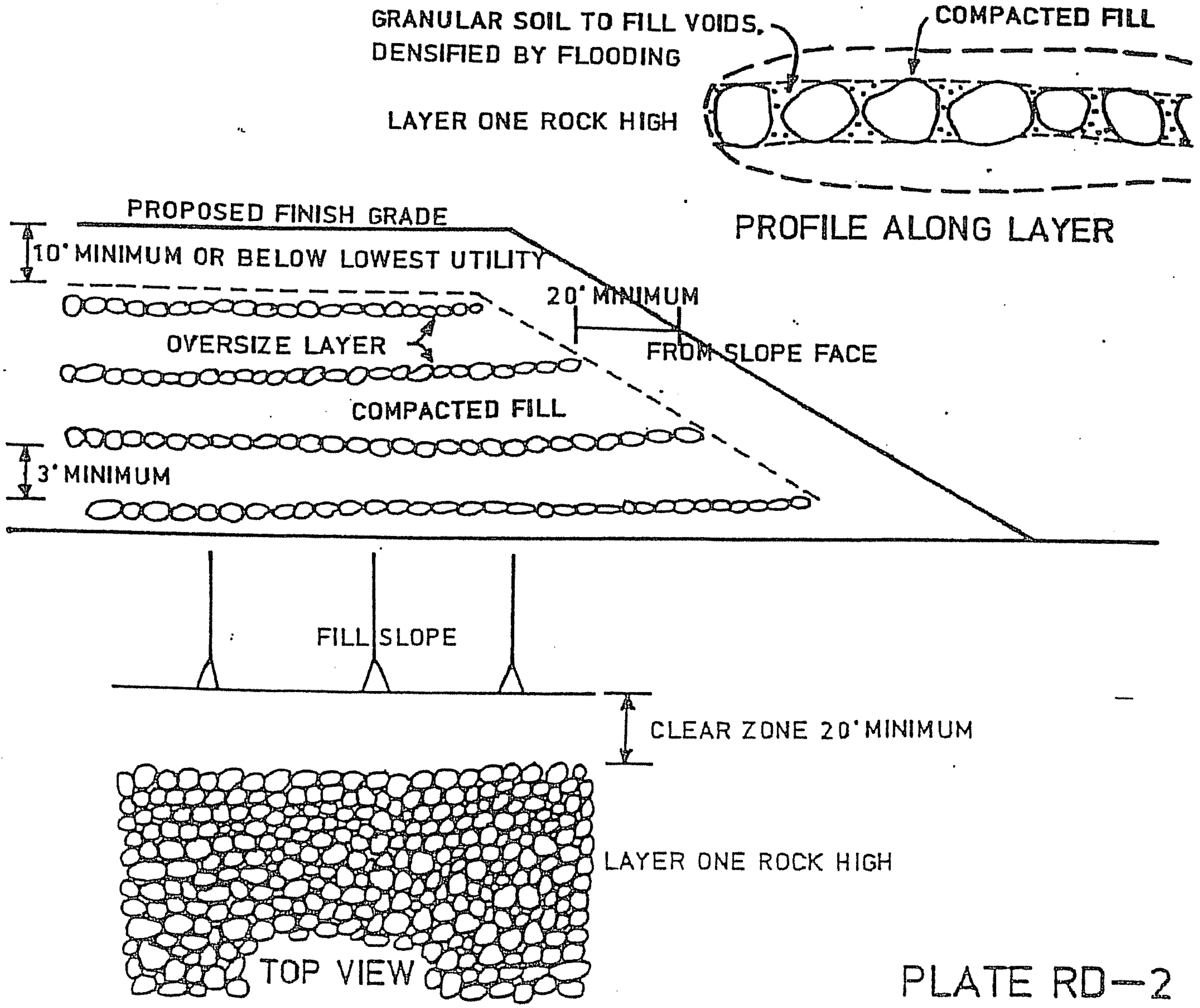


PLATE RD-2

F.2 - Due Diligence Geotechnical Investigation, Sleger and Martin Properties, Petra, May 1, 2006

May 1, 2006
J.N. 241-06

Ms. Rhonda Neely
ARMADA LLC
430 Thirty Second St., #200
Newport Beach, CA 92663

Subject: Due Diligence Geotechnical Investigation, 10129 and 10241 Edison Avenue, City of Ontario, San Bernardino County, California.

Dear Ms. Neely:

Petra Geotechnical, Inc., is pleased to present our due diligence geotechnical investigation for the subject site. The purposes of our study were to evaluate the overall feasibility of the proposed residential project from a geotechnical engineering standpoint and to determine what geotechnical constraints inherent to the site may have an impact on the development. Particular attention has been given to evaluating the required depths of removal of unsuitable surficial soils and the organic content of on-site soils.

It should be noted that this geotechnical evaluation does not address soil contamination or other environmental issues affecting the property. Environmental issues affecting the property, including methane mitigation, are deferred to the project environmental consultant.

We appreciate this opportunity to be of service and look forward to continuing to provide consulting services to you on this and other projects in the future.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

Daniel J. Gifford
Senior Project Geologist

DG/nls

EXECUTIVE SUMMARY

General Information

1. The site consists of two adjacent properties that collectively encompass approximately 80 acres of land on the south side of Edison Avenue, approximately 2,500 feet east of Archibald Avenue in the city of Ontario. Both properties have been used as dairy farms and are now scheduled for residential development.

2. Based on our review of published maps and literature, the site is not located within a designated State of California Alquist-Priolo earthquake fault rupture hazard zone. The nearest active fault placed within the boundaries of an Alquist-Priolo zone is the Chino-Central Avenue Fault, which is part of the Whittier-Elsinore fault system, located approximately 6 miles southwest of the site.

3. The San Bernardino County Hazard Overlay Map for the Corona North Quadrangle (San Bernardino County, 2004) indicates that the site is not located within an area designated as being potentially susceptible to liquefaction. Furthermore, based on the results of previous investigations at the site (GeoSoils, 2003), our firms previous investigations within the immediate site vicinity, and review of pertinent literature, liquefaction and associated dynamic settlement resulting from the effects of strong ground shaking are not expected to occur at the site due to the depth to groundwater (120 feet) and the relatively dense nature of underlying soils.

Summary of Conclusions and Recommendations

Based on the results of our due diligence investigation, it is our opinion that development of the subject site for residential purposes is feasible from a geotechnical standpoint; however, there are several geotechnical issues that should be taken into consideration by the client and other members of the design team during the due diligence period. Specifically, these issues include the following:

1. Removal and Recompaction of Compressible Surficial Soils: Based on the results of our subsurface investigation and the previous subsurface investigation by GeoSoils, Inc. (2003), the site is underlain by surficial materials that are generally soft and porous and will thus require overexcavation and recompaction to mitigate excessive settlement. These unsuitable surficial materials typically extend to depths on the order of 5 to 8 feet below the existing ground surface (bgs); however, locally deeper removals may be necessary in areas located between boreholes and test pits advanced during field investigations. Ultimate removal depths must be determined based on observation and testing by the geotechnical

consultant during grading operations. In an effort to aid project planners in determining earthwork quantities, an average removal depth of 6.5 feet may be considered. However, contingencies should be made for the balancing of earthwork quantities based on actual removal depths during grading.

Provided ***complete*** removal and recompaction of these unsuitable surficial materials is performed as part of remedial grading operations, conventional slab on grade foundations are expected to provide adequate support for the proposed structures.

2. Removal of Manure and Organic-Rich Soil: The site is occupied by cattle pens that are mantled by a layer of manure that generally varies in thickness from about 6 to 24 inches. In addition, stockpiled manure was noted at various locations at the site. Isolated manure stockpiles within the cattle pens were generally 3 to 6 feet high, but a 5 to 15-feet high manure stockpile was observed within the southeast portion of the site. Prior to grading, all manure should be removed and disposed of offsite.

   Organic-rich soils were encountered within pasture areas, where manure appears to have been previously blended with onsite soil. In general, based on visual observations and limited testing, soil within the pasture areas contained excessive levels of organics to a depth of 6 to 12 inches. However, additional testing of these soils, as wells as soil within the cattle pens, should be performed following removal of the manure to more accurately determine the actual depth and extent of excessive organic-rich soil that may also require removal from the site. If required, the removals should be performed prior to commencement of earthwork operations and observed by the geotechnical consultant of record.

3. Organic Content of Engineered Fill: It is our understanding that the City of Ontario has yet to adopt specific guidelines for the allowable percentage of organic material, mainly manure, in engineered fill. It is, however, a common engineering practice to allow a maximum organic content of around 1.0 percent in engineered fills at former dairy properties. Therefore, based on the results of our field observations, laboratory testing and experience with earthwork grading at similar dairy properties, it is our opinion that engineered fills could have an average organic content of about 1 percent less if appropriately processed. This could be achieved by exporting existing manure and organic-rich topsoil, as well as vegetation, off the property prior to grading operations. In addition, soils exhibiting an organic content greater than 1.0 percent should be thoroughly mixed with other soils during remedial grading.

4. Shrinkage and Subsidence: Volumetric changes will occur when surficial fill and native soils are removed and replaced as properly compacted fill. Based on laboratory test data generated during our investigation as well as the previous investigation by GeoSoils, Inc., and our experience with similar earth materials, a shrinkage factor of 10 to 15 percent may

be anticipated. Subsidence on the order of 0.10 to 0.15 feet is anticipated as a result of the scarification and recompaction of the exposed ground surfaces within the removal areas. It should be understood that these shrinkage and subsidence values are merely estimates and are only intended for use by project planners in determining earthwork quantities and should not be considered absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that occurs during grading.

5. Strong Ground Motion: The subject site is located in a seismically active area of southern California. Strong ground shaking hazards caused by earthquakes along regional active faults do exist and must be taken into account in the design and construction of the dwelling structures proposed within the subject site. The site is located about 10 kilometers from the Chino-Central Avenue Fault and 19 kilometers from the Cucamonga Fault, which are Type B and A seismic sources, respectively, according to the 2001 California Building Code (CBC). Relatively high near-source factors and seismic coefficients will be required for structural design of the proposed dwellings.

DUE DILIGENCE GEOTECHNICAL INVESTIGATION, 10129 AND 10241 EDISON AVENUE, CITY OF ONTARIO, SAN BERNARDINO COUNTY, CALIFORNIA

INTRODUCTION

This due diligence geotechnical investigation report presents our preliminary findings and opinions with respect to the geotechnical feasibility of residential development at the subject site and outlines key geologic and soils engineering factors that could impact the cost of earthwork grading and development. This evaluation was based on our review of published and unpublished geotechnical reports and maps describing local conditions, our subsurface investigation and laboratory testing of representative samples of on-site materials, and our previous experience with other projects in the site area.

SITE LOCATION AND DESCRIPTION

The subject site includes two adjacent properties that collectively encompass approximately 80 acres of land on the south side of Edison Avenue, approximately 2,500 feet east of Archibald Avenue in the city of Ontario. The western parcel, located at 10129 Edison Avenue, has been known as the Martin Dairy. The eastern parcel, located at 10241 Edison Avenue, has been known as the Sleger Dairy.

At the time of our field investigation on April 19, 2006, both properties were active dairy farms that included residential structures, a series of cattle pens and milking facilities, and related facilities. Earthen retention basins exist along the southern limits of both properties. Existing groundwater wells and on-site sewage disposal systems are also assumed to be present.

Surface drainage conditions are variable across the site. However, the overall site exhibits a generally planar and nearly level surface topography that dips approximately one percent to the south-southwest.

PROPOSED DEVELOPMENT AND GRADING

The conceptual development plan that was provided for our review indicates that the northern portion of the site will be developed as single-family residential units and that the southern portion will be developed as part of a community recreational facility that may include baseball and soccer fields and associated appurtenances. The residential and recreational portions will occupy approximately 2/3 and 1/3 of the site acreage, respectively.

It is expected that standard cut-and-fill grading techniques will be employed to establish design grades within the site. Although a grading plan is not yet available, it is our understanding that finished grades within the residential portion of the site will be higher than the recreational portion of the site. Based on site area topography and experience with similar projects, it is estimated that maximum proposed cuts and fills will to be on the order of 5 feet or less except within the retention basins where thicker fills are likely.

BACKGROUND INFORMATION

GeoSoils, Inc., performed a feasibility-level investigation of the subject site in 2003 (GeoSoils, 2003). Their project included the drilling and sampling of 6 soil borings to depths ranging from 21.5 to 51 feet and the excavation and logging of 24 test pits to depths ranging from 6 to 12 feet. Associated laboratory testing and engineering analyses was performed as part of GeoSoils' investigation. Based on their report, conditions at the site have not appreciably changed since 2003.

DUE DILIGENCE INVESTIGATION

Aerial Photograph Review

An aerial photograph review was performed to assess previous land usage and to determine whether geomorphic features are present within or adjacent to the site that would be suggestive of active faulting or former natural drainage courses that may have flooded the site in the past, or whether evidence suggestive of past grading activities is present in the aerial photographs but not currently discernable at the site. Single and stereo-paired and black-and-white aerial photographs for intermittent years between 1939 and 2000 were reviewed as part of our investigation (see references). The photographs were obtained from in-house files and from Continental Aerial Photo, Inc., of Los Alamitos, California.

Based on our review of historic aerial photographs, cultivation of the entire site for agricultural purposes began as early as 1939. Dairy operations began on the eastern and western portions of the site by 1967 and 1974, respectively. Dairy operations appear to have been in continual operation until the present time. Our review did not reveal any obvious evidence of active faulting, flooding, or other significant geotechnical issues at the site.

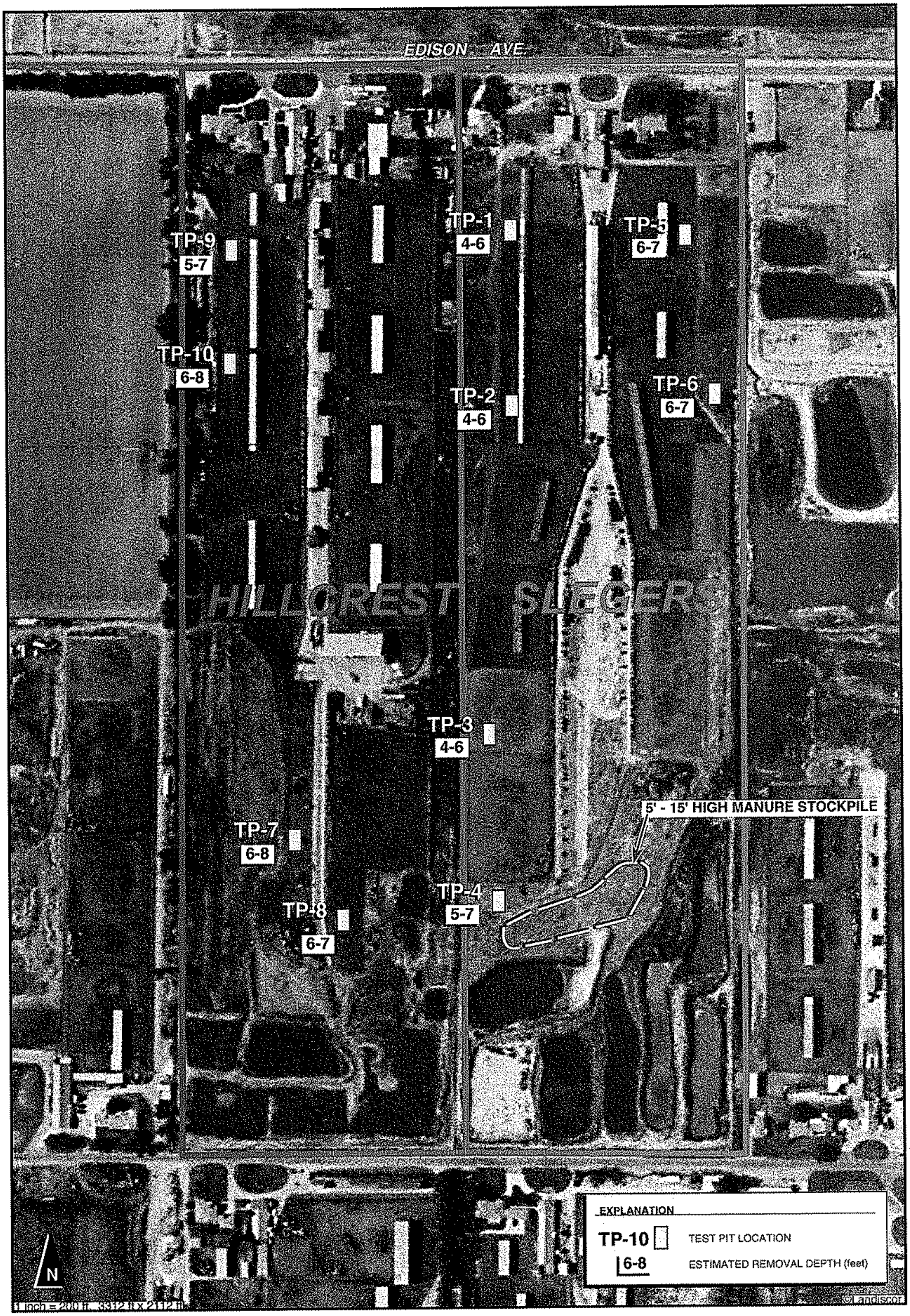
Subsurface Exploration and Laboratory Testing

A subsurface investigation was performed by our firm as part of this due diligence study and included the excavation of 10 exploratory test pits using a rubber-tired backhoe. The test pits were excavated to depths ranging from 7 to 10 feet. Soils encountered in the test pits were visually classified and logged in accordance with the Unified Soil Classification System. The approximate locations of the exploratory test pits are shown on Figure 1 and descriptive exploration logs are provided in Appendix A.

In order to evaluate the engineering properties of the onsite soil materials, laboratory tests were performed on selected samples considered representative of the soils encountered during our investigation. Our testing included determination of the following:

- In-situ moisture and density
- Maximum dry density and optimum moisture
- Expansion index
- Consolidation characteristics
- Soluble sulfate and chloride content
- Minimum resistivity and pH
- Organic Content

A description of laboratory test procedures and summaries of the test data are presented in Appendix B. An evaluation of this data is reflected throughout the subsequent sections of this report.



PETRA GEOTECHNICAL, INC.

JN 241-06 APRIL, 2006

FIGURE 1

FINDINGS

Subsurface Soil Conditions

Based on our subsurface investigation and our review of pertinent geotechnical literature, the subject site is underlain by a surficial veneer of undocumented artificial fill (including manure) that is underlain by young eolian (wind-blown) deposits, and in turn by Quaternary-age alluvial fan deposits. The general nature of these materials is described below.

Undocumented Artificial Fill (Afu)

Undocumented artificial fill overlies the entire site and generally consists of loose to medium dense, fine to medium-grained sand and silty sand. The fill extends to variable depths that generally range from 1 to 2 feet in thickness. Localized areas of deeper fill likely exist within portions of the site.

Within the cattle pens, the fill commonly consists of pure manure as thick as 24 inches. Stockpiled manure was also noted at various locations at the site, including several 3 to 6 feet high stockpiles within the cattle pens and a 5 to 15-feet high manure stockpile within the southeast portion of the site. Organic-rich soils were also encountered in areas beyond the cattle pens, where manure appears to have been previously blended with onsite soil to an average depth of 6 to 12 inches.

Young Eolian Deposits (Qye)

Native eolian deposits were observed beneath the fill materials within all of our exploratory test pits. These materials were wind-deposited and generally consist of sand and silty sand with subordinate intervals of sandy silt and silt. These materials were generally fine-grained, slightly porous to porous, and loose to medium dense and extended to variable depths of 3 to 7 feet.

The combined existing fill and eolian materials are generally lower in density and more porous as compared to the deeper alluvial fan materials and are considered unsuitable for support of additional fill, residential structures, or other improvements.

Alluvial Fan Deposits (Qf)

Quaternary-age alluvial fan deposits were encountered beneath the eolian deposits within all of our exploratory test pits. The alluvial fan materials generally consisted of clayey silt and sandy silt. The uppermost layers of alluvial fan deposits were typically slightly porous and firm. Below a general depth of approximately 5 to 8 feet, the native alluvial fan materials transition to a stiff condition with only occasional slight porosity.

Groundwater

The site is located within the Chino Basin, which is host to an extensive groundwater aquifer that is managed by the Chino Basin Watermaster. Historic groundwater data for the Chino Basin dating back to 1933 is provided in Bulletin No. 104-3 that was prepared by the California Department of Water Resources in 1970. Historic groundwater elevation maps in Bulletin 104-3, and those prepared by the Chino Basin Watermaster (2002) indicate that since 1933, the regional water table beneath the site has dropped about 65 feet. According to the 2000 water level map prepared by the Chino Basin Watermaster (Wildermuth Environmental, 2002), the regional groundwater level is currently at an elevation of about 580 feet above mean sea level, which is approximately 120 feet below ground surface at the site.

According to the State of the Basin report prepared by Wildermuth Environmental Inc. (2005), the Chino Basin Watermaster recently implemented a Hydraulic Control Monitoring Program (HCMP) that includes installation of desalter well fields within the Basin. One of the main objectives of this program is to maintain groundwater levels at their current elevations. Taking into account the implementation and continuation of this program and current demands on groundwater, it is expected that groundwater levels beneath the site will maintain near their current levels or may continue to drop slowly with the passage of time.

Faulting

The site is not included within the boundaries of an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1999). No evidence of active faulting was observed during our limited investigation of the subject site. In addition, our review of aerial photographs of the site and vicinity did not reveal evidence of lineaments or other geomorphic features that would suggest the presence of active faults on or adjacent to the property.

Seismic Exposure

The site is located in a seismically active area of southern California and is likely to be subjected to moderate to severe ground shaking during the life of the project. Based on our evaluation, the Chino-Central Avenue Fault (approximately 6 miles or 10 kilometers southwest of the site) would probably generate the most severe site ground motions with an anticipated maximum moment magnitude (Mw) of 6.7 and an anticipated slip rate of 1.0 mm/year. This fault is officially classified by the State of California as active, meaning that surface rupture has occurred along this fault within about the last 11,000 years (Hart and Bryant, 1999).

Liquefaction Susceptibility

The California Geological Survey (CGS) has yet to publish a Seismic Hazard Zones map for the subject area (Corona North Quadrangle) and no seismically related liquefaction or landslide hazard zones have yet been delineated by that agency in the area. Based on our review of San Bernardino County Hazard Overlays Map for the Corona North Quadrangle (San Bernardino County, 2004), the site is not located within a zone of potential liquefaction. Furthermore, based on site-specific subsurface information and on review of pertinent literature, liquefaction and associated dynamic settlement resulting from the effects of strong ground shaking are deemed negligible considering the depth of groundwater (approximately 120 feet) and the relatively dense nature of underlying soil.

Flooding Hazards

Based on the San Bernardino County Hazard Overlays Map for the Corona North Quadrangle (San Bernardino County, 2004), the site is not located within a dam inundation area. However, the western portion of the site is located within a 500-year flood zone as determined by the Federal Emergency Management Agency (FEMA).

Seismically induced flooding from seiches or tsunamis are not considered to be of concern with respect to the proposed development since the site lies approximately 700 feet above sea level, is more than 40 miles from the Pacific Ocean, and does not lie in close proximity to a large enclosed body of water.

CONCLUSIONS AND RECOMMENDATIONS

General Feasibility

Based on our review of available geotechnical literature and maps, it is our opinion that development of the subject site for residential purposes is feasible from a geotechnical standpoint; however, there are three primary geotechnical constraints that should be taken into consideration by the client and other members of the design team during the planning phases of the development. These issues are discussed in the following section.

Primary Geotechnical Constraints

1. Removal and Recompaction of Compressible Surficial Soils: Based on the results of our subsurface investigation and the previous subsurface investigation by GeoSoils, Inc. (2003), the site is underlain by surficial materials that are generally soft and porous and will thus require overexcavation and recompaction to mitigate excessive settlement. These unsuitable surficial materials typically extend to depths on the order of 5 to 8 feet below the existing ground surface (bgs); however, locally deeper removals may be necessary in areas located between boreholes and test pits advanced during field investigations. Ultimate removal depths must be determined based on observation and testing by the geotechnical consultant during grading operations.

   In an effort to aid project planners in determining earthwork quantities, an average removal depth of 6.5 feet may be considered. However, contingencies should be made for the balancing of earthwork quantities based on actual removal depths during grading.

2. Manure and Organic-Rich Soils: The site is largely occupied by cattle pens that are mantled by a layer of manure that generally varies in thickness from about 6 to 24 inches. In addition, stockpiled manure was noted at various locations at the site. Isolated manure stockpiles within the cattle pens were generally 3 to 6 feet high, but a 5 to 15-feet high manure stockpile was observed within the southeast portion of the site. Prior to grading, all manure should be removed and disposed of offsite.

   Organic-rich soils were encountered within pasture areas, where manure appears to have been previously blended with onsite soil. In general, based on visual observations and limited testing, soil within the pasture areas contained excessive levels of organics to a depth of 6 to 12 inches. However, additional testing of these soils, as wells as soil within the cattle pens, should be performed following removal of the manure to more accurately determine the actual depth and extent of excessive organic-rich soil that may also require removal from the site. If required, the removals should be performed prior to commencement of earthwork operations and observed by the geotechnical consultant of record.

3. Organic Content of Engineered Fill: Organic content tests were performed on a total of 26 samples that were obtained from the upper 1 to 4 feet of on-site soils. The results of our laboratory testing indicate that the organic contents of these soils range from approximately 0.1 to 1.3 percent by weight, with an average value of 0.7 percent.

   It is our understanding that the City of Ontario has yet to adopt specific guidelines for the allowable percentage of organic material, mainly manure, in engineered fill. It is, however, a common engineering practice to allow a maximum organic content of around 1.0 percent in engineered fills at former dairy sites. Therefore, based on the results of our field observations, laboratory testing and experience with earthwork grading at similar dairy properties, it is our opinion that engineered fills could have an average organic content of about 1 percent or less if appropriately processed. This could be achieved by exporting existing manure and organic-rich topsoil, as well as vegetation, off the property prior to grading operations. In addition, any remaining soils exhibiting an organic content greater than 1.0 percent should be thoroughly mixed with other soils during remedial grading.

4. Shrinkage and Subsidence: Volumetric changes will occur when surficial fill and native soils are removed and replaced as properly compacted fill. Based on laboratory test data generated during our investigation as well as the previous investigation by GeoSoils, Inc., and our experience with similar earth materials, a shrinkage factor of 10 to 15 percent may be anticipated. Subsidence on the order of 0.10 to 0.15 feet is anticipated as a result of the scarification and recompaction of the exposed ground surfaces within the removal areas. It should be understood that these shrinkage and subsidence values are merely estimates and are only intended for use by project planners in determining earthwork quantities and should not be considered absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that occurs during grading.

5. Strong Ground Motion: The subject site is located in a seismically active area of southern California. Strong ground shaking hazards caused by earthquakes along regional active faults do exist and must be taken into account in the design and construction of the dwelling structures proposed within the subject site. The site is located about 10 kilometers from the Chino-Central Avenue Fault and 19 kilometers from the Cucamonga Fault, which are Type B and A seismic sources, respectively, according to the 2001 California Building Code (CBC). Relatively high near-source factors and seismic coefficients will be required for structural design of the proposed dwellings.

Additional Design Considerations

Tentative Building Foundation Design

Based on the results of this due diligence investigation and on our experience on nearby properties with similar soil conditions, it is our professional opinion that conventional or, alternatively, post-tensioned foundation systems will generally be feasible for the structures within the proposed residential development provided remedial grading is performed as described herein.

Expansive Soil Considerations

Preliminary laboratory testing of representative samples of on-site soils by our firm and previously by GeoSoils, Inc., indicates that onsite materials exhibit very low to low expansion potentials. A final evaluation of expansion potential should be performed based on sampling and testing immediately following rough grading of the site.

Soil Corrosivity

Based on the results of laboratory testing by our firm and previously by GeoSoils, Inc., on-site soils contain a negligible amount of soluble sulfate and foundations can most likely be constructed with concrete containing Type II cement.

The results of preliminary testing for chlorides, pH and minimum resistivity indicate that on-site soil materials could be severely to very severely corrosive to ferrous metals. Additional selective sampling and analysis should be performed at or near the completion of rough grading to more accurately assess soil corrosivity and a certified corrosion engineer should be consulted to prepare project-specific recommendations to protect against corrosion.

Recommendations for Additional Study

When grading plans have been developed for the site, they should be submitted to the project geotechnical consultant for review. Based on the results of that review, additional studies (possibly including supplemental subsurface investigation and geotechnical analysis) may be necessary to provide detailed recommendations that are appropriate for the grading and construction proposed.

We hope that this information meets with your needs at this time. Should you have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

Daniel J. Gifford
Senior Project Geologist
CEG 1959

Ahmad Ghazinoor
Senior Associate Engineer
GE 2019

Darrel Roberts
Principal Geologist
CEG 1972

Distribution: Addressee (5)
John Lucarelli, Developers' Research (1)

DG/AG/DR/nls

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Aerial Photographs Reviewed

Date	Flight Series	Frame No.	Source
1939	5928	22	In-house files
1947	N/A	N/A (not stereo)	In-house files
1957	N/A	N/A (not stereo)	In-house files
10-16-59	16W	164 (not stereo)	Continental Aerial
1-30-62	24244	N/A (not stereo)	In-house files
5-15-67	4HH	164 (not stereo)	Continental Aerial
1-30-70	60-2	37,38	Continental Aerial
5-24-74	N/A	78	In-house files
10-24-75	75000	104,105	Continental Aerial
1-15-76	PC-C11	42,43	Continental Aerial
2-15-77	RIV-2	1,2	Continental Aerial
Jan 1980	SBD-16	15,17	Continental Aerial
1980	N/A	N/A (not stereo)	In-house files
1-2-83	83001	61,62	Continental Aerial
1-8-87	F	159	Continental Aerial
1990	N/A	N/A (not stereo)	In-house files
6-12-90	C83-11	30,31	Continental Aerial
5-19-93	C92-19	71,72	Continental Aerial
7-11-95	C114-29	221,222	Continental Aerial
2-2-99	C131-29	48,49	Continental Aerial
2000	1990	N/A (not stereo)	In-house files

APPENDIX A

EXPLORATION LOGS

PETRA

TABLE I

LOG OF TEST PITS

Test Pit Number	Depth (ft.)	Description
TP-1		ARTIFICIAL FILL, UNDOCUMENTED (Afu)
	0.0 – 0.9	Manure
	0.9 – 1.2	Silty Sand (SM): Light olive-brown to black, slightly moist, loose, fine grained, some manure.
	1.2 – 1.7	Silty Sand to Sand (SM/SP): Light olive-gray, slightly moist, loose, fine grained.
		EOLIAN SAND DEPOSITS
	1.7 – 4.0	Silty Sand to Sand (SM/SP): Yellow brown to light olive brown, slightly moist, loose to medium dense, fine to medium grained.
	4.0 – 6.0	Silty Sand (SM): Light olive brown, moist, medium dense, fine grained, slight porosity.
		QUATERNARY FAN DEPOSITS
	6.0 – 9.0	Sandy Silt (ML): Light olive brown, moist to very moist, firm to very stiff, fine grained with scattered medium to coarse, slight porosity.
		Total Depth = 9 feet No Caving No Groundwater
TP-2		ARTIFICIAL FILL, UNDOCUMENTED (Afu)
	0.0 – 1.5	Manure
	1.5 – 1.8	Sand (SP): Light olive-gray, slightly moist, loose, fine grained.
		EOLIAN SAND DEPOSITS
	1.8 – 3.0	Silty Sand (SM): Light olive-brown, moist, loose to medium dense, fine grained with scattered medium, slight porosity.
		QUATERNARY FAN DEPOSITS
	3.0 – 7.0	Sandy Silt to Silt (ML): Light olive brown, moist, stiff to very stiff, fine grained, slight porosity, trace roots/rootlets.
		Total Depth = 7 feet No Caving No Groundwater

TABLE I

LOG OF TEST PITS

Test Pit Number	Depth (ft.)	Description
TP-3		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 0.4	**Manure**
		EOLIAN SAND DEPOSITS
	0.4 – 4.5	**Sand (SP)**: Yellow brown to light olive brown, slightly moist, loose, fine to medium grained.
	4.5 – 5.5	**Silty Sand (SM)**: Yellow brown to light olive brown, moist, loose, fine grained.
		QUATERNARY FAN DEPOSITS
	5.5 – 10.0	**Clayey Silt (ML)**: Light gray to olive-gray, moist, stiff to very stiff, very slight porosity.
		Total Depth = 10 feet No Caving No Groundwater
TP-4		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 0.5	**Manure**
	0.5 – 1.0	**Silty Sand (SM)**: Olive gray, moist, loose, fine to medium grained, some manure and organics.
		EOLIAN SAND DEPOSITS
	1.0 – 5.0	**Sand (SP)**: Yellow brown to light olive brown, slightly moist, loose, fine to medium grained.
	5.0 – 7.0	**Silty Sand to Sand (SM/SP)**: Yellow brown to light olive brown, moist, medium dense, fine to medium grained.
		QUATERNARY FAN DEPOSITS
	7.0 – 9.5	**Silt (ML)**: Light olive-gray, moist, stiff to very stiff, very slight porosity.
		Total Depth = 9.5 feet No Caving No Groundwater

TABLE I

LOG OF TEST PITS

Test Pit Number	Depth (ft.)	Description
TP-5		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 1.0	**Manure**
		EOLIAN SAND DEPOSITS
	1.0 – 5.5	**Sand (SP)**: Light olive-gray to light olive brown, slightly moist, loose, fine to medium grained.
	5.5 – 6.5	**Silty Sand to Sandy Silt (SM/ML)**: Yellow brown, moist, medium dense/stiff, fine grained, slight porosity.
		QUATERNARY FAN DEPOSITS
	6.5 – 8.5	**Sandy Silt (ML)**: Light olive-brown, moist, stiff, slight porosity.
		Total Depth = 8.5 feet No Caving No Groundwater
TP-6		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 0.8	**Silty Sand (SM)**: Brown, slightly moist to moist, loose, fine to medium grained, few roots, organic-rich.
		EOLIAN SAND DEPOSITS
	0.8 – 3.0	**Silty Sand to Sand (SM/SP)**: Light olive-brown, slightly moist to moist, medium dense, fine grained.
	3.0 – 4.0	**Silt to Sandy Silt (ML)**: Light olive-brown, moist, stiff, fine grained, slight porosity, trace roots.
		QUATERNARY FAN DEPOSITS
	4.0 – 6.0	**Silt to Clayey Silt (ML)**: Light olive-brown, moist to very moist, stiff, slight porosity.
	6.0 – 9.0	**Clayey Silt (ML)**: Light olive-gray, moist to very moist, stiff to very stiff, slight porosity.
		Total Depth = 9.0 feet No Caving No Groundwater

TABLE I

LOG OF TEST PITS

Test Pit Number	Depth (ft.)	Description
TP-7		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 0.3	**Manure**
	0.3 – 1.0	**Silty Sand (SM)**: Yellow-brown, slightly moist to moist, loose, fine to medium grained, some deleterious material (twine), organic and manure rich.
	1.0 – 3.0	**Sand (SP)**: Light olive-brown, moist, medium dense, fine to medium grained.
		EOLIAN SAND DEPOSITS
	3.0 – 3.5	**Silty Sand (SM)**: Light olive-brown, moist, loose to medium dense, fine to medium grained.
	3.5 – 6.0	**Sandy Silt to Silt (ML)**: Light olive-brown, moist to very moist, stiff, fine grained, slight porosity.
		QUATERNARY FAN DEPOSITS
	6.0 – 7.5	**Clayey Silt (ML)**: Light olive-gray, moist to very moist, stiff, slight porosity, some rootlets.
	7.5 – 10.0	**Sandy Silt (ML)**: Light olive-gray, moist, stiff, fine grained, slight porosity.
		Total Depth = 10.0 feet No Caving No Groundwater
TP-8		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 1.5	**Manure**
	1.5 – 2.0	**Sand to Silty Sand (SP/SM)**: Light olive-brown, slightly moist, loose to medium dense, fine to medium grained, some manure.
		EOLIAN SAND DEPOSITS
	2.0 – 4.0	**Silty Sand (SM)**: Light olive-brown, slightly moist, medium dense, fine to medium grained, slight porosity.
	4.0 – 6.0	**Sandy Silt to Silty Sand (ML/SM)**: Light olive-brown, moist to very moist, medium dense/stiff, fine grained, slight porosity.
		QUATERNARY FAN DEPOSITS
	6.0 – 9.0	**Clayey Silt (ML)**: Light olive-gray, moist to very moist, firm to very stiff, slight porosity.
		Total Depth = 9.0 feet No Caving No Groundwater

TABLE I

LOG OF TEST PITS

Test Pit Number	Depth (ft.)	Description
TP-9		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 0.6	**Manure**
		EOLIAN SAND DEPOSITS
	0.6 – 4.5	**Sand to Silty Sand (SP/SM)**: Yellow-brown to light olive-brown, slightly moist, loose to medium dense, fine to medium grained.
	4.5 – 6.0	**Silt to Sandy Silt (ML)**: Light olive-brown to yellow-brown, moist, stiff to very stiff, fine grained, slight porosity.
		QUATERNARY FAN DEPOSITS
	6.0 – 8.5	**Clayey Silt (ML)**: Light olive-gray, moist, stiff to very stiff, slight porosity.
		Total Depth = 8.5 feet No Caving No Groundwater
TP-10		**ARTIFICIAL FILL, UNDOCUMENTED (Afu)**
	0.0 – 1.0	**Manure**
		EOLIAN SAND DEPOSITS
	1.0 – 3.0	**Silty Sand to Sand (SM/SP)**: Light olive-brown, slightly moist, loose to medium dense, fine to medium grained.
	3.0 – 5.0	**Sandy Silt to Silt (ML)**: Light olive-brown, moist, stiff to very stiff, fine grained, slight porosity.
		QUATERNARY FAN DEPOSITS
	5.0 – 10.0	**Clayey to Sandy Silt (ML)**: Light olive-gray, moist, firm to very stiff, fine grained, slight porosity.
		Total Depth = 10.0 feet No Caving No Groundwater

APPENDIX B

LABORATORY TEST PROCEDURES

LABORATORY TEST DATA

PETRA

LABORATORY TEST PROCEDURES

Soil Classification

Soil materials encountered within the property were classified and described utilizing the visual-manual procedures of the Unified Soil Classification System, and in general accordance with Test Method ASTM D 2488-00. The assigned group symbols are presented in the "Exploration Logs," Appendix A.

In-Situ Moisture and Density

Moisture content and dry density of the in place soils were determined in representative strata in accordance with Method ASTM D 2216-98. Test data are summarized on Plate B-1.

Laboratory Maximum Dry Density

Maximum dry density and optimum moisture contents were determined for selected samples of on-site soils in accordance with Method A of ASTM D 1557-02. Pertinent test values are given on Plate B-1.

Expansion Potential

Expansion index tests were performed on selected samples of on-site soil materials in accordance with California Building Code Standard 18-2. The results of these tests are presented on Plate B-1.

Soluble Sulfates and Chlorides

Chemical analyses were performed on selected samples of near-surface soils to determine preliminary soluble sulfate and chloride contents in accordance with California Test Method Nos. 417 and 422, respectively. Test results are presented on Plate B-1.

pH and Resistivity

pH and resistivity tests were performed on selected samples of near-surface site soils to provide a preliminary evaluation of their corrosive potential to concrete and metal construction materials. These tests were performed in accordance with California Test Method Nos. 532 and 643, respectively. The results of these tests are included in Plate B-1.

Organic Content

In-place organic contents of the near-surface soils were determined in accordance with ASTM Test Method D 2974-00. The test results are presented on Plate B-1.

Consolidation

Settlement predictions under anticipated loads were made on the basis of the consolidation tests. These tests were performed in general accordance with Test Method ASTM D 2435-96. Axial loads were applied in several increments to a laterally restrained 1-inch-high sample. Loads were applied in a geometric progression by doubling the previous load, and the resulting deformations were recorded at selected time intervals. Test samples were inundated at the calculated overburden pressure. Results of these are graphically presented on Plates B-2 through B-8.

LABORATORY TEST DATA

IN SITU MOISTURE AND DRY DENSITY [1]

Test Pit Number	Depth (feet)	Soil Type	Moisture (%)	Dry Density (pcf)
TP-1	4	Silty Sand	9.7	106.3
TP-2	2	Sandy Silt	16	99.4
TP-3	3	Sand w/ Silt	3.5	101.3
	5	Silty Sand	9.6	100.9
TP-4	4	Sand w/ Silt	4.1	100.9
	7.5	Silty Sand	17.1	94.3
TP-5	5	Silty Sand	9.3	100.5
TP-6	4	Sandy Silt	17.8	92.5
TP-7	5	Sandy Silt	22.3	97.7
	7.5	Sandy Silt	24.3	97.6
TP-8	3	Silty Sand	10.7	111.5
	6	Clayey Silt	19.1	100.6

LABORATORY MAXIMUM DRY DENSITY [2]

Test Pit No.	Depth (feet)	Soil Type	Optimum Moisture (%)	Maximum Dry Density (pcf)
TP-3	1-4	Sand w/ Silt	11	105
TP-5	5-8	Sandy Silt	9.5	124
TP-6	4-7	Clayey Silt	13	114

EXPANSION INDEX TEST DATA [3]

Test Pit No.	Depth (feet)	Soil Type	Expansion Index	Expansion Potential [4]
TP-3	1-4	Sand w/ Silt	1	Very Low
TP-5	5-8	Sandy Silt	3	Very Low
TP-6	4-7	Clayey Silt	25	Low

SOLUBLE SULFATES AND CHLORIDES [5]

Test Pit No.	Depth (feet)	Soil Type	Sulfate Content (%)	Chloride Content (ppm)
TP-3	1-4	Sand w/ Silt	0.01215	220
TP-5	5-8	Sandy Silt	0.03645	408
TP-6	4-7	Clayey Silt	0.00405	325

PLATE B-1
(Sheet 1 of 2)

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LABORATORY TEST DATA (continued)

pH AND MINIMUM RESISTIVITY [6]

Test Pit No.	Depth (feet)	Soil Type	pH	Minimum Resistivity (ohm-cm)
TP-3	1-4	Sand w/ Silt	8.4	810
TP-5	5-8	Sandy Silt	7.9	340
TP-6	4-7	Clayey Silt	7.9	650

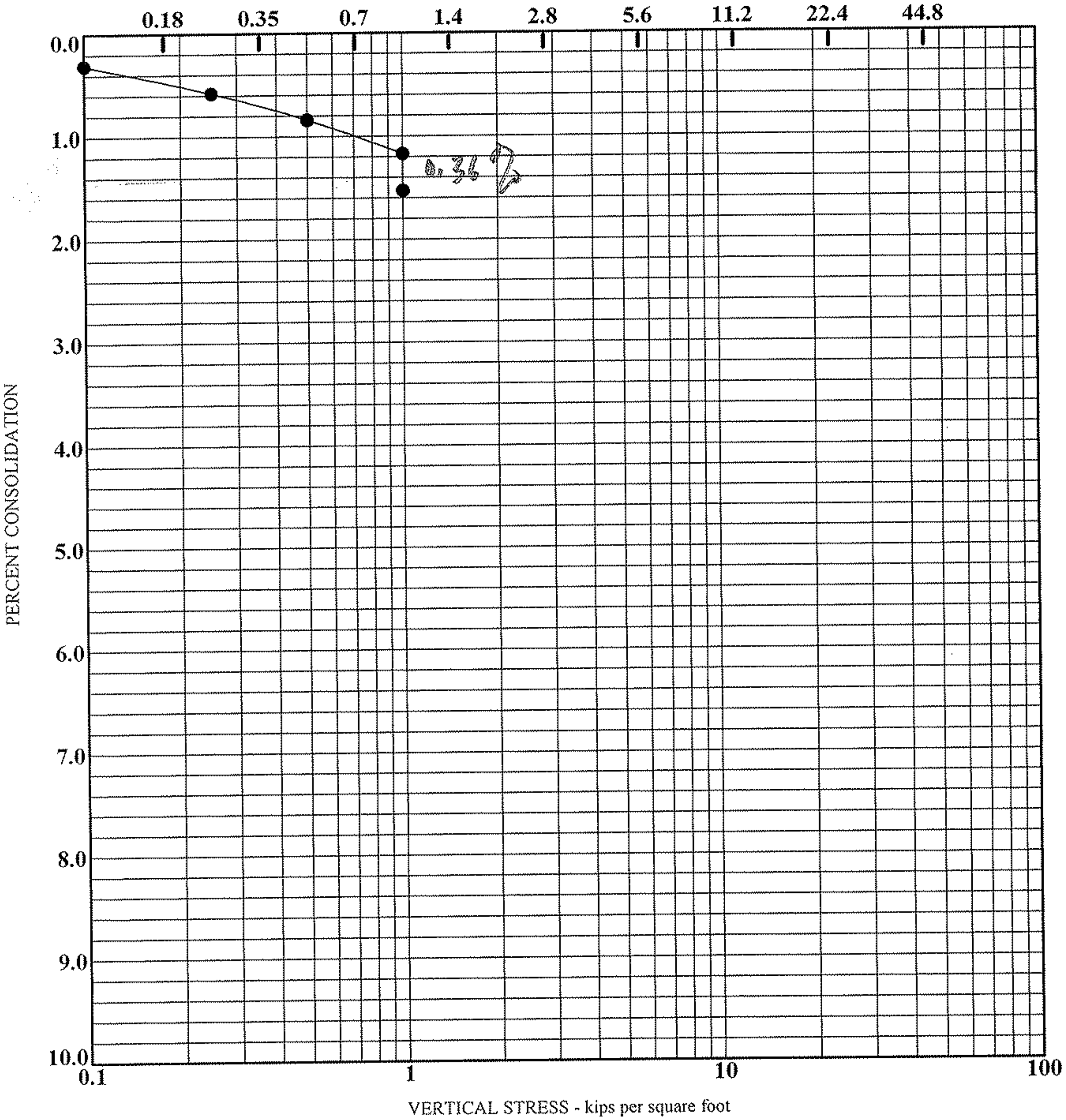
IN PLACE ORGANIC CONTENT [7]

Test Pit Number	Depth (feet)	Organic Content (%)
TP-1	1.5	0.6
	2.5	0.6
	3.5	0.7
TP-2	2	1.1
	3	1.3
	4	1.0
TP-3	1	0.5
	2	0.5
	3	0.5
TP-5	1.5	0.4
	2.5	0.4
	3.5	0.1

Test Pit Number	Depth (feet)	Organic Content (%)
TP-7	1	0.5
	2	0.5
	3	0.7
	4	1.2
TP-8	1.5	0.8
	2.5	0.7
	3.5	0.9
TP-9	1	0.6
	2	0.5
	3	0.4
	4	0.9
TP-10	1.5	0.4
	2.5	0.8
	3.5	1.3

(1) Per ASTM Test Method D 2216-98
(2) Per Test Method ASTM D 1557-02
(3) Per ASTM Test Method D 4829-03
(4) Per CBC (2001) Table 18-I-B
(5) Per California Test Method Nos. 417 and 422
(6) Per California Test Method Nos. 532 and 643
(7) Per ASTM Test Method D 2974-00

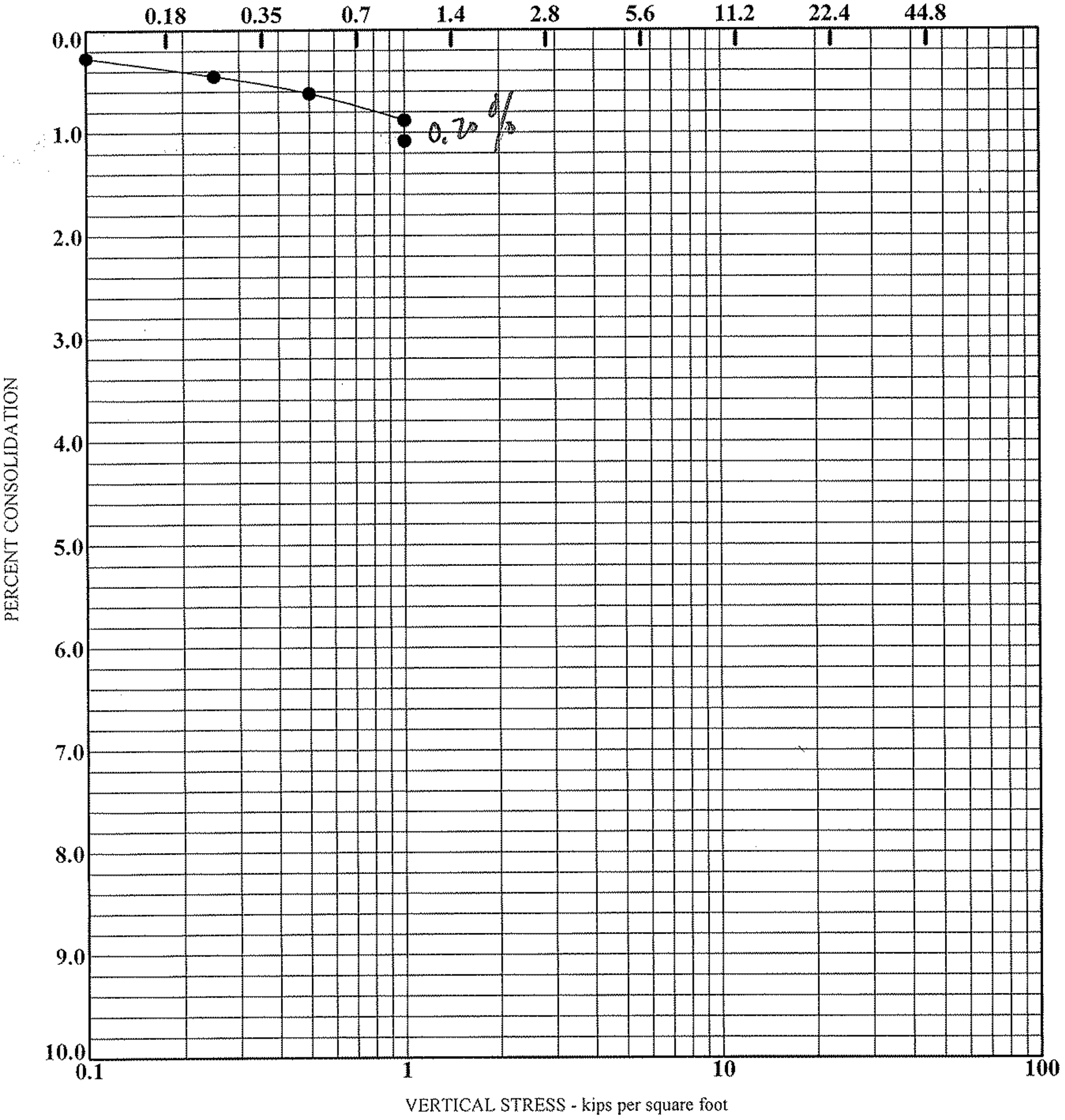
SAMPLE LOCATION	MATERIAL DESCRIPTION	INITIAL			INUNDATED
		DENSITY (pcf)	MOISTURE (%)	SATURATION (%)	LOAD (ksf)
● TP- 1 @ 4.0	Silty Sand (SM)	107.5	10.2	48	1.00



CONSOLIDATION - STRAIN 241-06.GPJ PETRA.GDT 4/25/06

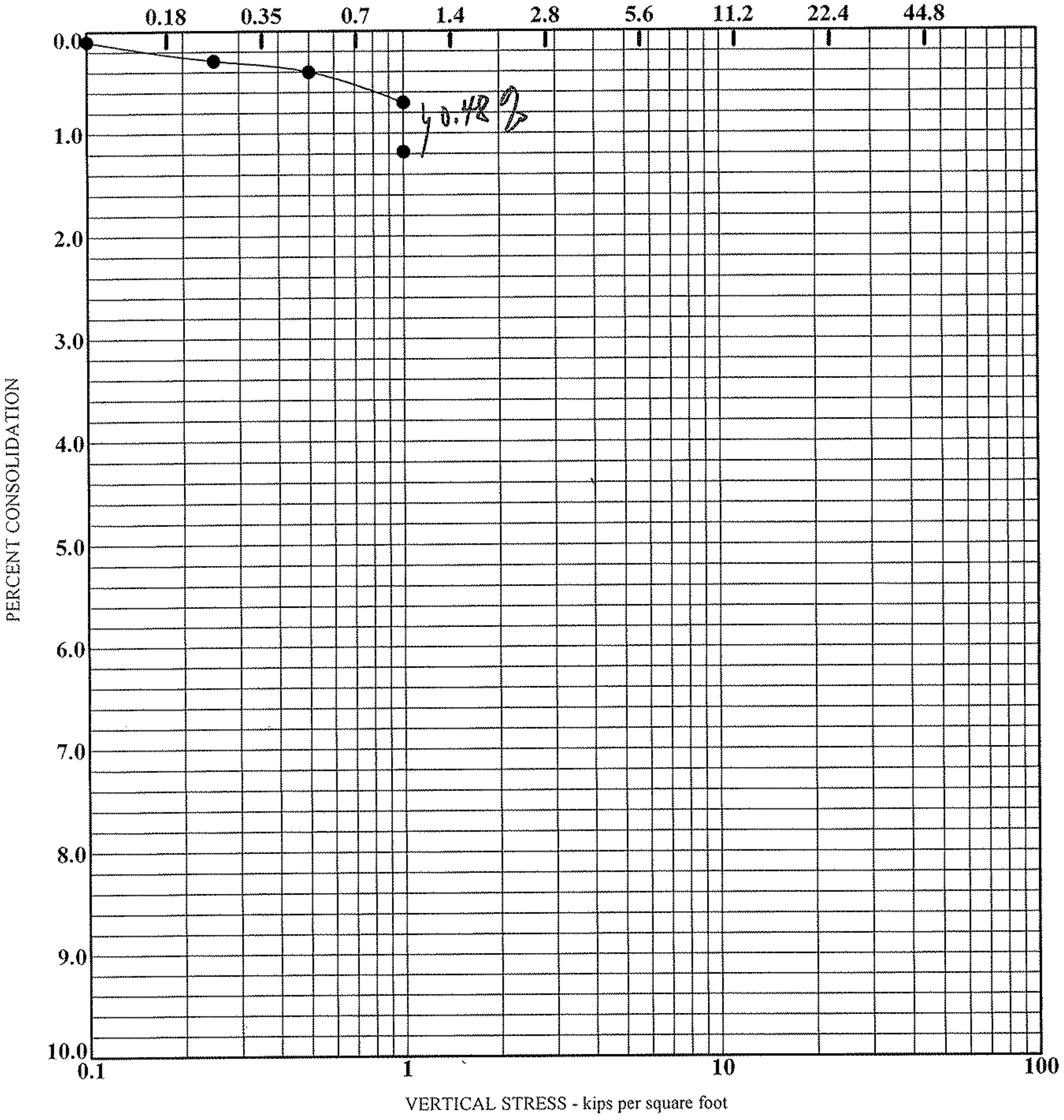
J.N. 241-06	CONSOLIDATION TEST RESULTS	April, 2006
PETRA GEOTECHNICAL, INC.		PLATE B-2

SAMPLE LOCATION	MATERIAL DESCRIPTION	INITIAL			INUNDATED
		DENSITY (pcf)	MOISTURE (%)	SATURATION (%)	LOAD (ksf)
● TP- 3 @ 3.0	Sand with Silt (SP-SM)	94.2	4.6	16	1.00



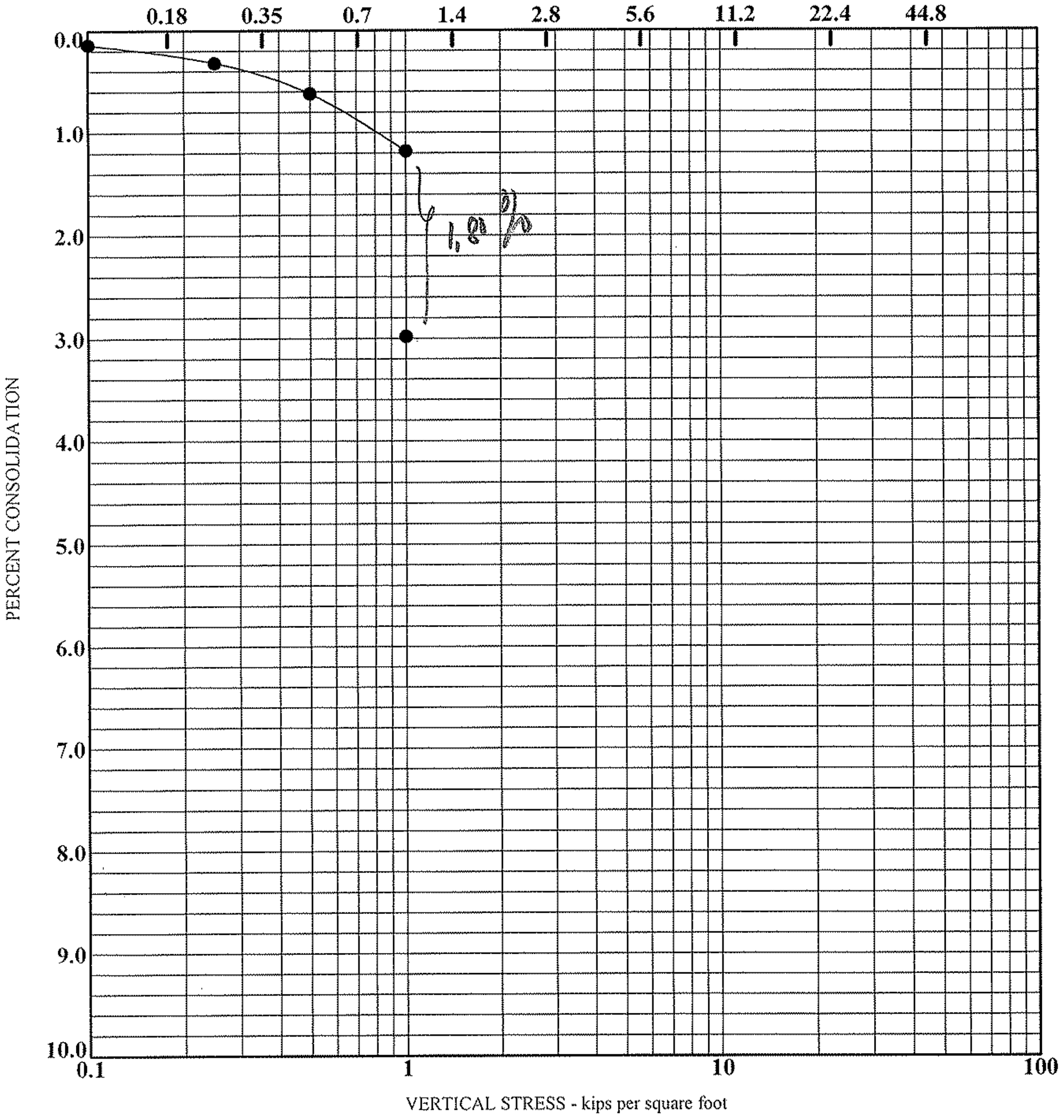
J.N. 241-06	CONSOLIDATION TEST RESULTS	April, 2006
PETRA GEOTECHNICAL, INC.		PLATE B-3

SAMPLE LOCATION	MATERIAL DESCRIPTION	INITIAL			INUNDATED
		DENSITY (pcf)	MOISTURE (%)	SATURATION (%)	LOAD (ksf)
● TP- 4 @ 4.0	Sand with Silt (SP-SM)	97.6	5.3	20	1.00



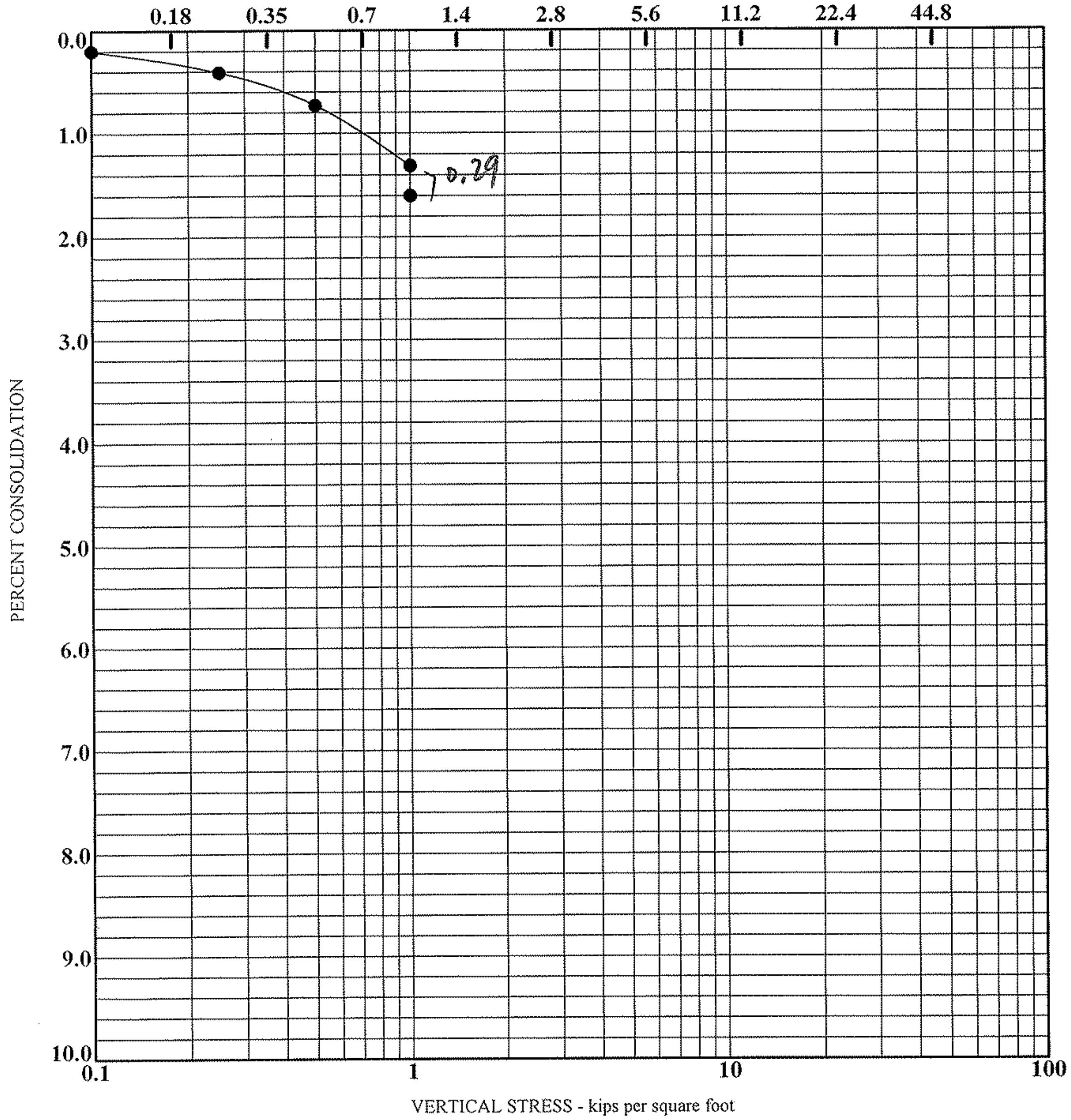
J.N. 241-06	CONSOLIDATION TEST RESULTS	April, 2006
PETRA GEOTECHNICAL, INC.		PLATE B-4

SAMPLE LOCATION	MATERIAL DESCRIPTION	INITIAL			INUNDATED
		DENSITY (pcf)	MOISTURE (%)	SATURATION (%)	LOAD (ksf)
● TP- 4 @ 7.0	Sandy Silt (ML)	89.9	18.4	57	1.00



J.N. 241-06	**CONSOLIDATION TEST RESULTS**	**April, 2006**
PETRA GEOTECHNICAL, INC.		**PLATE B-5**

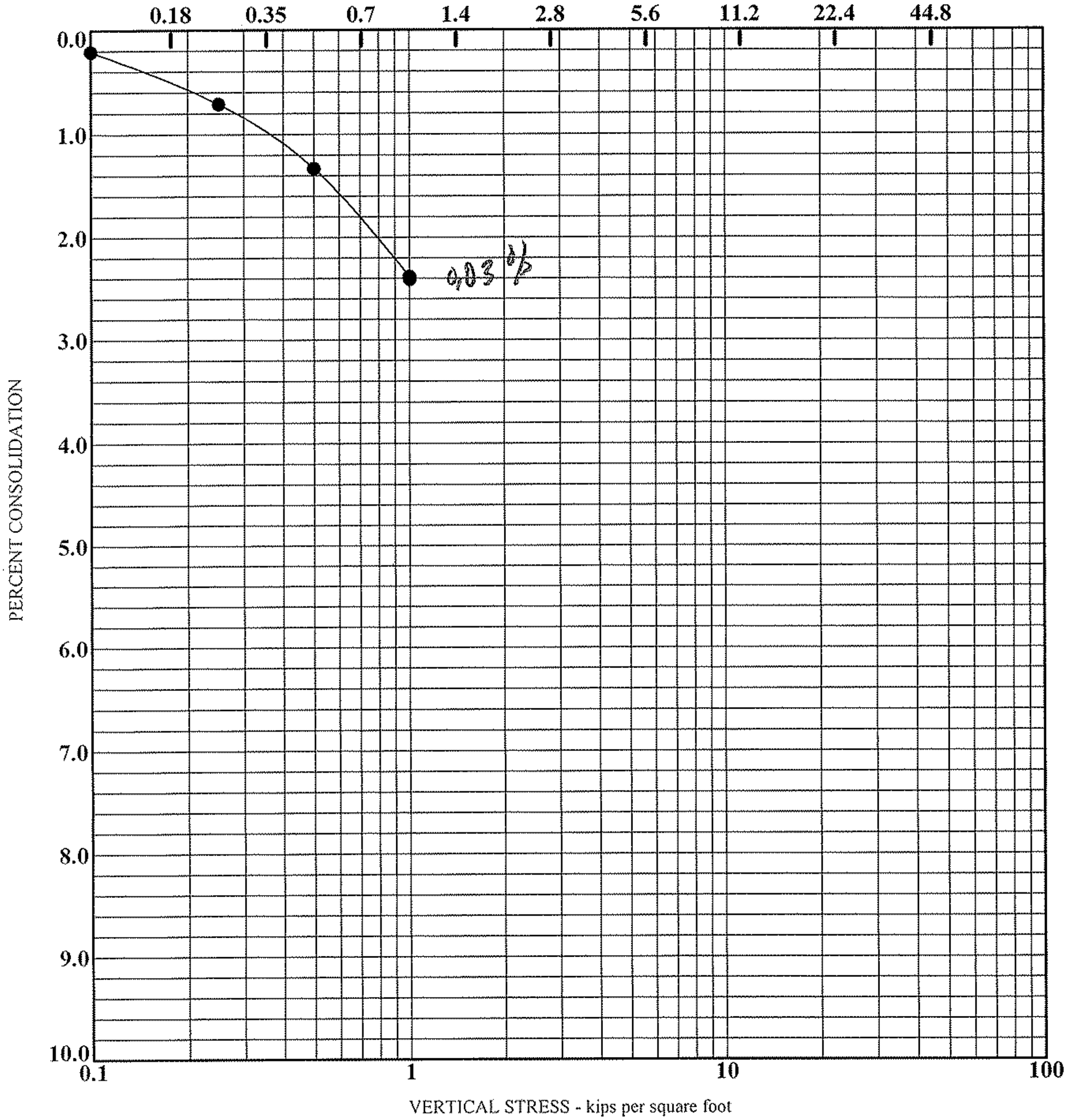
SAMPLE LOCATION	MATERIAL DESCRIPTION	INITIAL			INUNDATED
		DENSITY (pcf)	MOISTURE (%)	SATURATION (%)	LOAD (ksf)
● TP- 6 @ 4.0	Sandy Silt (ML)	100.2	19.1	76	1.00



CONSOLIDATION - STRAIN 241-06.GPJ PETRA.GDT 4/25/06

J.N. 241-06	**CONSOLIDATION TEST RESULTS**	**April, 2006**
PETRA GEOTECHNICAL, INC.		**PLATE B-6**

SAMPLE LOCATION	MATERIAL DESCRIPTION	INITIAL			INUNDATED
		DENSITY (pcf)	MOISTURE (%)	SATURATION (%)	LOAD (ksf)
● TP- 7 @ 5.0	Silt (ML)	97.7	22.7	85	1.00



CONSOLIDATION - STRAIN 241-06.GPJ PETRA.GDT 4/25/06

J.N. **241-06**

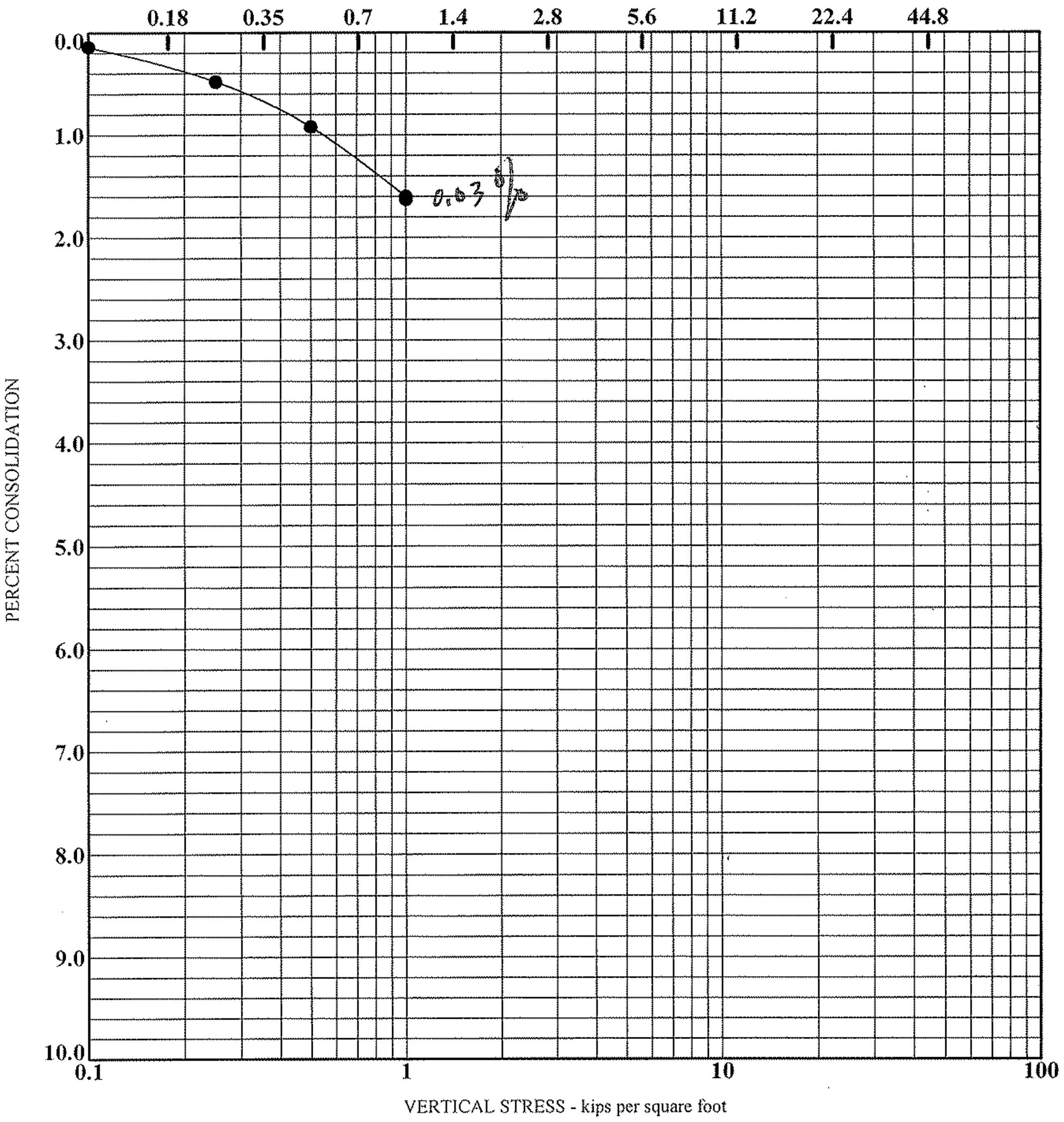
PETRA GEOTECHNICAL, INC.

CONSOLIDATION TEST RESULTS

April, 2006

PLATE B-7

SAMPLE LOCATION	MATERIAL DESCRIPTION	INITIAL			INUNDATED
		DENSITY (pcf)	MOISTURE (%)	SATURATION (%)	LOAD (ksf)
● TP- 7 @ 7.5	Sandy Silt (ML)	97.1	24.7	91	1.00



J.N. 241-06

PETRA GEOTECHNICAL, INC.

CONSOLIDATION TEST RESULTS

April, 2006

PLATE B-8

F.3 - Due Diligence Geotechnical Investigation, Planning Area 4, 5, and 6, LGC Inland, July 20, 2011

DUE-DILIGENCE GEOTECHNICAL EVALUATION, PROPOSED GREAT PARK PLANNING AREAS 4, 5 AND 6 RESIDENTIAL DEVELOPMENT LOCATED SOUTHEAST OF EDISON AVENUE AND ARCHIBALD AVENUE, APPROXIMATE 80-ACRE PARCEL, CITY OF ONTARIO, SAN BERNARDINO COUNTY, CALIFORNIA

Dated: July 20, 2011

Project No.: I11-2498-10

Prepared For:

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LGC INLAND
Geotechnical
Environmental
Materials Testing

July 20, 2011

Project No. I11-2498-10

Mr. Jason Lee
DISTINGUISHED HOMES
160 S. Old Springs Road, Suite 250
Anaheim Hills, California 92808

Subject: ***Due-Diligence Geotechnical Evaluation, Proposed Great Park Planning Areas 4, 5 and 6 Residential Development Located Southeast of Edison Avenue and Archibald Avenue, Approximate 80 Acre Parcel, City of Ontario, San Bernardino County, California***

Introduction

This report presents the results of our geotechnical due-diligence evaluation of the subject approximately 80 acre site located in the City of Ontario, California. The site is depicted on the enclosed Boring Location Map (Figure 1). The proposed construction within the site is to include residential development with associated access streets and drainage improvements. It is anticipated that the proposed structures will be of one to two-story wood frame construction with concrete-floor slabs constructed on-grade. For this type of construction, relatively light to moderate loads will likely be imposed on the underlying foundation soils.

While development plans were not available at the time of this report, grading is anticipated to consist generally of minor cuts and fills (exclusive of remedial grading) to depths of up to approximately 5 feet. Minor fill slopes are anticipated to be planned at a slope ratio of 2:1 or flatter (horizontal: vertical). It is not known at this time if retaining walls are proposed.

Purpose and Scope of Services

The purpose of this study is to preliminarily address various geotechnical concerns that may have an impact on the development of the site. To accomplish this task, the following services were performed.

- Geologic Reconnaissance Mapping of the site.
- Subsurface investigation consisting of the excavation, sampling, and logging of three (3) hollow-stem auger bores, to a maximum depth of 26½ feet. Logs of the boringes are presented in Appendix B, with the approximate locations depicted on the Boring Location Map, Plate 1. The borings were excavated to evaluate the general characteristics of the

subsurface soil on the site including classification of site soil, determination of depth to groundwater (if present), and to obtain representative soil samples.

- Laboratory testing of representative soil samples obtained during our subsurface exploration,
- Review of available pertinent geotechnical and environmental reports and/or publications by others that have information regarding the soil and geologic conditions of the site or in the vicinity of the site.
- Review of available aerial photographs for the site.
- Consult with you at the completion of our evaluation to discuss our findings and conclusions.
- Prepare a due-diligence geotechnical evaluation report for the site presenting the results of our evaluation and conclusions regarding geotechnical conditions, which may affect the proposed development.

Research of Previous Geological/Geotechnical Data

This firm researched and reviewed available published and unpublished geologic data, and aerial photographs (from 1959 to 2011). Based upon our review of the photos, no lineations indicating active faulting appear to be present onsite.

FIELD INVESTIGATION

Geologic Reconnaissance Mapping & Investigation

Surface geologic reconnaissance mapping of the site was performed in July 6, 2011, by an engineering geologist from this firm.

Our subsurface investigation was performed on July 6, 2011, which consisted of three (3) hollow-stem bores to a maximum depth of 26½ feet below existing ground surface. Prior to the subsurface work, an underground utilities clearance was obtained from Underground Service Alert of Southern California. The approximate locations of the bores are shown on the Boring Location Map (Figure 1.

At the conclusion of the subsurface exploration, all bores were loosely backfilled with native materials. Minor settlement of the backfill soils may occur over time.

During our subsurface exploration, representative relatively undisturbed, standard penetration test and bulk samples were retained for laboratory testing. Laboratory testing was performed on representative soil/bedrock samples and consisted of in-situ density and moisture content, maximum dry density and optimum moisture content, expansion, sulfate and chloride content, resistivity, and pH.

Site Location and Description

The rectangular 80-acre site is bounded on the Edison Avenue, south by Eucalyptus Avenue, and east and west by agricultural/dairy property. The subject property is located on a previously existing dairy farm. Existing dairy slabs extend north-south along two central portions of the property. An existing residential slab with entry way walls, driveways, and other flatwork is located along the northwest portion of the site. The site has a moderate to dense growth of brush throughout the site. Earth materials are comprised of a thin veneer (approximately 4-5 inches) of manure/compost underlain by undocumented fill, Quaternary Eolian Deposits, and Quaternary young alluvial fan deposits.

Topography and Drainage

Topographic relief on the site to be developed was approximately 20-feet from the highest portion at the northeast corner to the southwest corner. Current drainage is generally by sheet flow to the south and southwest.

General Geologic Conditions

Based on review of the referenced reports (Appendix A) and our limited geotechnical investigation, the geologic units that exist on the site included the following materials:

- Manure/Compost: Manure/compost was encountered throughout the site sourced from the previous dairy farm. The organic rich manure was noted to depths of approximately 4-inches during this study and up to 24-inches during previous investigations.

- Artificial Fill, Undocumented: Undocumented artificial fill was encountered within the vicinity of the existing dairy slabs located on the central east and west portions of the subject site. Other artificial fill may exist on the site in association with the backfill of existing utility or irrigation lines that may be adjacent or cross at random locations.

- Quaternary Young Eolian Deposits: Quaternary eolian deposits were encountered to depths of 5 to 7 feet. These deposits generally consist of wind deposited sand to silty sand with silt. These deposits are generally dry and loose to medium dense in condition.

- Quaternary Alluvium: Quaternary alluvium was encountered below the eolian deposits to the maximum depth explored of 26.5 feet. The alluvial deposits predominately consist of reddish brown to yellowish brown, silty sand, sandy silt, sandy clay, and poorly graded sands. These deposits are generally damp to moist and loose to dense in condition.

Groundwater

Groundwater was not encountered in the exploratory bores advanced during this investigation (maximum depth of 26.5 feet) or the previous referenced geotechnical investigations (maximum depth of 51-feet). According to previously reviewed literature, groundwater is estimated to be approximately 100+ feet below the ground surface. However seasonal perched water may exist within lithologic changes in the subsurface.

Faulting and Seismicity

Based on our review of the referenced reports (Appendix A), as well as published and unpublished geotechnical maps and literature pertaining to the regional geology, the closest active fault that may generate the most severe ground shaking affect the site is the Chino-Central Avenue Fault. However, the subject site is not considered to be at a particularly greater level of seismic risk than other areas in the region.

No active or potentially active faults are known to project through the site nor does the site lie within an Earthquake Fault Hazard Zone as designated by the State of California in the Alquist-Priolo Earthquake Zoning Act.

Ground Shaking

The site will probably experience ground shaking from moderate to large size earthquakes during the life of the proposed development. Furthermore, it should be recognized that the southern California region is an area of high seismic risk.

Structures within the site should be designed and constructed to resist the effects of seismic ground motions as provided in Chapter 16 of the 2010 California Building Code (CBC). The method of design is dependent of the seismic zoning, site characteristics, occupancy category, building configuration, type of structural system and on the building height.

Secondary Seismic Hazards

Secondary effects of seismic activity normally considered as possible hazards to a site include several types of ground failure as well as induced flooding. Various general types of ground failures which might occur as a consequence of severe ground shaking of the site include liquefaction, landsliding, ground subsidence; ground lurching, and shallow ground rupture. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, subsoil's and groundwater conditions, in addition to other factors. Based on our findings, none of the above mentioned secondary effects of seismic activity are considered likely at the site.

SUMMARY OF GEOTECHNICAL CONDITIONS

Based on this preliminary evaluation, the following geotechnical conditions were identified that could affect site development:

Ground Preparation

Any non-engineered fill that may exist, topsoil, manure, upper loose eolian sand deposits and the upper loose alluvium are considered unsuitable for support of proposed fills, structures and/or improvements. Organic rich soil/manure should be properly disposed of offsite prior to grading. Additional organic content testing should be performed upon completion to verify values and provide additional recommendations if necessary. Existing non-engineered fill that may exist are anticipated to be generally up to about 2 to 3 feet deep, where present within the site. It is anticipated overexcavation of unsuitable material will range generally from about 3 to 7 feet in depth over the majority of the site with locally deeper removals based on in-field conditions.

Actual depths of overexcavation should be determined upon review of grading and foundation plans. The actual depths of overexcavation should be determined during grading on the basis of grading observations made and testing by the project geotechnical consultant. The geotechnical consultant should be provided with appropriate survey staking during grading to document that depths and/or locations of recommended overexcavation are adequate.

Fill Suitability

Based upon our limited geotechnical investigation and review of previous geotechnical reports, water may be required locally to bring near-surface soil (about the upper 5 to 7 feet) to a moisture content of optimum or higher. Selective pre-watering prior to grading operations may be needed.

Excavatability

Based upon our limited geotechnical investigation and review, the onsite materials should be excavated with conventional heavy-duty grading equipment.

Oversize Material

Oversize materials greater than 12 inches in diameter are not expected to be generated from excavations within the onsite soils. Rocks larger than 12 inches in diameter should be reduced in size or removed from the site.

Shrinkage and Subsidence

Volumetric changes in earth quantities will occur when excavated onsite soils materials are replaced as engineered fill. We concur with the previous investigations (Appendix A) estimate of 8 to 10 % of shrinkage onsite based on our limited geotechnical investigation and review.

Based on LGC's experience with similar materials on nearby sites, the subsidence may be on the order of 0.15 to 0.25 foot.

The above preliminary estimates of shrinkage and subsidence are intended as an aid for project engineers in determining earthwork quantities and should be updated with further sampling and testing during further subsurface exploration. However, these estimates should be used with some caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence occurring during grading.

Expansive Soils

Laboratory test results of the near surface soil indicate a very low expansion potential. However, modifications may be necessary depending on as-graded conditions and additional laboratory testing within the building pad sites upon completion of grading. Provided site grading is performed as recommended herein and future geotechnical investigation and plan review(s), the use of conventional shallow or post tension foundations appear to be feasible for proposed structures, retaining walls and other lightly to moderately loaded structures or improvements.

Corrosion

The corrosion potential of the onsite materials was evaluated by LGC for its effect on concrete. The corrosion potential was evaluated using the results of laboratory tests on a representative sample obtained during our field exploration. Laboratory testing was performed to evaluate soluble sulfate content.

Testing indicates a soluble sulfate content of 0.002 (% by weight), which is a negligible potential for soluble sulfate attack on Type II/V concrete as classified in accordance with the 2010 California Building Code (CBC). We recommend that Type II Modified Portland Cement be used and that a 3-inch thick concrete cover be maintained over the reinforcing steel in concrete in contact with the soil. It is also our opinion that onsite soil should be considered to have a moderate corrosion potential to buried metals because of its low resistivity. However, corrosion testing conducted during previous geotechnical investigations indicated severe to highly severe corrosion results. A corrosion engineer can be consulted to provide additional recommendations if desired.

This recommendation is based on one sample of the subsurface soil. The initiation of grading at the site could blend various soil types and import soil may be used locally. These changes made to the foundation soil could alter sulfate-content and corrosion levels. Accordingly, it is recommended that additional testing be performed at the completion of grading.

Settlement

Based on the anticipated recommended allowable-bearing capacity (2,000 psf), proposed construction and anticipated site conditions, the total post-construction settlement of the footings is anticipated to be 1 inch and a differential settlement of approximately 3/4-inch over 40 feet, provided the recommended overexcavation and compaction of unsuitable soil materials is accomplished. These settlement estimates should be re-evaluated when grading plans, foundation plans and proposed loads are available, as well as possible future recommended subsurface exploration.

RECOMMENDATIONS FOR ADDITIONAL STUDY

The findings and conclusions presented in this due-diligence evaluation report are based on our review of the previous preliminary geotechnical investigations by others and the limited geotechnical investigation performed by this firm. When the grading plans for the site have been developed, additional studies will be necessary to provide detailed recommendations that are appropriate for the grading and construction proposed.

We hope this information meets your needs at this time. Should you have any questions, please contact the undersigned.

Respectfully submitted,

LGC INLAND, INC.

Scott E. Richtmyer, P.G., C.E.G. 2514 Project Geologist	Chris Josef Operations Manager / Engineer

SER/CEJ/RLG

Appendices: Appendix A - References
Appendix B – Boring Logs

Figure 1 – Boring Location Map

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MN (12.5° E)

Data Zoom 14-2

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FIGURE 1
BORING LOCATION MAP

Project Name	Distinguished-Great Park, Ontario
Project No.	I11-2498-10
Geol./ Eng.	SER/CEJ
Scale	NOT TO SCALE
Date	July 2011

APPENDIX A

REFERENCES

APPENDIX A

References

GeoSoils, Inc., 2003, Feasibility Level Geotechnical Investigation, 80-Acre Parcels, 10241 and 10129 Edison Avenue, (Sleger and Martin Properties), Ontario Area, San Bernardino County, California, Work Order 3914-A-SC, dated June 13, 2003.

Hillman Environmental Group, LLC, 2003, Phase I Environmental Assessment, Sleger/Martin Dairies, 10129-10241 Edison Avenue, Ontario, California, 91710, Project No. C1-2968, dated April 23, 2003.

Petra Geotechnical, Inc., 2006, Due Diligence Geotechnical Investigation, 10129 and 10241 Edison Avenue, City of Ontario, San Bernardino County, California, Job No. 241-06, dated May 1, 2006.

Aerial Photograph Interpretation Table

DATE	***FLIGHT NUMBER***	***SCALE***
1996 to 2011	Google Earth	Variable
6-12-90	C83-11-30, 31	1" = 2,000'
1-2-83	83001-66, 67	1" = 4,000'
1-15-76	PC-C-11-42, 43	1" = 2,000'
5-15-67	4HH-164	1" = 1,667'
10-16-59	16W-164	1" = 1,667'

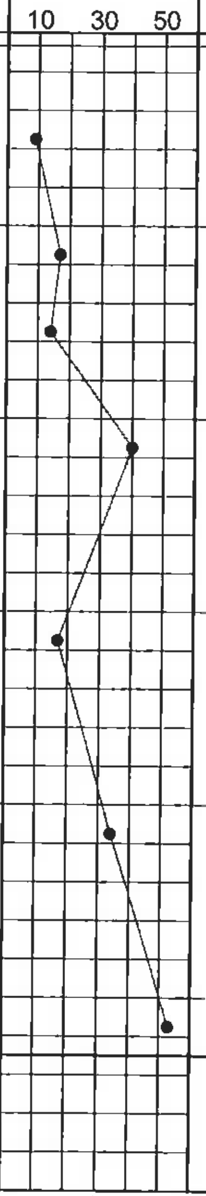
APPENDIX B

BORING LOGS

Geotechnical Boring Log B-1

Date: 7-6-11
Project Name: Distinguished-Great Park
Page 1 of 1
Project Number: I11-2498-10
Logged By: SER
Drilling Company: Cascade Drilling
Type of Rig: CME-75 Hollow Stem
Drive Weight (lbs.): 140
Drop (in.): 30 **Hole Dia. (in.):** 8
Top of Hole Elevation (ft): 711
Hole Location: See Boring Location Map

Elevation (MSL) and Depth (ft.)	Blow Count / 12"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	N	CURVE	Type of Test
0 710		Bag 1 @ 0-4"		Qe SP-SM	**Artficial Fill, Undocumented** Manure/Compost [0-4"]						
	7 5 9	R-1 Bag 2 @ 1-4'			**Quaternary Eolian Sand Deposits** Poorly graded SAND with SILT; reddish brown, damp. loose to medium dense, slightly friable	4.8	106.0	2.0-3.5	9		
5 705	10 12 13	R-2		Qyf ML	**Quaternary Young Alluvial Fan Deposits** Sandy SILT; yellow brown, moist, stiff	13.8	105.4	5.0-6.5	17		
	4 7 14	R-3			dark brown	19.8	104.4	7.0-8.5	14		
10 700	18 30 30	R-4		SM	Silty SAND; yellow brown to red brown, moist, dense, scattered sand pods	16.1	100.8	10.0-11.5	40		
15 695	6 7 10	S-1		ML	Sandy SILT; gray brown, damp to moist, stiff	11.1		15.0-16.5	17		
20 690	7 24 26	R-5		SP	Poorly graded SAND; red brown to brown, damp, dense, iron-stained, highly friable	6.9	103.3	20.0-21.5	34		
25 685	17 20 23	S-2		SM	Silty SAND; yellow brown to red brown, moist, dense, scattered sand pods	8.1		25.0-26.5	53		
					Total Depth: 26.5' No Groundwater						
30											



Sample Legend
☒ Bag Sample
◩ SPT
⧗ Ring Sample (CA modified)

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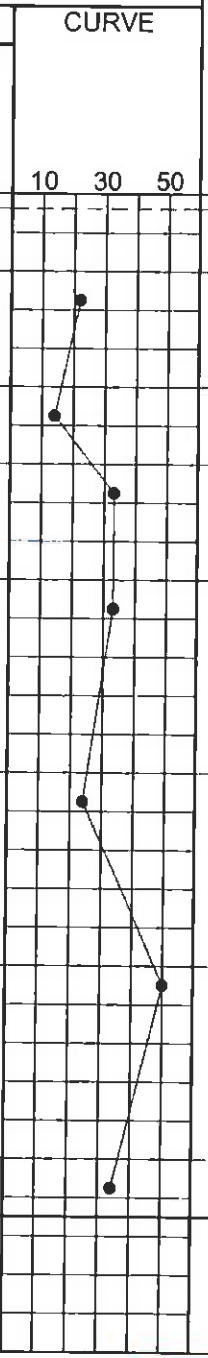
Geotechnical Boring Log B-2

Date: 7-6-11	**Project Name:** Distinguished-Great Park — Page 1 of 1
Project Number: I11-2498-10	**Logged By:** SER
Drilling Company: Cascade Drilling	**Type of Rig:** CME-75 Hollow Stem
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8
Top of Hole Elevation (ft): 709	**Hole Location:** See Boring Location Map

Elevation (MSL) and Depth (ft.)	Blow Count / 12"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	N	Type of Test
0				SM	**Artificial Fill, Undocumented** Concrete Slab [0-4.5"] Silty SAND; reddish brown, damp, medium dense, fine to medium grained, rootlets					
705	7 16 17	R-1		SM	**Quaternary Eolian Sand Deposits** Silty SAND; reddish brown to brown, damp, medium dense	9.0	102.0	2 0-3 5	22	
5	6 9 12	R-2		SM-ML	**Quaternary Young ALluvial Fan Deposits** Poorly graded silty fine SAND; brown, moist, medium dense, slightly porous, scattered root hairs	13.9	104.2	5 0-6.5	14	
700	10 21 28	R-3		ML	Sandy SILT; brown, moist, hard	14.7	107.6	7.0-8 5	33	
10 695	17 21 28	R-4		CL	Sandy CLAY; yellow brown to red brown, moist, hard, scattered sand pods and calcium carbonate	25.9	95.1	10 0-11.5	33	
15 690	7 11 13	S-1		SM	Silty SAND; brown, moist, medium dense	9.6		15 0-16.5	24	
20 685	26 50	R-5		SP	Poorly graded SAND; red brown to brown, damp, very dense	7.0	132.5	20 0-21 0	50	
25	12 14 20	S-2		SM	Silty SAND; yellow brown to red brown, moist, dense	8.7		25 0-26 5	34	
680 30					Total Depth: 26.5' No Groundwater					



Sample Legend

☒ Bag Sample

◪ SPT

☒ Ring Sample (CA modified)

Geotechnical Consulting

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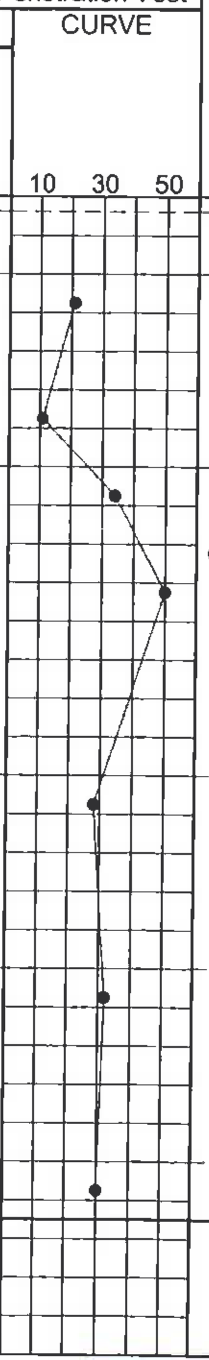
Geotechnical Boring Log B-3

Date: 7-6-11
Project Name: Distinguished-Great Park
Page 1 of 1
Project Number: I11-2498-10
Logged By: SER
Drilling Company: Cascade Drilling
Type of Rig: CME-75 Hollow Stem
Drive Weight (lbs.): 140
Drop (in.): 30 **Hole Dia. (in.):** 8
Top of Hole Elevation (ft): 708
Hole Location: See Boring Location Map

Elevation (MSL)	Depth (ft.)	Blow Count / 12"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	N	Type of Test
	0				SP	**Artficial Fill, Undocumented** Concrete Slab [0-4.5"] Poorly graded SAND; brown, moist, medium dense					
705		8 15 16	R-1		Qe SP	**Quaternary Eolian Sand Deposits** Poorly graded SAND; reddish brown to brown, moist, medium dense	6.4	103.6	2.0-3 5	21	
	5	8 8 9	R-2				7.3	98.9	5.0-6 5	11	
700		10 23 27	R-3 Bag 1 @ 5-10'		ML	**Quaternary Young Alluvial Fan Deposits** Sandy SILT; brown, moist, hard, calcium carbonate stringers	18.2	88.6	7 0-8.5	34	Corrosion
	10	50	R-4			gray brown, damp, very hard	16.7	87.9	10 0-10 5	50	
695											
	15	10 13 15	S-1		SP-SM	Poorly graded SAND with SILT; brown, moist, medium dense, highly friable	9.2		15 0-16 5	28	
690											
	20	16 21 26	R-5		ML	Sandy SILT; gray brown, moist, hard	20.6	97.3	20 0-21 5	32	
685											
	25	10 14 16	S-2		SM	Silty SAND; yellow brown to red brown, moist, dense, scattered sand pods and calcium carbonate	9.9		25.0-26.5	30	
680						Total Depth: 26.5' No Groundwater					
	30										



Sample Legend
- ☒ Bag Sample
- ◩ SPT
- ⧗ Ring Sample (CA modified)

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