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EPD Solutions, Inc.
3333 Michelson Drive, Suite 500
Irvine, California 92612

Attention: Dane Palanjian

Subject: Response to Riverside County Comments and Addendum to Geotechnical Lotting Study Plan Review, Tentative Tract 31687, Proposed 157 Lot Single-Family Residential Project, Romoland Area, Riverside County, California

Dear Mr. Palanjian:

In accordance with the Riverside County comments received and your authorization, GeoSoils, Inc. (GSI) has prepared this County response and addendum to our geotechnical lotting study plan review report (GSI, 2025, see Appendix A) for the subject tentative tract in the Romoland area of Riverside County, California. The scope of our services has included reviews of our lotting study plan review report (GSI, 2025), the Riverside County Planning Department comments received (RCPD, 2025), a review of the new 50-scale preliminary grading plan by KWC Engineers (KWC, 2026a), a compilation of previous preliminary and as-graded geotechnical data for the project site, analysis of the data obtained, and preparation of this response report and accompaniments. The following discussions present the geotechnical County review comments received in *italics*, and our responses follow:

<u>Geotechnical Report Review Comment No. 1:</u>

"Please provide a geotechnical map using the most current proposed project grading plan that has been submitted to the County by the applicant as a map base (Preliminary Grading Plan, N/E Corner of Mapes Road and Trade Winds, Sheet 2, by KWC Engineers, 8-29-25 or most current version). The geotechnical map must show at the minimum, but not limited to, the locations of all geotechnical explorations (including compiled exploration data from previous studies); locations of all cross sections; locations and dimensions of all recommended remedial measures (limits of grading, remedial grading overexcavation depths, rock disposal areas, etc.); geological information (units and symbols, etc.); legend describing the geology units and structure and geotechnical exploration data; appropriate scale and north arrow. The author of the map/plan used for the base must be referenced in the report. The geotechnical map exhibit base should not be modified from what has been submitted to the County and must be presented at an appropriate scale as to be clearly legible to the reader."

Response to Geotechnical Report Review Comment No. 1:

Comment acknowledged. Based on our review of the newly provided 50-scale preliminary grading plan by KWC Engineers (KWC, 2026a, plotted February 3), the plan now shows the development of a proposed 157-lot single-family residential subdivision within Tentative Tract 31687. As requested, an updated geotechnical map has been developed using the most current preliminary grading plan by KWC (plotted February 3, 2026) as a base map. The updated geotechnical map shows the locations of all previous geotechnical explorations (e.g., compiled exploration data from our approved preliminary geotechnical investigation and 40-scale grading plan review reports [GSI, 2005 and 2006, under BGR 060348, see Appendix B]); the locations of geologic cross sections; and the approximate location and depth of existing compacted fills. In addition, pertinent geological information (units and symbols) is presented on the geotechnical map and legend (see Plate 1). The base map by KWC (plotted February 3, 2026a) was not modified by GSI, and is presented at a scale of 1"=50' to be clearly legible to the reader. For convenience, PDF copies of GSI's approved preliminary geotechnical investigation and 40-scale grading plan review reports, under BGR 060348 (GSI, 2005 and 2006) are presented in Appendix B.

Based on additional review of our project files, and the County approved original site grading conducted in 2007, the reviewer is respectfully requested to review any pertinent preliminary geotechnical data that may be associated with the project site under BGR 060348. The original County grading plan approval (e.g., Building and Safety Department plan approval, dated February 20, 2007; and Planning Department approval, dated February 21, 2007); and associated grading permits for Tract 31687 may also be located, to help the reviewer in better understanding the project history and site grading completed to date.

Geotechnical Review Comment No. 2:

"Please update the project description, describe the proposed grading as shown on plan (cuts, fills, etc.) and address any needed geotechnical related items relative to the latest proposed design (see Comment 1 above)."

Response to Geotechnical Review Comment No. 2:

As amended from our geotechnical lotting study plan review report (GSI, 2025), and based on the newly provided 50-scale preliminary grading plan by KWC Engineers (KWC, 2026a, plotted February 3), the preliminary grading plan now shows the development of a proposed 157-lot single-family residential subdivision within Tentative Tract 31687. Understanding that the site was previously graded under BGR 060348, typical cut and fill grading techniques would be necessary to reconfigure the site to the currently proposed design grades. Planned cuts and fills (excluding remedial removals), are currently on the order of approximately 18¼ and 14¼ feet in thickness, respectively. The preliminary grading plan by KWC (2026a), shows cut and fill slopes that are proposed to be constructed at gradients of 2:1 (h:v), or

flatter, up to about 18 and 11 feet in vertical height, respectively. Based on our review of the Grading Analysis by KWC (2026b), the site does not currently balance, and approximately 5,797 cubic yards of export soil materials is currently shown. Sewage disposal will be accommodated by connection to the regional municipal system.

As discussed within our geotechnical lotting study plan review report (GSI, 2025), remedial removals during original site grading were generally on the order of approximately 5 to 8 feet, with localized deeper removals up to about 12 feet. Complete remedial grading was conducted across the entire site, with the exception of the areas of Lot N (basin) Lots 154 through 157, the western portion of Street "C," and the northern margins of Lots 125 through 133 as depicted on Plate 1 (Updated Geotechnical Map).

As also discussed within our geotechnical lotting study plan review report (GSI, 2025), GSI recommends that at a minimum, the upper 12 to 24 inches of the exposed subsoils on the area to be filled or graded pads and streets, should be reprocessed (cross-ripped) and brought to at least optimum moisture content, and then recompacted to a minimum relative compaction of 90 percent of the laboratory standard (ASTM D 1557), prior to additional fill placement, if not removed by planned cuts.

For planned cut areas that will expose the existing oversized rock placement area (Lots 137 through 140, Lots 143 through 146, and portions of Street "D, "see Plate 1), the oversized rock placement area will need to be relocated during site grading activities. The open-space area (Lot M) and existing basin appear suitable, or other area(s) as selected by the grading contractor. In general, the reuse of oversized rock materials, greater than 12-inches in diameter for fill will require special handling procedures and localized rock burial pits, if not reduced in size during rough grading. Crushing and grinding operations may also be used to reduce oversized rock materials to a particle size of approximately 8 inches, or less, to be incorporated into the granular fill materials during site grading activities. Any oversized rock constituents greater than 12 inches in any one dimension should not be placed within 10 feet of finish pad or street grade. Procedures for oversized rock placement are outlined below in the "Rock Placement Guidelines" section of this response report.

For planned cut areas that may expose dense Cretaceous-age granitic bedrock (Map symbol - Klmt), in the areas of Lots 137 through 150, the entire cut portion of the exposed granitic bedrock should be overexcavated to a minimum depth of 3 feet below finish grade, or 2 feet below the bottom of proposed footings, whichever is greater, and replaced with compacted fill. In areas of exposed bedrock, the overexcavation should be performed such that a minimum 1 percent gradient is maintained toward the front of the lot, in order to reduce the potential for the accumulation of perched water (from irrigation or rainfall) in the fill caps.

In addition, for planned cut areas on building pads that may expose, or penetrate into, the underlying "native" old alluvial fan deposits (Map symbol - Qof) additional overexcavation should also be conducted, to a minimum depth of 3 feet below finish pad grade, or 2 feet

below the bottom of proposed footings, whichever is greater, and replaced with compacted fill. No native cut and fill transitions on building pads should remain at the conclusion of site grading.

For cut areas within street areas beyond 12-inches in depth, no specific overexcavation is required; however, consideration should be given to the overexcavation of streets in dense bedrock areas to one foot below the lowest utility invert, to allow for anticipated utility trenching with conventional heavy-duty equipment.

Rock Placement Guidelines

We anticipate that soils to be used as fill material for the subject project will contain some rock. Appropriately, rock disposal will be necessary during grading operations on the site. Generally, for the purpose of this report the materials may be described as either 8 inches or less, greater than 8 and less than 36 inches, and greater than 36 inches. These three categories set the basic dimensions for where and how the materials are to be placed.

Materials 8 Inches in Diameter or Less

Since rock fragments along with the overburden materials are anticipated to be a part of the materials used in the grading of the site, criteria are needed to facilitate the placement of these materials within guidelines which would be workable during the rough grading, post-grading improvements, and serve as acceptable compacted fill.

1. Fines and rock fragments 8 inches or less in diameter may be placed as compacted fill cap materials within the building pads, slopes, and street/driveway areas as described below. The rock fragments and fines should be brought to at least optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard. Within streets, utility guidelines may reduce maximum particle size to about < 3 inches, and may be a select grading requirement where this condition occurs.

2. The purpose for the 8-inch diameter limits is to allow reasonably sized rock fragments into the fill under selected conditions (optimum moisture or above) surrounded with compacted fines. The 8-inch diameter size also allows a greater volume of the rock fragments to be handled during grading, while staying in reasonable limits for later onsite excavation equipment (backhoes and trenchers) to excavate footings and utility lines.

3. Fill materials 8 inches or less in diameter should be placed, but not limited to, within the upper 10 feet of proposed fill pads, the upper 3 feet of overexcavated cut areas of cut/fill transition pads, and the entire street/driveway right-of-way width, including

the proposed overexcavated areas and replacement fill areas, from the depth of the lowest utility to subgrade, or to a depth of 10 feet below finish grade.

Materials Greater Than 8 inches and Less Than 36 Inches in Diameter

1. During the process of bedrock excavation, a significant amount of rock fragments or constituents larger than 8 inches in diameter may be generated. These significant amounts of oversized materials between greater than 8 and less than 36 inches in diameter may be incorporated into the fills using a series of rock blankets.

2. Each rock blanket should consist of rock fragments of approximately greater than 8 and less than 36 inches in diameter along with fines generated from the proposed cuts and overburden materials from removal areas. The blankets should be limited to 24 to 36 inches in thickness and should be placed with granular fines which are flooded into and around the rock fragments.

3. Rock blankets should be restricted to areas which are at least 1 foot below the lowest utility invert within the street right-of-way, 10 feet below finish grade on the proposed fill lots, and a minimum of 20 horizontal feet from any fill slope surface.

4. Compaction may be achieved by using wheel rolling methods with scrapers and water trucks, track-walking by bulldozers, and sheepsfoot tampers.

5. Each rock blanket should be completed with its surface compacted prior to placement of any further rock blanket or rock windrow.

Materials Greater Than 36 Inches in Diameter

1. Oversize rock greater than 36 inches in diameter should be placed in single rock windrows. The windrows should be at least 15 feet or an equipment width apart, whichever is greatest, and at least 10 feet below final grade.

2. The void spaces between rocks in windrows should be filled with the more granular soils by flooding them into place.

3. A minimum vertical distance of 3 feet between soil fill and rock lift should be maintained. Also, the windrows should be staggered from lift to lift. Rock windrows should not be placed closer than 20 feet from the face of fill slopes.

4. Larger rocks too difficult to be placed into windrows may be individually placed into a dozer trench. Each trench should be excavated into the compacted fill or dense natural ground a minimum of 1 foot deeper than the size of the rock to be buried.

After the rocks are placed in the trench (not immediately adjacent to each other), granular fill material should be flooded into the trench to fill the voids.

5. The oversize rock trenches should be no closer together than 15 feet at a particular elevation and at least 20 feet from any slope face. Trenches at higher elevations should be staggered and there should be 4 feet of compacted fill between the top of one trench and the bottom of the next higher trench. Placement of rock into these trenches should be under the full-time observation of the geotechnical consultant.

6. Consideration should also be given to using oversize materials in open space "green belt" areas that would be designated as non-structural fills.

Geotechnical Review Comment No. 3:

"Please provide all laboratory tests to support the values presented in the report used from previous studies."

Response to Geotechnical Review Comment No. 3:

As requested, the laboratory test results, used from previous studies, to support the values within our report (GSI, 2025) are presented within Appendix D of our preliminary geotechnical investigation (GSI 2005), contained in Appendix B of this report. An addition, the "as-graded" sulfate and corrosion laboratory test results (most unpublished) obtained at the conclusion of site grading are presented in Appendix C.

Geotechnical Review Comment No. 4:

"Please provide all exploration data used from previous studies."

Response to Geotechnical Review Comment No. 4:

As discussed previously, the exploration data (Boring and Test Pit Logs) from our previous preliminary geotechnical investigation for the site can be found in Appendix B of GSI 2005, contained in Appendix B of this report. In addition, the seismic refraction data from our rippability assessment can be found in Appendix E of GSI 2005, contained in Appendix B of this report. This preliminary report by GSI (2005) was apparently approved by the County (under BGR 060348), as the site was graded under the geotechnical observation and testing services of GSI in 2007.

Geotechnical Review Comment No. 5:

"Please show on the geotechnical map the depths and limits of the certified engineered fill."

Response to Geotechnical Review Comment No. 5:

Comment acknowledged. Spot elevations for the approximate depths and the limits of the certified engineered fill are presented on the Updated Geotechnical Map (Plate 1).

Geotechnical Review Comment No. 6:

"Please provide cross sections to adequately depict the limits of the certified fill across the site in major directions. Show any setbacks related to limited remedial grading due to edge conditions (property line limitations if pertinent, etc.)."

Response to Geotechnical Review Comment No. 6:

Now that the site topography is provided on the new 50-scale preliminary grading plan by KWC (2026a), geologic cross sections A-A' and B-B' have been prepared that depict the approximate depths and limits of the certified fill across the sections, as well as any necessary remedial regrading (see Plate 2). Based on the original grading conducted in 2007 (under BGR 060348), no structural setbacks were, or are now considered warranted due to edge conditions or property line limitations.

Geotechnical Review Comment No. 7:

"Please provide the as-graded geotechnical report showing the limits of the certified engineered fill and supporting compaction test data, etc."

Response to Geotechnical Review Comment No. 7:

As discussed within our geotechnical lotting study plan review (GSI, 2025), only the former Model site (formerly Lots 62 through 65), have been reported in a final as-graded geotechnical report, outlining the geotechnical observation and testing services provided during original rough grading of the tract (GSI, 2007, under BGR 060348). For convenience a copy of our as-graded report for the former Model site is provided in Appendix D. In addition, field density tests were performed original site grading using nuclear (densometer) methods per ASTM D 6938 (Procedure A) and the sand cone method per ASTM D 1556. The test results conducted during original site grading of the tract, including removal bottom testing, are presented in the enclosed Table 1 (Field Density Test Results [unpublished]) in Appendix D. The limits of the certified engineered fill placed during original site grading are presented on Plate 1 (Updated Geotechnical Map).

Geotechnical Review Comment No. 8:

"Please address all potential geologic hazards per the California Environmental Quality Act and Riverside County General Plan Safety Element."

Response to Geotechnical Review Comment No. 8:

Comment acknowledged. Our previous preliminary geotechnical investigation (GSI, 2005) provided discussions on potential geologic hazards relevant to residential development of the tract. However, the potential for seismic and geologic hazards to affect the site are further discussed below in accordance with the new Riverside County General Plan Safety Element (2024 update) and the California Environmental Quality Act (CEQA, 2025).

FAULTING AND REGIONAL SEISMICITY

Local and Regional Faults

The site is situated in an area of active as well as potentially-active faults. The nearby San Jacinto fault zone is considered active and is included within an Alquist-Priolo Earthquake Fault Zone. Our review of published data indicates that there are no known active faults crossing the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (California Geological Survey [CGS], 2018). However, the site is generally situated in a region subject to strong earthquakes occurring along active faults. These faults include, but are not limited to: the local San Jacinto fault; the Elsinore fault; and the San Andreas fault. During our review of aerial photographs (USDA, 1980), we did not observe any photolineaments transecting or projected into the site. The possibility of ground acceleration, or shaking at the site, may be considered as approximately similar to the southern California region as a whole.

Faults

According to California Department of Conservation, California Geological Survey (CGS, 2026) the San Jacinto fault zone is the closest known Holocene-active fault to the project site, located at a distance of approximately 9.6 miles (15.4 kilometers) to the northeast. This fault would have the greatest effect on the project site in the form of strong ground shaking, should an earthquake occur on this fault.

Updated Seismic Ground Motion Values

Using a latitude of 33.7596 degrees and a longitude of -117.1649, risk category of II and Default site soil class, the following table summarizes the updated seismic ground motion values consistent with the 2025 CBC (CBSC, 2025), Chapter 16 Structural Design, Section 1613, Earthquake Loads. The ASCE Hazard Tool (ASCE Hazard Tool) has been used to aid in the design. Appendix E presents the "ASCE Hazards Report" including graphs for the Multi-Period and Two-Period response spectra, and numerical values for the Multi-Period Design Spectrum.

ASCE 7-22 SEISMIC GROUND MOTION VALUES		
PARAMETER	VALUE	REFERENCE
Risk Category	II	Table 1.5-1
Site Class	Default	Sections 11.4.2 and 11.4.2.1
Shear Wave Velocity Profile, $\overline{V}s$	853 ft/s (260m/s)	Table 20.2-1
MCE_R spectral acceleration - (0.2 sec), S_s	1.5 g	Section 11.4.3
MCE_R spectral acceleration - (1.0 sec), S_1	0.54 g	Section 11.4.3
MCE_R spectral acceleration (0.2 sec), S_{MS}	1.65 g	Section 11.4.3
MCE_R spectral acceleration (1.0 sec), S_{M1}	1.37 g	Section 11.4.3
Design spectral acceleration (0.2 sec), S_{DS}	1.1 g (1)	Section 11.4.4
Design spectral acceleration (1.0 sec), S_{D1}	0.91 g	Section 11.4.4
PGA_M	0.58 g	Section 11.8.3
Seismic Design Category	D	Section 11.6

(1) If the simplified alternative design procedure of Section 12.14 is used, the value of S_{DS} should be calculated per Section 12.14.8.1

Conformance to the criteria above for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur in the event of a large earthquake. The primary goal of seismic design is to protect life, not to eliminate all damage, since such design may be economically prohibitive. Cumulative effects of seismic events are not addressed in the 2025 CBC (CBSC, 2025) and regular maintenance and repair following locally significant seismic events will likely be necessary, as is the case in all southern California.

Liquefaction

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motions, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to vertical deformation, lateral movement, lurching, sliding, and as a result of seismic loading, volumetric strain and manifestation in surface settlement of loose sediments, sand boils, and other damaging lateral 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.

Based on our review of the Riverside County Information Technology (RCIT), Graphic Information Services, Map my County website (RCIT, 2026), a majority of the site is located within a zone designated with “Low” potential liquefaction. Based on the relatively dense nature of the old alluvial fan deposits and the Cretaceous-age granitic bedrock in the northeast portion of the site, the previous removal of low density surficial soils, and depth to

regional groundwater, the potential for liquefaction to affect the development of the site is considered very low.

Lateral Spreading

Lateral spread phenomenon is described as the lateral movement of stiff, surficial, mostly intact blocks of sediment or compacted fill displaced downslope towards a free face along a shear zone that has formed within the liquefied sediment. The resulting ground deformation typically has extensional fissures at the head of the failure, shear deformations along the side margins, and compression or buckling of the soil at the toe. Given, the very low liquefaction potential and flat laying nature of the site, the potential for lateral spreading to directly affect the site is also considered very low, based on the available data.

Other Geologic and Secondary Seismic Hazards

The following list includes other geologic and seismic related hazards that have been considered during our evaluation of the project site. The hazards listed are considered negligible or mitigated as a result of site location, soil characteristics, and typical site development procedures. Further discussions are presented below.

Subsidence

The effects of areal subsidence generally occur at the transition or boundaries between low-lying areas and adjacent hillside terrain, where materials of substantially different strength and stiffness engineering properties (e.g., young alluvium vs. bedrock) are present. Subsidence may also occur due to groundwater withdrawal and regional tectonics. Our review of Map My County Website (RCIT, 2026) indicates a majority of the site is located within a zone of potential subsidence. The site is also mapped as having old alluvium and bedrock materials onsite. However, based on our review of the previous boring and test pit logs (GSI, 2005) and the previous site grading conducted, the relatively dense nature of the old alluvial fan deposits, and the generally low-gradient geologic contact between the old alluvial fan deposits and bedrock onsite, the potential for subsidence to affect the development of the site is considered very low.

In addition, subsidence at the subject site due to groundwater withdrawal and regional tectonics should be no greater than other nearby already developed areas. California regulations have been enacted by the Sustainable Groundwater Management Act (SGMA) to mitigate the subsidence potential from the withdraw of groundwater. Provided the SGMA guidelines are properly implemented, the potential for areal subsidence from groundwater withdrawal, is also considered very low.

Hydro-consolidation/Hydro-collapse

Our review of the boring and test pit logs (GSI, 2005), the lack of low-density uncemented soils, and unconsolidated sands underlying the site, and regional groundwater data indicate that soils are not likely to experience hydro-collapse.

Ground Lurching or Shallow Ground Rupture

As discussed previously, the site is not located with an Alquist-Priolo Earthquake Fault Zone (California Geological Survey [CGS], 2018), and the nearest active faulting is located approximately 9.6 miles (15.4 kilometers) to the northeast, as such the potential for ground lurching or shallow ground rupture is considered very low.

Tsunami

Based on the project site's Inland Empire location and relative distance from the coastline, the potential for a Tsunami to affect the development of the site is considered nil.

Seiche and Dam Inundation

Our review of the California Department of Water Resources, Division of Safety of Dams (DSOD, 2026), California Dam Breach Inundation Maps website indicates the site is not located within a dam inundation zone. Furthermore, based on the site's proximity to large bodies of water, the potential for a seiche is considered nil.

Geotechnical Review Comment No. 9:

"Please provide analyses and provide actual values (not estimates) for potential total and differential settlement for static and dynamic conditions based on site-specific testing and analysis."

Response to Geotechnical Review Comment No. 9:

Comment acknowledged. The following discussion is provided for our updated static and seismic settlement analysis for the subject tract.

Static Settlements

Two representative soil columns were developed using our previous boring logs, test pits, laboratory testing results (GSI, 2005), and the as-graded site conditions. One soil column developed has a 2-feet thick compacted fill layer of colluvium/topsoil on top of the old alluvial fan deposits (representing the fan deposits or bedrock), and the other soil column developed has a 6-feet thick compacted fill layer of colluvium/topsoil on top of the old alluvial fan

deposits. Both soil layers were modeled as sand, the upper layer as medium dense, and the Quaternary old alluvial fan deposits as very dense. The soil properties were obtained from our laboratory testing results (GSI, 2005). Given the soil types, we calculated immediate settlements for both continuous and spread footings. The loads assumed in our calculations for both types of footings are presented in our lotting study plan review report (GSI, 2025).

Static settlement calculations were performed using elasticity theory as implemented by the commercially available computer program SETTLE3, version 5.027, 64 bit (RocScience, 2026). SETTLE3 is capable of analyzing immediate settlement, primary consolidation, and secondary settlement of foundations, embankments, and surface loads. The program can create different soil profiles in a quasi-three-dimensional space.

For the continuous footings, we calculated maximum total settlements of 0.10 inch and 0.15 inch for the upper 2-feet thick and 6-feet thick soil layer, respectively. For square spread footings, we calculated maximum total settlements of 0.40 inch and 0.80 inch for the upper 2-feet thick and 6-feet thick soil layer, respectively. Differential settlements are calculated as one-half the total settlements, over a horizontal distance of 40 feet. Results of our calculations are presented in Appendix E.

Seismic Settlements

Seismically induced settlement occurs most frequently in areas underlain by loose, sand-like soils. Damage as a result of seismically induced settlement is most dramatic when differential settlement occurs in areas with large variations in the thickness of underlying sediments. Settlement caused by ground motions is often non-uniformly distributed, which can result in differential settlement.

Seismic settlement was evaluated using a PGA_M =0.58g, and a magnitude M=8.11 (Appendix E, 2025 CBC). The PGA_M was calculated using the ASCE Hazard Tool (https://ascehazardtool.org/), and the magnitude using the USGS Earthquake Hazard Toolbox (https://earthquake.usgs.gov/nshmp/). We used the method developed by Tokimatsu and Seed (1987) as implemented by the commercially available computer program LiquefyPro (CivilTech Corporation, 2021). Using the information from our deepest boring B-1, we calculated approximately 1/4-inch of total seismically induced ground settlement may occur at the site (see calculations in Appendix E). Differential seismic settlement may be taken as one-half of the computed total seismic settlement over a horizontal distance of 30 feet (CGS, 2025).

Geotechnical Review Comment No. 10:

“Please clarify the recommendations regarding onsite infiltration. The report states that the site does not meet the requirements for an onsite infiltration system. But then provides 17 geotechnical guidelines for the design of an onsite infiltration system. This appears to be

a contradiction and may be interpreted that infiltration is feasible. Please clarify and remove infiltration design recommendations if infiltration is not feasible."

Response to Geotechnical Review Comment No. 10:

As indicated by the reviewer, our report clearly states that stormwater infiltration onsite is not feasible; however, many of the items within our onsite infiltration-runoff retention system section are also pertinent to the development of stormwater treatment systems and stormwater basins on any site. As such, and as requested, the runoff retention system section has been appropriately modified as presented below.

ONSITE STORMWATER-RUNOFF RETENTION SYSTEMS

Since onsite stormwater-runoff retention systems (OSRRS) are planned for Best Management Practices (BMPs) or Low Impact Development (LID) principles for the project, some guidelines should/must be followed in the planning, design, and construction of such systems. Such facilities, if improperly designed or implemented without consideration of the geotechnical aspects of site conditions, can contribute to flooding, saturation of bearing materials beneath site improvements, slope instability, and possible concentration and contribution of pollutants into the groundwater or storm drain or utility trench systems. Locally, relatively impermeable formations include: claystone, siltstone, cemented sandstone, igneous and metamorphic bedrock, as well as expansive fill soils.

Every site will have characteristics which should lend themselves to the type of OSRRS selected for the project; however, not every site is suitable for OSRRS. In practice, OSRRS are usually initially designed by the project design civil engineer. Selection of methods should include (but should not be limited to) review by licensed professionals including the geotechnical engineer, hydrogeologist, engineering geologist, project civil engineer, and landscape architect. Applicable governing agency requirements should be reviewed and included in design considerations.

USDA Site Soil Groups, Soil Units, Ksat Values, and Basin Siting Requirements

Our review of the United States Department of Agriculture (USDA, 2025) Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx), indicates six (6) major soil units underlie the project site. The soil units are described with a generalized Hydrologic Soil Group ranging between "A" to "D," with a capacity of the most limiting soil layer to transmit water (Ksat) ranging between "very low" (i.e., 0.00 to 0.00 in/hr) to "high" (i.e., 1.98 to 5.95 in/hr). However, the near-surface native soils have been removed and recompacted in most areas during previous site grading activities. As such, the site is mostly capped with compacted artificial fills, and any basin constructed entirely of compacted fill is considered as belonging to HSG D, and a "no infiltration" BMP design is

warranted (Clar, et al., 2004). In addition, our review of the general infiltration basin siting requirements and limitations (CASQA, 2003), indicates sites with Hydrologic Soil Groups of "C" and "D," are not suitable for infiltration.

Our supplemental percolation/infiltration testing conducted within the existing basin found that due to the dense alluvial fan deposits located onsite and lower infiltration rates obtained during our study (GSI, 2019a), supplemental up-gradient filtration/detention systems or filtration/detention systems within the existing basin (e.g., bio-retention facilities, extended detention basins, sand filter/media treatment areas, or vegetated swales) may need to be incorporated onsite that do not rely on infiltration.

As such, and based on the grading conducted to date, the current location of the basin (KWC, 2026a), and the underlying earth materials, apparently do not meet current siting requirements as set forth by the controlling authorities for an infiltration treatment area (CASQA, 2003).

Based on the above, the following geotechnical guidelines should be considered when designing onsite stormwater-runoff retention systems:

1. Wherever possible, OSRRS should not be installed within approximately 50 feet of the tops of slopes steeper than 7:1 (h;v) or within H/3 from the tops of slopes (where H equals the height of slope).

2. Impermeable liners used in conjunction with basins should consist of a 30-mil polyvinyl chloride (PVC) membrane that is covered by a minimum of 12 inches of clean soil, free from rocks and debris, and meets the following minimum specifications:

   Specific Gravity (ASTM D792): 1.2 (g/cc [min.]); Tensile (ASTM D882): 73 (lb/in-width [min.]); Elongation at Break (ASTM D882): 380 (% [min.]); Modulus (ASTM D882): 30 (lb/in-width [min.]); and Tear Strength (ASTM D1004): 8 (lbs [min.]); Seam Shear Strength (ASTM D882) 58.4 (lb/in [min.]); Seam Peel Strength (ASTM D882) 15 (lb/in [min]).

3. Wherever possible, OSRRS should not be placed within a distance of H/2 from the toes of slopes (where H equals the height of slope).

4. The landscape architect should be notified of the location of the proposed OSRRS. If landscaping is proposed within the OSRRS, consideration should be given to the type of vegetation chosen and their potential effect upon subsurface improvements (e.g., some trees/shrubs will have an effect on subsurface improvements with their extensive root systems). Over-watering landscape areas above, or adjacent to, the proposed OSRRS could adversely affect performance of the system.

5. Areas adjacent to, or within, the OSRRS that are subject to inundation should be properly protected against scouring, undermining, and erosion, in accordance with the recommendations of the design engineer.

6. OSRRS should not be installed within approximately 8 feet of building foundations, utility trenches, and walls, or a 1:1 (h:v) slope (down and away) from the bottom elements of these improvements. Alternatively, deepened foundations or pile/pier supported improvements may be used.

7. OSRRS should not be installed adjacent to pavement or hardscape improvements. Alternatively, deepened/thickened edges and curbs or impermeable liners may be used in areas adjoining the OSRRS.

8. As with any OSRRS, if not lined, localized ponding and groundwater seepage should be anticipated. The potential for seepage or perched groundwater to occur after site development should be disclosed to all interested or affected parties.

9. As with any OSRRS, proper care will need to provided. Best management practices should be followed at all times, especially during inclement weather. Provisions for the management of any siltation, debris within the OSRRS, or overgrown vegetation (including root systems) should be considered. An appropriate inspection schedule will need to adopted and provided to all interested or affected parties.

10. Any designed system will require regular and periodic maintenance, which may include rehabilitation or complete replacement of the filter media (e.g., sand, gravel, filter fabrics, topsoils, mulch, and other materials) or other components used in construction, so that the design life exceeds 15 years. Due to the potential for piping and adverse seepage conditions, a burrowing rodent control program should also be implemented onsite.

11. Newly established vegetation/landscaping (including phreatophytes) may have root systems that will influence the performance of the OSRRS or LID systems. As such, the landscape architect should consider the effects of root systems if vegetation or landscaping is proposed within the OSRRS or LID system.

12. The potential for surface flooding, in the case of system blockage, should be evaluated by the design engineer.

13. Any proposed utility backfill materials (e.g., inlet and outlet piping or other subsurface utilities) located within or near the proposed area of the OSRRS may become saturated. This is due to the potential for piping, water migration, or seepage along the utility trench line backfill. If utility trenches cross or are proposed near the OSRRS, cut-off walls or other water barriers will need to be installed to mitigate the potential

for piping and excess water entering the utility backfill materials. Planned or existing utilities may also be subject to piping of fines into open-graded gravel backfill layers unless separated from overlying or adjoining OSRRS by geotextiles or slurry backfill.

14. The use of OSRRS above existing utilities that might degrade or corrode with the introduction of water or seepage should be avoided.

LIMITATIONS

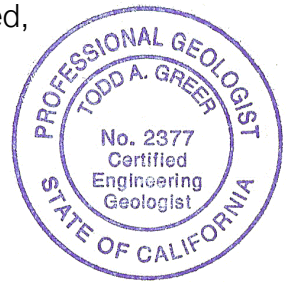
The materials encountered on the project site and used for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed before or after during mass grading. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as this study is based upon our review and engineering analyses, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion 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.





Todd A. Greer
Engineering Geologist, CEG 2377

Jorge F. Meneses, PhD, PE, GE, BC. GE, F.ASCE
Geotechnical Engineer, GE 3041

TAG/JFM/ek

Enclosures: Appendix A - References
Appendix B - GSI, 2005 and 2006
Appendix C - "As-Graded" Laboratory Test Results
Appendix D - GSI, 2007 and Table 1 - Field Density Test Results
Appendix E - Settlement Analysis and Seismic Ground Motion Values
Plate 1 - Geotechnical Map
Plate 2 - Geologic Cross-Sections A-A' & B-B'

Distribution: (1) Addressee (PDF via email)

APPENDIX A

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APPENDIX A

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APPENDIX B

GSI, 2005 AND 2006

PRELIMINARY GEOTECHNICAL INVESTIGATION AND GENERAL RIPPABILITY ASSESSMENT TRACT 31687, ROMOLAND AREA RIVERSIDE COUNTY, CALIFORNIA

FOR

SOUTHERN CALIFORNIA LAND MANAGEMENT
31566 RAILROAD CANYON ROAD, #643
CANYON LAKE, CALIFORNIA 92587

W.O. 4787-A-SC JUNE 30, 2005

GeoSoils, Inc.

Geotechnical • Coastal • Geologic • Environmental

26590 Madison Avenue • Murrieta, California 92562 • (909) 677-9651 • FAX (909) 677-9301

June 30, 2005

W.O. 4787-A-SC

Southern California Land Management
31566 Railroad Canyon Road, #643
Canyon Lake, California 92587

Attention: Mr. Brian Merritt

Subject: Preliminary Geotechnical Investigation and General Rippability Assessment, Tract 31687, Romoland Area, Riverside County, California

Dear Mr. Merritt:

In accordance with your request and authorization, this report presents the results of GeoSoils, Inc.'s (GSI) preliminary geotechnical investigation and general rippability assessment of Tract 31687, in the Romoland area of Riverside County, California. The purpose of this study was to provide a preliminary geotechnical report, in light of onsite soils and geologic conditions and their effects on the proposed site development from a geologic/geotechnical viewpoint. In general, our study was to evaluate potential remedial removal depths, rock hardness (i.e., general rippability assessment), etc. In addition, preliminary geotechnical foundation design parameters, slope stability evaluations, settlement evaluations, and developed recommendations for earthwork construction for the proposed residential development are provided herein.

EXECUTIVE SUMMARY

Based on our review of data (Appendix A), field exploration, laboratory testing, and geologic and engineering analyses, the proposed site appears suitable for its intended use, from a geotechnical viewpoint, provided the recommendations presented in the text of this report are properly implemented. The most significant elements of our preliminary investigation are provided below:

- In general, the site may be characterized as being underlain at depth by Cretaceous-aged granitic bedrock, which is discontinuously overlain by ±1½ feet to in excess of +39½ feet of older alluvial fan deposits, which are likely Pleistocene in age. Alluvium, of likely Holocene-age, ranging up to ±5 feet in thickness, underlies the northwest portion of the site, contained within a gully/swale. These units are mantled by ±1½ to ±6 feet of potentially compressible topsoil/colluvium.

Removal and recompaction of the topsoil/colluvium, alluvium, and weathered near surface fan deposits (additional ±1 to ±2 feet) will be required should settlement sensitive improvements be proposed within their influence. For preliminary planning purposes, these depths are estimated to range from ±2½ to ±4 feet across the site, with localized deeper removals on the order of ±8 feet deep, or deeper, if not removed by planned excavation. A minimum of 2 feet of compacted fill is recommended below foundation elements.

- Based upon our experience in this area, and the seismic refraction data obtained, assuming a D9L, or equivalent, the granitic bedrock, where encountered, should be generally rippable (i.e., seismic velocities of less than about 6,000 feet per second [fps]) to depths ranging from about ±15 to greater than ±35 feet. However, there are localized areas (e.g., boulder outcrops, buried corestones, etc.) which may potentially require very difficult ripping to possible blasting. This should be considered during preliminary planning and cost estimation purposes.

- Using the 3,800 fps cut-off for non-rippable trenching, assuming a CAT 235 hoe, the granitic bedrock, if encountered, throughout much of the site should be generally trenchable (i.e., seismic velocities of less than about 3,800 fps) to depths ranging from about ±14 to greater than ±35 feet. However, very difficult trenching to possible line-blasting, may not be precluded during utility installation assuming a commercial rubber-tire backhoe, and should also be considered during preliminary planning and cost estimation purposes.

- Oversize materials (boulders, etc., greater than 12 inches in diameter) should be anticipated during grading and trenching. Many stockpiled boulders and/or boulder outcrops were mapped on the northeastern portion of the site. Excavation and placement difficulties, as well as possible offsite disposal of these materials should be considered. As per the Uniform Building Code/California Building Code ([UBC/CBC], International Conference of Building Officials [ICBO], 1997 and 2001) requirements, no oversize materials greater than 12 inches in diameter should be placed within 10 feet of finish grade. This may necessitate the need for scraper/dozer pits, if the oversized materials are not removed from the site, or reduced in size, prior to or, during grading.

- Cut and fill slopes are designed at gradients of 2:1 horizontal to vertical (h:v), or flatter, and are proposed to a maximum height of about ±9 and ±15½ feet, respectively. Based on the current proposed configurations of cut and fill slopes, field mapping, current sampling and laboratory testing, and our preliminary evaluation, the proposed cut and fill slopes are considered grossly and surficially stable. Keyways for fills-over-cut, and daylight cuts, should be properly constructed, as depicted in the General Earthwork and Grading Guidelines section of this report.

- Preliminary laboratory testing and our experience on other nearby properties, indicates the expansion potentials of the onsite soils are generally very low to low; however, soils exhibiting medium expansion potentials cannot be precluded from occurring onsite. Preliminary foundation recommendations for conventional and post-tension design are provided herein, for very low to medium expansive conditions.

- Typical samples of the site materials have been analyzed for soluble sulfate/corrosion potential. Based on preliminary laboratory testing results, which indicated 0.0052 percent by weight, the use of sulfate resistant (Type V) concrete is generally not anticipated for the site. In addition, based on the preliminary test results, the onsite soils are considered moderately alkaline and are moderately corrosive to ferrous metals in a saturated state. Accordingly, additional recommendations should be obtained from a consulting corrosion engineer, including recommendations for foundations, metals, and piping, etc., where such materials may come into contact with site soils.

- No groundwater was encountered onsite to a depth in excess of ±39½ feet below the ground surface. However, due to the relatively dense nature of the underlying bedrock/alluvial fan deposits, the possibility of local seepage may not be precluded, during or after site development, and should be anticipated. The need for subdrainage systems for the control of localized seepage and/or groundwater may not be precluded during grading or after development. This potential should be disclosed to all homeowners and any homeowners association.

- The potential for liquefaction, subsidence, or significant mass wasting within the site is considered low, provided our recommendations are properly implemented.

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

- Adverse geologic features that would preclude project feasibility were not encountered.

- The recommendations presented in this report should be incorporated into the 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 the undersigned.

Respectfully submitted,

GeoSoils, Inc.

John P. Franklin
Engineering Geologist, CEG 1340

David W. Skelly
Civil Engineer, RCE 47857

Todd A. Greer
Engineering Geologist, CEG 2377

TAG/JPF/DWS/jh

Distribution: (6) Addressee

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Appendix B - Boring Logs and Test Pit Logs . . . . . Rear of Text
Appendix C - EQFAULT, EQSEARCH, and FRISKSP Data . . . . . Rear of Text
Appendix D - Laboratory Test Results . . . . . Rear of Text
Appendix E - Seismic Refraction Data . . . . . Rear of Text
Appendix F - General Earthwork and Grading Guidelines . . . . . Rear of Text
Plate 1 - Geotechnical Map . . . . . Rear of Text in Folder

PRELIMINARY GEOTECHNICAL INVESTIGATION
AND GENERAL RIPPABILITY ASSESSMENT
TRACT 31687, ROMOLAND AREA
RIVERSIDE COUNTY, CALIFORNIA

SCOPE OF SERVICES

The scope of our services has included the following:

1. Review of available geologic maps and data, including aerial photography, for the site area (Appendix A).

2. Review of the current tentative tract map for the site (CSL Engineering, Inc., [CSL], 2005).

3. Geologic site reconnaissance and mapping, as well as meeting with Underground Service Alert (USA).

4. Performance of a photo-lineament analysis for the site and vicinity.

5. Surface and subsurface exploration consisting of the advancement of three 8-inch hollow stem borings and excavation of 19 backhoe test pits, utilizing a rubber-tire backhoe, across the site for geotechnical logging and sampling (see Appendix B). The approximate locations of exploratory test pits and borings are shown on Plate 1 (Geotechnical Map).

6. General areal seismicity (see Appendix C).

7. Relevant laboratory testing of representative soil samples collected during our subsurface exploration program (see Appendix D).

8. Execution of four double-directional seismic refraction survey lines to generally evaluate the potential depth, occurrence, and hardness (rippability) of the underlying granitic bedrock across the site (see Appendix E). The approximate locations of the seismic refraction survey lines are shown on Plate 1 (Geotechnical Map).

9. Appropriate engineering and geologic analysis of data collected.

10. Preparation of this geotechnical report, and attachments, including boring and test pit logs, seismic refraction data (including rock hardness evaluations), laboratory test results, regional seismic data, preliminary foundation design, general earthwork factors, and recommendations for site grading.

SITE LOCATION/CONDITIONS

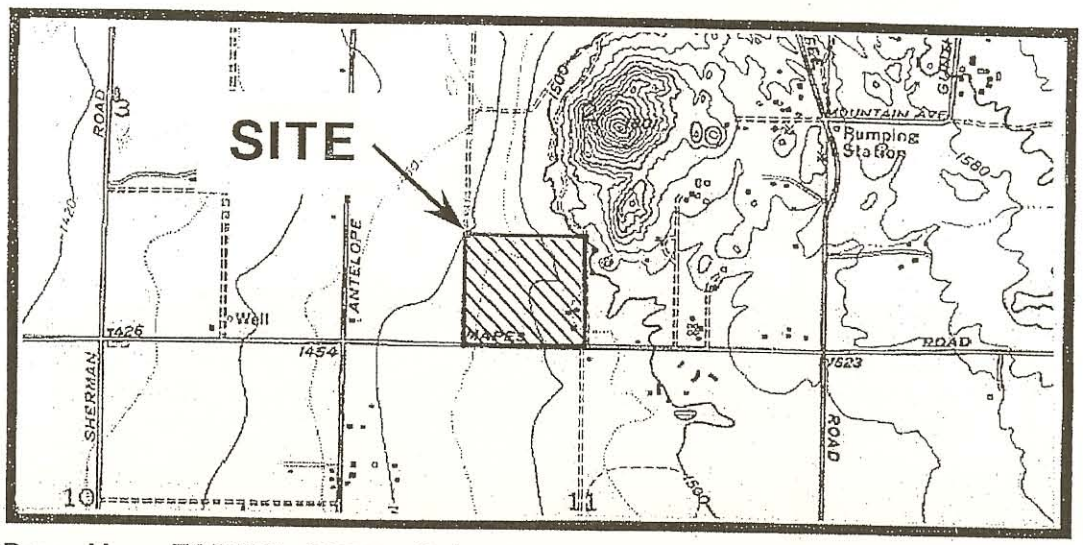
Tentative Tract 31687 is an rectangular-shaped parcel that consists of ±40 acres of generally undeveloped land, located on the northeast corner of the intersection of Mapes Road and Trade Winds Drive in the Romoland area of Riverside County, California (see Figure 1, Site Location Map). The property is bounded on the south by Mapes Road, on the west by Trade Winds Drive, on the east by the extension of Palomar Road, and on the north by an undeveloped property. The site slopes gently to the northwest, and onsite elevations generally range from a low of about ±1,458 feet mean sea level (MSL) in the northwest corner of the site to a high of about ±1,492 feet MSL in the southeast corner of the site. Drainage across the site is primarily to the northwest by sheetflow and one small incised gully/swale located on the northeast portion of the property.

PROPOSED DEVELOPMENT/PLAN REVIEW

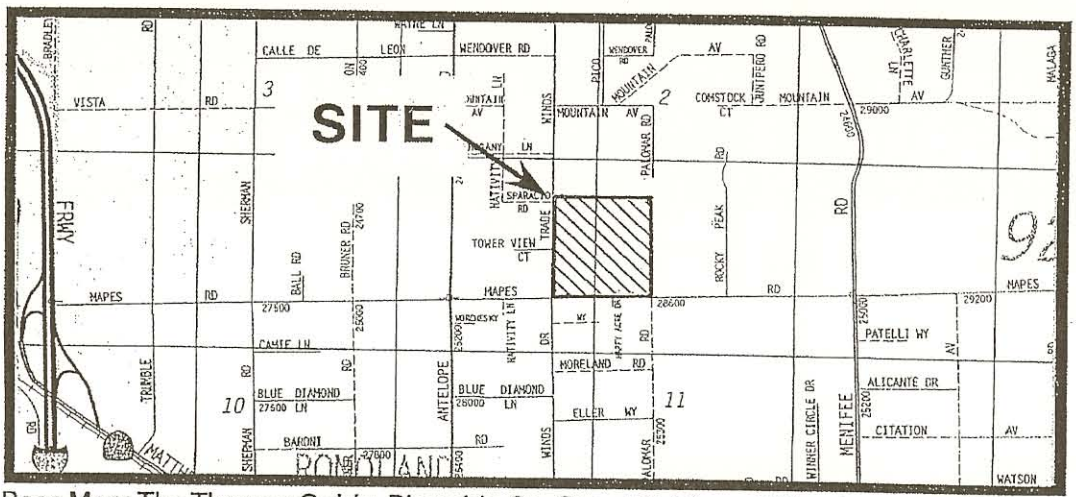
The 100-scale plans prepared by CSL (2005), indicate that typical cut and fill grading techniques would be utilized to ready the site for single-family residential development of 65 lots, with associated infrastructure, landscaping, and underground utilities. According to the plans, rough grading will create cut and fill slopes designed at inclinations of 2:1 (h:v), or flatter, attaining maximum heights of about ±9 and ±15½ feet, respectively. The maximum thickness of proposed cuts and fills are on the order of ±11 and ±9 feet, respectively. It is also our understanding 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 utilizing 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 currently unknown.

FIELD STUDIES

Field investigations conducted during our preliminary evaluation of the property for this study entailed geologic reconnaissance mapping, advancement of three 8-inch hollow-stem exploratory borings, excavation of 19 exploratory test pits, and performance of five double-directional seismic refraction survey lines. The exploratory borings and test pits were logged by a geologist from our firm who collected representative bulk and undisturbed ring samples for appropriate laboratory testing. The seismic refraction surveys were performed by geologists from our firm. Logs of the borings and test pits are presented in Appendix B. The seismic refraction survey data is presented in Appendix E. The approximate locations of the borings, test pits, and seismic refraction surveys are shown on Plate 1 (Geotechnical Map).



Base Map: TOPO!® ©2003 National Geographic, USGS Perris Quadrangle, California–Riverside Co., 7.5-Minute, dated 1978, current 1979.



Base Map: The Thomas Guide, Riverside Co. Street Guide and Directory, 2005 Edition, by Thomas Bros. Maps, page 808

LOCATION AND SCALES APPROXIMATE

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GeoSoils, Inc.	W.O. 4787-A-SC
SITE LOCATION MAP	
Figure 1	

GEOLOGY

Regional Geologic Setting

The property is situated in the eastern portionn of the Perris Block, a portion of a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. The Perris Block is a stable structural block bounded on the west by the Elsinore fault zone and on the east by the San Jacinto fault zone. The Peninsular Ranges 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-age (Quaternary-age) 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 materials.

Local Geology

As mapped by Dibblee (2003), the majority of the site is underlain by Quaternary-age alluvial deposits, which are in-turn underlain by plutonic bedrock (commonly called "granitics") at depth, and locally exposed at the surface on the northeastern portion of the site. However, based on our subsurface investigation, the underlying sedimentary deposits are more aptly termed alluvial fan deposits. The alluvial fan deposits, as encountered onsite, are likely Pleistocene in age based on Stage II carbonate veins, veinlets, and generally indurated nature of the fan deposits encountered onsite during our subsurface exploratory program. The basement rocks were described by Dibblee (2003) as foliated granitic rocks of quartz tonalite and quartz diorite composition.

SITE EARTH MATERIALS

The geologic units encountered within the project site consist of colluvium/topsoil, alluvium, Quaternary-age alluvial fan deposits, and Cretaceous-age granitic bedrock. Mappable geologic units are shown on Plate 1, these units are described as follows, from youngest to oldest:

Colluvium/Topsoil (Unmapped)

In general, the site is mantled by a relatively thin layer of colluvium/topsoil. These materials were generally observed to be light brown to reddish brown, silty sands. The materials were dry to damp, loose to locally medium dense with depth, and locally porous. These surficial soils occasionally contained minor to locally abundant rootlets. In general, these materials typically have a low, and sometimes medium, expansion potential. The colluvium/topsoil was encountered ranging from ±1½ to ±6 feet in thickness. Due to the

potentially compressible nature of these surficial 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-age Alluvium (Map Symbol - Qal)

Quaternary-age alluvium was mapped in a northwest-trending gully/swale, in the northern portion of the site. The materials were generally observed to be brown, silty sands that were damp to moist and loose; the alluvial layer is about ±5 feet in thickness. Due to the potentially compressible nature of these surficial 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-age Alluvial Fan Deposits (Map Symbol - Qf)

Quaternary-age alluvial fan deposits were encountered underlying topsoil/colluvium onsite. These sediments were basically distinguished to be dark brown to reddish brown, silty sands. Localized layers contained minor amounts of clay. These deposits were generally noted to be dry to moist and medium dense to dense with depth. Localized areas were encountered that contained Stage II carbonate veinlets near the stratigraphic top of the formation, and thus are likely at least Pleistocene in age, near the surface. As encountered onsite, the alluvial fan deposits typically have a low expansion potential; however, medium expansive soils may not be entirely precluded. Due to the potential for settlement, near surface weathered alluvial fan deposits should be removed and/or processed prior to compacted fill placement (additional ±1 to ±2 feet), should settlement-sensitive improvements be proposed within their influence.

Cretaceous-age Granitics-Undifferentiated (Map Symbol - Kgr)

Cretaceous-age plutonic rocks (commonly called "granitics") underlie the site at varying depths. These rocks have been mapped (Dibblee, 2003) as quartz diorite and tonalite. The granitic materials encountered in our test pits were primarily moderately to heavily weathered near the surface. The weathered granitics encountered in our exploratory test pits were generally observed to be quartz diorite that had weathered to grayish to reddish brown silty sands. These materials were dry to moist and medium dense to very dense, at depth. Generally, these materials typically have a very low to low expansion potential; however, residual colluvium developed on granitic rocks may be medium expansive. These rocks were generally more heavily weathered and fractured in the near surface and will, therefore, require surficial removal (upper ±1 foot) if not removed by planned excavation.

GEOLOGIC STRUCTURE

Field mapping from this study, indicates that the strike of the regional foliation patterns within the granitic bedrock onsite are generally from N20W to N45W, and are steeply inclined to the northeast. Joint spacing within the granitic bedrock onsite ranges from 4 to 18 inches to greater than 10 feet or more. It is likely that these regional joint and foliation trends are pervasive (primary discontinuity systems), and may reasonably be projected to depth owing to their formation from regional: a) tectonic stresses causing fracturing essentially contemporaneously with tectonic activity; b) residual stresses due to events that happened long before the fracturing; or, c) caused by regional uplift, and faulting related to other nearby batholithic emplacements along weakened planes within the granitic bedrock unit.

Based on the above, it appears that structural conditions within the bedrock are relatively complex. Jointing, foliation, and fracturing represent potentially weak planes in otherwise massive rock that, when unfavorably oriented, may adversely affect cut slope stability. Based on the available data, adverse geologic structures are not anticipated to significantly affect the proposed development. Geologic structure within the granitic bedrock, where encountered, should be further evaluated during actual site earthwork, to assess bedrock structure relative to actual slope designs. Based on the conditions disclosed during the plan review or grading stages, supplemental recommendations regarding slope stabilization may be warranted.

FAULTING AND REGIONAL SEISMICITY

The site is situated in an area of active as well as potentially-active faults. The nearby San Jacinto fault zone is considered active and is included within an Alquist-Priolo Earthquake Fault Zone. Our review indicates that there are no known active faults crossing the site, and the site is not within a Fault-Rupture Hazard Zone (Hart and Bryant, 1997). During our review of aerial photographs (USDA, 1980), we did not observe photolineaments or other features specifically indicative of faulting crossing the site.

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)
Burnt Mountain	47.1 (75.8)
Chino - Central Avenue (Elsinore)	24.4 (39.2)
Clamshell - Sawpit	53.1 (85.5)
Cleghorn	36.0 (58.0)

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE MILES (KM)
Compton Thrust	47.0 (75.6)
Coronado Bank	55.4 (89.2)
Cucamonga	35.0 (56.4)
Earthquake Valley	52.1 (83.9)
Elsinore - Glen Ivy	13.4 (21.6)
Elsinore - Julian	27.9 (44.9)
Elsinore - Temecula	13.2 (21.3)
Elysian Park Thrust	41.8 (67.2)
Emerson South - Copper Mountain	60.9 (98.0)
Eureka Peak	49.8 (80.1)
Helendale - South Lockhardt	45.5 (73.3)
Johnson Valley (Northern)	56.5 (90.9)
Landers	51.3 (82.5)
Lenwood - Lockhart - Old Woman Springs	51.1 (82.3)
Newport - Inglewood (L.A. Basin)	45.0 (72.4)
Newport - Inglewood (Offshore)	39.0 (62.7)
North Frontal Fault Zone (East)	38.8 (62.4)
North Frontal Fault Zone (West)	33.9 (54.6)
Palos Verdes	55.1 (88.6)
Pinto Mountain	32.7 (52.7)
Rose Canyon	46.0 (74.1)
San Andreas - 1857 Rupture	43.6 (70.1)
San Andreas - Coachella	41.5 (66.8)
San Andreas - Mojave	43.6 (70.1)
San Andreas - San Bernardino	23.4 (37.6)
San Andreas - Southern	23.4 (37.6)
San Jacinto - Anza	14.4 (23.1)
San Jacinto - Coyote Creek	43.1 (69.4)
San Jacinto - San Bernardino	18.4 (29.6)
San Jacinto - San Jacinto Valley	9.6 (15.4)
San Jose	39.5 (63.5)
Sierra Madre	42.2 (67.9)
Whittier	28.0 (45.1)

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 (see Figure 2). Our field observations and review of readily available geologic data indicate that known active faults do not cross the site.

The acceleration-attenuation relations of Bozorgnia, Campbell, and Niazi (1999), and Campbell and Bozorgnia (1997), have been incorporated into EQFAULT (Blake, 2000a). 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 Bozorgnia, Campbell, and Niazi (1999), and Campbell and Bozorgnia (1997). These acceleration-attenuation relations have been incorporated in EQFAULT, a computer program by Thomas F. Blake (2000a), which performs deterministic seismic hazard analyses using 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 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 0.24g to 0.48g.

Historical site seismicity was evaluated with the acceleration-attenuation relations of Bozorgnia, Campbell, and Niazi (1999), and the computer program EQSEARCH (Blake, 2000b, updated to December 2004). This program performs a search of historical earthquake records for magnitude 4.0 to 9.0 seismic events within a 100-mile radius, between the years 1800 to December, 2004. 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, 2005 was 0.38g. 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. Printouts from EQSEARCH are provided in Appendix C.

A probabilistic seismic hazards analysis was performed using FRISKSP (Blake, 2000c) 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 0.55g 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). Printouts from FRISKSP are also included in Appendix C.

CALIFORNIA FAULT MAP

4787-A

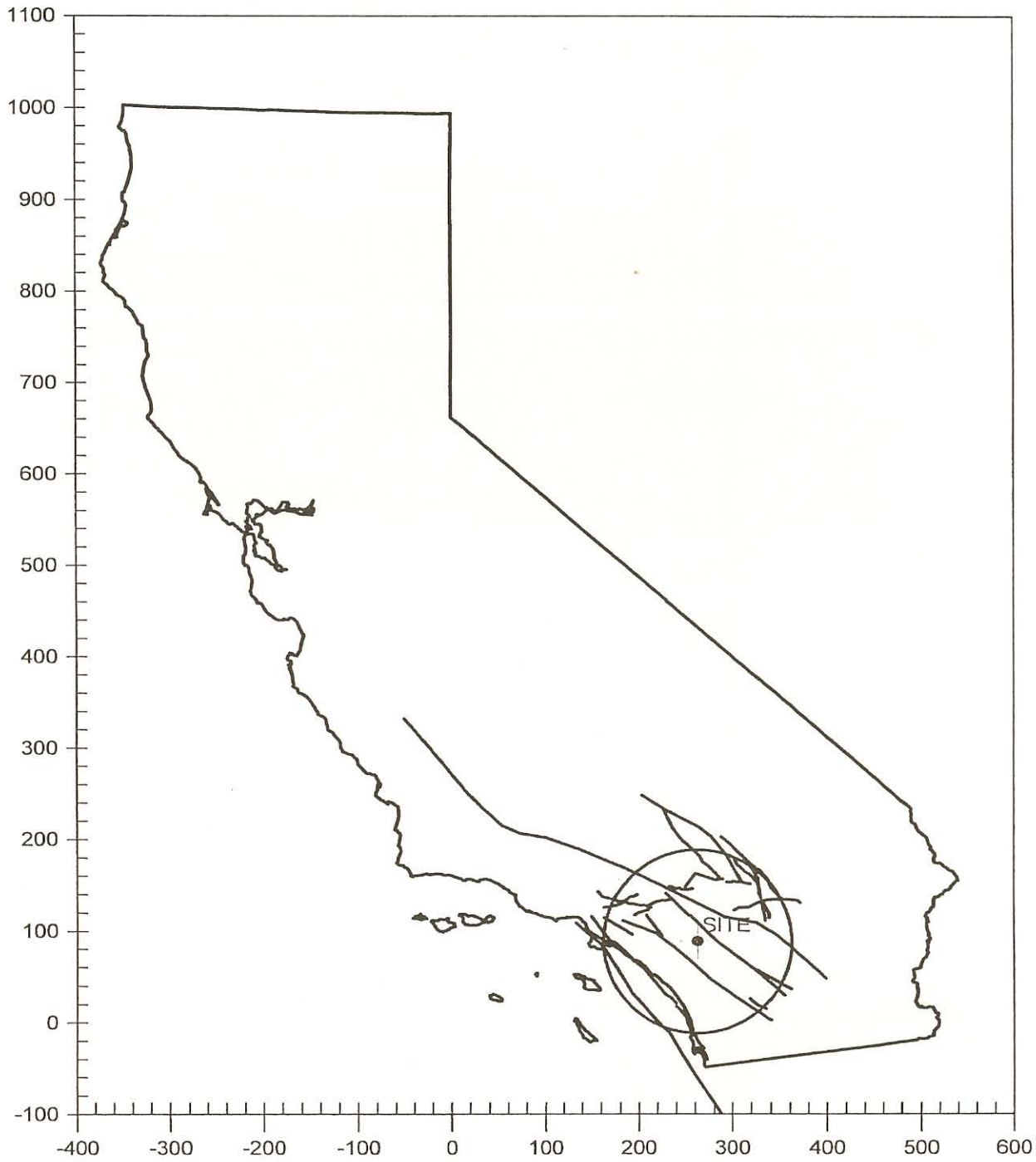


Figure 2

Seismic Shaking Parameters

Based on the site conditions, Chapter 16 of the UBC/CBC (ICBO, 1997), and ICBO (1998), the following seismic parameters are provided.

UBC/CBC TABLE/FIGURE DESIGNATION	FAULT PARAMETERS
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*)	1.0
Distance to Seismic Source (San Jacinto Valley fault)	9.6 mi. (15.4 km)
Seismic Source Type (per Table 16-U*)	B**
Upper Bound Earthquake (San Jacinto Valley fault)	M_W 6.9**
* Figure and table references from Chapter 16 of the UBC/CBC (ICBO, 1997 and 2001). ** ICBO (1998).	

GROUNDWATER

Seeps, springs, mottled soils, or other indications of a high groundwater level were not noted on the subject property during the time of our field investigation to depths in excess of ±39½ feet. Based on historic water well data acquired from the California Department of Water Resources (CDWR, 2004), "Water Data Library," groundwater levels in other nearby wells were previously measured at depths ranging from ±92 feet to in excess of +135 feet below the ground surface. However, perched groundwater onsite may occur in the bedrock and alluvial fan materials, or along jointing and/or fractures due to migration from adjacent drainage areas and development during and/or after periods of above normal or heavy precipitation or irrigation. Thus, perched groundwater conditions may occur in the future, and should be anticipated. Should manifestations of perched conditions (i.e., seepage) develop in the future, GSI could assess the conditions and provide mitigative recommendations, as necessary. This potential should be disclosed to all homeowners and any homeowners association. Additional discussions of groundwater are presented within the conclusions section of this report.

OTHER GEOLOGIC HAZARDS

Liquefaction

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.

Liquefaction susceptibility is related to numerous factors and the following conditions should be concurrently 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.

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 or natural ground slopes within susceptible materials. No such loading conditions exist on the site. In the site area, we found there is a potential for seismic activity and a groundwater table deeper than ±39½ feet below the ground surface. In addition, relatively shallow granitic bedrock was encountered across portions of the site that was dense to very dense.

It should be noted that throughout our site observations and borings and test pits, 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 sediment, lateral spreads, or soft-sediment deformation. 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 regional water table.

Inasmuch as at least two or three of these five required concurrent conditions discussed above do not have the potential to affect the site, evidence of paleoliquefaction features was not observed, and the relatively dense alluvial fan deposits or bedrock that underlies the site, our evaluation indicates that the potential for liquefaction and associated adverse

effects within the site is low, even with a future rise in groundwater levels. The site conditions will also be improved by removal and recompaction of low density near-surface soils. Therefore, it is our opinion that the liquefaction potential does not constitute a significant risk to site development.

Subsidence

The effects of areal subsidence generally occur at the transition or boundaries between low-lying areas and adjacent hillside terrain, where materials of substantially different engineering properties (i.e., alluvium vs. bedrock) are present. The potential for this condition exists between the bedrock and alluvial fan deposits. However, based on the available data, the site is not situated at, or near the boundaries of an actively subsiding basin. Therefore, the potential for this phenomena to affect the site is also considered low.

In addition, our review of available data, as well as 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, or hydroconsolidation in the specific site vicinity, is occurring at this time. Therefore, the potential for areal subsidence or ground fissures is deemed low. However, groundwater levels may change in the future as a result of groundwater withdrawal/pumping, climatic change, or irrigation.

Mass Wasting

Mass wasting refers to the various processes by which earth materials are moved down slope in response to the force of gravity. Examples of these processes include slope creep, surficial failures, rockfall, deep-seated landslides, etc. Creep is the slowest form of mass wasting and generally involves the outer 5 to 10 feet of the slope surface. During heavy rains, such as those in 1969, 1978, and 1980, 1983, 1993, 1998, and 2004/2005 creep-affected materials may become saturated, resulting in a more rapid form of down slope movement (i.e., landslides, surficial failures, and/or rockfall). However, the subject site consists of relatively low gradient terrain and indications of significant mass wasting phenomena on the site were not observed during our review of stereoscopic photographs of the area (USDA, 1980) or during our site reconnaissance mapping. However, due to the non-cohesive materials that may exist on portions of the site, caving and sloughing should be anticipated in all subsurface excavations and trenching. Appropriate safety considerations for potential caving and sloughing, such as shoring or layback cuts, should be incorporated into the construction design details. Therefore, based on the above, the potential for mass wasting phenomena within the site is considered low, provided our recommendations are properly implemented. Likewise, the potential for seismically induced landsliding is considered low. The potential for flooding should be evaluated by the design civil engineer.

LABORATORY TESTING

Classification

Soils were classified visually according to the Unified Soils Classification System and by supplemental index testing. The soil classifications are shown on the Boring Logs and Test Pit Logs (Appendix B).

Moisture-Density

The field moisture content and dry unit weight were determined for each undisturbed sample of the soils encountered in the borings. The dry unit weight was determined in pounds per cubic foot (pcf), and the field moisture content was determined as a percentage of the dry weight. The results of these tests are shown on the Boring Logs (Appendix B).

Laboratory Standard

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

SOIL TYPE	LOCATION AND DEPTH (ft.)	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
Gray, SILTY SAND	TP-4 @ 3' - 4'	135.0	8.5
Reddish Brown, SILTY SAND	TP-10 @ 3' - 4'	136.0	8.0

Expansion Index Testing

Expansion Index (E.I.) testing was performed on a representative soil sample, according to Standard No. 18-2 of the UBC/CBC (ICBO, 1997 and 2001). The test results are presented below as well as the expansion classification according to UBC/CBC (ICBO, 1997 and 2001).

LOCATION	SOIL TYPE	EXPANSION INDEX	EXPANSION POTENTIAL
TP-4 @ 3' - 4'	Gray, SILTY SAND	0	Very Low
TP-13 @ 2½' - 3½'	Reddish Brown, SILTY SAND	23	Low

Plasticity Index Testing/Atterberg Limits

For preliminary foundation planning purposes, plasticity index testing was performed where E.I. testing indicated an E.I. greater than 20. Testing was performed to evaluate the liquid limit, plastic limit and plasticity index in general accordance with ASTM D-4318-64. The test results were also utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test result and classification are presented in the following table:

LOCATION	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
TP-13 @ 2½' - 3½'	34	18	16

Sulfate/Corrosion Testing

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 @ 5 - 6'	0.0052	8.4	2,100

For preliminary planning purposes, based upon the soluble sulfate test results and the latest edition of the UBC/CBC (ICBO, 1997 and 2001), the soluble sulfate content is categorized as negligible. Therefore, on a preliminary basis, sulfate-resistant concrete (Type V), with 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 judged to be generally moderately alkaline (pH of 7.9 to 8.4) and are considered to be moderately corrosive (resistivity of 2,000 to 10,000) toward ferrous metals in a saturated state.

Although the site soils are categorized as being moderately corrosive toward ferrous metals, no exposure conditions stated in Table 19-A-2 of the UBC/CBC (ICBO, 1997 and 2001) were 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 preliminary soluble sulfate content on the subject site is considered negligible. Based on the test results obtained, a consulting corrosion engineer should be retained to provide specific recommendations for foundations, metal, piping, etc., that may come into contact with site soils.

Consolidation Testing

Consolidation testing was performed on a relatively undisturbed soil samples in general accordance with ASTM Test Method D-2435. The consolidation test results are presented in Appendix D.

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 samples were sheared under varying confining loads in order to determine the Coulomb shear strength parameters, angle of internal friction and cohesion. The testing was performed on an undisturbed and remolded sample of the alluvial fan deposits. The shear testing results are presented in Appendix D.

R-value Testing

Two representative samples were collected for resistance (R-value) testing to aid with preliminary pavement design. The samples were tested and evaluated in general accordance with California Materials Method No. 301. The test results indicated R-values of 15 and 41. The test results are presented in Appendix D. Preliminary pavement design recommendations are presented in following sections of this report.

EMBANKMENT FACTORS

Embankment factors (shrinkage) for the site have been estimated based upon our field and laboratory testing, visual site observations, and experience. 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, and discing. However, all these factors are difficult to define in a three-dimensional fashion. Therefore, the information presented below represents average shrinkage/bulking values, using certain earthwork assumptions as follows:

Range of maximum density = 135.0 to 136.0 pcf
Relative Compaction = 92%

Material	% Range
Colluvium/Topsoil Deposits	-15 to -22 (shrinkage)
Alluvium Deposits	-18 to -25 (shrinkage)
Quaternary Alluvial Fan Deposits	-10 to -15 (shrinkage)
Bedrock (Weathered - 25% Rock Fragments, 75% Earth Materials)	0 to -8 (shrinkage)
Bedrock (Mix - 50% Rock Fragments, 50 % Earth Materials)	0 to -5 (shrinkage)
Bedrock (Unweathered -75% Rock Fragments, 25% Earth Materials)	0 to +12 (bulking)

An additional shrinkage factor item would include the removal of individual large plants or trees. The root structures/root balls of these plants and trees vary in size, but when pulled, they may result in a loss of ½ to 1½ cubic yards. This factor needs to be multiplied by the number of significant plants or trees present to determine the net loss. Subsidence due to dynamic compaction from equipment routes, etc., is estimated to be 0.10 feet in non-bedrock areas. Furthermore, the grading contractor also influences shrinkage based on the degree of compaction attained in the field (i.e., 90 vs. 94 percent compaction, etc.)

The above factors indicate that earthwork balance of the site would be difficult to define and flexibility in design is essential to achieve a balanced end product.

ROCK HARDNESS EVALUATION

A seismic refraction survey, consisting of four seismic refraction lines, was conducted using a Geometrics SmartSeis 12-channel exploration seismograph, with a hammer and plate energy source. The approximate seismic line locations are shown on the enclosed Plate 1 (Geotechnical Map), and the velocity and depth interval results are graphically shown in Appendix E. An example of the raw seismic data is included as Plate E-1, and illustrates a forward and split spread shot from the same line.

The first arrival information, shot point locations, geophone locations, and line geometry from each survey are utilized in the computer programs SIPIK, SIPT2, and SIPLOT and/or SIPwin (Rimrock Geophysics, 1995,1997, and 2002) which produces time-distance plots for each of the survey lines (see example, Plate E-2). The graphic curves reflect the actual time-distance plots generated by the program, showing the shot points and phone locations. The first curve, from left to right shows the forward spread from the first shot. The second, or split spread shot point creates two curves in opposite directions from the shot in the middle of the spread. The third curve represent the reverse shot from the distant end of the spread.

The data for the surveys performed generally show a three-layer case. The uppermost layer is generally thin as would be expected, reflecting the surficial materials (i.e., topsoil/colluvium and/or alluvium). Undulations in time-distance curves can be attributed to a lack of elevation corrections to the raw data, possible minor disturbances from noise (e.g., wind or traffic), decreased energy at distant geophones, and discontinuities in the subsurface.

The velocity-depth models, or cross-sections, generated are included as Plates E-3 through E-6 for SL-1 through SL-4, respectively. As can be seen on these plates, the boundaries between various seismic velocity layers appear to be somewhat undulatory, typical of fractured and weathered crystalline (i.e., granitic) rocks where there is a access to the subsurface for air and water. Fracture density/frequency also contributes to the variation in depth of weathering and therefore differences in seismic velocities.

Layer boundaries tend to mimic the surface topography, although variations are common depending upon the depth of weathering, fracturing, etc. Thickness of the surficial layer (i.e., colluvium/topsoil and/or alluvium, or weathered bedrock) averages about ±3 feet, but generally varies from ±2 to ±4 feet. Average velocity of Layer 1 materials is about ±1,517 feet per second (fps). This is typical for such material. The average thickness of Layer 2 (generally weathered bedrock) is about ±20 feet, but ranges from ±14 to ±34 feet. Average velocity of Layer 2 is about ±3,355 fps, with some variability. Average velocity in Layer 3 (unweathered bedrock), is about ±5,065 fps, with seismic velocities ranging from 3,889 to 7,802 fps. At depths where velocities are greater than about 5,000 to 6,000 fps, rippability is ambiguous and blasting usually is required.

An evaluation has been made of the seismic refraction line data to estimate the approximate depth to non-rippable trenching (i.e., utility excavation) and to non-rippable bedrock. Approximate cut-off velocities of ±3,800 and ±6,000 fps were used as a basis for non-rippable trenching (assuming a Cat 235 Hoe [a large trackhoe], or equivalent), and non-rippable bedrock (assuming a D9L, or equivalent), respectively. It should be noted that a conventional rubber-tired backhoe will experience non-productive trenching at seismic velocities much less than ±2,000 to 2,500 fps.

Bedrock excavatability with respect to trenching shallower than the approximate ±3,800 fps cut-off depth is expected to vary from easy to very difficult and the necessity for localized areas requiring blasting cannot be precluded. Similarly, bedrock rippability shallower than the approximate ±6,000 fps cut-off depth is expected to vary from easy to very difficult, and the necessity for localized areas requiring blasting cannot be entirely precluded.

Variations should be expected. As such, bedrock excavations from the surface downward may generate oversize rock. Isolated "floaters or corestones may also be encountered, and should be anticipated, based on our field mapping and rock outcrops exposed at the surface (see Plate 1). The bulk of the materials derived from the weathered portion of the bedrock (up to and including the ±3,800 to 6,000 fps cut-off) are anticipated to disintegrate to approximately 12 to 24 inches and smaller constituents. Any oversize materials (≥ 12 inches) generated would require special handling for use in fills, and may not be placed within 10 feet of finish grade or used as backfill in utility trenches.

Based upon our experience in this area, and the seismic refraction data obtained, the following table reflects our estimates of the rippability at the various seismic refraction survey lines; other interpretations are possible:

SEISMIC LINE NO.	GENERAL RIPPABILITY (ASSUMING A D9L DOZER OR CAT 235 HOE, OR EQUIVALENT)
SL-1	Rippable to a depth of ±45 feet on the north, and ±45 feet on the south. Non-trenchable below ±30 feet on the north, and ±19 feet on the south.
SL-2	Rippable to a depth of ±55 feet on the east, and ±55 feet on the west. Non-trenchable below ±24 feet on the east, and ±18 feet on the west.
SL-3	Rippable to a depth of ±35 feet on the north, and ±25 feet on the south. Non-trenchable below ±3 feet on the north, and ±2 feet on the south.
SL-4	Rippable to a depth of ±45 feet on the east, and ±45 feet on the west. Non-trenchable below ±14 feet on the east, and ±14 feet on the west.

Due to the nature of the surficially discontinuous and/or relatively near-surface granitic terrain in the northeastern part of the site, localized blasting may be anticipated in those areas to achieve proposed cut depths as well as street/roadway undercuts for utility construction in the future, or for foundations.

Using the 3,800 fps cut-off for non-rippable trenching (in lieu of street overexcavation), it is likely that very difficult ripping to possible blasting (e.g., "line-shooting") may be necessary for trenching of utilities along the proposed roadway alignments in the northeastern portion of the site. As an alternative to blasting for utilities, overexcavation of street areas during mass grading to 1 foot below the depth of the lowest utility should be considered. This is not a geotechnical requirement; however, it may be mandated by the governing agency.

Summary

In general, utilizing the seismic data in conjunction with relevant boring and test pit information, it appears the majority of the site (excepting the granitic knoll area in the northeastern part of the site) may be characterized as being mantled by a relatively thin layer of topsoil/colluvium to depths generally ranging from about ±2, up to about ±4 feet in thickness. Below that horizon (excepting the granitic knoll area in the northeastern part of the site), Quaternary fan deposits were encountered to a depth in excess of ±39½ feet in thickness. Underlying the surficial soils and weathered bedrock in the granitic knoll area in the northeastern part of the site, fresh and very dense granitic rock locally exists within ±25 to ±34 feet from the surface (see SL-3). Based on all of the above, it is anticipated that the need for overexcavation and/or line shooting may be necessary in some portions of the site. The need for localized blasting cannot be ruled out. It should be noted that a conventional rubber-tired backhoe will experience non-productive trenching at seismic velocities much less than ±2,000 to 2,500 fps. The seismic refraction data presented herein should be further reviewed in conjunction with future grading plans (when available).

Variations should be expected. As such, bedrock excavations from the surface downward may generate oversize rock. The bulk of the materials derived from the weathered portion of the bedrock (up to and including the ±3,800 fps and ±6,000 fps cut-offs) are anticipated to disintegrate to approximately 12- to 24-inch and smaller constituents. Any oversize materials generated would require special handling for use in fills, as outlined later in this report under "Rock Disposal." Due to the nature of the bedrock terrain, localized blasting may be anticipated on the northern portion of the site to achieve proposed cut depths.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

General

Based on our field exploration, laboratory testing and geotechnical engineering analysis, it is our opinion that the site appears suitable for the proposed development from a geotechnical engineering and geologic viewpoint, provided that the recommendations presented in the following sections are incorporated into the design and construction phases of site development. The primary geotechnical concerns with respect to the proposed development are:

- Depth to suitable bearing strata.
- Rock hardness/rippability, and potential for oversize materials requiring special handling and placement.
- Ongoing expansion and corrosion potential of site soils.
- Ongoing potential for perched water to occur during and after site development.
- Regional seismic activity.

The recommendations presented herein consider these as well as other aspects of the site. The engineering analyses performed concerning site preparation and the recommendations presented herein have been completed using the information provided by the client and obtained during our field work.

The conclusions and recommendations contained in this report shall not be considered valid unless the proposed development is reviewed and the recommendations of this report verified or modified in writing by this office. Foundation design parameters are considered preliminary until the foundation design, layout, and structural loads are provided to this office for review.

1. Soil engineering, observation, and testing services should be provided during grading to aid 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, supplemental recommendations and earthwork may be warranted.

3. Removal and recompaction of the topsoil/colluvium, alluvium, and weathered near surface fan deposits (additional ±1 to ±2 feet) will be required should settlement sensitive improvements be proposed within their influence. For preliminary planning purposes, these depths are estimated to range from ±2½ to ±4 feet across the site, with localized deeper removals on the order of ±8 feet deep, or deeper, if not removed by planned excavation. Moisture-density and consolidation test results indicate the materials are not uniform, are potentially subject to hydrocollapse and/or compression in their present condition, and may be subject to adverse differential settlement, if not mitigated during site grading operations.

4. Due to the nature of bedrock materials on the northeastern portion of the site oversize materials (boulders) will be encountered during grading. This may necessitate the construction of rock fills, rock fill blankets, or reduction of size during grading operations. Offsite disposal, placement in proposed non-structural fill areas, and/or landscape use of any oversized materials encountered may also be considered. As per UBC/CBC (ICBO, 1997 and 2001) requirements, no oversize materials greater than 12 inches in diameter should be placed within 10 feet of finish grade. Procedures for the construction of rock fills or rock fill blankets are outlined in the Fill Placement and Rock Disposal sections of this report.

5. In general and based upon the available data to date, groundwater is not expected to be a major factor in 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 within any drainage areas. In addition, seepage may be encountered in "daylighted" joint systems within the granitic bedrock and/or alluvial fan deposits. Therefore, subdrainage systems for the control of localized groundwater seepage should be anticipated, both during and after grading.

6. Cavities or loose soils remaining after demolition and site clearance (including geotechnical test pits) should be cleaned out and observed by the soil engineer. The cavities should be replaced with fill materials that have been moisture conditioned to at least optimum moisture content and compacted to at least 90 percent of the laboratory standard.

Treatment of Existing Ground

1. All topsoil/colluvium, alluvium, and near-surface weathered fan deposits and/or weathered bedrock should be removed to competent alluvial fan deposits or dense bedrock, as defined herein, (i.e., removal bottoms should be greater than, or equal to, 85 percent saturation, and/or greater than, or equal to, 105 pcf dry density for

in-place native materials), which has been demonstrated and proven to the controlling authorities as acceptable in the past to mitigate the potential for hydroconsolidation. For preliminary planning purposes, these depths are estimated to range from ±4 to ±5 feet across the site, with localized deeper removals on the order of ±8 feet deep, or deeper. Variations from these thicknesses should be anticipated. Actual depths of removals will be evaluated in the field during grading by the soil engineer.

2. Subsequent to the above removals, the upper 12 inches of the exposed fan deposits and/or granitic bedrock 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. Existing topsoil/colluvium and alluvium, etc., and removed natural ground materials may be reused as compacted fill provided that major concentrations of vegetation and miscellaneous trash and debris are removed prior to or during fill placement.

4. 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. Subsequent to ground preparation, fill materials should be brought to at least optimum moisture content, 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 8 inches in diameter should be placed under the recommendations and supervision of the soils engineer and/or reduced in size and/or removed from the site. Should significant amounts of oversize rock be encountered, recommendations for rock fill placement will be provided by GSI. As per UBC/CBC (ICBO, 1997 and 2001) requirements, no oversize materials greater that 12 inches in diameter should be 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 a greater sulfate and/or expansion value than the onsite materials encountered in this investigation.

Transition Areas/Overexcavation

In order to reduce the potential for differential settlements between cut and fill materials, materials of differing expansion potentials, or dense bedrock, the entire cut portion of cut/fill transitions within proposed residential lots (per the UBC/CBC) should be overexcavated to a minimum depth of 3 feet below finish grade, or 2 feet below foundation elements, and/or a maximum ratio of fill thickness on the lot of 3:1 (h:v), whichever is more onerous, and replaced with compacted fill.

ROCK PLACEMENT GUIDELINES

Rock Disposal

We anticipate that soils to be utilized as fill material for the subject tract may contain rock. Appropriately, the need for rock disposal may be necessary during grading operations on the site. Generally for the purpose of this report, the materials may be described as either 8 inches or less, greater than 8 and less than 36 inches, and greater than 36 inches. These three categories set the basic dimensions for where and how the materials are to be placed.

Materials 8 Inches in Diameter or Less:

Since imported rock fragments along with the overburden materials are anticipated to be a part of the materials used in the grading of the site, a criteria is needed to facilitate the placement of these materials within guidelines which would be workable during the rough grading, post-grading improvements, and serve as acceptable compacted fill.

1. Fines and rock fragments 8 inches or less in diameter may be placed as compacted fill cap materials within the building pads, slopes, and street areas as described below. The rock fragments and fines should be brought to at least optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard.

2. The purpose for the 8-inch diameter limits is to allow reasonable sized rock fragments into the fill under selected conditions (optimum moisture or above) surrounded with compacted fines. The 12-inch diameter size also allows a greater volume of the rock fragments to be handled during grading, while staying in reasonable limits for later onsite excavation equipment (backhoes and trenchers) to excavate footings and utility lines.

3. Fill materials 8 inches or less in diameter should be placed, but not limited to, within the upper 10 feet of proposed fill pads, the upper 3 feet of overexcavated cut areas of cut/fill transition pads, and the entire street right-of-way width, including the proposed overexcavated areas and replacement fill areas, from the depth of the lowest utility to subgrade, or to a depth of 10 feet below finish grade. Overexcavation is discussed earlier in this report.

Materials Greater Than 8 and Less Than 36 Inches in Diameter:

1. During the process of bedrock excavation, a significant amount of rock fragments or constituents larger than 8 inches in diameter may be generated. These significant amounts of oversized materials between greater than 8 and less than 36 inches in diameter may be incorporated into the fills utilizing a series of rock blankets.

2. Each rock blanket should consist of rock fragments of approximately greater than 8 and less than 36 inches in diameter along with fines generated from the proposed cuts and overburden materials from removal areas. The blankets should be limited to 24 to 36 inches in thickness and should be placed with granular fines which are flooded into and around the rock fragments.

3. Rock blankets should be restricted to areas which are at least 1 foot below the lowest utility invert within the street right-of-way, 10 feet below finish grade on the proposed fill lots, and a minimum of 15 horizontal feet from any fill slope surface.

4. Compaction may be achieved by utilizing wheel rolling methods with scrapers and water trucks, track-walking by bulldozers, and sheepsfoot tampers.

5. Each rock blanket should be completed with its surface compacted prior to placement of any subsequent rock blanket or rock windrow.

Materials Greater Than 36 Inches in Diameter:

1. Oversize rock greater than 36 inches in diameter should be placed in single rock windrows. The windrows should be at least 15 feet or an equipment width apart, whichever is greatest.

2. The void spaces between rocks in windrows should be filled with the more granular soils by flooding them into place.

3. A minimum vertical distance of 3 feet between soil fill and rock lift should be maintained. Also, the windrows should be staggered from lift to lift. Rock windrows should not be placed closer than 15 feet from the face of fill slopes.

4. Larger rocks too difficult to be placed into windrows may be individually placed into a dozer trench. Each trench should be excavated into the compacted fill or dense natural ground a minimum of 1 foot deeper than the size of the rock to be buried. After the rocks are placed in the trench (not immediately adjacent to each other), granular fill material should be flooded into the trench to fill the voids.

5. The oversize rock trenches should be no closer together than 15 feet at a particular elevation and at least 15 feet from any slope face. Trenches at higher elevations should be staggered and there should be 4 feet of compacted fill between the top of one trench and the bottom of the next higher trench. Placement of rock into these trenches should be under the full-time inspection of the soils engineer.

6. Consideration should be given to using oversize materials in open space "greenbelt" areas that would be designated as non-structural fills.

SUBDRAINS

Subdrains may be necessary where local seepage along the contact between the proposed fill and underlying alluvial fan deposits and/or bedrock exist, or within the proposed fill along contrasting zones of permeabilities (e.g., sand vs. silt, or clay). Owing to the generally flat nature of the site, lack of canyons, lack of gradient at flowline elevations, and the lack of suitable cover (i.e., less than about 10 feet of fill), subdrains are generally not anticipated during grading, but may not be entirely precluded. If required, where removals are below the subdrain flowline, the removal materials may be reused as compacted fill provided they are granular, and at a moisture content of at least 2 percent over optimum moisture content (or 1.2 times optimum moisture content, whichever is greater). If necessary, actual locations of subdrains will be provided during the grading plan review stage or during grading, based on exposed conditions. The project civil engineer should locate and map any subdrain and outlet systems.

PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

The governing agency may retain the authority to approve the final structural design sections after subgrade elevations and actual Resistance Values (R-values) have been obtained at the conclusion of earthwork. Typically actual pavement sections will likely vary, therefore final pavement sections should be based on actual R-value testing performed during, or shortly after site grading for the street improvements, by the controlling authorities.

The preliminary pavement sections presented in the following table are based on assumed Traffic Indices (T.I.'s) for a short local street, a general local road, a residential collector, an industrial collector or secondary highway, and the guidelines presented in the latest

revision to the California Department of Transportation "Highway Design Manual" fifth edition. It is our understanding that the minimum pavement section required by the County for a short local street is 3 inches of AC (asphaltic concrete) on 6 inches of Class 2 aggregate base for a T.I. of 5.0 to 6.0.

Based on the laboratory test results obtained (R=15 and R=41), the following ranges for preliminary pavement design are presented.

PRELIMINARY PAVEMENT THICKNESS			
STREET CLASSIFICATION	STANDARD PAVEMENT DESIGNS		
TRAFFIC INDEX (T.I.)	R-VALUE RANGE	AC (INCHES)	CLASS 2 BASE ROCK [1] (INCHES)
Short Local Street 5.0	15 41	3.0 3.0*	8.0 6.0*
General Local Road 5.5	15 41	3.0 3.0	10.0 6.0*
Residential Collector 6.5	15 41	3.6* 3.6*	12.5 6.5
Industrial Collector or Secondary Highway 7.5	15 41	4.3* 4.3*	14.5 7.5

[1] Assumed R-values for base rock R=78 - Cal-Trans standard Class 2 base rock. Values for T.I. (Traffic Index= 5.0, 5.5, 6.5, and 7.5).
* Minimum required by the County of Riverside

The preliminary range of pavement sections provided above are intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. If the traffic index (T.I.), ADT (average daily traffic) or ADTT (average daily truck traffic) increases beyond that intended, as reflected by the traffic index used for design, increased maintenance and repair could be required for the pavement section.

SLOPE CONSIDERATIONS AND SLOPE DESIGN

All slopes should be designed and constructed in accordance with the minimum requirements of the UBC (ICBO, 1997), County of Riverside, the recommendations in Appendix F, and the following:

1. Fill slopes should be designed at a 2:1 (h:v) gradients 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 F.

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

3. Local areas of highly to severely weathered bedrock 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 fan deposits and/or bedrock materials. 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 debris and fines remaining on the face of the cut slopes should be removed during grading. This can be accomplished by a slope board 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.

6. Cut slopes should be mapped by the project engineering geologist during grading to allow amendments to the recommendations should exposed conditions warrant alternation of the design or stabilization.

PRELIMINARY RECOMMENDATIONS - FOUNDATIONS

General

The foundation design and construction recommendations are based on laboratory testing and engineering analysis of onsite earth materials by GSI. Recommendations for conventional foundation and post-tensioned systems are provided in the following sections, and are not intended to preclude the transmission of water or water vapor through slabs and foundations. Mitigation of this potential can be provided upon request. 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/CBC (ICBO, 1997 and 2001).

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 or other competent bearing material.

2. Analyses indicate that an allowable bearing value of 1,500 pounds per square foot (psf) 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 compacted fill. Isolated, square footings should extend a minimum of 18 inches into the compacted fill. The bearing value may be increased by one-third for seismic or other temporary loads. This value may be increased by 20 percent for each additional 12 inches in depth to a maximum of 2,000 psf. An increase in bearing value for footing width is recommended, only in the case of retaining wall footings. The increase should be limited to 100 psf for each additional foot of width. Continuous perimeter footings for soils with an E.I. greater than 20 should be designed in accordance with the UBC/CBC (ICBO, 1997 and 2001).

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 pcf with a maximum earth pressure of 2,500 psf.

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/CBC (ICBO, 1997 and 2001).

Construction

The following foundation construction recommendations are presented as a minimum criteria from a soils engineering viewpoint. The onsite soils expansion potentials are generally very low to Low (E.I. 0 to 50). However, based on our experience medium expansive soils may not be precluded from occurring onsite. Post-tensioned foundations will likely be recommended for medium expansive soils (i.e., E.I.>50). Therefore, recommendations for very low to medium expansion potentials, are included in the following sections.

Accordingly, the following foundation construction recommendations assume that the soils in the top 5 feet from finish grade may have a very low to medium expansion potential. 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 (E.I. 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, excluding the landscape zone. A minimum of 2 feet of compacted fill is recommended below foundation elements.

   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 piers and columns should be founded at a minimum depth of 18 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 large entrances. The base of the reinforced grade beam should be at the same elevation as the adjoining footings.

3. Concrete slabs in structural areas, including garage slabs, should be underlain with a vapor barrier consisting of a minimum of 10-mil, polyvinyl-chloride membrane with all laps sealed, per the UBC/CBC. This membrane should be and covered with a minimum of 2 inches of sand to aid in uniform curing of the concrete and prevent puncturing of the vapor barrier.

4. Concrete slabs, including garage slabs, should be a minimum of 4 inches thick, and 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 other structural 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 structural slabs should have an actual, minimum thickness of 4 inches, and the slab subgrade should be free of loose and uncompacted material prior to placing concrete.

7. Specific presaturation is not required 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/CBC (ICBO, 1997 and 2001) and provide a minimum of 7 feet horizontal distance from the slope face. Rigid block wall designs located along the top of slope should be reviewed by a soils engineer.

10. Proposed pools and other appurtenant structures should consider that excavation difficulties could be encountered in bedrock areas at depths greater than approximately ±3 to ±10 feet below proposed building pad grades.

11. As an alternative, an engineered post-tension foundation system may be used.

PRELIMINARY POST-TENSIONED SLAB DESIGN

The recommendations presented below should be followed in addition to those contained in the previous sections, as appropriate. As indicated previously, post-tensioned foundations will likely be recommended for medium expansive soils (i.e., E.I.>50). The information and recommendations presented below in this section are not meant to supercede design by a registered structural engineer or civil engineer familiar with post-tensioned slab design. Post-tensioned slabs should be designed using sound engineering practice and be in accordance with local and/or national code requirements. Upon request, GSI can provide additional data/consultation regarding soil parameters as related to post-tensioned slab design.

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

Perimeter cut-off walls should be a minimum of 18 inches deep for medium expansive soils. The cut-off walls may be integrated into the slab design or independent of the slab. The cutoff walls should be a minimum of 6 inches thick. For medium expansive soils, slab underlayment should consist of 4 inches of washed sand with a vapor barrier consisting of 10-mil polyvinyl chloride or equivalent placed mid-depth within the sand.

Specific soil presaturation is required if medium expansive soils are exposed at finish grade. The moisture content of the slab subgrade soils should be equal to, or greater than, 120 percent of the soil's optimum moisture content to a depth of 24 inches for medium expansive soils.

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 the slab. The potential for differential uplift can be evaluated using Section 1816 of the UBC/CBC (ICBO, 1997 and 2001), 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
Modulus of Subgrade Reaction (pci)	75
Moisture Velocity	0.7 inches/month

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 positive drainage that 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 Section 1816 of the UBC/CBC (ICBO, 1997 and 2001). 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	VERY LOW EXPANSION (E.I. = 0-20)	LOW EXPANSION (E.I. = 21-50)	MEDIUM EXPANSION (E.I. = 51-90)
e_m center lift	5.0 feet	5.0 feet	5.5 feet
e_m edge lift	2.5 feet	3.5 feet	4.0 feet
y_m center lift	1.0 inch	1.7 inches	2.7 inches
y_m edge lift	0.3 inch	0.75 inch	0.75 inch

Deepened footings/edges around the slab perimeter must be used to minimize non-uniform surface moisture migration (from an outside source) beneath the slab. An edge depth of 12 inches should be considered a minimum. 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 under conventional foundation and the California Foundation Slab Method should be adhered to during the design and construction phase of the project.

PRELIMINARY FOUNDATION SETTLEMENTS

In addition to designing slab systems (post-tension or other) for the soil conditions described herein, the estimated settlement and angular distortion values that an individual structure (including walls, spas, pools, or other settlement-sensitive improvements, etc.), 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 the minimum dimension of buildings; if, from a structural standpoint, a decreased or increased length over which the differential settlement is assumed to occur is justified, this change should be incorporated into the design.

The site is underlain at depth by Quaternary fan deposits and/or granitic bedrock. A preliminary evaluation of primary settlement and secondary compression within the area under the purview of this report has been conducted. The calculated estimate for the total settlement in approximately 2 inches over the life of the structure. Worst-case differential settlement has been calculated as 1 inch in 40 feet (i.e., at least 1 inch in a 40-foot span [1/480]).

Therefore, in addition to designing slab systems for the above soil conditions, the following settlement values should be utilized by the project structural engineer.

ESTIMATED TOTAL SETTLEMENT (Inches)	ESTIMATED DIFFERENTIAL SETTLEMENT (Inches)	ESTIMATED ANGULAR DISTORTION
2.0	1.0	1/480

Any post-construction settlement of the fill should be readily mitigated by proper foundation design, provided the design parameters, provided in this report, are properly utilized in final design of the residential 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 controlling authorities and/or the UBC/CBC (ICBO, 1997 and 2001). Alternatives to Post- Tensioning Institute methodology (i.e., "spanability") may be used if equivalent systems can be proposed which accommodate the angular distortions, expansion parameters, and settlements noted for the project. If alternatives to Post-Tensioning Institute are suggested by the structural consultant, this office should review the final foundation plans.

PRELIMINARY WALL DESIGN PARAMETERS

Conventional Retaining Walls

The design parameters provided below assume that either non expansive soils (typically Class 2 permeable filter material or Class 3 aggregate base) or native onsite materials (up to and including an E.I. of 65) are used to backfill any retaining walls. The type of backfill (i.e., select or native), should be specified by the wall designer, and clearly shown on the plans. 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 this and preceding sections of this report, as appropriate. Footings should be embedded a minimum of 18 inches below adjacent grade (excluding landscape layer, 6 inches) and should be 24 inches in width. There should be no increase in bearing for footing width. Recommendations for specialty walls (i.e., crib, earthstone, geogrid, etc.) can be provided upon request, and would be based on site specific conditions.

Restrained Walls

Any 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 (EFP) of 65 pounds per cubic foot (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 (2H) laterally from the corner.

Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 10 feet high. Design parameters for walls less than 3 feet in height may be superceded by City and/or County standard design. 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 due to traffic, structures, seismic events or adverse geologic conditions. When wall configurations are finalized, the appropriate loading conditions for superimposed loads can be provided upon request.

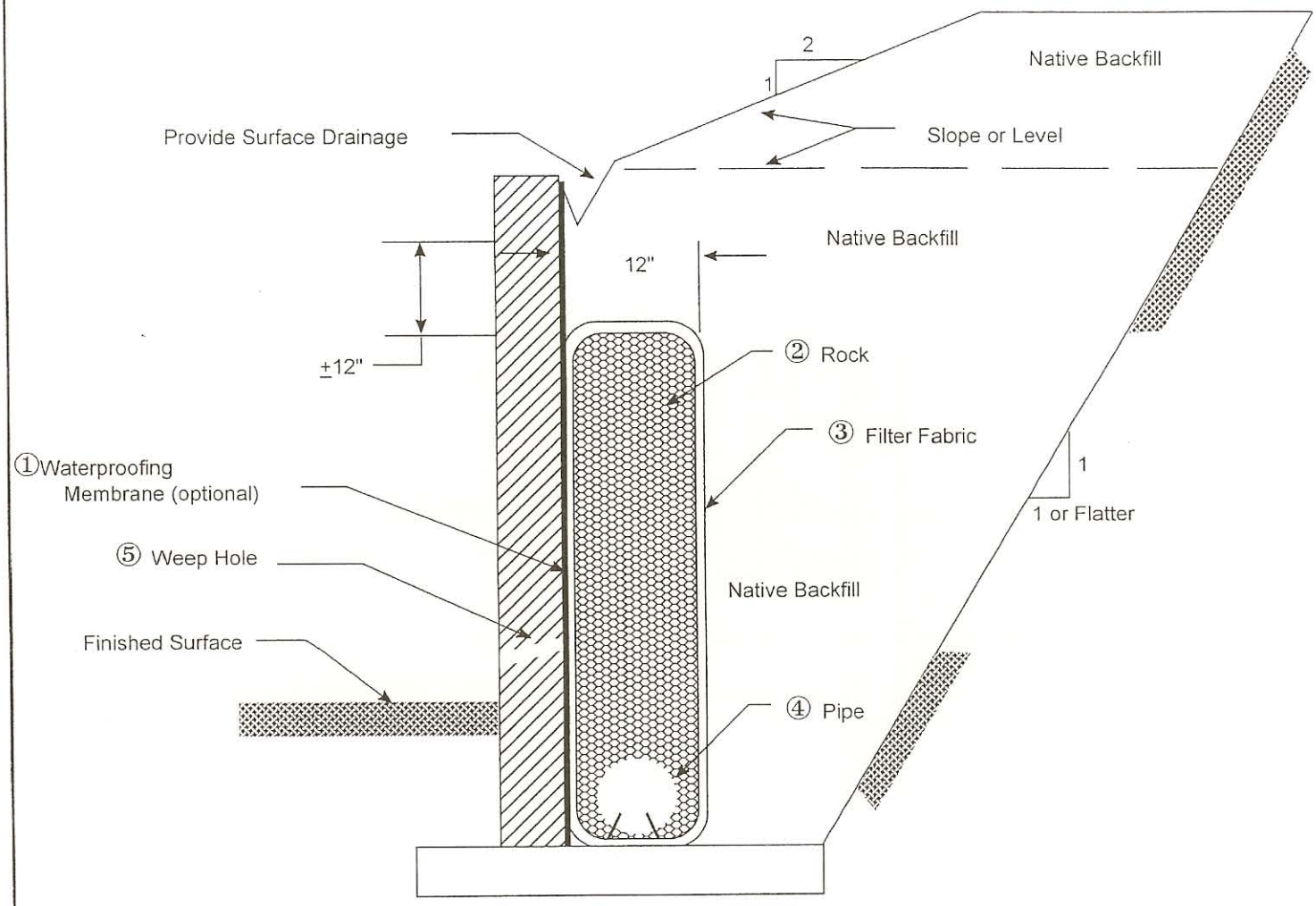
SURFACE SLOPE OF RETAINED MATERIAL (HORIZONTAL:VERTICAL)	EQUIVALENT FLUID WEIGHT P.C.F. (SELECT BACKFILL)	EQUIVALENT FLUID WEIGHT P.C.F. (NATIVE BACKFILL)
Level*	35	45
2 to 1	50	60
* Level backfill behind a retaining wall is defined as compacted earth materials, properly drained, without a slope for a distance of 2H behind the wall.		

Retaining Wall Backfill and Drainage

Positive drainage must be provided behind all retaining walls in the form of gravel wrapped in geofabric and outlets. A backdrain system is considered necessary for retaining walls that are 2 feet or greater in height. Details 1, 2, and 3, present the back drainage options discussed below. Backdrains should consist of a 4-inch diameter perforated PVC or ABS pipe encased in either Class 2 permeable filter material or ¾-inch to 1½-inch gravel wrapped in approved filter fabric (Mirafi 140 or equivalent). For low expansive backfill, the filter material should extend a minimum of 1 horizontal foot behind the base of the walls and upward at least 1 foot. For native backfill that has up to medium expansion potential, continuous Class 2 permeable drain materials should be used behind the wall. This material should be continuous (i.e., full height) behind the wall, and it should be constructed in accordance with the enclosed Detail 1 (Typical Retaining Wall Backfill and Drainage Detail). For limited access and confined areas, (panel) drainage behind the wall may be constructed in accordance with Detail 2 (Retaining Wall Backfill and Subdrain Detail Geotextile Drain). Materials with an E.I. potential of greater than 65 should not be used as backfill for retaining walls. For more onerous expansive situations, backfill and drainage behind the retaining wall should conform with Detail 3 (Retaining Wall And Subdrain Detail Clean Sand Backfill).

DETAILS

N . T . S .



① **WATERPROOFING MEMBRANE (optional):**
Liquid boot or approved equivalent.

② **ROCK:**
3/4 to 1-1/2" (inches) rock.

③ **FILTER FABRIC:**
Mirafi 140N or approved equivalent; place fabric flap behind core.

④ **PIPE:**
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point (Perforations down).

⑤ **WEEP HOLE:**
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface (No weep holes for basement walls.).

GeoSoils, Inc.

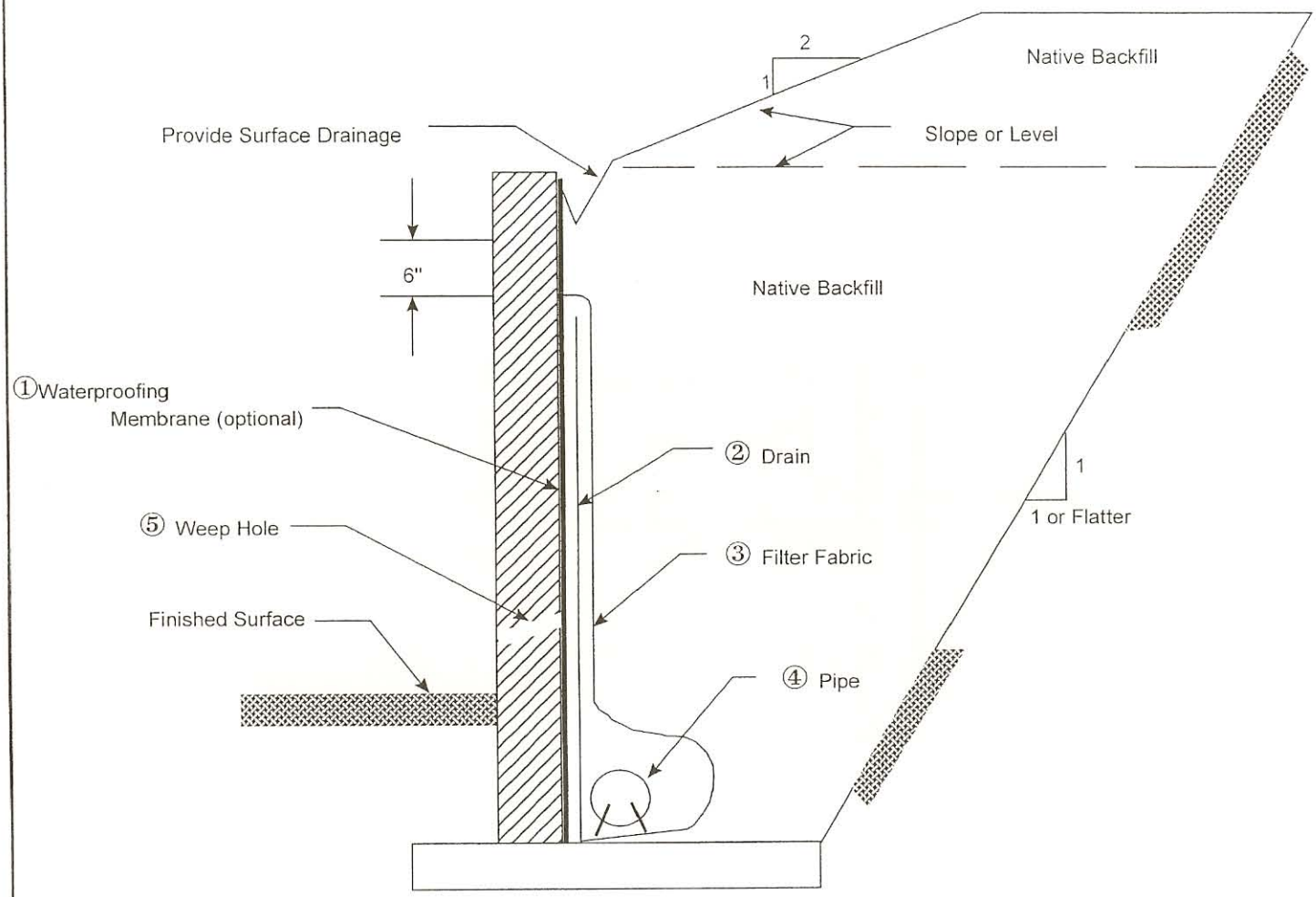
TYPICAL RETAINING WALL BACKFILL AND DRAINAGE DETAIL

DETAIL 1

Geotechnical • Coastal • Geologic • Environmental

DETAILS

N . T . S .



① **WATERPROOFING MEMBRANE (optional):**
Liquid boot or approved equivalent.

② **DRAIN:**
Miradrain 6000 or J-drain 200 or equivalent for non-waterproofed walls.
Miradrain 6200 or J-drain 200 or equivalent for waterproofed walls (All Perforations down).

③ **FILTER FABRIC:**
Mirafi 140N or approved equivalent; place fabric flap behind core.

④ **PIPE:**
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point.

⑤ **WEEP HOLE:**
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface. (No weep holes for basement walls.)

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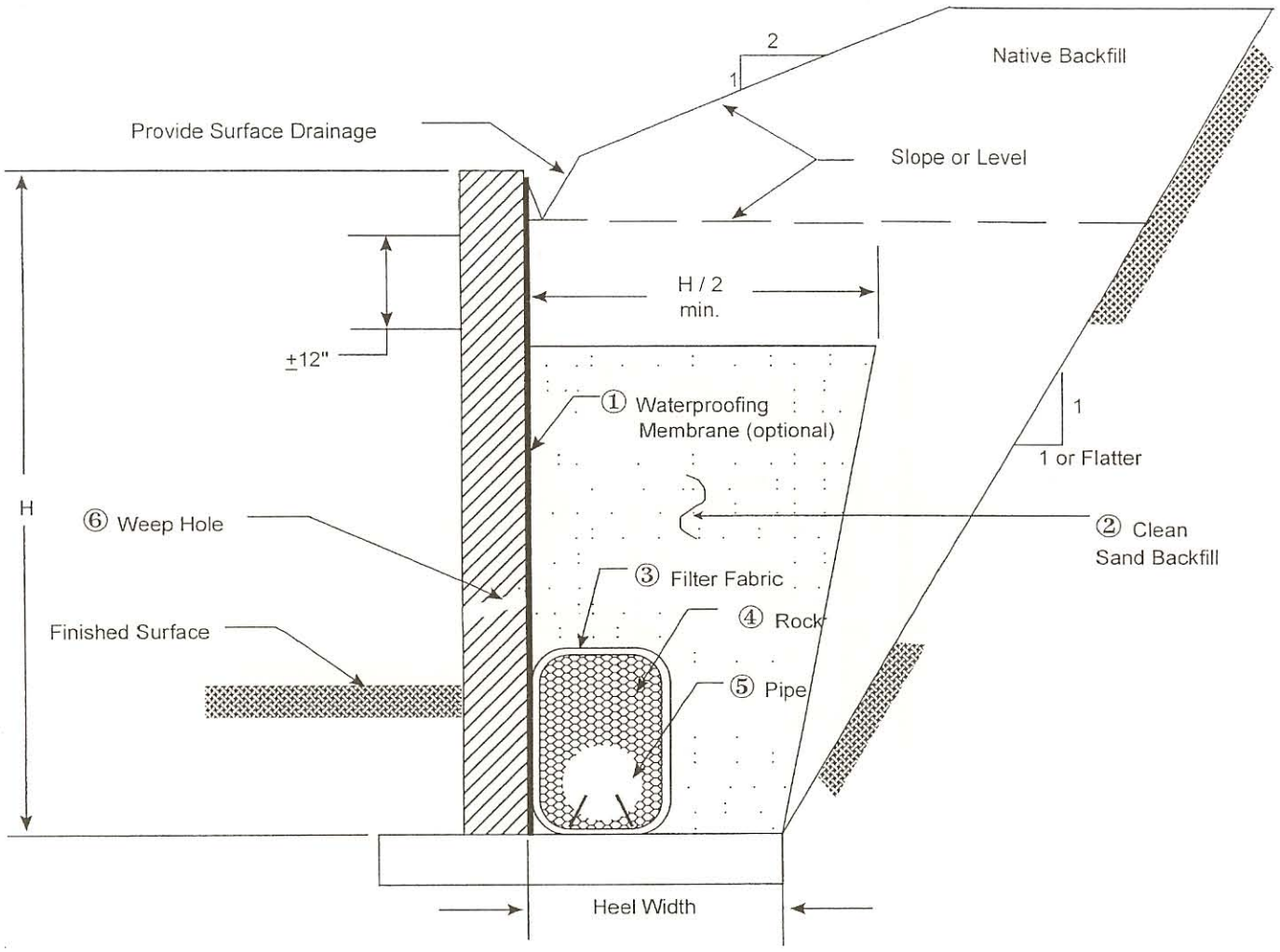
RETAINING WALL BACKFILL AND SUBDRAIN DETAIL GEOTEXTILE DRAIN

DETAIL 2

Geotechnical • Coastal • Geologic • Environmental

DETAILS

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① **WATERPROOFING MEMBRANE (optional):**
Liquid boot or approved equivalent.

② **CLEAN SAND BACKFILL:**
Must have sand equivalent value of 30 or greater; can be densified by water jetting.

③ **FILTER FABRIC:**
Mirafi 140N or approved equivalent.

④ **ROCK:**
1 cubic foot per linear feet of pipe or 3/4 to 1-1/2" (inches) rock.

⑤ **PIPE:**
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point (Perforations down).

⑥ **WEEP HOLE:**
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface. (No weep holes for basement walls.)

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RETAINING WALL AND SUBDRAIN DETAIL CLEAN SAND BACKFILL

DETAIL 3

Geotechnical • Coastal • Geologic • Environmental

Outlets should consist of a 4-inch diameter solid PVC or ABS pipe spaced no greater than ±100 feet apart, with a minimum of two outlets, one on each end. The use of weep holes, only, in walls higher than 2 feet, is not recommended. The surface of the backfill should be sealed by pavement or the top 18 inches compacted with native soil (E.I. ≤90). Proper surface drainage should also be provided. For additional mitigation, consideration should be given to applying a water-proof membrane to the back of all retaining structures. The use of a waterstop should be considered for all concrete and masonry joints.

Wall/Retaining Wall Footing Transitions

Site walls are anticipated to be founded on footings designed in accordance with the recommendations in this report. Should wall footings transition from cut to fill, the civil designer may specify either:

a) A minimum of a 2-foot overexcavation and recompaction of cut materials for a distance of 2H, from the point of transition.

b) Increase of the amount of reinforcing steel and wall detailing (i.e., expansion joints or crack control joints) such that a angular distortion of 1/360 for a distance of 2H on either side of the transition may be accommodated. Expansion joints should be placed no greater than 20 feet on-center, in accordance with the structural engineer's/wall designer's recommendations, regardless of whether or not transition conditions exist. Expansion joints should be sealed with a flexible, non-shrink grout.

c) Embed the footings entirely into native formational material (i.e., deepened footings).

If transitions from cut to fill transect the wall footing alignment at an angle of less than 45 degrees (plan view), then the designer should follow recommendation "a" (above) and until such transition is between 45 and 90 degrees to the wall alignment.

TOP-OF-SLOPE WALLS/FENCES/IMPROVEMENTS

Slope Creep

Soils at the site may be expansive and therefore, may become desiccated when allowed to dry. Such soils are susceptible to surficial slope creep, especially with seasonal changes in moisture content. Typically in southern California, during the hot and dry summer period, these soils become desiccated and shrink, thereby developing surface cracks. The extent and depth of these shrinkage cracks depend on many factors such as the nature and expansivity of the soils, temperature and humidity, and extraction of moisture from surface soils by plants and roots. When seasonal rains occur, water percolates into the cracks and fissures, causing slope surfaces to expand, with a

corresponding loss in soil density and shear strength near the slope surface. With the passage of time and several moisture cycles, the outer 3 to 5 feet of slope materials experience a very slow, but progressive, outward and downward movement, known as slope creep. For slope heights greater than 10 feet, this creep related soil movement will typically impact all rear yard flatwork and other secondary improvements that are located within about 15 feet from the top of slopes, such as swimming pools, concrete flatwork, etc., and in particular top of slope fences/walls. This influence is normally in the form of detrimental settlement, and tilting of the proposed improvements. The dessication/swelling and creep discussed above continues over the life of the improvements, and generally becomes progressively worse. Accordingly, the developer should provide this information to any homeowners and homeowners association.

Top of Slope Walls/Fences

Due to the potential for slope creep for slopes higher than about 10 feet, some settlement and tilting of the walls/fence with the corresponding distresses, should be expected. To mitigate the tilting of top of slope walls/fences, we recommend that the walls/fences be constructed on deepened foundations without any consideration for creep forces, where the expansion index of the materials comprising the outer 15 feet of the slope is less than 50, or a combination of grade beam and caisson foundations, for expansion indices greater than 50 comprising the slope, with creep forces taken into account. The grade beam should be at a minimum of 12 inches by 12 inches in cross section, supported by drilled caissons, 12 inches minimum in diameter, placed at a maximum spacing of 6 feet on center, and with a minimum embedment length of 7 feet below the bottom of the grade beam. The strength of the concrete and grout should be evaluated by the structural engineer of record. The proper ASTM tests for the concrete and mortar should be provided along with the slump quantities. The concrete used should be appropriate to mitigate sulfate corrosion, as warranted. The design of the grade beam and caissons should be in accordance with the recommendations of the project structural engineer, and include the utilization of the following geotechnical parameters:

Creep Zone: 5-foot vertical zone below the slope face and projected upward parallel to the slope face.

Creep Load: The creep load projected on the area of the grade beam should be taken as an equivalent fluid approach, having a density of 60 pcf. For the caisson, it should be taken as a uniform 900 pounds per linear foot of caisson's depth, located above the creep zone.

Point of Fixity: Located a distance of 1.5 times the caisson's diameter, below the creep zone.

Passive Resistance: Passive earth pressure of 300 psf per foot of depth per foot of caisson diameter, to a maximum value of 4,500 psf may be used to determine caisson depth and spacing, provided that they meet or exceed the minimum requirements stated above. To determine the total lateral resistance, the contribution of the creep prone zone above the point of fixity, to passive resistance, should be disregarded.

Allowable Axial Capacity:

Shaft capacity : 350 psf applied below the point of fixity over the surface area of the shaft.

Tip capacity: 4,500 psf.

DRIVEWAY, FLATWORK, AND OTHER IMPROVEMENTS

The soil materials on site may be expansive. The effects of expansive soils are cumulative, and typically occur over the lifetime of any improvements. On relatively level areas, when the soils are allowed to dry, the dessication and swelling process tends to cause heaving and distress to flatwork and other improvements. The resulting potential for distress to improvements may be reduced, but not totally eliminated. To that end, it is recommended that the developer should notify any homeowners or homeowners association of this long-term potential for distress. To reduce the likelihood of distress, the following recommendations are presented for all exterior flatwork:

1. The subgrade area for concrete slabs should be compacted to achieve a minimum 90 percent relative compaction, and then be presoaked to 2 to 3 percentage points above (or 125 percent of) the soils' optimum moisture content, to a depth of 18 inches below subgrade elevation. If very low expansive soils are present, only optimum moisture content, or greater, is required and specific presoaking is not warranted. The moisture content of the subgrade should be proof tested within 72 hours prior to pouring concrete.

2. Concrete slabs should be cast over a non-yielding surface, consisting of a 4-inch layer of crushed rock, gravel, or clean sand, that should be compacted and level prior to pouring concrete. If very low expansive soils are present, the rock or gravel or sand may be deleted. The layer or subgrade should be wet-down completely prior to pouring concrete, to minimize loss of concrete moisture to the surrounding earth materials.

3. Exterior slabs should be a minimum of 4 inches thick. Driveway slabs and approaches should additionally have a thickened edge (12 inches) adjacent to all landscape areas, to help impede infiltration of landscape water under the slab.

4. The use of transverse and longitudinal control joints are recommended to help control slab cracking due to concrete shrinkage or expansion. Two ways to mitigate such cracking are: a) add a sufficient amount of reinforcing steel, increasing tensile strength of the slab; and, b) provide an adequate amount of control and/or expansion joints to accommodate anticipated concrete shrinkage and expansion.

   In order to reduce the potential for unsightly cracks, slabs should be reinforced at mid-height with a minimum of No. 3 bars placed at 18 inches on center, in each direction. If subgrade soils within the top 7 feet from finish grade are very low expansive soils (i.e., E.I. $\leq$20), then 6x6-W1.4xW1.4 welded-wire mesh may be substituted for the rebar, provided the reinforcement is placed on chairs, at slab mid-height. The exterior slabs should be scored or saw cut, ½ to ⅜ inches deep, often enough so that no section is greater than 10 feet by 10 feet. For sidewalks or narrow slabs, control joints should be provided at intervals of every 6 feet. The slabs should be separated from the foundations and sidewalks with expansion joint filler material.

5. No traffic should be allowed upon the newly poured concrete slabs until they have been properly cured to within 75 percent of design strength. Concrete compression strength should be a minimum of 2,500 psi.

6. Driveways, sidewalks, and patio slabs adjacent to the house should be separated from the house with thick expansion joint filler material. In areas directly adjacent to a continuous source of moisture (i.e., irrigation, planters, etc.), all joints should be additionally sealed with flexible mastic.

7. Planters and walls should not be tied to the house.

8. Overhang structures should be supported on the slabs, or structurally designed with continuous footings tied in at least two directions. If very low expansion soils are present, footings need only be tied in one direction.

9. Any masonry landscape walls that are to be constructed throughout the property should be grouted and articulated in segments no more than 20 feet long. These segments should be keyed or doweled together.

10. Utilities should be enclosed within a closed utilidor (vault) or designed with flexible connections to accommodate differential settlement and expansive soil conditions.

11. Positive site drainage should be maintained at all times. Finish grade on the lots should provide a minimum of 1 to 2 percent fall to the street, as indicated herein. It should be kept in mind that drainage reversals could occur, including post-construction settlement, if relatively flat yard drainage gradients are not periodically maintained by the homeowner or homeowners association.

12. Air conditioning (A/C) units should be supported by slabs that are incorporated into the building foundation or constructed on a rigid slab with flexible couplings for plumbing and electrical lines. A/C waste water lines should be drained to a suitable non-erosive outlet.

13. Shrinkage cracks could become excessive if proper finishing and curing practices are not followed. Finishing and curing practices should be performed per the Portland Cement Association Guidelines. Mix design should incorporate rate of curing for climate and time of year, sulfate content of soils, corrosion potential of soils, and fertilizers used on site.

DEVELOPMENT CRITERIA

Slope Deformation

Compacted fill slopes designed using customary factors of safety for gross or surficial stability and constructed in general accordance with the design specifications should be expected to undergo some differential vertical heave or settlement in combination with differential lateral movement in the out-of-slope direction, after grading. This post-construction movement occurs in two forms: slope creep, and lateral fill extension (LFE). Slope creep is caused by alternate wetting and drying of the fill soils which results in slow downslope movement. This type of movement is expected to occur throughout the life of the slope, and is anticipated to potentially affect improvements or structures (e.g., separations and/or cracking), placed near the top-of-slope, up to a maximum distance of approximately 15 feet from the top-of-slope, depending on the slope height. This movement generally results in rotation and differential settlement of improvements located within the creep zone. LFE occurs due to deep wetting from irrigation and rainfall on slopes comprised of expansive materials. Although some movement should be expected, long-term movement from this source may be minimized, but not eliminated, by placing the fill throughout the slope region, wet of the fill's optimum moisture content.

It is generally not practical to attempt to eliminate the effects of either slope creep or LFE. Suitable mitigative measures to reduce the potential of lateral deformation typically include: setback of improvements from the slope faces (per the 1997 UBC and/or adopted California Building Code), positive structural separations (i.e., joints) between improvements, and stiffening and deepening of foundations. Expansion joints in walls should be placed no greater than 20 feet on-center, and in accordance with the structural

engineer's recommendations. All of these measures are recommended for design of structures and improvements. The ramifications of the above conditions, and recommendations for mitigation, should be provided to each homeowner and/or any homeowners association.

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 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 adversely affects site improvements, and causes perched groundwater conditions. Graded slopes constructed 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. Compaction to the face of fill slopes would tend to minimize short-term erosion until vegetation is established. Plants selected for landscaping should be light weight, deep rooted types that require little water and are capable of surviving the prevailing climate. Jute-type matting or other fibrous covers may aid in allowing the establishment of a sparse plant cover. Utilizing plants other than those recommended above will increase the potential for perched water, staining, mold, etc., to develop. A rodent control program to prevent burrowing should be implemented. Irrigation of natural (ungraded) slope areas is generally not recommended. These recommendations regarding plant type, irrigation practices, and rodent control should be provided to each homeowner. Over-steepening of slopes should be avoided during building construction activities and landscaping.

Drainage

Adequate lot surface drainage is a very important factor in reducing the likelihood of adverse performance of foundations, hardscape, and slopes. Surface drainage should be sufficient to prevent ponding of water anywhere on a lot, and especially near structures and tops of slopes. Lot surface drainage should be carefully taken into consideration during fine grading, landscaping, and building construction. Therefore, care should be taken that future landscaping or construction activities do not create adverse drainage conditions. Positive site drainage within lots and common areas should be provided and 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. In general, the area within 5 feet around a structure should slope away from the structure. We recommend that unpaved lawn and landscape areas have a minimum gradient of 1 percent sloping away from structures, and whenever possible, should be above adjacent paved areas. Consideration should be given to avoiding construction of planters adjacent to structures (buildings, pools, spas, etc.). Pad drainage should be directed toward the street or other approved area(s). Although not a geotechnical requirement, roof gutters, down spouts, or other appropriate means may be utilized 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.

Toe of Slope Drains/Toe Drains

Where significant slopes intersect pad areas, surface drainage down the slope allows for some seepage into the subsurface materials, sometimes creating conditions causing or contributing to perched and/or ponded water. Toe of slope/toe drains may be beneficial in the mitigation of this condition due to surface drainage. The general criteria to be utilized by the design engineer for evaluating the need for this type of drain is as follows:

- Is there a source of irrigation above or on the slope that could contribute to saturation of soil at the base of the slope?

- Are the slopes hard rock and/or impermeable, or relatively permeable, or; do the slopes already have or are they proposed to have subdrains (i.e., stabilization fills, etc.)?

- Are there cut-fill transitions (i.e., fill over bedrock), within the slope?

- Was the lot at the base of the slope overexcavated or is it proposed to be overexcavated? Overexcavated lots located at the base of a slope could accumulate subsurface water along the base of the fill cap.

- Are the slopes north facing? North facing slopes tend to receive less sunlight (less evaporation) relative to south facing slopes and are more exposed to the currently prevailing seasonal storm tracks.

- What is the slope height? It has been our experience that slopes with heights in excess of approximately 10 feet tend to have more problems due to storm runoff and irrigation than slopes of a lesser height.

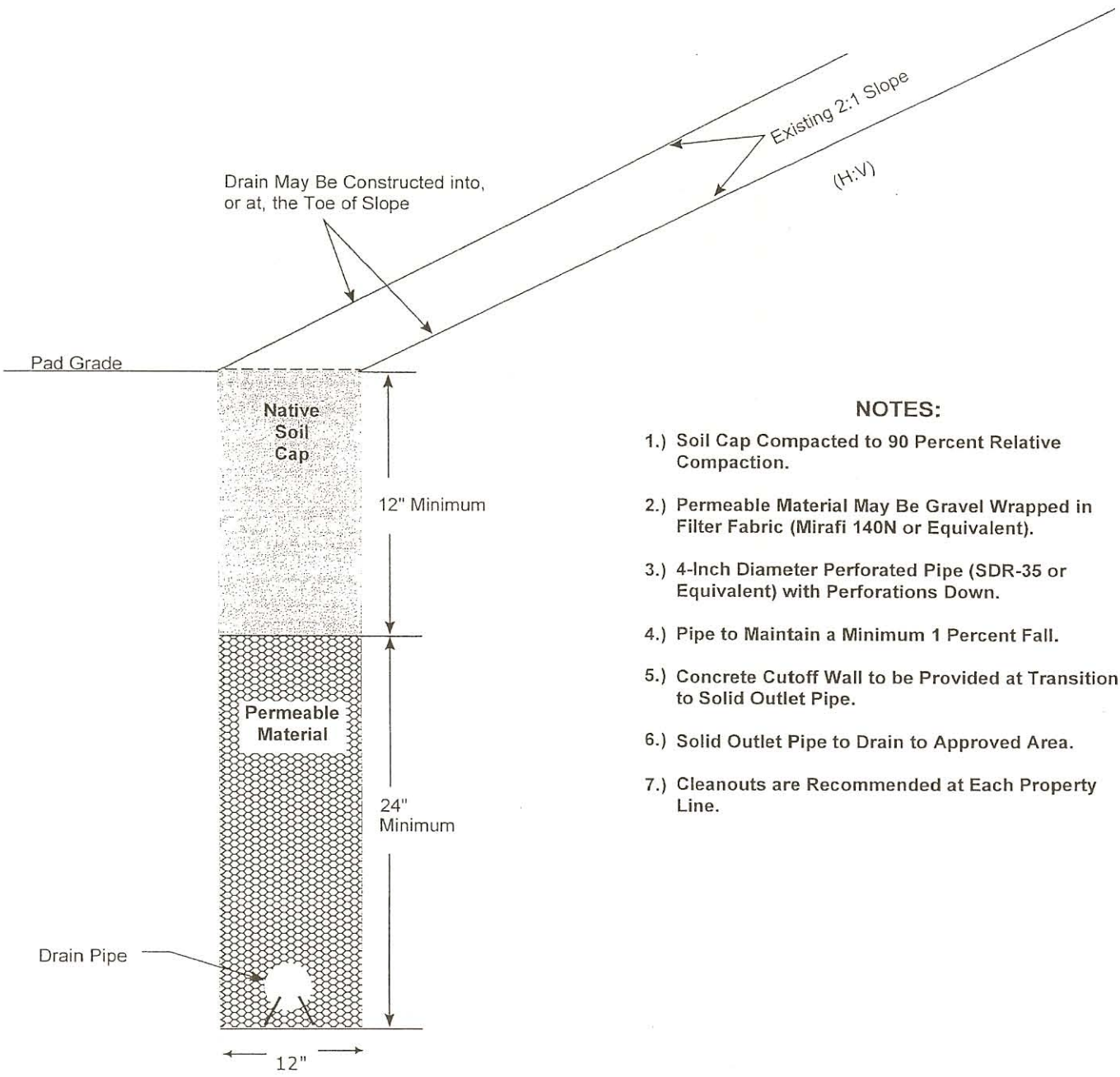
- Do the slopes "toe out" into a residential lot or a lot where perched or ponded water may adversely impact its proposed use?

Based on these general criteria, the construction of toe drains may be considered by the design engineer along the toe of slopes, or at retaining walls in slopes, descending to the rear of such lots. Following are Detail 4 (Schematic Toe Drain Detail) and Detail 5 (Subdrain Along Retaining Wall Detail). Other drains may be warranted due to unforeseen conditions, homeowner irrigation, or other circumstances. Where drains are constructed

DETAILS

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SCHEMATIC TOE DRAIN DETAIL



NOTES:

1.) Soil Cap Compacted to 90 Percent Relative Compaction.

2.) Permeable Material May Be Gravel Wrapped in Filter Fabric (Mirafi 140N or Equivalent).

3.) 4-Inch Diameter Perforated Pipe (SDR-35 or Equivalent) with Perforations Down.

4.) Pipe to Maintain a Minimum 1 Percent Fall.

5.) Concrete Cutoff Wall to be Provided at Transition to Solid Outlet Pipe.

6.) Solid Outlet Pipe to Drain to Approved Area.

7.) Cleanouts are Recommended at Each Property Line.

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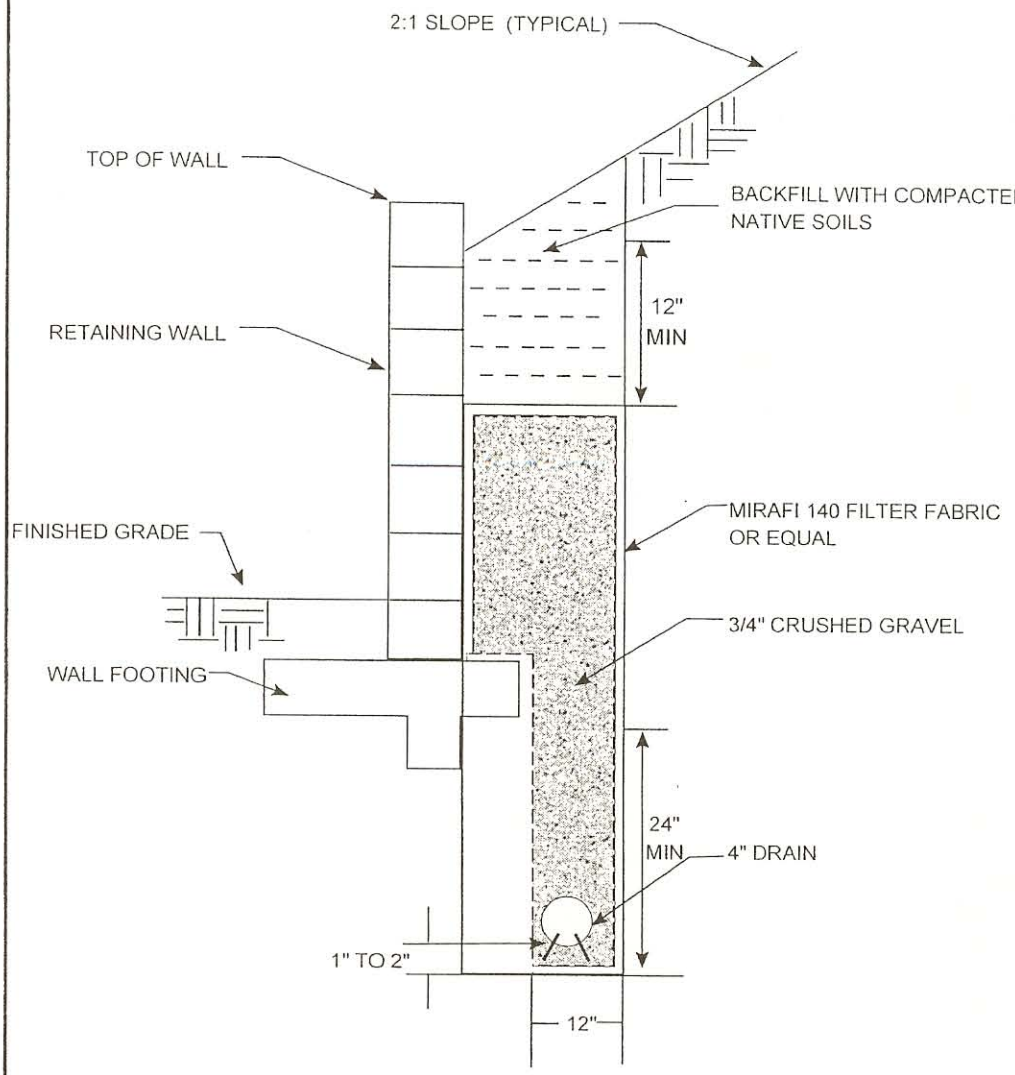
SCHEMATIC TOE DRAIN DETAIL

DETAIL 4

Geotechnical • Coastal • Geologic • Environmental

DETAILS

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NOTES:

1.) **Soil Cap Compacted to 90 Percent Relative Compaction.**

2.) **Permeable Material May Be Gravel Wrapped in Filter Fabric (Mirafi 140N or Equivalent).**

3.) **4-Inch Diameter Perforated Pipe (SDR-35 or Equivalent) with Perforations Down.**

4.) **Pipe to Maintain a Minimum 1 Percent Fall.**

5.) **Concrete Cutoff Wall to be Provided at Transition to Solid Outlet Pipe.**

6.) **Solid Outlet Pipe to Drain to Approved Area.**

7.) **Cleanouts are Recommended at Each Property Line.**

8.) **Compacted Effort Should Be Applied to Drain Rock.**

SUBDRAIN ALONG RETAINING WALL DETAIL

NOT TO SCALE

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SUBDRAIN ALONG RETAINING WALL DETAIL

DETAIL 5

Geotechnical • Coastal • Geologic • Environmental

during grading, including subdrains, the locations/elevations of such drains should be surveyed, and recorded on the final as-built grading plans by the design engineer. It is recommended that the above be disclosed to all interested parties, including homeowners and any homeowners association.

Erosion Control

Cut and fill slopes will be subject to surficial erosion during and after grading. Onsite earth materials have a moderate to high erosion potential. Consideration should be given to providing hay bales and silt fences for the temporary control of surface water, from a geotechnical viewpoint.

Landscape Maintenance

Only the amount of irrigation necessary to sustain plant life should be provided. Over-watering the landscape areas will 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. If planters are constructed adjacent to structures, the sides and bottom of the planter should be provided with a moisture barrier to prevent penetration of irrigation water into the subgrade. Provisions should be made to drain the excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Graded slope areas should be planted with 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.

Gutters and Downspouts

As previously discussed in the drainage section, the installation of gutters and downspouts should be considered to collect roof water that may otherwise infiltrate the soils adjacent to the structures. If utilized, the downspouts should be drained into PVC collector pipes or other non-erosive devices (e.g., paved swales or ditches; below grade, solid tight-lined PVC pipes; etc.), that will carry the water away from the house, to an appropriate outlet, in accordance with the recommendations of the design civil engineer. Downspouts and gutters are not a requirement; however, from a geotechnical viewpoint, provided that positive drainage is incorporated into project design (as discussed previously).

Subsurface and Surface Water

Subsurface and surface water 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 may not be precluded from occurring in the future due to site irrigation, poor drainage conditions, or damaged utilities, and should be anticipated. Should perched groundwater conditions develop, this office could assess the affected area(s) and provide the appropriate recommendations to mitigate the observed groundwater conditions. Groundwater conditions may change with the introduction of irrigation, rainfall, or other factors.

Site Improvements

If in the future, any additional improvements (e.g., pools, spas, etc.) are planned for the site, recommendations concerning the geological or geotechnical aspects of design and construction of said improvements could be provided upon request. Pools and/or spas should not be constructed without specific design and construction recommendations from GSI, and this construction recommendation should be provided to the homeowners, any homeowners association, and/or other interested parties. 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, flatwork, etc.

Tile Flooring

Tile flooring can crack, reflecting cracks in the concrete slab below the tile, although small cracks in a conventional slab may not be significant. Therefore, the designer should consider additional steel reinforcement for concrete slabs-on-grade where tile will be placed. The tile installer should consider installation methods that reduce possible cracking of the tile such as slipsheets. Slipsheets or a vinyl crack isolation membrane (approved by the Tile Council of America/Ceramic Tile Institute) are recommended between tile and concrete slabs on grade.

Additional Grading

This office should be notified in advance of any fill placement, supplemental regrading of the site, or trench backfilling after rough grading has been completed. This includes completion of grading in the street, driveway approaches, driveways, parking areas, and 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 evaluate that the excavations have been 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/Temporary Construction Backcuts

Considering the nature of the onsite earth materials, it should be anticipated that caving or sloughing could be a factor in subsurface excavations and trenching. Shoring or excavating the trench walls/backcuts at the angle of repose (typically 25 to 45 degrees [except as specifically superceded within the text of this report]), should be anticipated. All excavations should be observed by an engineering geologist or soil engineer from GSI, prior to workers entering the excavation or trench, and minimally conform to CAL-OSHA, state, and local safety codes. Should adverse conditions exist, appropriate recommendations would be offered at that time. The above recommendations should be provided to any contractors and/or subcontractors, or homeowners, etc., that may perform such work.

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-inch to 18-inch) 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 evaluate 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 evaluate the desired results.

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

4. Utilities crossing grade beams, perimeter beams, or footings should either pass below the footing or grade beam utilizing a hardened collar or foam spacer, or pass through the footing or grade beam in accordance with the recommendations of the structural engineer.

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.
- During excavation.
- During placement of subdrains, toe drains, or other subdrainage devices, prior to placing fill and/or backfill.
- After excavation of building footings, retaining wall footings, and free standing walls footings, prior to the placement of reinforcing steel or concrete.
- Prior to pouring any slabs or flatwork, after presoaking/presaturation of building pads and other flatwork subgrade, before the placement of concrete, reinforcing steel, capillary break (i.e., sand, pea-gravel, etc.), or vapor barriers (i.e., visqueen, etc.).
- 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.
- During slope construction/repair.
- When any unusual soil conditions are encountered during any construction operations, subsequent to the issuance of this report.
- When any developer or homeowner improvements, such as flatwork, spas, pools, walls, etc., are constructed, prior to construction.
- A report of geotechnical observation and testing should be provided at the conclusion of each of the above stages, in order to provide concise and clear documentation of site work, and/or to comply with code requirements.

- GSI should review project sales documents to homeowners/homeowners associations for geotechnical aspects, including irrigation practices, the conditions outlined above, etc., prior to any sales. At that stage, GSI will provide homeowners maintenance guidelines which should be incorporated into such documents.

OTHER DESIGN PROFESSIONALS/CONSULTANTS

The design civil engineer, structural engineer, post-tension designer, architect, landscape architect, wall designer, etc., should review the recommendations provided herein, incorporate those recommendations into all their respective plans, and by explicit reference, make this report part of their project plans. This report presents minimum design criteria for the design of slabs, foundations and other elements possibly applicable to the project. These criteria should not be considered as substitutes for actual designs by the structural engineer/designer. Please note that the recommendations contained herein are not intended to preclude the transmission of water or vapor through the slab or foundation. The structural engineer/foundation and/or slab designer should provide recommendations to not allow water or vapor to enter into the structure so as to cause damage to another building component, or so as to limit the installation of the type of flooring materials typically used for the particular application.

The structural engineer/designer should analyze actual soil-structure interaction and consider, as needed, bearing, expansive soil influence, and strength, stiffness and deflections in the various slab, foundation, and other elements in order to develop appropriate, design-specific details. As conditions dictate, it is possible that other influences will also have to be considered. The structural engineer/designer should consider all applicable codes and authoritative sources where needed. If analyses by the structural engineer/designer result in less critical details than are provided herein as minimums, the minimums presented herein should be adopted. It is considered likely that some, more restrictive details will be required.

If the structural engineer/designer has any questions or requires further assistance, they should not hesitate to call or otherwise transmit their requests to GSI. In order to mitigate potential distress, the foundation and/or improvement's designer should confirm to GSI and the governing agency, in writing, that the proposed foundations and/or improvements can tolerate the amount of differential settlement and/or expansion characteristics and other design criteria specified herein.

PLAN REVIEW

Final project plans (grading, precise grading, foundation, retaining wall, landscaping, etc.), should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations and/or further geotechnical studies may be warranted.

LIMITATIONS

The materials encountered on the project site and utilized for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during mass grading. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as our study is based upon our review and engineering analyses and laboratory data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project. All samples will be disposed of after 30 days, unless specifically requested by the client, in writing.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

BORING LOGS AND TEST PIT LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with	GM	Silty gravels gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands more than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, mucic, and other highly organic soils

CONSISTENCY OR RELATIVE DENSITY

CRITERIA

Standard Penetration Test

Penetration Resistance N (blows/ft)	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
> 50	Very dense

Standard Penetration Test

Penetration Resistance N (blows/ft)	Consistency	Unconfined Compressive Strength (tons/ft^2)
<2	Very Soft	<0.25
2 - 4	Soft	0.25 - .050
4 - 8	Medium	0.50 - 1.00
8 - 15	Stiff	1.00 - 2.00
15 - 30	Very Stiff	2.00 - 4.00
>30	Hard	>4.00

	3"	3/4"	#4	#10	#40	#200 U.S. Standard Sieve

Unified Soil Classification	Cobbles	Gravel		Sand			Silt or Clay
		coarse	fine	coarse	medium	fine	

MOISTURE CONDITIONS

Dry	Absence of moisture: dusty, dry to the touch
Slightly Moist	Below optimum moisture content for compaction
Moist	Near optimum moisture content
Very Moist	Above optimum moisture content
Wet	Visible free water; below water table

MATERIAL QUANTITY

trace	0 - 5 %
few	5 - 10 %
little	10 - 25 %
some	25 - 45 %

OTHER SYMBOLS

C Core Sample
S SPT Sample
B Bulk Sample
▼ Groundwater
Qp Pocket Penetrometer

BASIC LOG FORMAT:
Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse grained particles, etc.

EXAMPLE:
Sand (SP), fine to medium grained, brown, moist, loose, trace silt, little fine gravel, few cobbles up to 4" in size, some hair roots and rootlets.

File:Mgr: c;\SoilClassif.wpd

PLATE B-1

BORING LOG

GeoSoils, Inc.

W.O. 4787-A-SC

PROJECT: SO CAL LAND MANAGEMENT
Tract 31687, Romoland

BORING B-1 SHEET 1 OF 2

DATE EXCAVATED 5-20-05

SAMPLE METHOD: 8" Hollow Stem Auger, 130 Lb @ 30" 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
				SM				**COLLUVIUM/TOPSOIL:** @ 0' SILTY SAND, light brown, dry, loose.
			48	SM/SC	124.2	12.5	100	**QUATERNARY FAN DEPOSITS:** @ 2' SILTY to CLAYEY SAND, reddish brown, saturated, dense.
5			69		126.6	10.4	89	@ 5' SILTY to CLAYEY SAND, medium to reddish brown, wet, dense.
10			27	SM		11.6		@ 10' SILTY SAND, brown, wet, medium dense; fine to coarse grained.
15			25		124.7	8.9	72	@ 15' SILTY SAND, reddish brown, moist, medium dense.
20			42			7.0		@ 20' As per 15', dense.
25			23/ 50-6"		117.9	8.3	55	@ 25' SILTY SAND, reddish brown, moist, dense; well indurated.

BORING LOG

GeoSoils, Inc.

W.O. 4787-A-SC

PROJECT: SO CAL LAND MANAGEMENT
Tract 31687, Romoland

BORING B-1 SHEET 2 OF 2

DATE EXCAVATED 5-20-05

SAMPLE METHOD: 8" Hollow Stem Auger, 130 Lb @ 30" 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
			34	SM		7.0		@ 30' SILTY SAND, reddish yellow, damp, dense.
35			50-6"		110.4	8.8	47	@ 35' SILTY SAND, reddish yellow, damp, very dense.
			20/ 50-5"			8.0		@ 38' SILTY SAND, red, damp, very dense.
40								Practical Refusal @ 39½' No Groundwater/Caving Encountered Backfilled 5-20-2005
45								
50								
55								

BORING LOG

GeoSoils, Inc.

W.O. 4787-A-SC

PROJECT: SO CAL LAND MANAGEMENT
Tract 31687, Romoland

BORING B-2 SHEET 1 OF 1

DATE EXCAVATED 5-20-05

SAMPLE METHOD: 8" Hollow Stem Auger, 130 Lb @ 30" 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
				SM				**COLLUVIUM/TOPSOIL:** @ 0' SILTY SAND, light brown, dry, loose to medium dense.
			40	SM/SC	129.0	10.1	95	@ 2½' **QUATERNARY FAN DEPOSITS:** @ 3' SILTY to CLAYEY SAND, reddish brown, wet, dense; minor stage II carbonate veins and veinlets.
5								
			39	SM	123.1	5.6	43	@ 7' SILTY SAND, brown, damp, dense; well indurated, abundant clay film on ped faces.
10								
			27	SM/SC		8.9		@ 12' SILTY to CLAYEY SAND, reddish brown to red, moist, medium dense.
15								
			40/ 50-3"	SM	123.0	10.1	77	@ 17' SILTY SAND, red, wet, very dense.
20								
			69			6.3		@ 22' As per 17', damp.
25								
			40/ 50-3"		11.2	3.0	17	@ 27' SILTY SAND, reddish brown, dry, very dense.
								Total Depth = 28' No Groundwater/Caving Encountered Backfilled 5-20-2005

BORING LOG

GeoSoils, Inc.

W.O. 4787-A-SC

PROJECT: SO CAL LAND MANAGEMENT
Tract 31687, Romoland

BORING B-3 SHEET 1 OF 2

DATE EXCAVATED 5-20-05

SAMPLE METHOD: 8" Hollow Stem Auger, 130 Lb @ 30" 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
			24	SC	128.7	8.7	81	**COLLUVIUM/TOPSOIL:** @ 0' CLAYEY SAND, dark brown, wet, loose to medium dense. @ 1' As per 0'.
				SM				**QUATERNARY FAN DEPOSITS:** @ 2½' SILTY SAND, reddish brown, moist, medium dense to dense.
5			16			5.3		@ 5' SILTY SAND, brown, moist, medium dense.
10			29/ 50-5"		128.5	9.6	88	@ 10' SILTY SAND, reddish yellow, wet, very dense; well indurated.
15			63			9.2		@ 15' SILTY SAND, reddish brown, wet, very dense.
20			33/ 50-5"		125.6	6.5	54	@ 20' SILTY SAND, yellowish brown, moist, very dense.
25			63			5.3		@ 25' SILTY SAND, reddish brown, moist, very dense.

BORING LOG

GeoSoils, Inc.

W.O. 4787-A-SC

PROJECT: SO CAL LAND MANAGEMENT
Tract 31687, Romoland

BORING B-3 SHEET 2 OF 2

DATE EXCAVATED 5-20-05

SAMPLE METHOD: 8" Hollow Stem Auger, 130 Lb @ 30" 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
		▨	50-6"	SM	11.0	10.4	55	@ 30' SILTY SAND, reddish yellow, moist, very dense; well indurated.

Total Depth = 31'
No Groundwater/Caving Encountered
Backfilled 5-20-2005

35
40
45
50
55

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-1	0-2½	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose to medium dense.
	2½-8	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, damp, medium dense to dense w/depth; fine to coarse grained.
						Total Depth = 8' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-2	0-5	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, brown, dry to damp, loose to medium dense.
	5-9	SM	Bulk @ 5-6			**QUATERNARY FAN DEPOSITS:** SILTY SAND, dark brown, damp to moist, medium dense to dense w/depth.
						Total Depth = 9' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-3	0-6	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry to damp, loose; minor roots and rootlets.
	6-7	SM				**BEDROCK - CRETACEOUS GRANITICS:** QUARTZ DIORITE degrades to SILTY SAND, gray, dry, dense; moderately weathered
						Total Depth = 7' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-4	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose.
	2-5	SM				**BEDROCK - CRETACEOUS GRANITICS:** QUARTZ DIORITE degrades to SILTY SAND, gray, dry, medium dense to dense.
						Total Depth = 5' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-5	0-3	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, lose; abundant rootlets.
	3-5	SM				**BEDROCK - CRETACEOUS GRANITICS:** QUARTZ DIORITE degrades to SILTY SAND, gray, dry, medium dense to dense w/depth; weathered.
						Total Depth = 5' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-6	0-5	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose.
	5-6	SM				**BEDROCK - CRETACEOUS GRANITICS:** QUARTZ DIORITE degrades to SILTY SAND, gray, dry, medium dense to dense w/depth; weathered near surface.
						Total Depth = 6' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-7	0-3	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose.
	3-8	SM				**ALLUVIUM (YOUNGER):** SILTY SAND, medium brown, damp to moist, loose; caving encountered.
	8-10	SM				**BEDROCK - CRETACEOUS GRANITICS:** QUARTZ DIORITE degrades to SILTY SAND, gray, dry to damp, medium dense to dense w/depth; weathered near surface.
						Total Depth = 10' No Groundwater Encountered Backfilled 5-19-2005
TP-8	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light reddish brown, dry, loose to medium dense.
	2-4	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, damp, medium dense to dense.
						Total Depth = 4' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-9	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose to medium dense.
	2-5½	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, dark reddish brown, damp to moist, medium dense to dense.
						Total Depth = 5½' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-10	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light reddish brown, dry, loose.
	2-4½	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, damp, medium dense to dense.
						Total Depth = 4½' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-11	0-2½	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, brown, dry, loose; minor rootlets.
	2½-6	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, damp, medium dense to dense w/depth.
						Total Depth = 6' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-12	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose to medium dense; minor rootlets, porous.
	2-6	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, damp, medium dense to dense.
						Total Depth = 6' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-13	0-2½	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, brown, dry, loose; porous, minor rootlets.
	2½-6	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, damp to moist, medium dense to dense w/depth.
						Total Depth = 6' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-14	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose; porous.
	2-5	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, dry to moist, medium dense to dense.
						Total Depth = 5' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-15	0-2½	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light reddish brown, dry, loose to medium dense.
	2½-6	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, dry to moist at depth, medium dense to dense.
						Total Depth = 6' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-16	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light reddish brown, dry to damp, loose to medium dense; porous.
	2-5½	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, dry to damp, medium dense to dense.
						Total Depth = 5½' No Groundwater/Caving Encountered Backfilled 5-19-2005

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
TP-17	0-1½	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose to medium dense; porous.
	1½-5	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, dry to damp, medium dense to dense.
						Total Depth = 5' No Groundwater/Caving Encountered Backfilled 5-19-2005
TP-18	0-2	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light reddish brown, dry, loose to medium dense.
	2-6	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, dry to damp, medium dense to dense.
						Total Depth = 6' No Groundwater/Caving Encountered Backfilled 5-19-2005

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	SM				**COLLUVIUM/TOPSOIL:** SILTY SAND, light brown, dry, loose.
	2-5½	SM				**QUATERNARY FAN DEPOSITS:** SILTY SAND, reddish brown, dry to damp, medium dense to dense w/depth.
						Total Depth = 5½' No Groundwater/Caving Encountered Backfilled 5-19-2005

APPENDIX C

EQFAULT, EQSEARCH, AND FRISKSP

MAXIMUM EARTHQUAKES

Southern Calif. Land Management

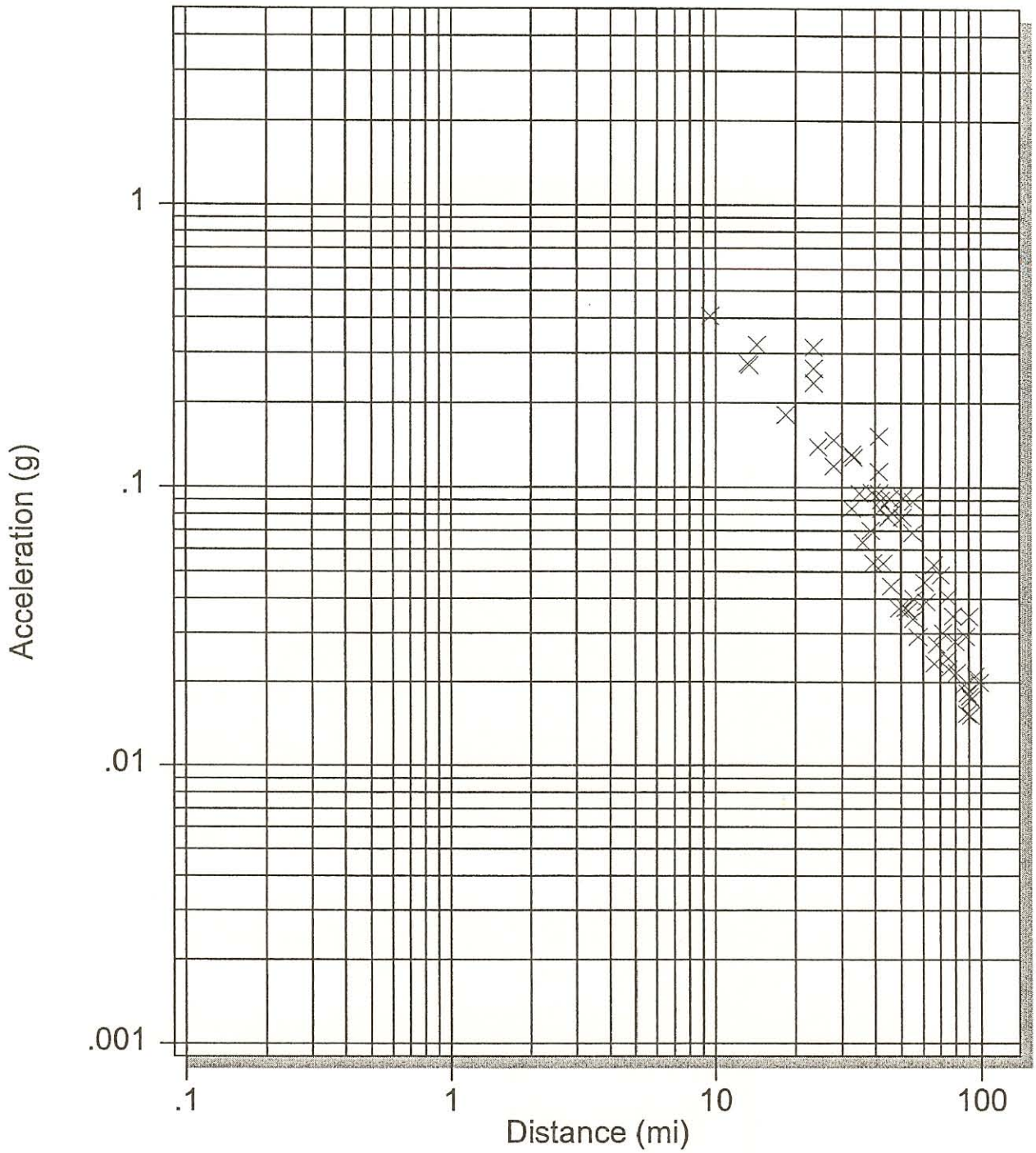


Figure C-1

EARTHQUAKE EPICENTER MAP

Southern Calif. Land Management

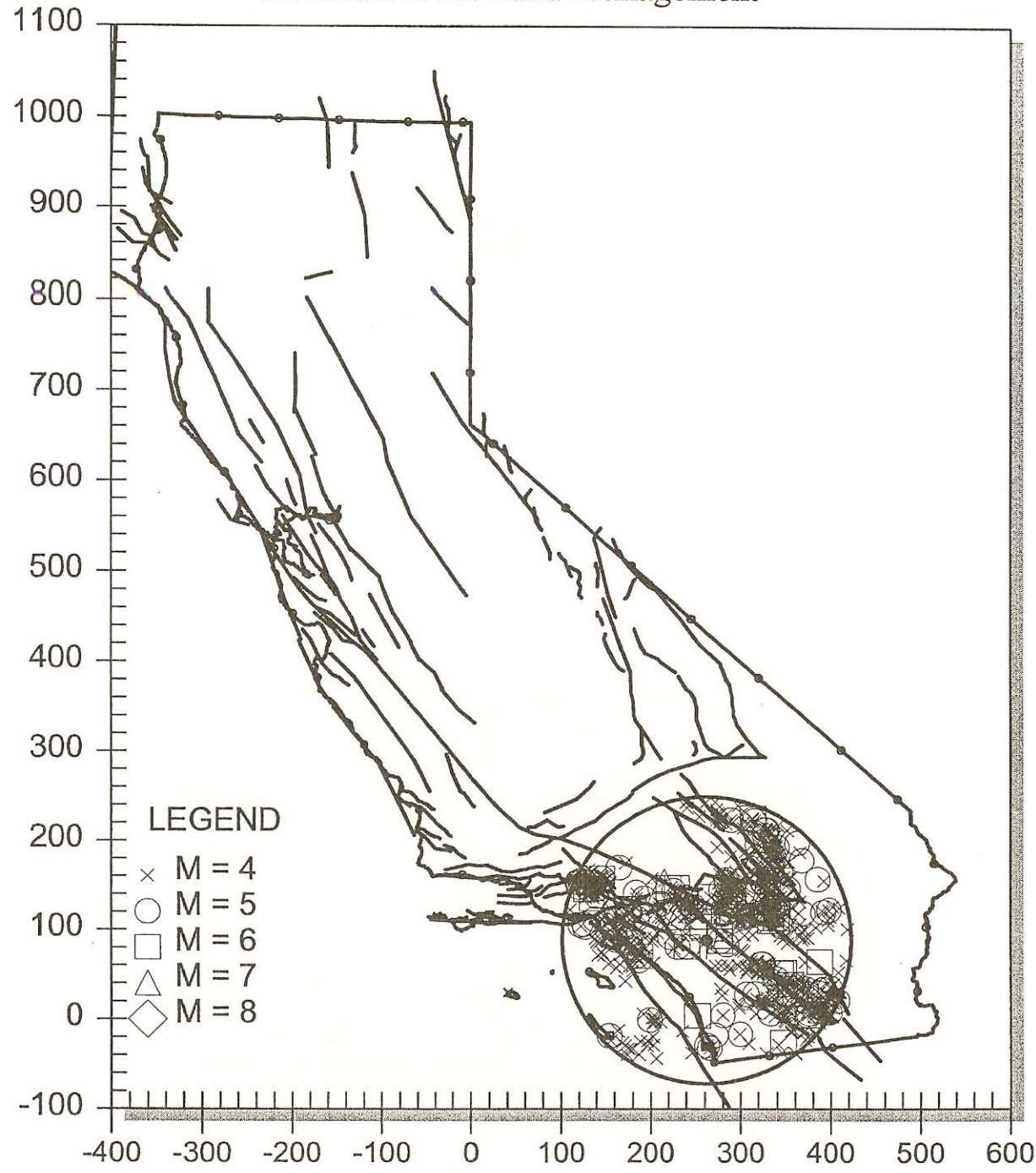


Figure C-2

EARTHQUAKE RECURRENCE CURVE

Southern Calif. Land Management

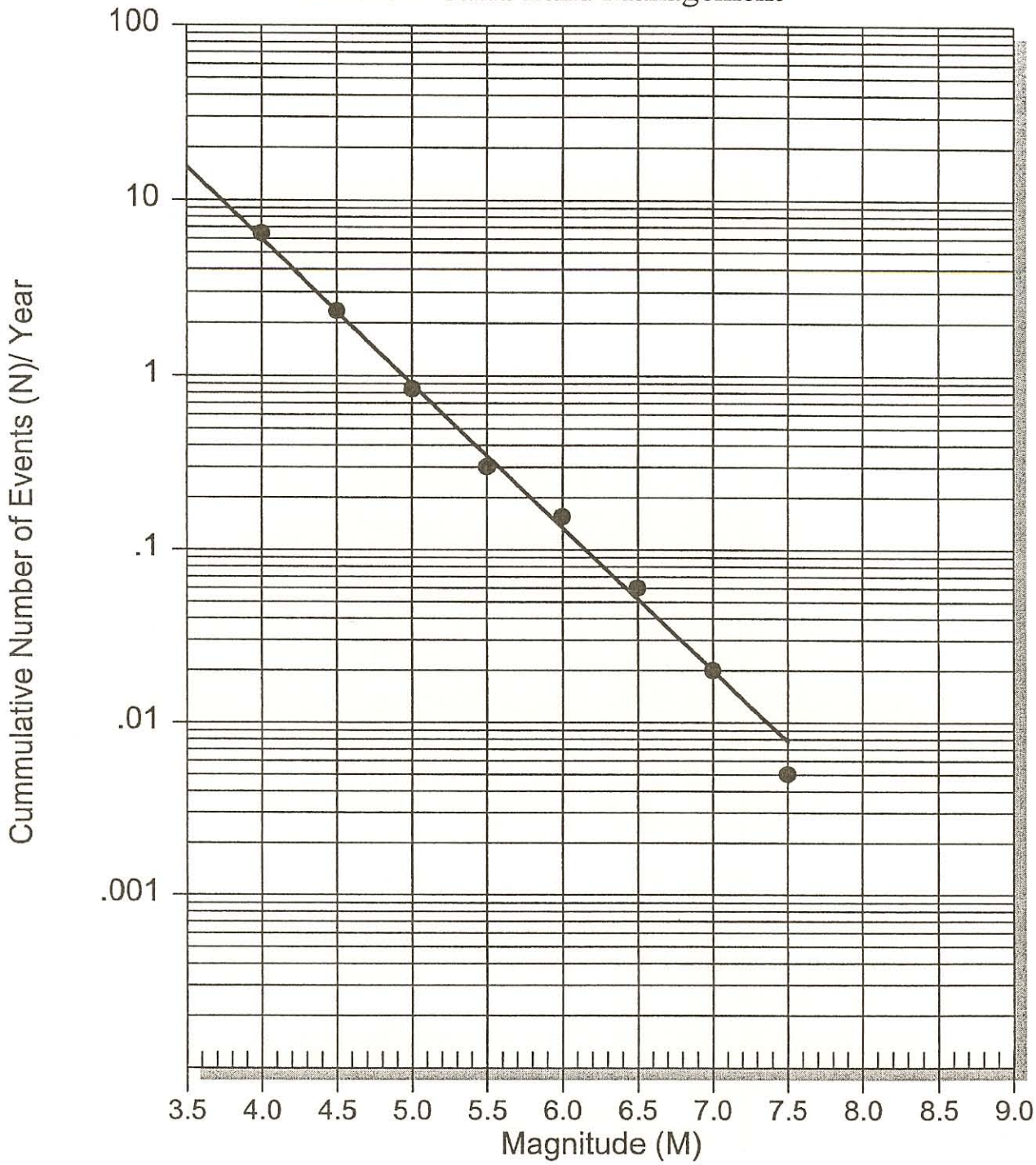


Figure C-3

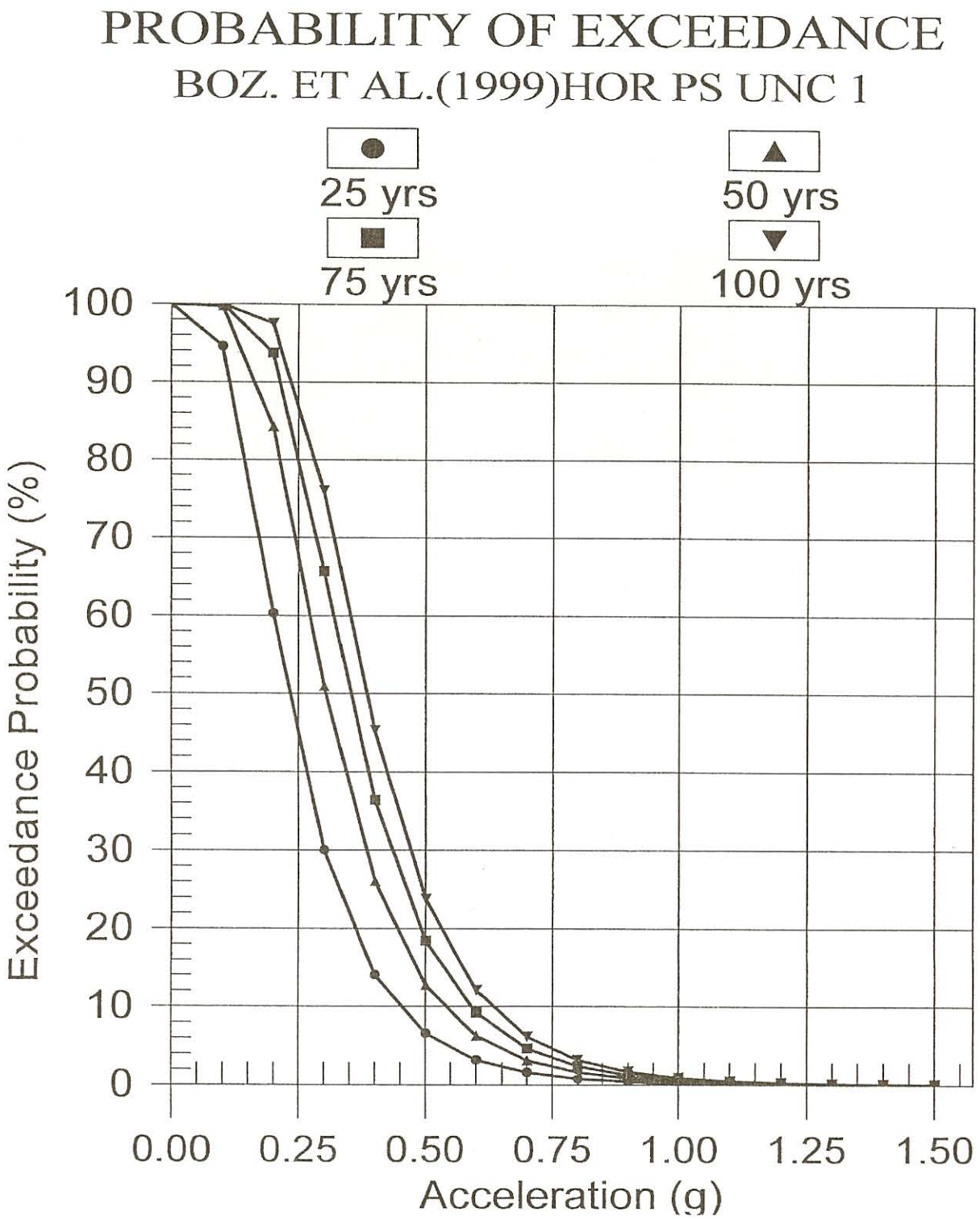

PROBABILITY OF EXCEEDANCE
BOZ. ET AL.(1999)HOR PS UNC 1
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

Figure C-4

RETURN PERIOD vs. ACCELERATION

BOZ. ET AL.(1999)HOR PS UNC 1

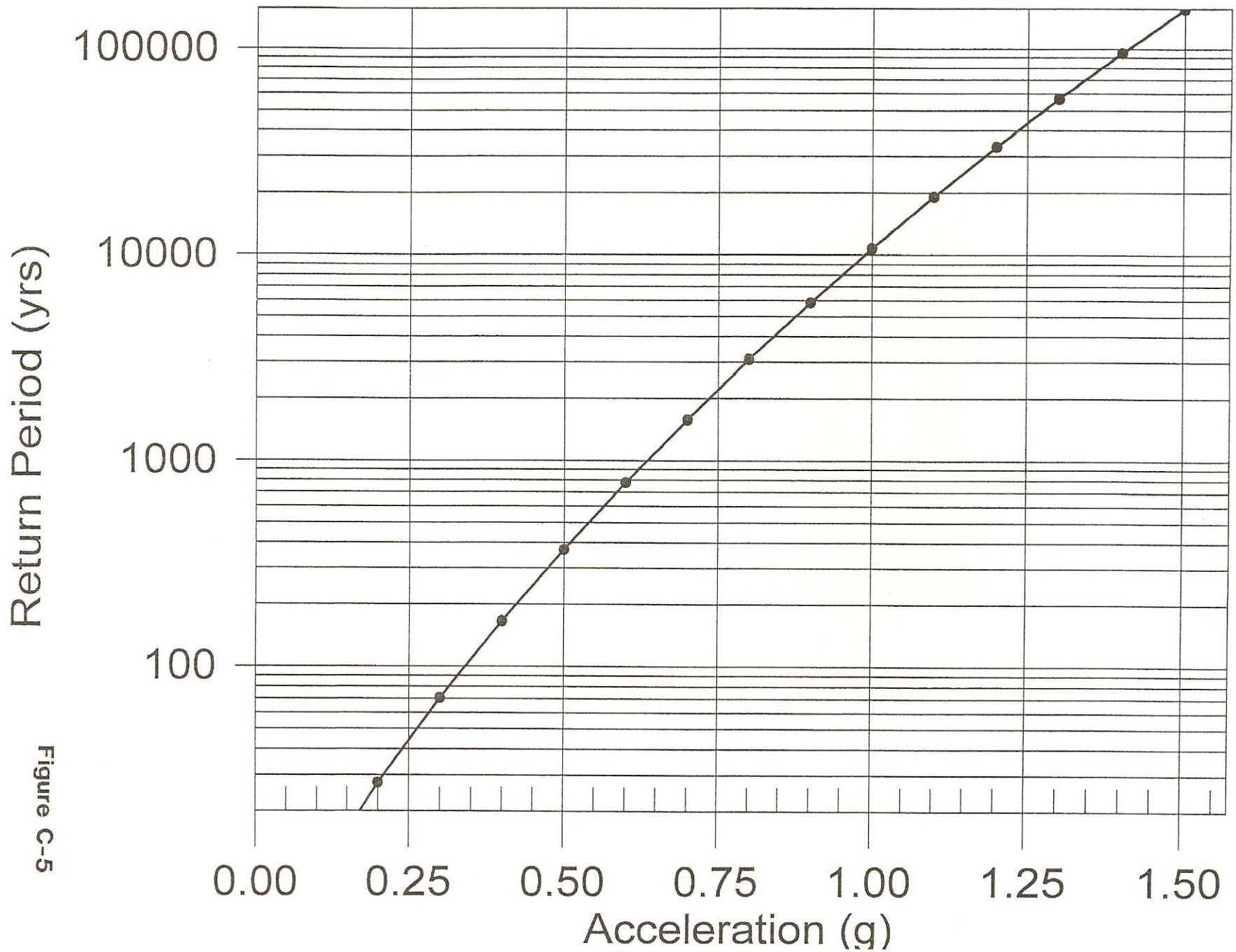
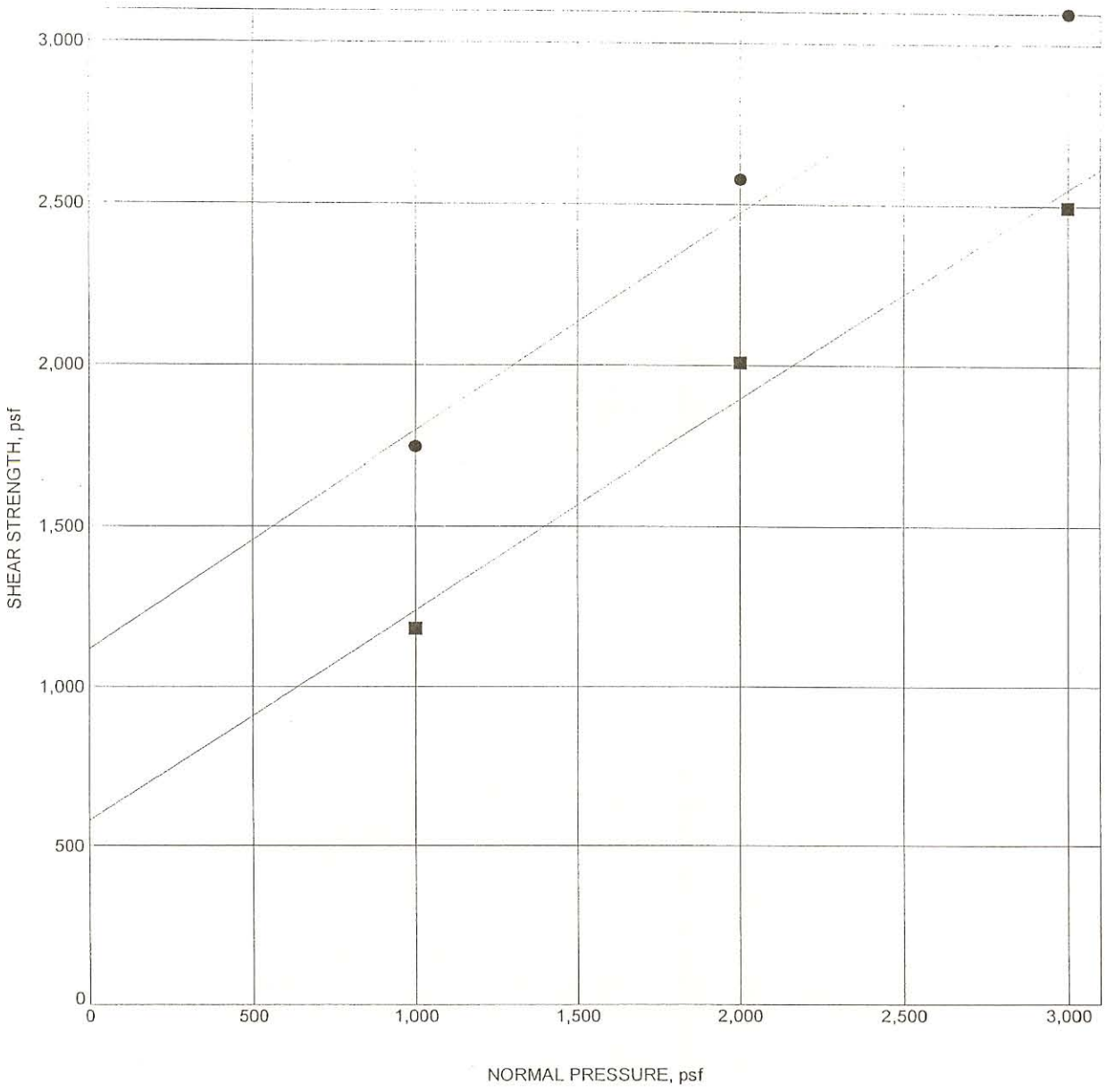


Figure C-5

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	126.3	10.4	1118	34
■	B-1	5.0	Residual Shear	Undisturbed	126.3	10.4	582	33

Note: Sample Innundated prior to testing

GeoSoils, Inc.
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GeoSoils, Inc.

DIRECT SHEAR TEST

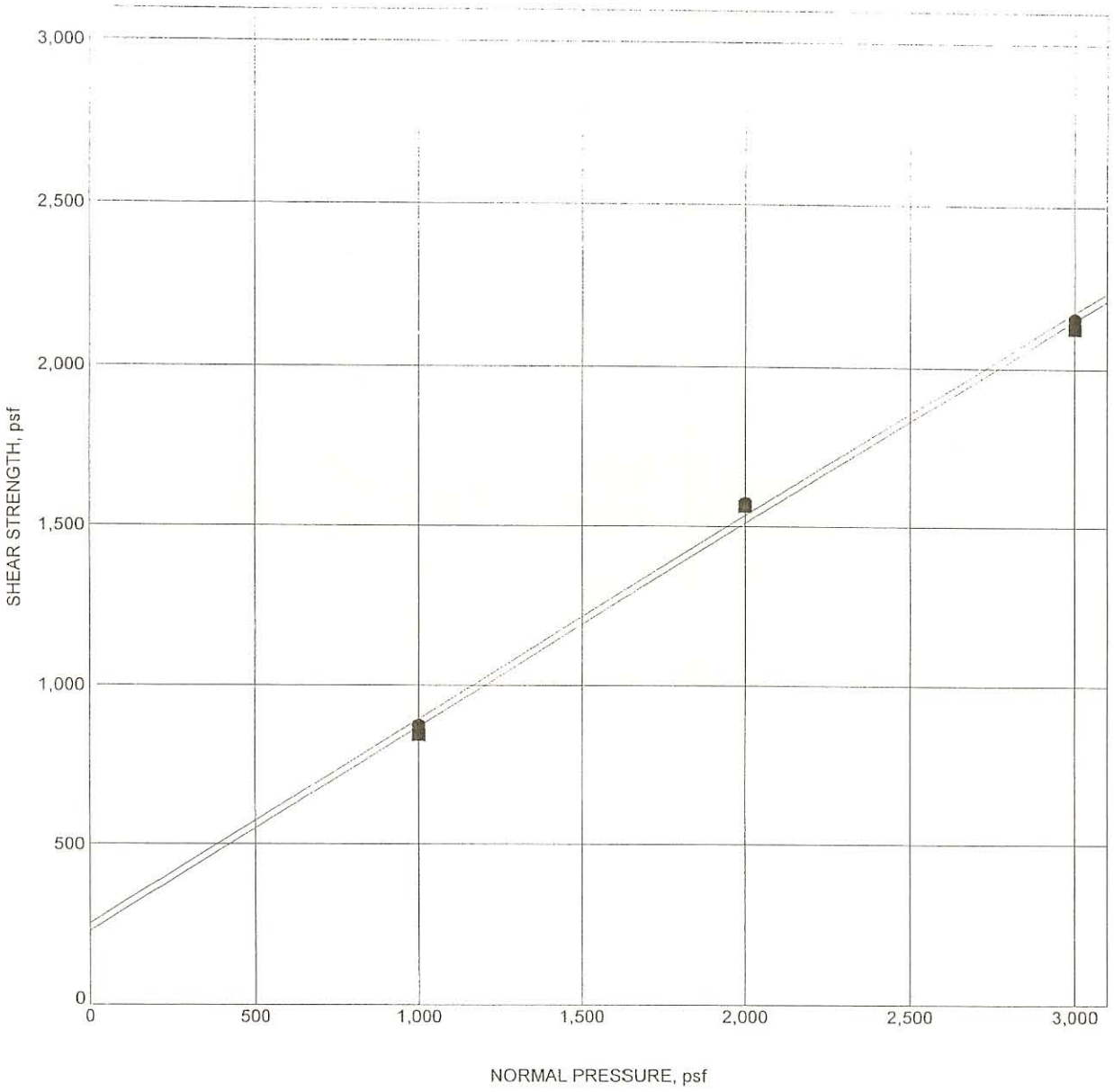
Project: SOUTHERN CALIFORNIA LAND MANAG.

Number: 4787-A-SC

Date: June 2005

Figure D-1

US_DIRECT_SHEAR_4787.GPJ US_LAB.GDT 6/6/05



	Sample	Depth/El.	Primary/Residual Shear	Sample Type	γ_d	MC%	c	ϕ
●	TP-10	3.0	Primary Shear	Remolded	122.4	8.0	254	33
■	TP-10	3.0	Residual Shear	Remolded	122.4	8.0	230	33

Note: Sample Innundated prior to testing

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DIRECT SHEAR TEST

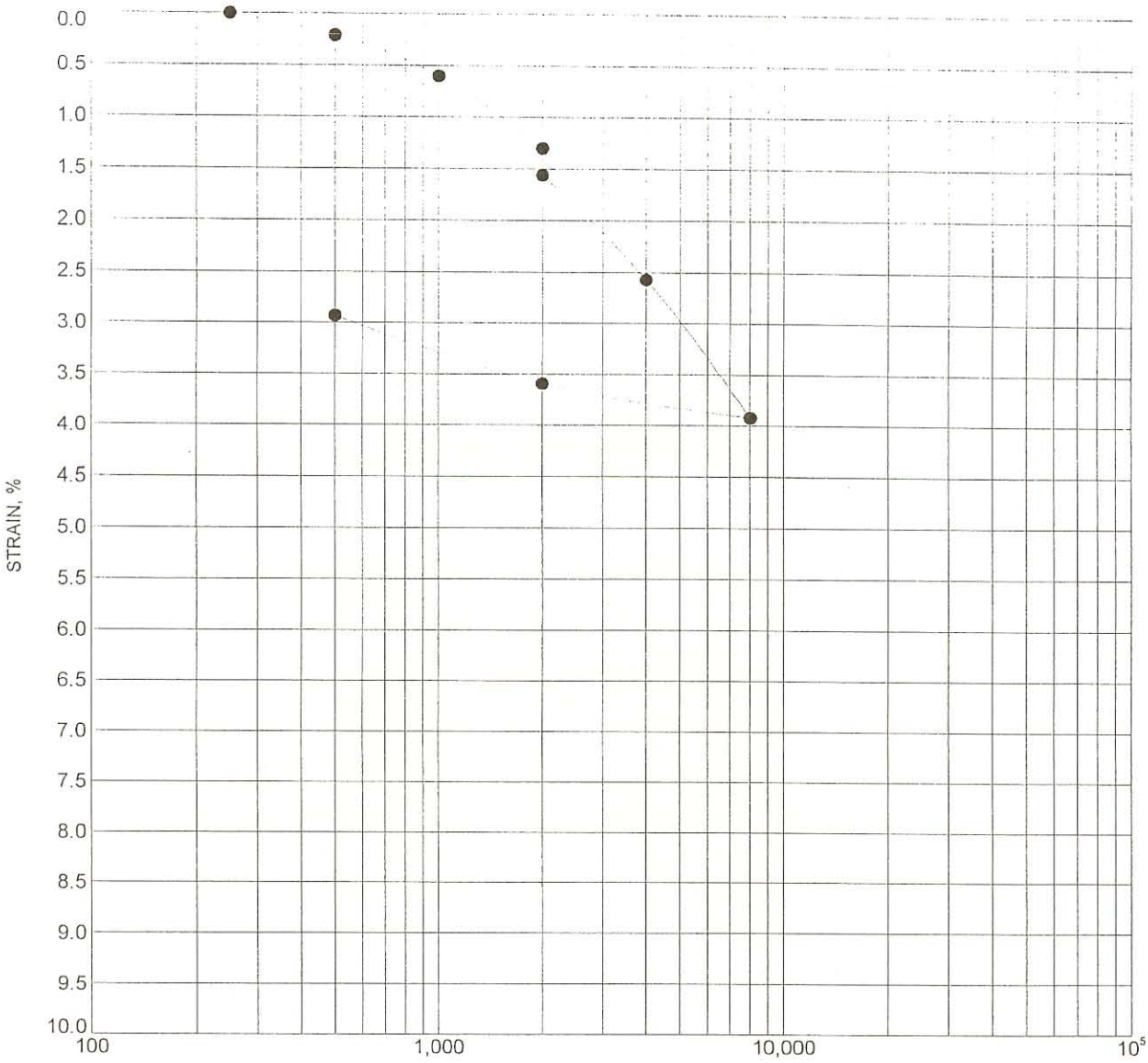
Project: SOUTHERN CALIFORNIA LAND MANAG.

Number: 4787-A-SC

Date: June 2005

Figure D-2

US_DIRECT_SHEAR 4787.GPJ US_LAB.GDT 6/6/05



Sample	Depth/El.	Visual Classification	γ_d Initial	MC Initial	MC Final	H20
● B-1	15.0	Silty Sand	124.0	8.9	11.2	2000

Stress at which water was added: 2000 psf
Strain Difference: _ _ _ _ _ 0.26%

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GeoSoils, Inc.

CONSOLIDATION TEST

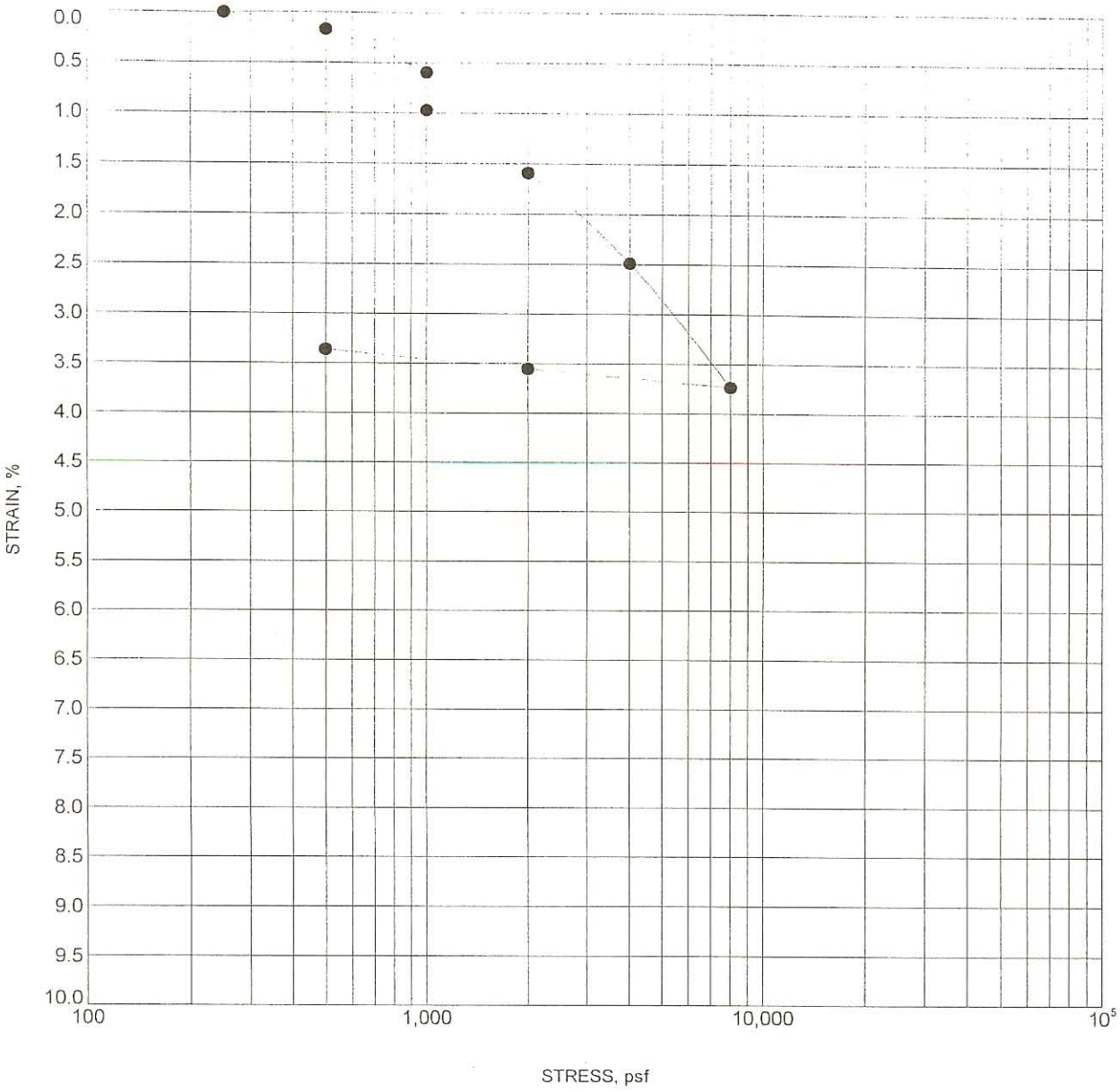
Project: SOUTHERN CALIFORNIA LAND MANAG.

Number: 4787-A-SC

Date: June 2005

Figure D-3

US CONSOL STRAIN 4787.GPJ US LAB.GDT 6/6/05



Sample		Depth/El.	Visual Classification	γ_d Initial	MC Initial	MC Final	H20
●	B-2	7.0	Silty Sand	108.3	5.6	17.5	1000

Stress at which water was added: 1000 psf
Strain Difference: _ _ _ _ 0.38%

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CONSOLIDATION TEST

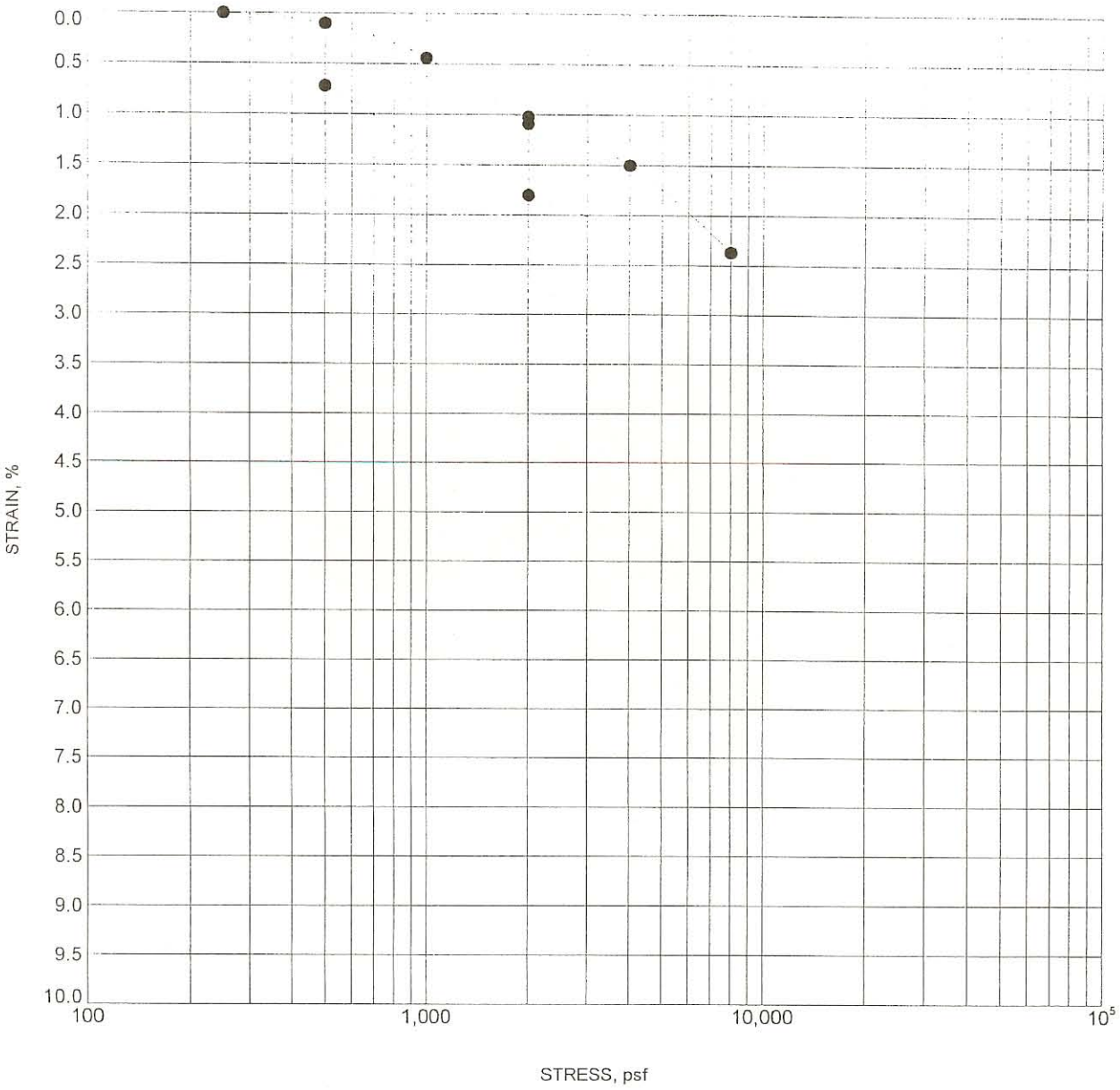
Project: SOUTHERN CALIFORNIA LAND MANAG.

Number: 4787-A-SC

Date: June 2005

Figure D-4

US_CONSOL_STRAIN 4787.GPJ US_LAB.GDT 6/6/05



Sample	Depth/El.	Visual Classification	γ_d Initial	MC Initial	MC Final	H20
● B-3	10.0	Clayey Sand	128.7	9.6	10.4	2000

Stress at which water was added: 2000 psf
Strain Difference: _____ -7.00000000000001E-02%

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CONSOLIDATION TEST

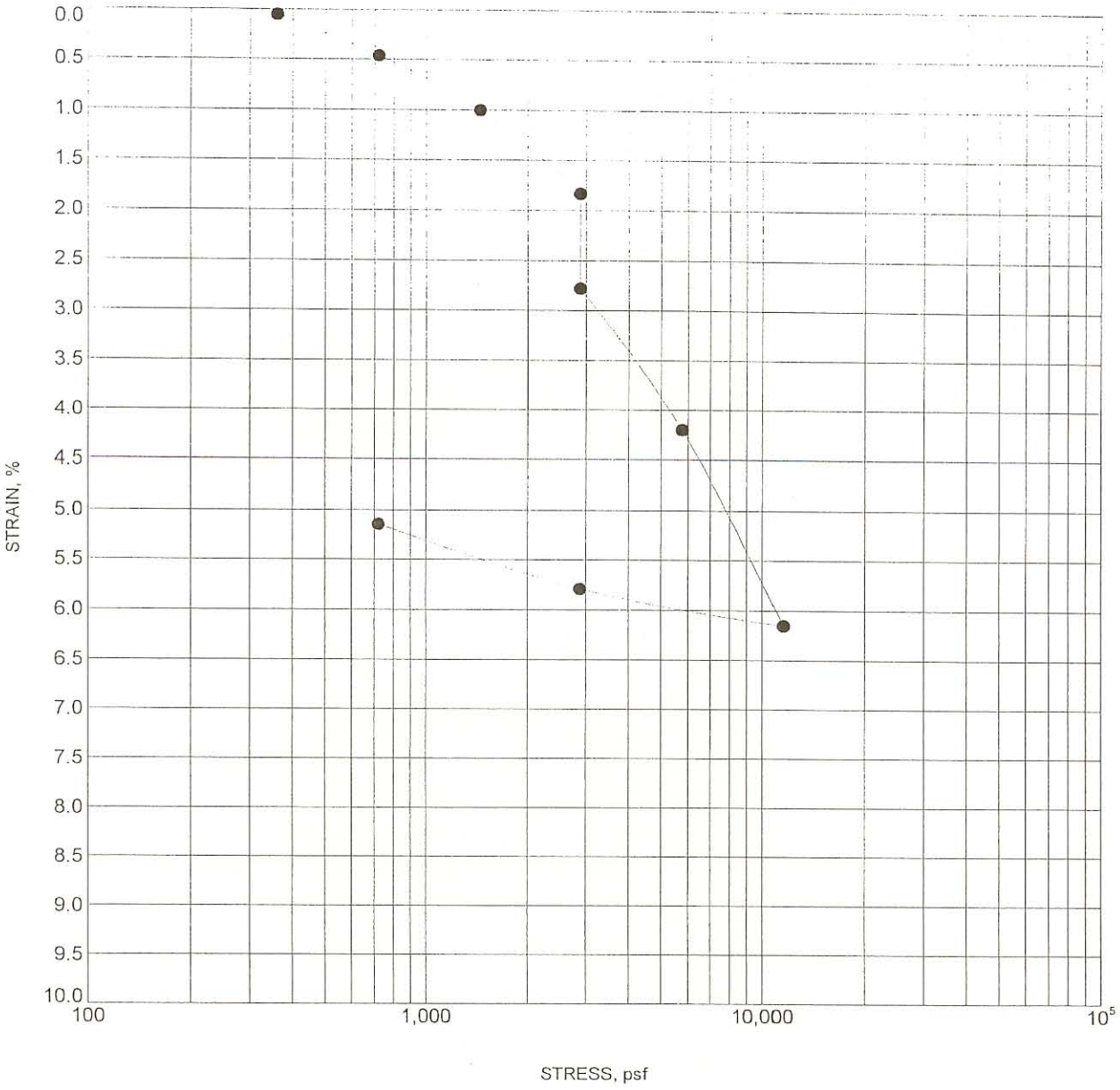
Project: SOUTHERN CALIFORNIA LAND MANAG.

Number: 4787-A-SC

Date: June 2005

Figure D-5

US_CONSOL_STRAIN 4787.GPJ US_LAB.GDT 6/6/05



Sample	Depth/El.	Visual Classification	γ_d Initial	MC Initial	MC Final	H20
● B-3	20.0	Silty Sand	132.4	6.5	5.6	2880

Stress at which water was added: 2880 psf
Strain Difference: _____ 0.95%

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CONSOLIDATION TEST

Project: SOUTHERN CALIFORNIA LAND MANAG.

Number: 4787-A-SC

Date: June 2005

Figure D-6

US_CONSOL_STRAIN 4787.GPJ US_LAB.GDT 6/6/05

TEST SPECIMAN		A	B	C	D
Compactor air pressure	PSI	350	230	110	
Water added	%	0.0	1.1	2.3	
Moisture at compaction	%	10.2	11.4	12.7	
Height of sample	IN	2.31	2.4	2.48	
Dry density	PCF	130.3	124.6	118.7	
R-Value by exudation		28	17	9	
R-Value by exudation, corrected		24	16	9	
Exudation pressure	PSI	649	414	179	
Stability thickness	FT	0.92	1.06	1.16	
Expansion pressure thickness	FT	1.77	0.87	0.00	

DESIGN CALCULATION DATA

Traffic index, assumed	5.0
Gravel equivalent factor, assumed	1.25
Expansion, stability equilibrium	0.95
R-Value by expansion	26
R-Value by exudation	15
R-Value at equilibrium	**15**

SAMPLE INFORMATION

Sample Location: TP-13 @ 2.5-3.5

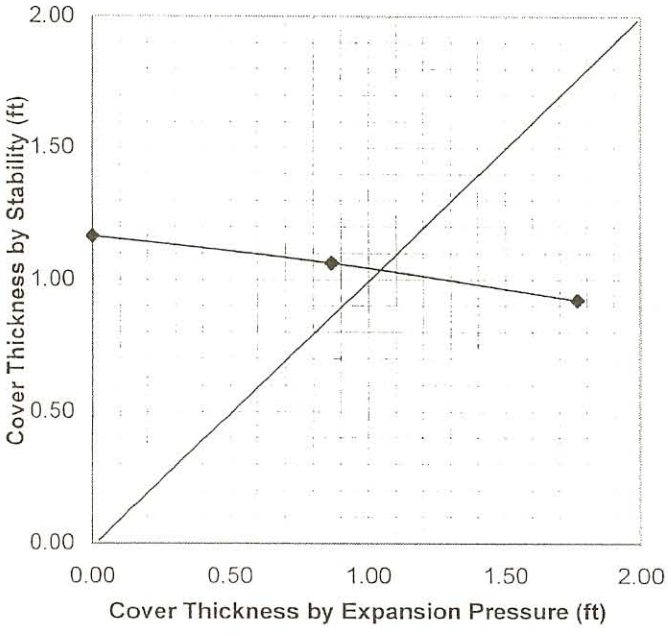
Sample Description: Dark Brown Silty Sand

Notes:

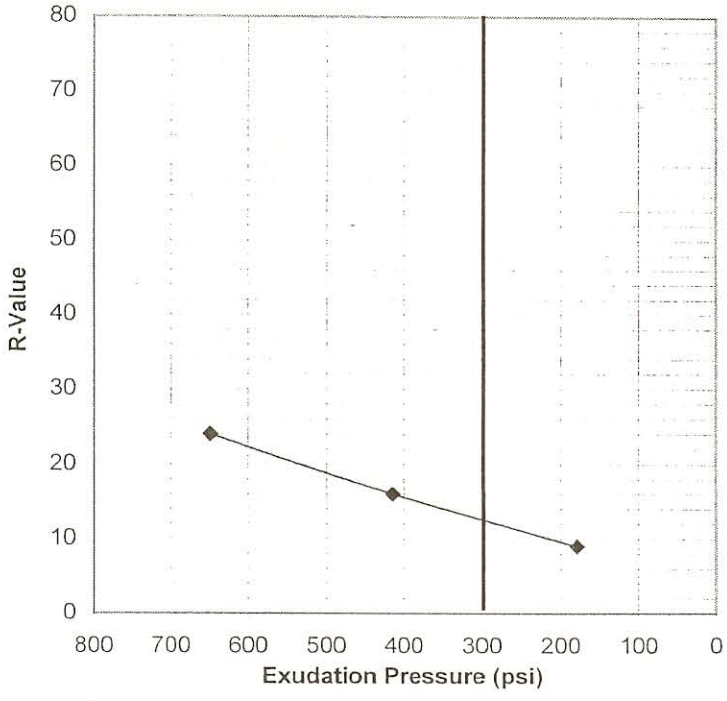
0% Retained on 3/4 inch sieve

Test Method: Cal-Trans Test 301

Expansion, Stability Equilibrium



R-Value By Exudation



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R - VALUE TEST RESULTS

Project: SOUTHERN CALIFORNIA LAND MANAGEMENT

Number: 4787-A-SC

Date: Jun-05

Figure D-7

TEST SPECIMAN		A	B	C	D
Compactor air pressure	PSI	350	350	110	
Water added	%	0.0	0.0	0.0	
Moisture at compaction	%	10.0	10.9	13.6	
Height of sample	IN	2.31	2.38	2.44	
Dry density	PCF	129.5	126.5	119.7	
R-Value by exudation		65	44	14	
R-Value by exudation, corrected		60	42	14	
Exudation pressure	PSI	589	314	139	
Stability thickness	FT	0.45	0.72	1.10	
Expansion pressure thickness	FT	0.80	0.33	0.07	

DESIGN CALCULATION DATA

Traffic index, assumed	5.0
Gravel equivalent factor, assumed	1.25
Expansion, stability equilibrium	0.53
R-Value by expansion	59
R-Value by exudation	41
R-Value at equilibrium	**41**

SAMPLE INFORMATION

Sample Location: TP-2 @ 5-6

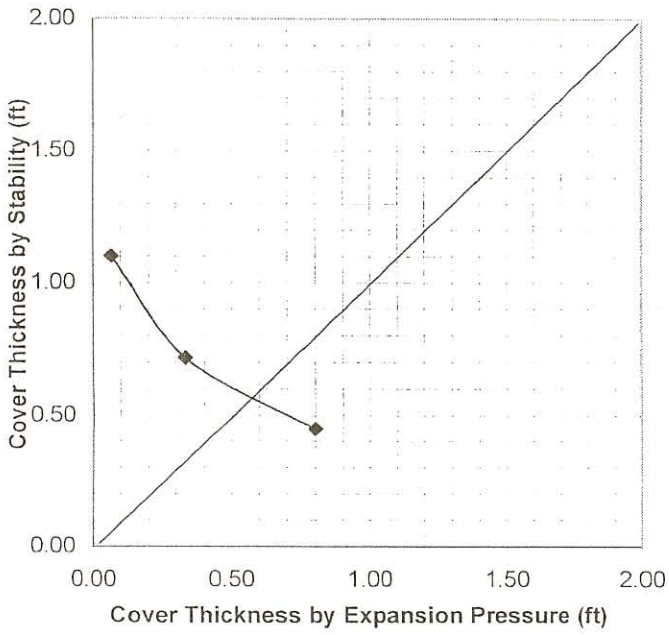
Sample Description: Dark Brown Silty Sand

Notes:

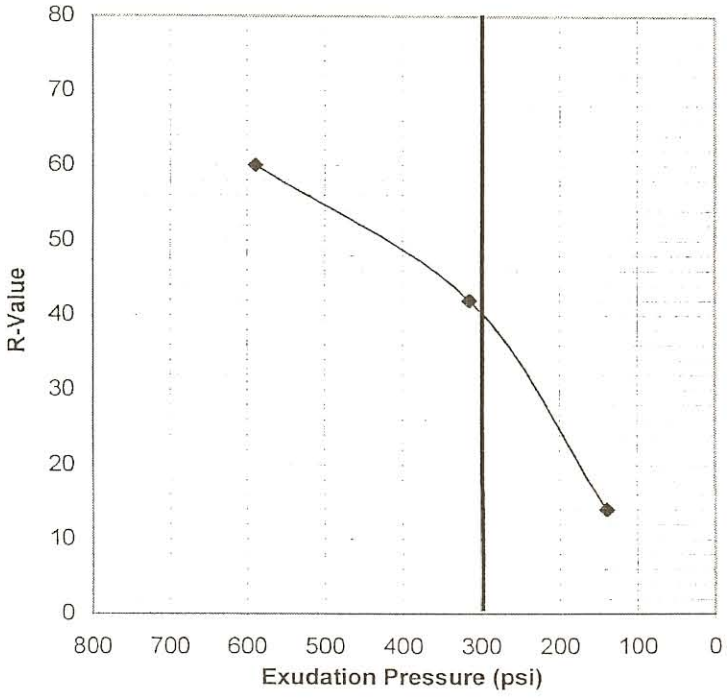
0% Retained on 3/4 inch sieve

Test Method: Cal-Trans Test 301

Expansion, Stability Equilibrium



R-Value By Exudation



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R - VALUE TEST RESULTS

Project: SOUTHERN CALIFORNIA LAND MANAGEMENT

Number: 4787-A-SC

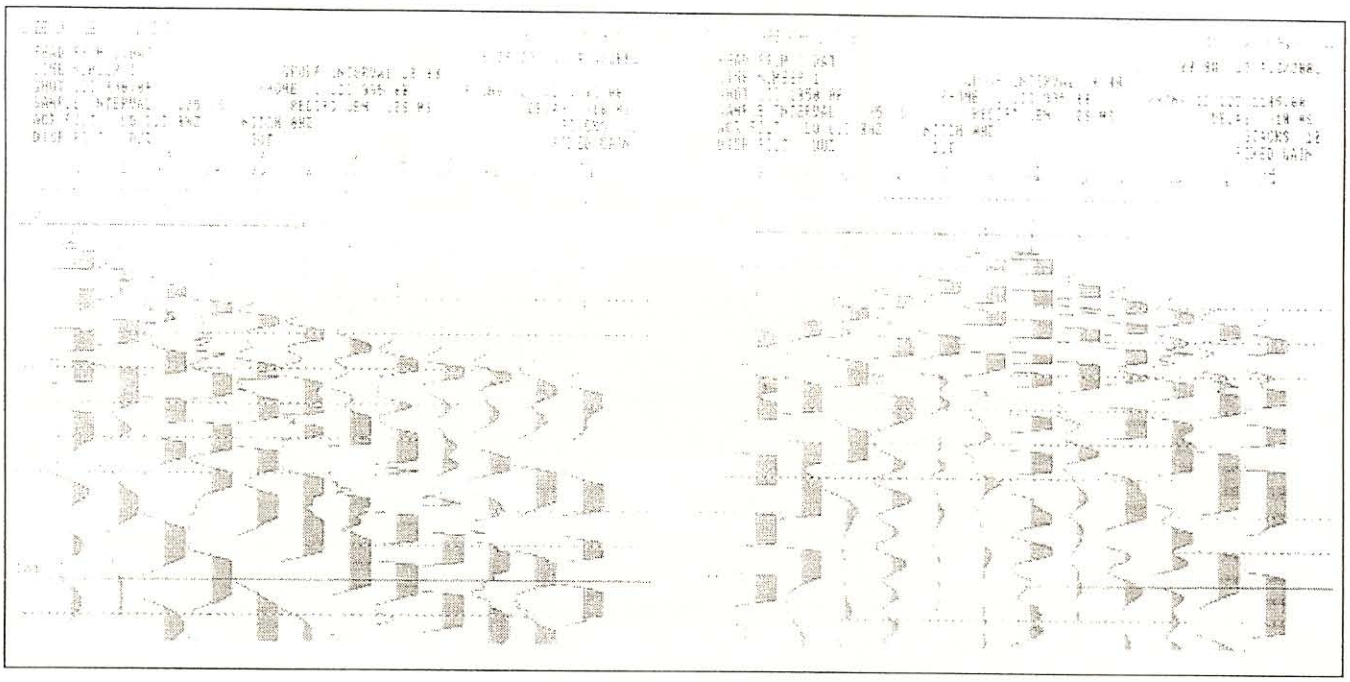
Date: Jun-05

Figure D-8

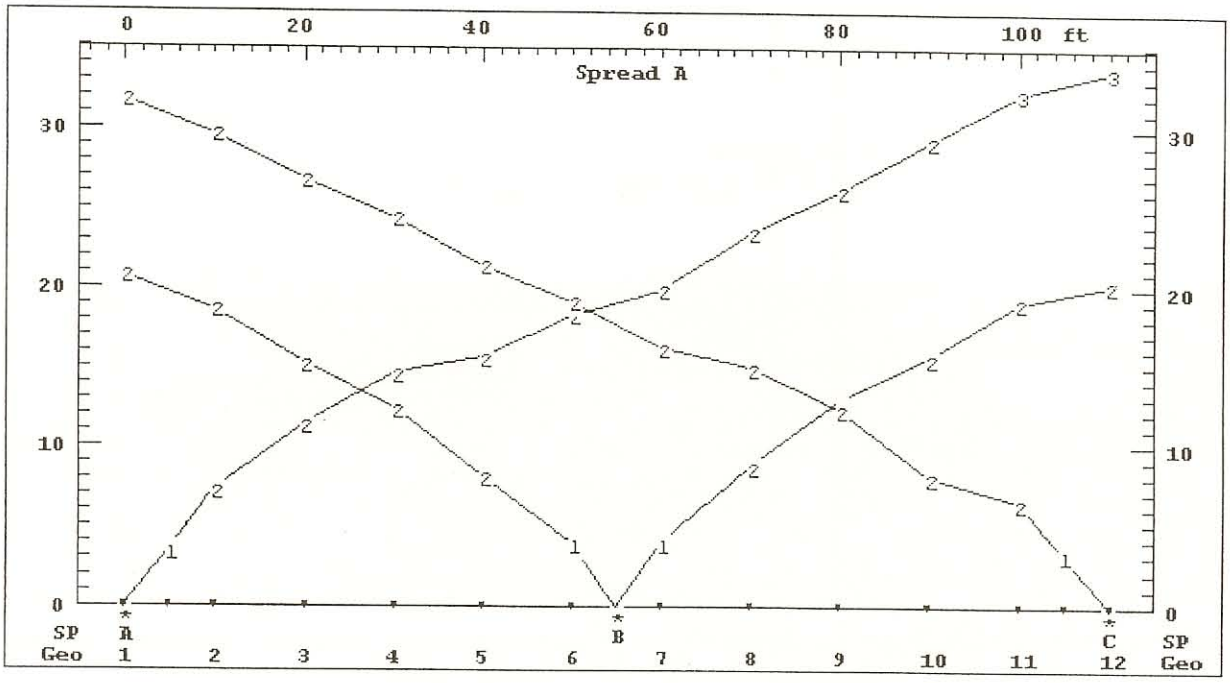
APPENDIX E

SEISMIC REFRACTION DATA

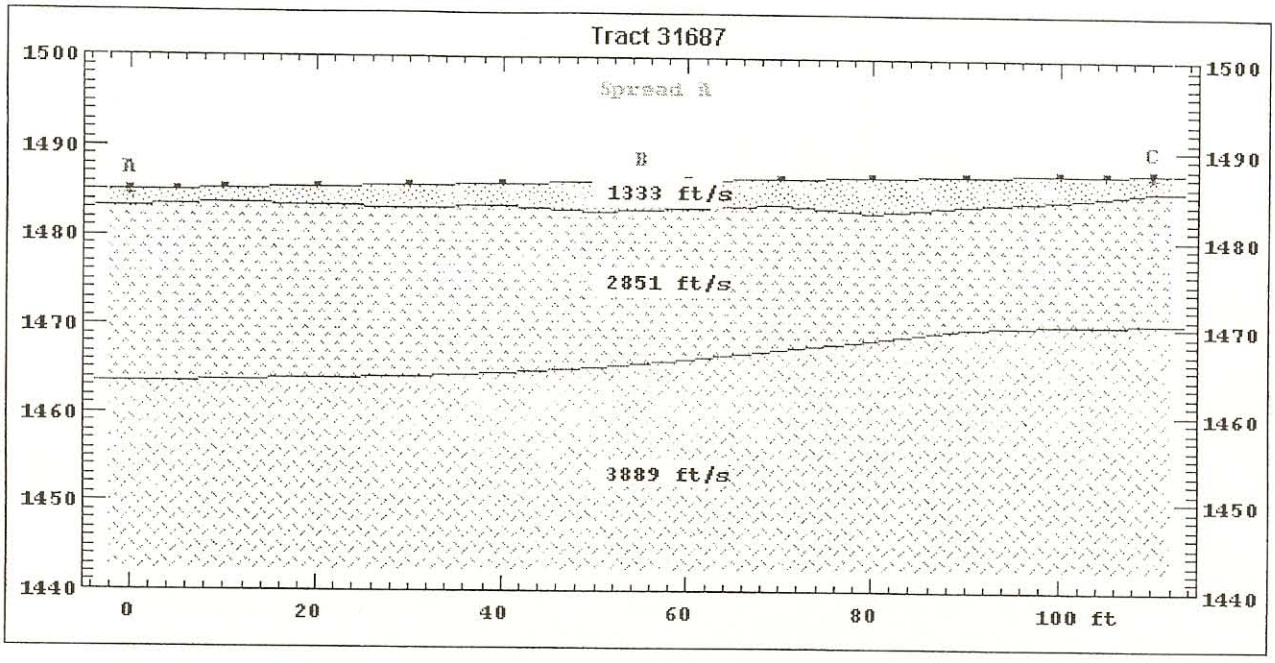
Example
Raw Seismic Data



Example
Seismic Line
Time Distance Curves



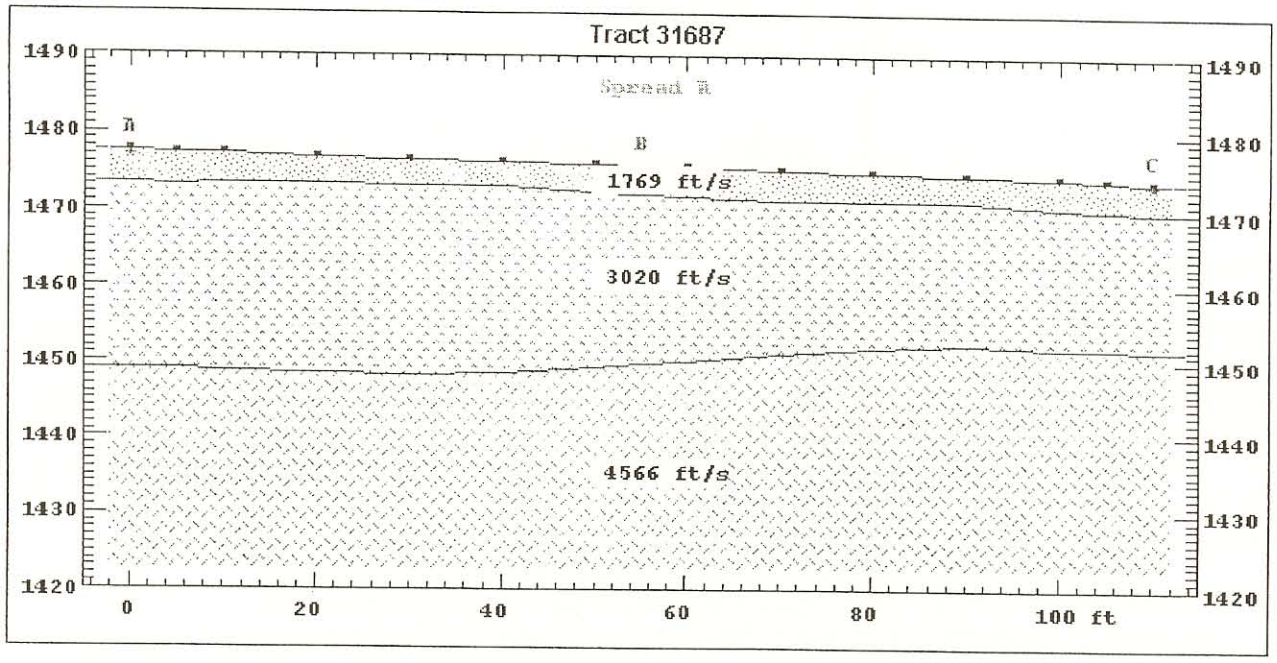
Seismic Line
SL-1



South

North

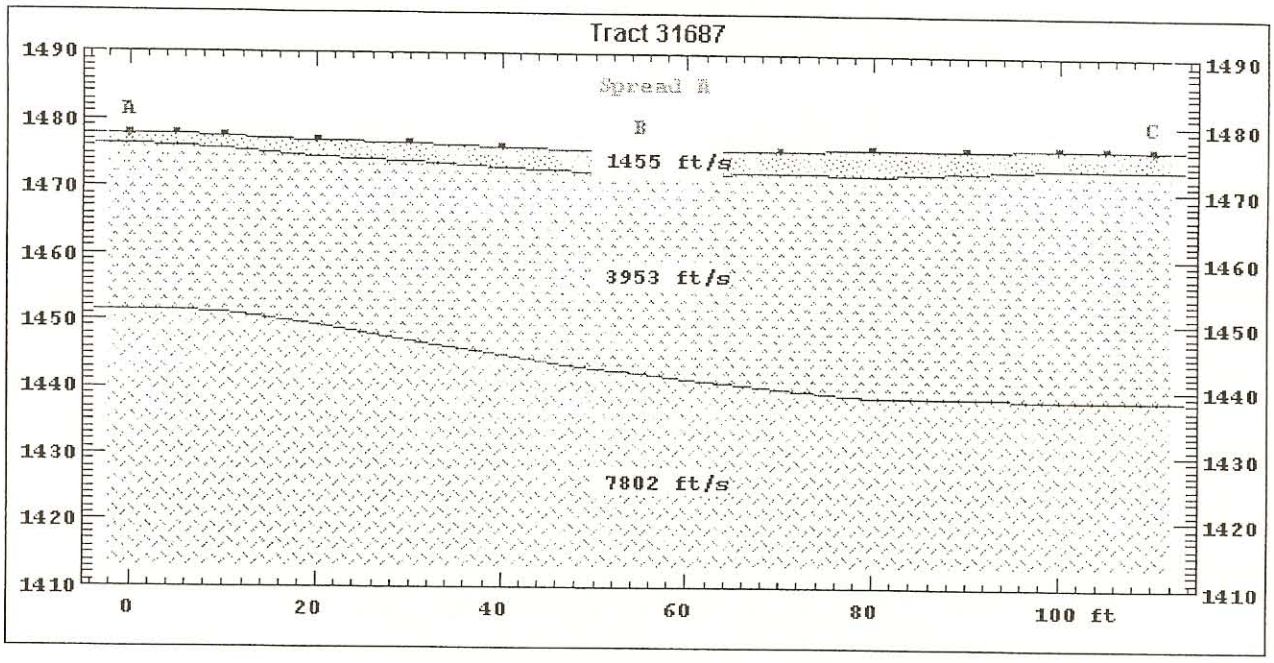
Seismic Line
SL-2



East

West

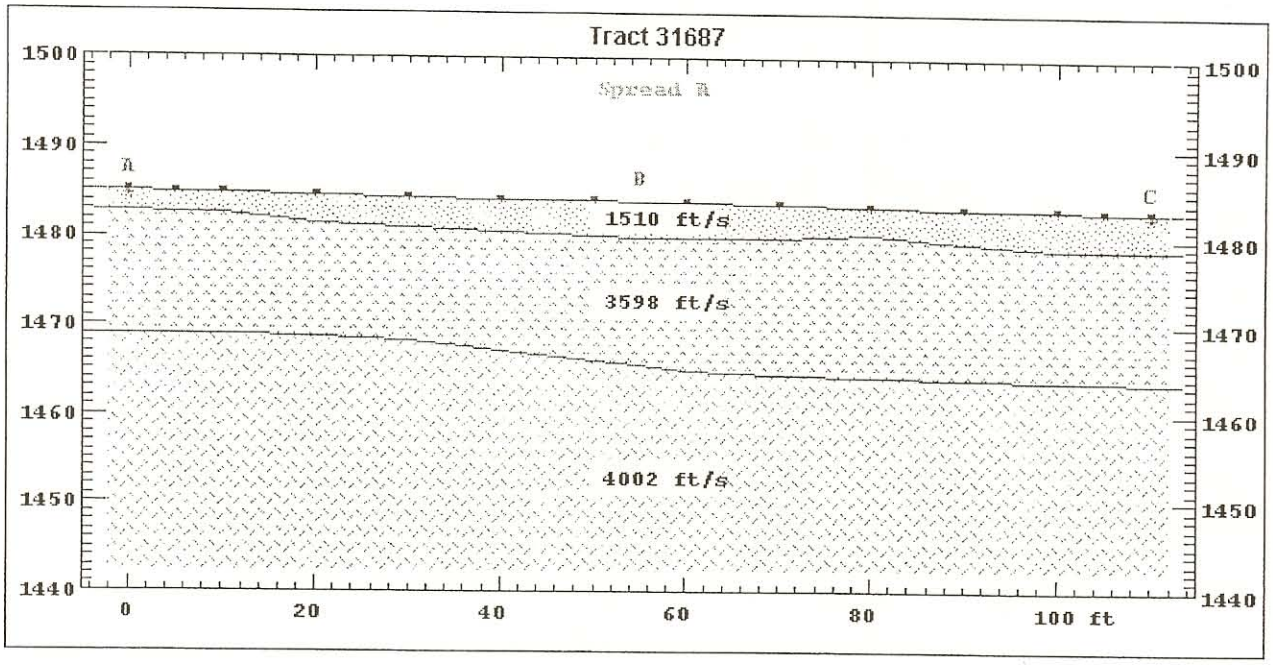
Seismic Line
SL-3



South

North

Seismic Line
SL-4



East

West

APPENDIX F

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.

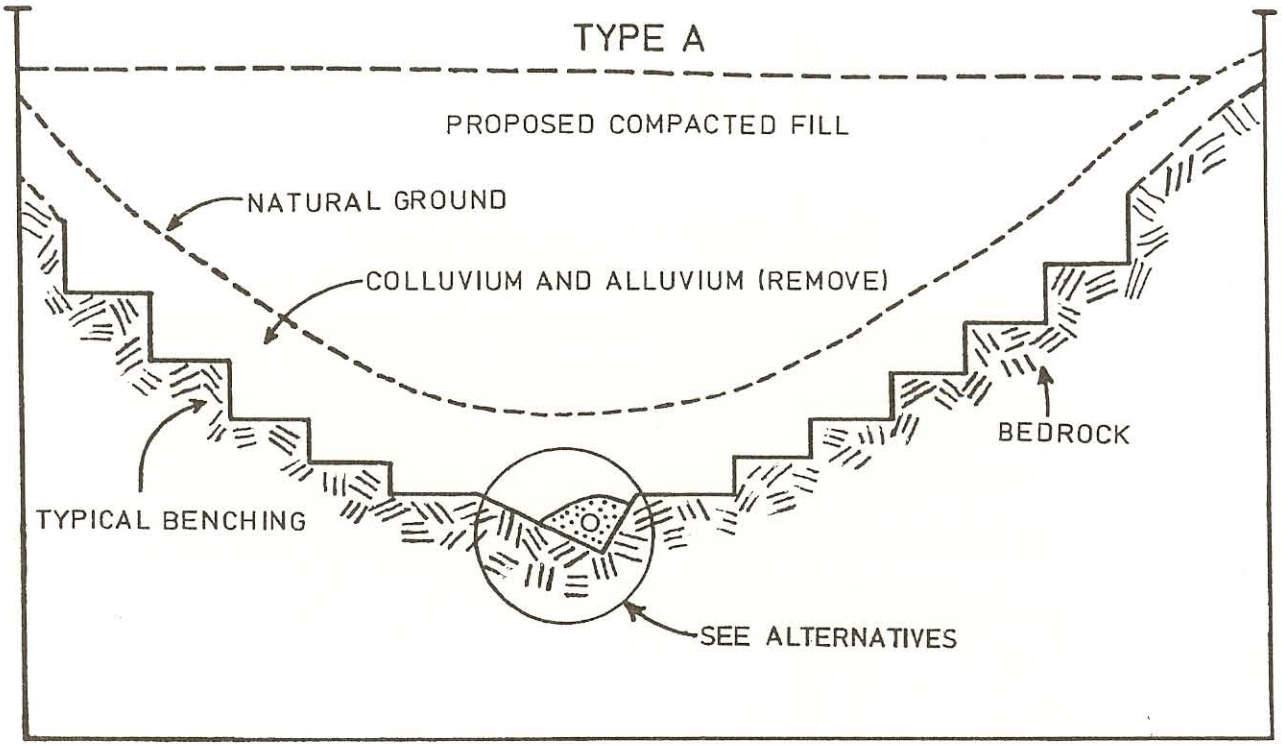
All trench excavations or vertical cuts in excess of 5 feet deep, which any person enters, should be shored or laid back.

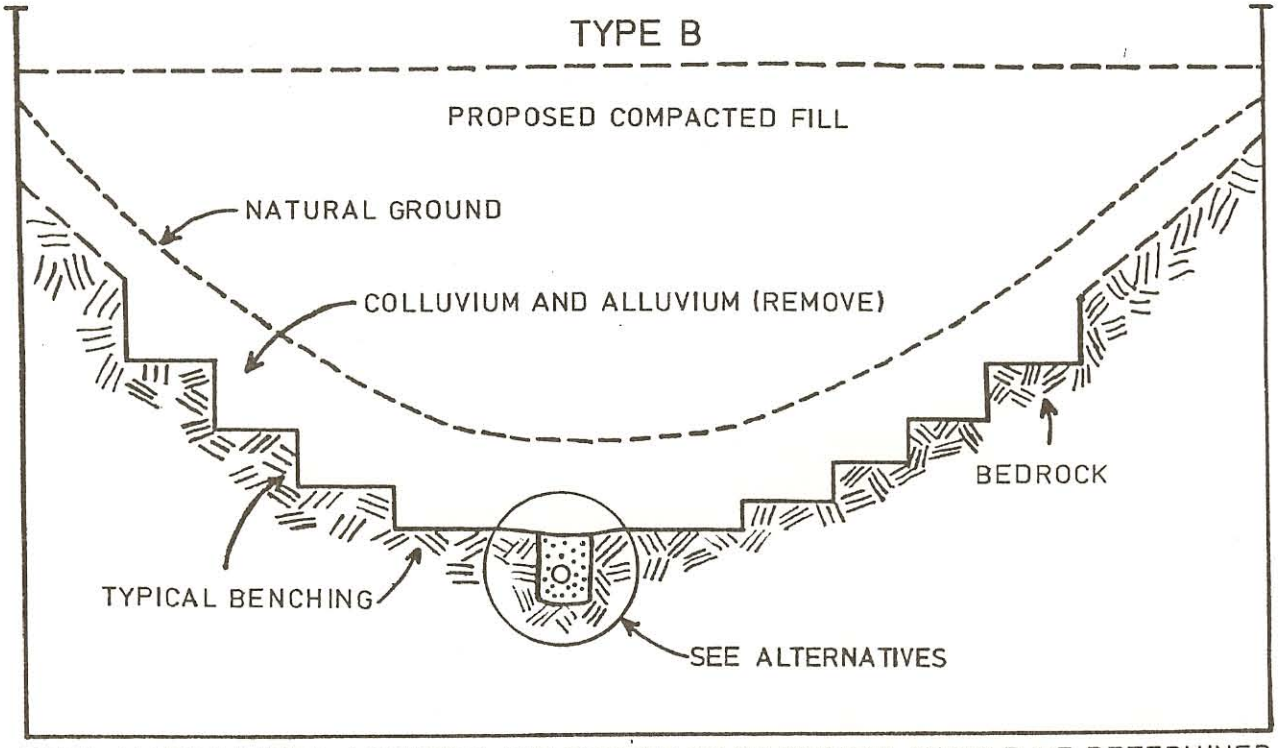
Trench access should be provided in accordance with CAL-OSHA and/or state and local standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

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



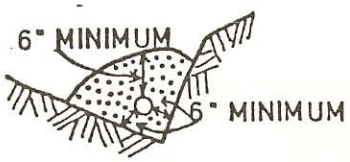


NOTE: ALTERNATIVES, LOCATION AND EXTENT OF SUBDRAINS SHOULD BE DETERMINED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST DURING GRADING.

PLATE EG–1

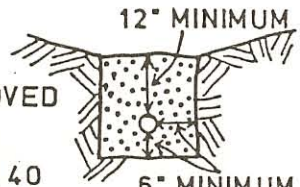
CANYON SUBDRAIN ALTERNATE DETAILS

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

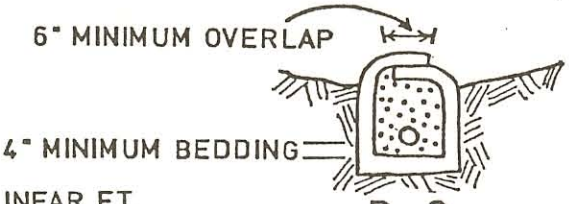
FILTER MATERIAL

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

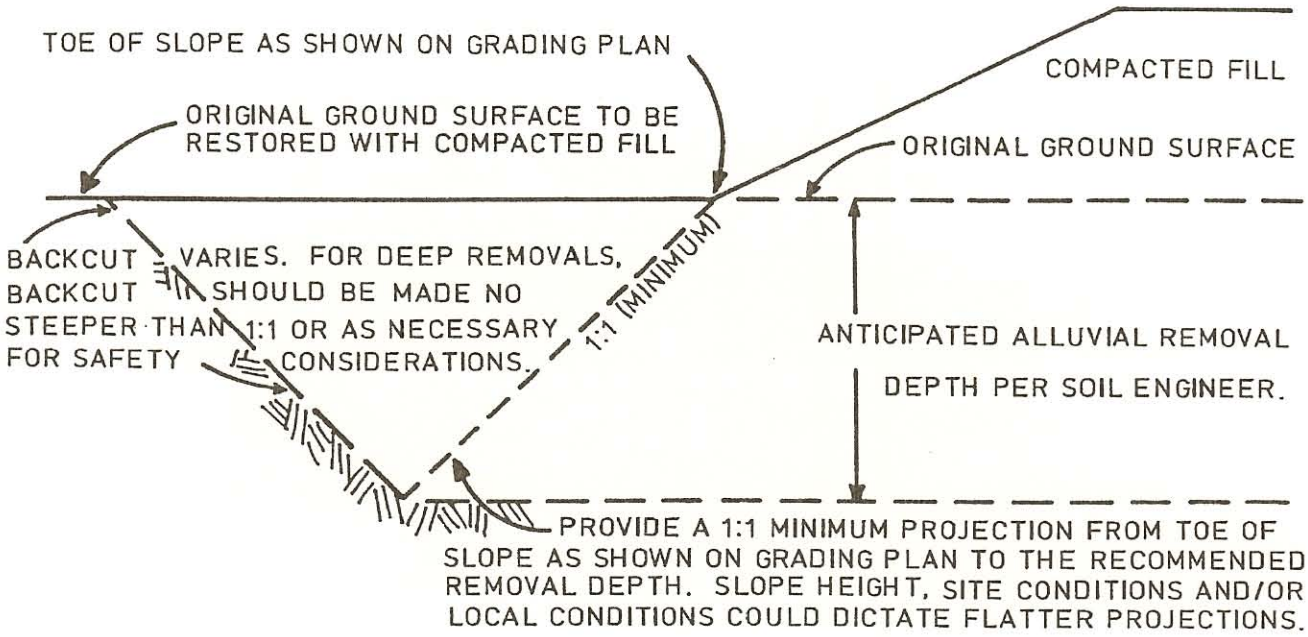


B–2

GRAVEL MATERIAL 9 FT³/LINEAR FT.
PERFORATED PIPE: SEE ALTERNATE 1
GRAVEL: CLEAN 3/4 INCH ROCK OR APPROVED SUBSTITUTE
FILTER FABRIC: MIRAFI 140 OR APPROVED SUBSTITUTE

PLATE EG–2

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON



REMOVAL ADJACENT TO EXISTING FILL

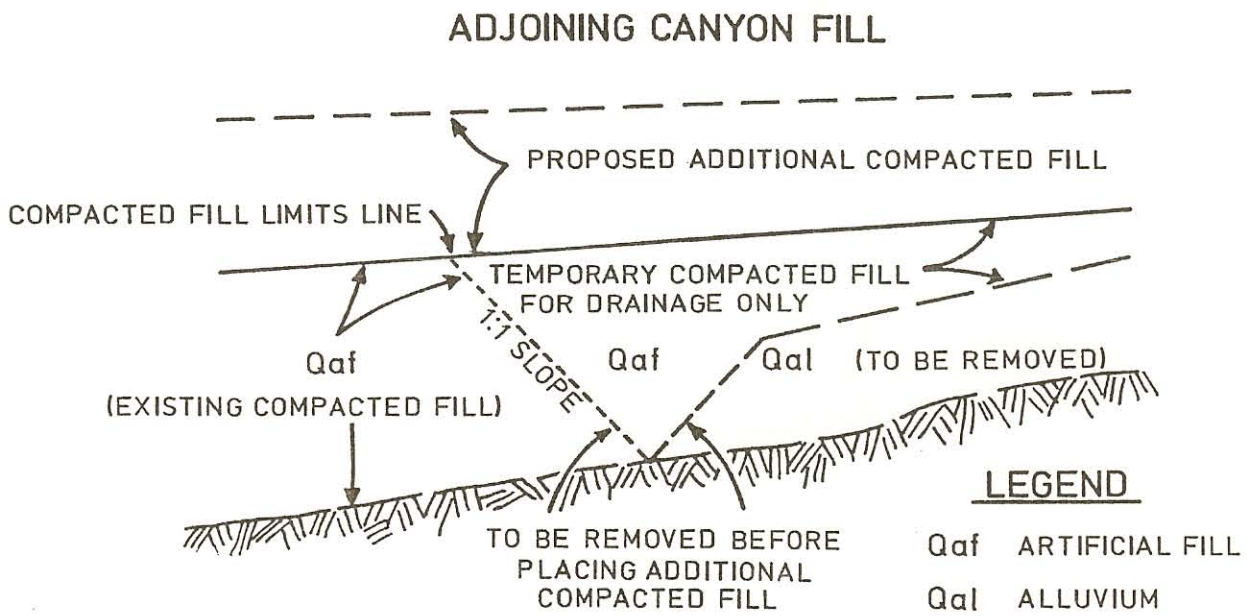


PLATE EG—3

TYPICAL STABILIZATION / BUTTRESS FILL DETAIL

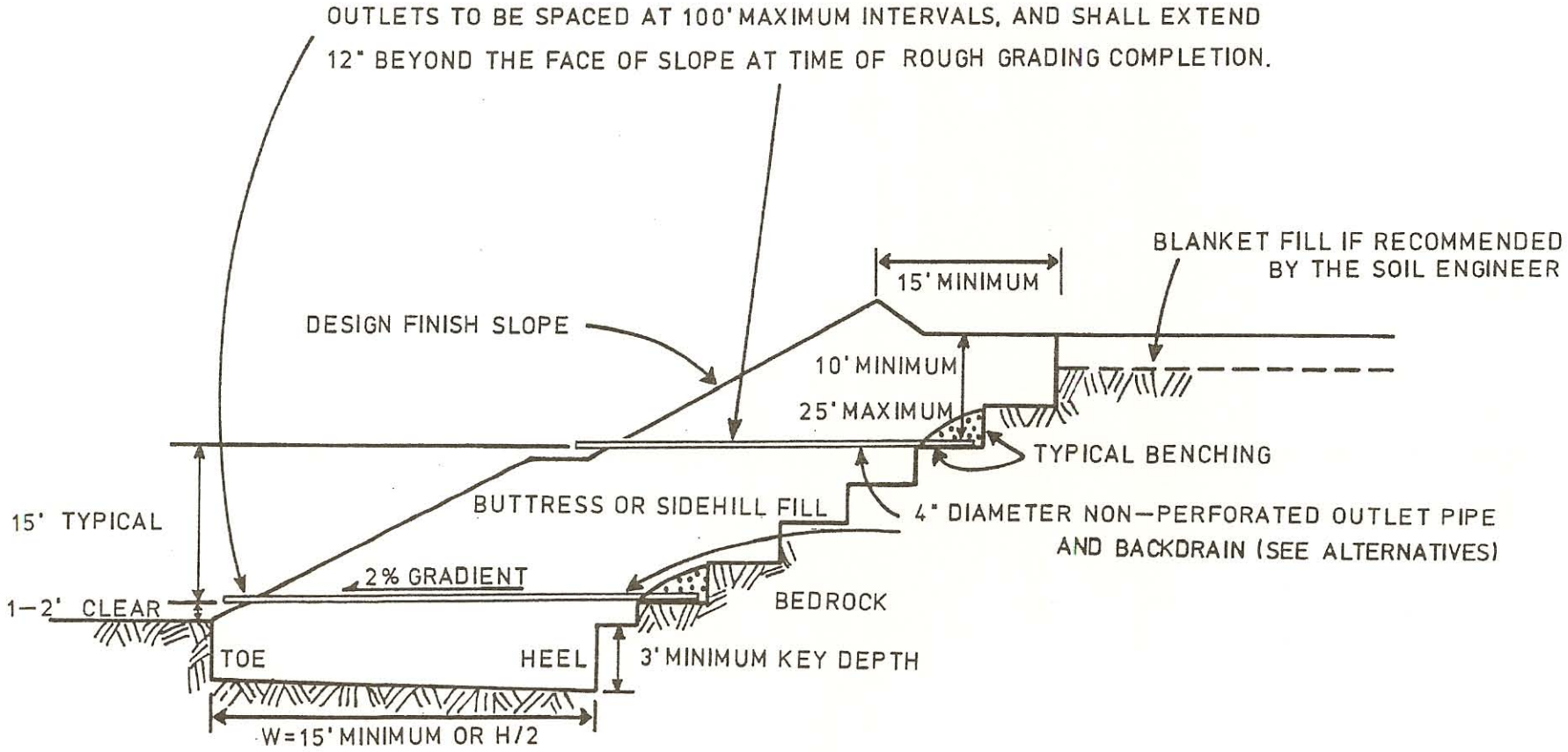
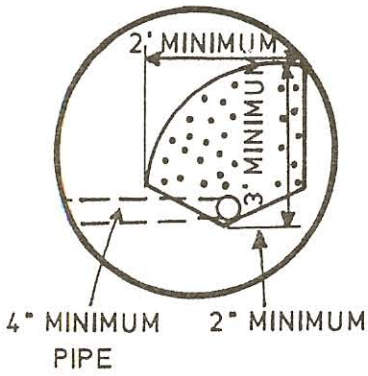
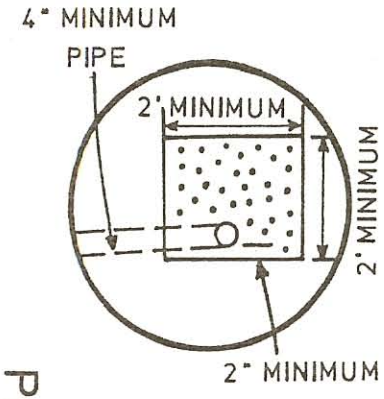


PLATE EG—4

TYPICAL STABILIZATION / BUTTRESS SUBDRAIN DETAIL





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

ALTERNATIVE IN LIEU OF FILTER MATERIAL: 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.

MINIMUM 4" DIAMETER PIPE: 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.

FILTER MATERIAL 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

GRAVEL SHALL BE OF THE FOLLOWING SPECIFICATION OR AN APPROVED EQUIVALENT:

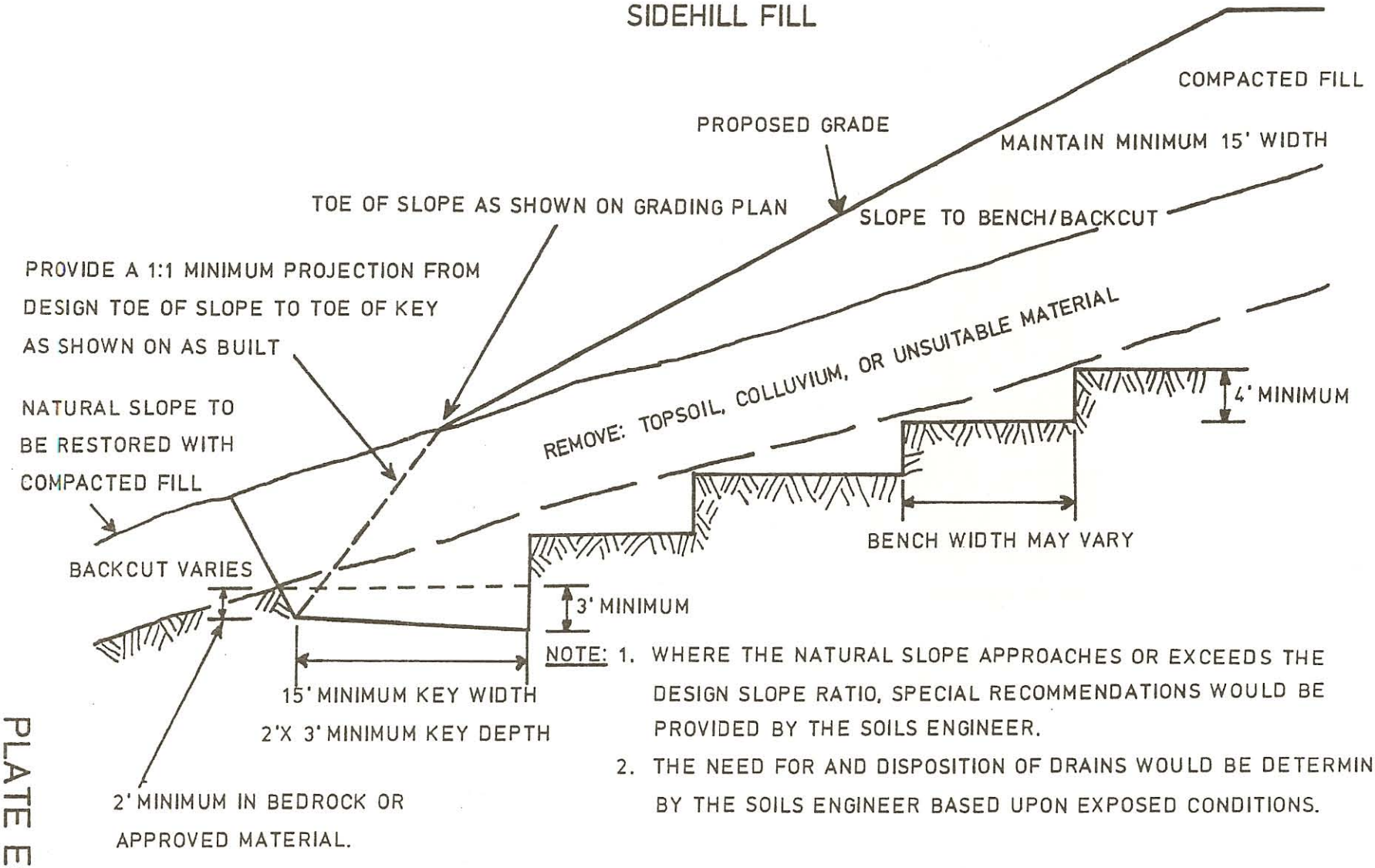
SIEVE SIZE	PERCENT PASSING
1 1/2 INCH	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT: MINIMUM OF 50

PLATE EG—5

FILL OVER NATURAL DETAIL

SIDEHILL FILL

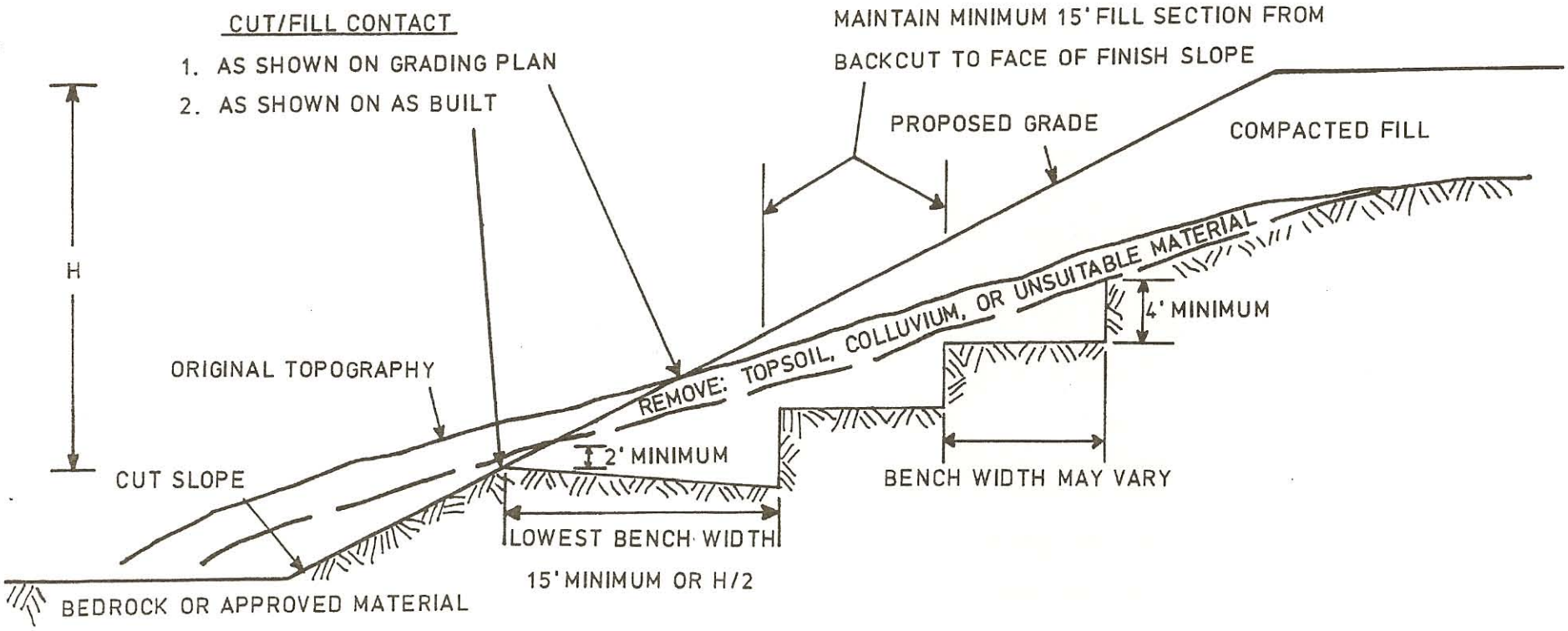


NOTE: 1. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WOULD BE PROVIDED BY THE SOILS ENGINEER.

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

PLATE EG-6

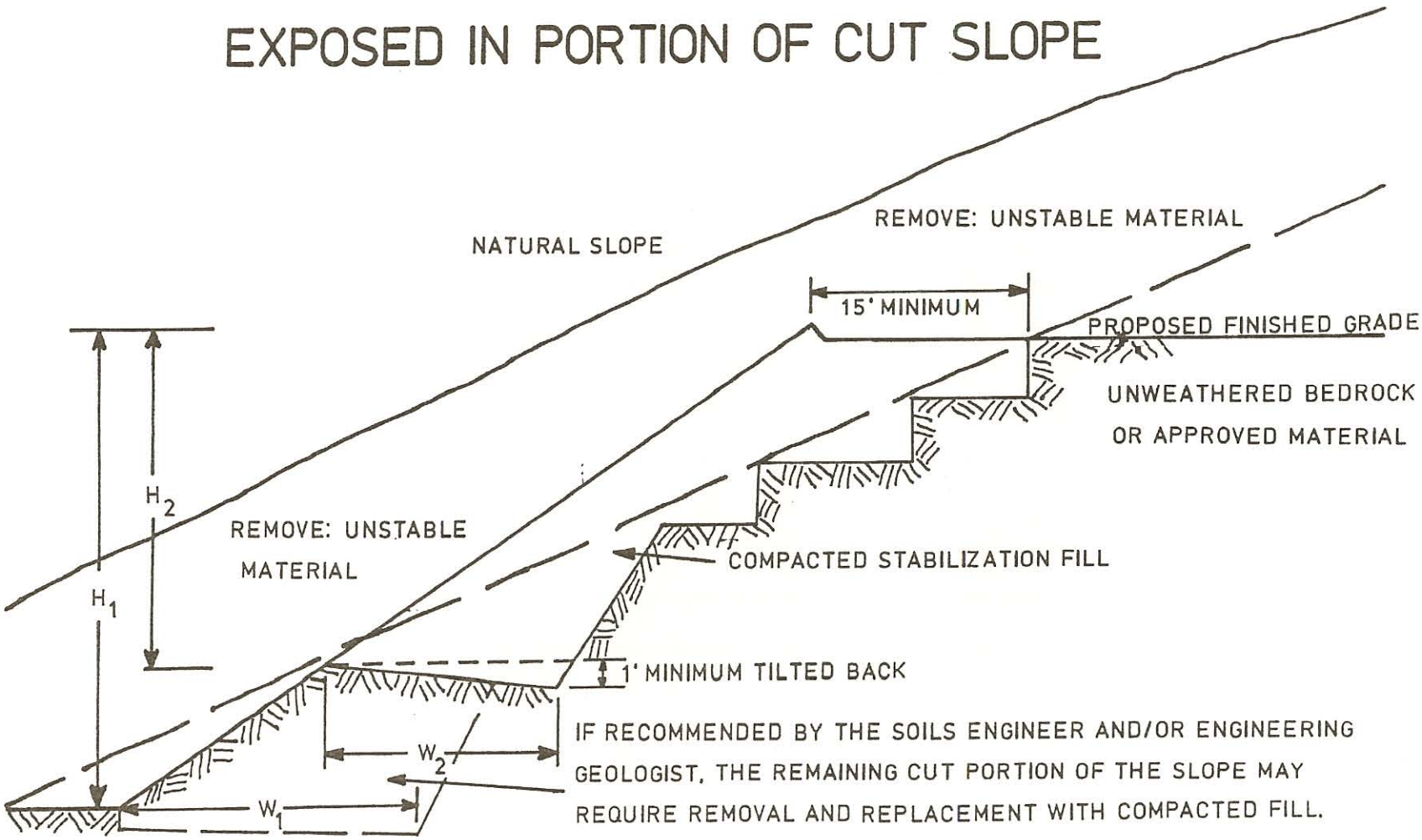
FILL OVER CUT DETAIL



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

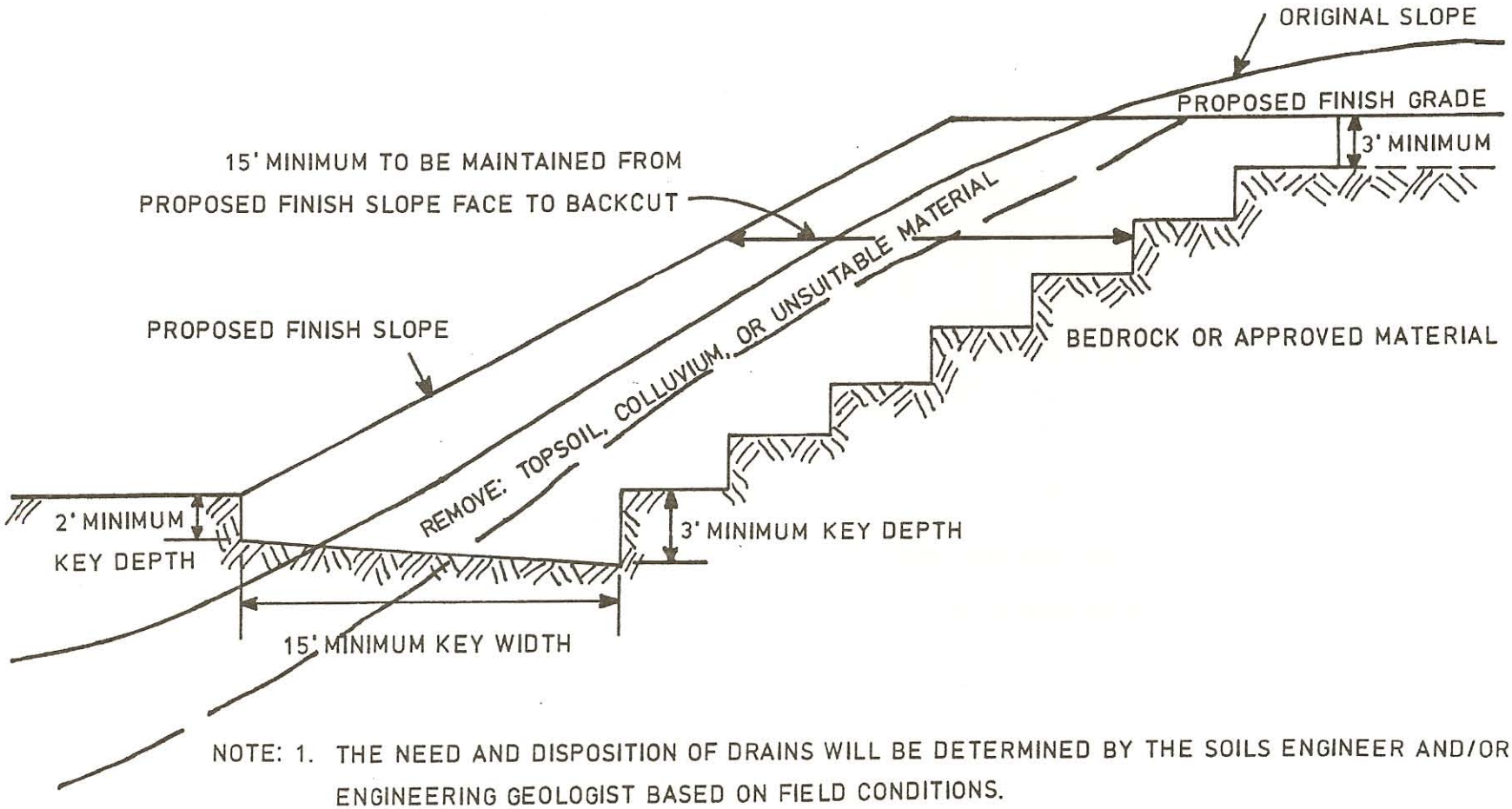


NOTE: 1. SUBDRAINS ARE NOT REQUIRED UNLESS SPECIFIED BY SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST.

2. "W" 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.

PLATE EG—8

SKIN FILL OF NATURAL GROUND

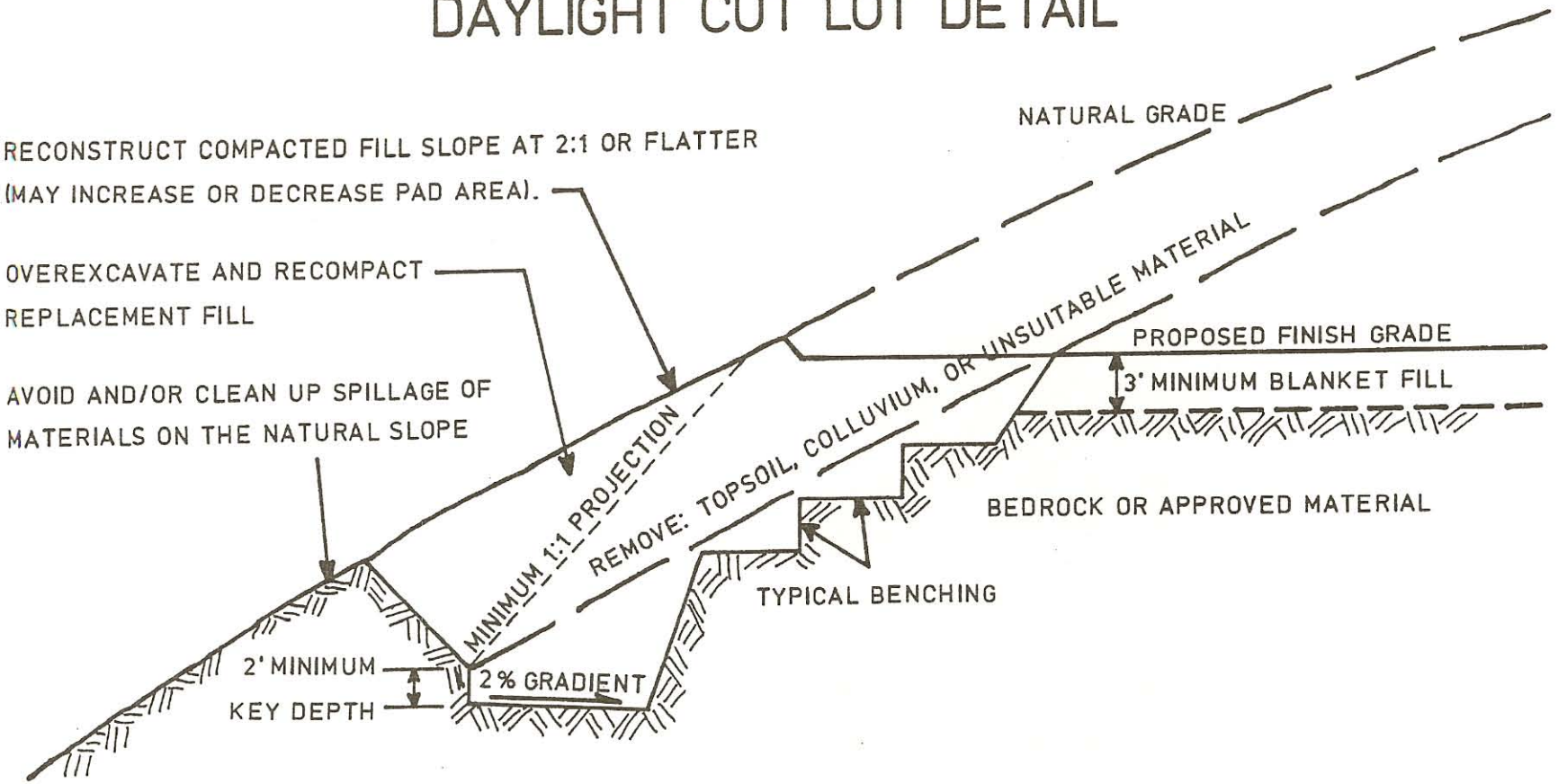


NOTE: 1. THE NEED AND DISPOSITION OF DRAINS WILL BE DETERMINED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST BASED ON FIELD CONDITIONS.

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



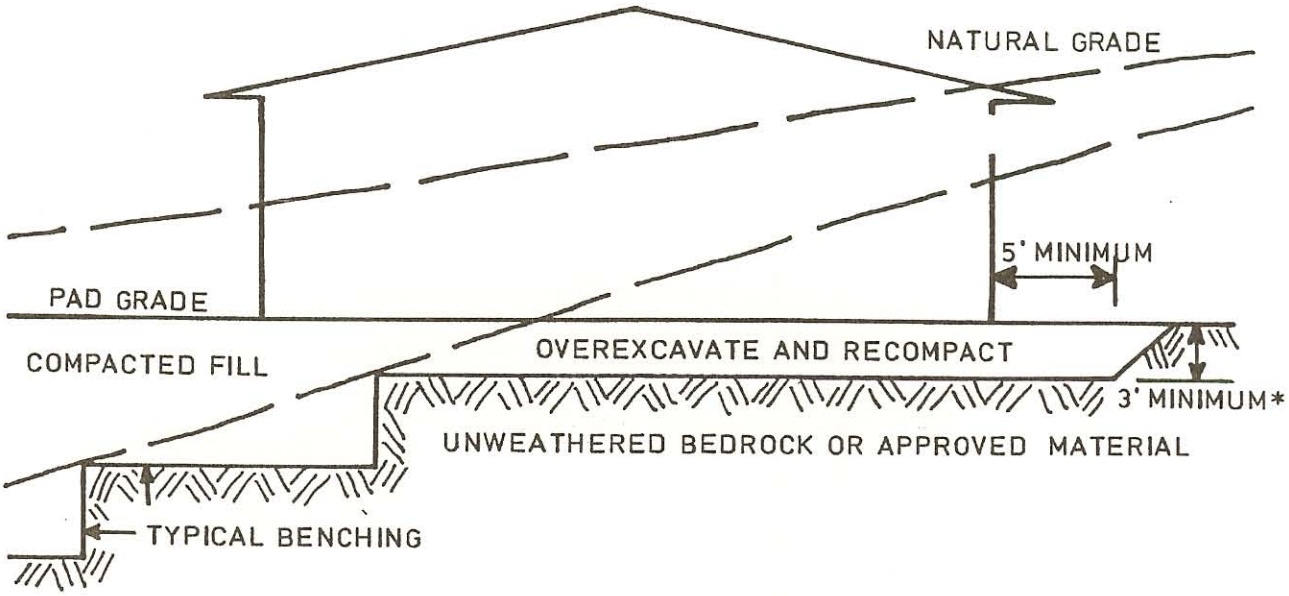
NOTE: 1. SUBDRAIN AND KEY WIDTH REQUIREMENTS WILL BE DETERMINED BASED ON EXPOSED SUBSURFACE CONDITIONS AND THICKNESS OF OVERBURDEN.

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

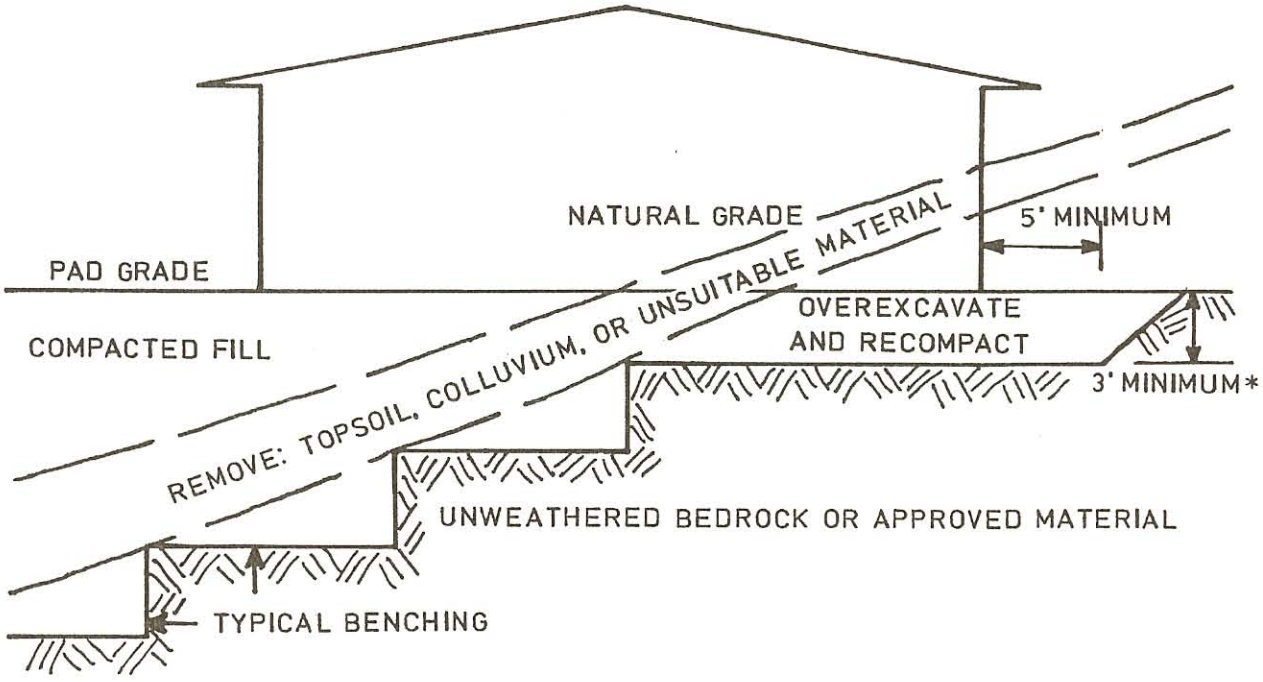
PLATE EG—10

TRANSITION LOT DETAIL

CUT LOT (MATERIAL TYPE TRANSITION)



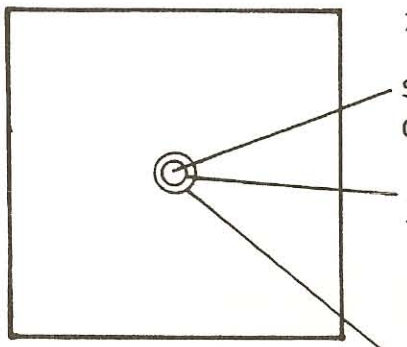
CUT—FILL LOT (DAYLIGHT TRANSITION)



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

PLATE EG—11

SETTLEMENT PLATE AND RISER DETAIL

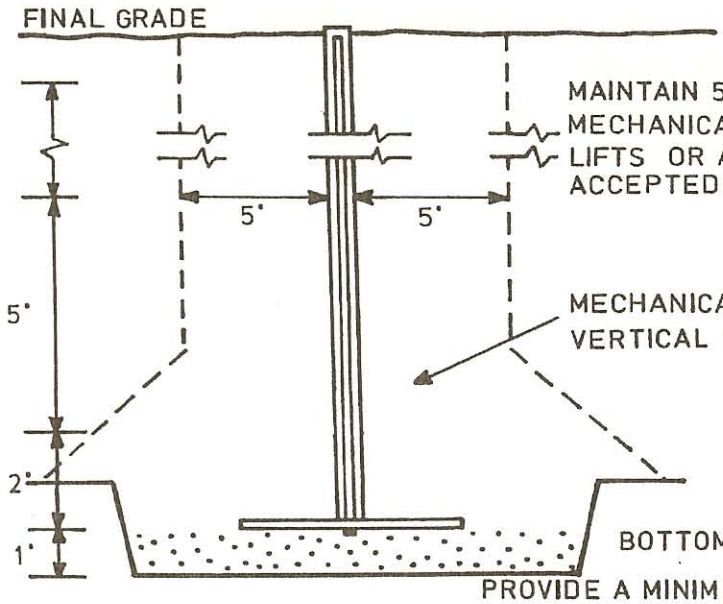


2'X 2'X 1/4" STEEL PLATE

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.

PLATE EG—14

TYPICAL SURFACE SETTLEMENT MONUMENT

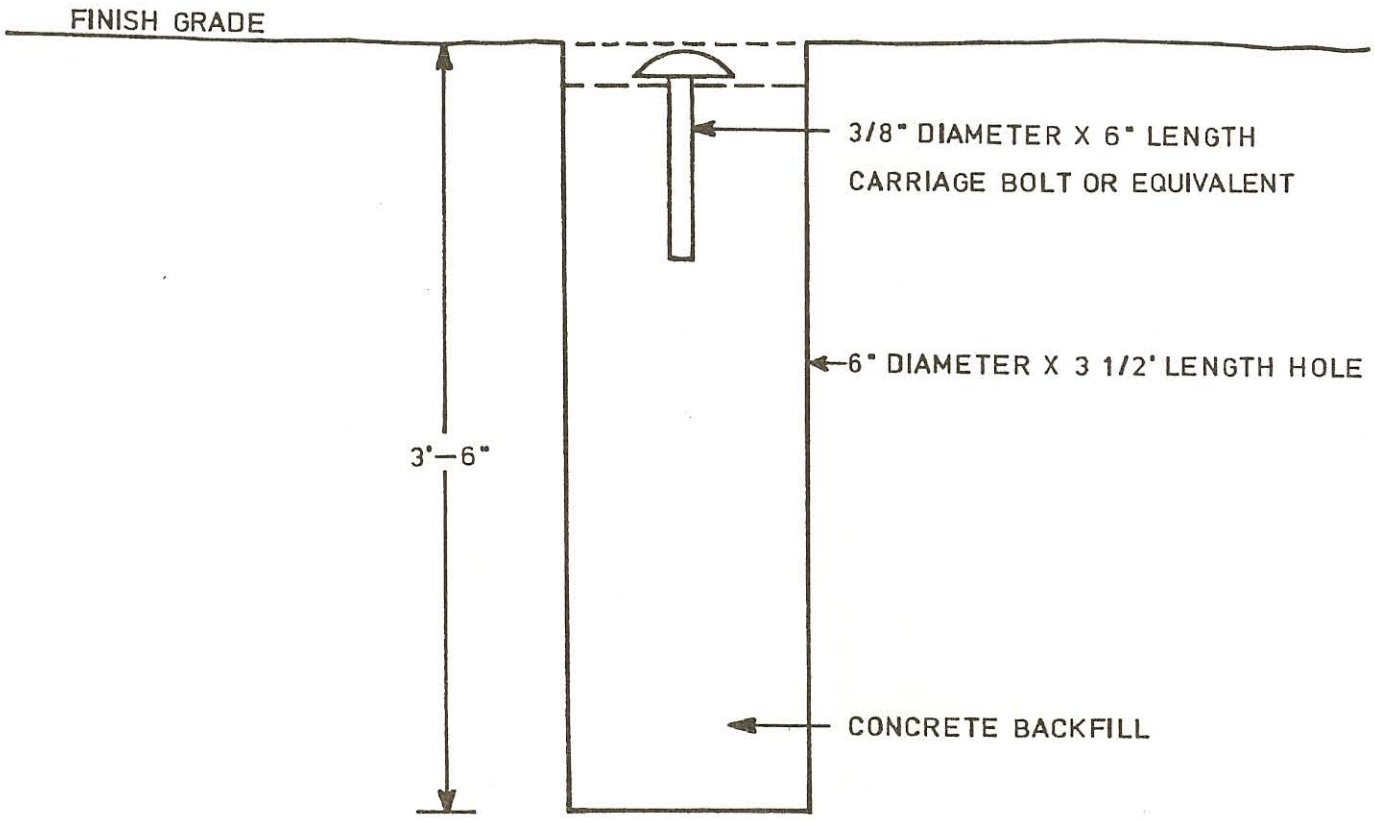
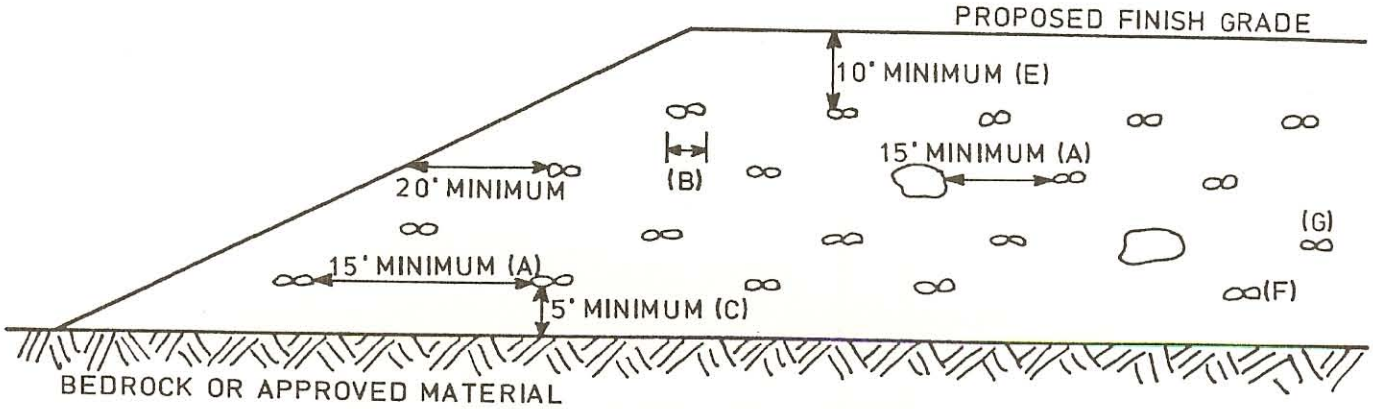


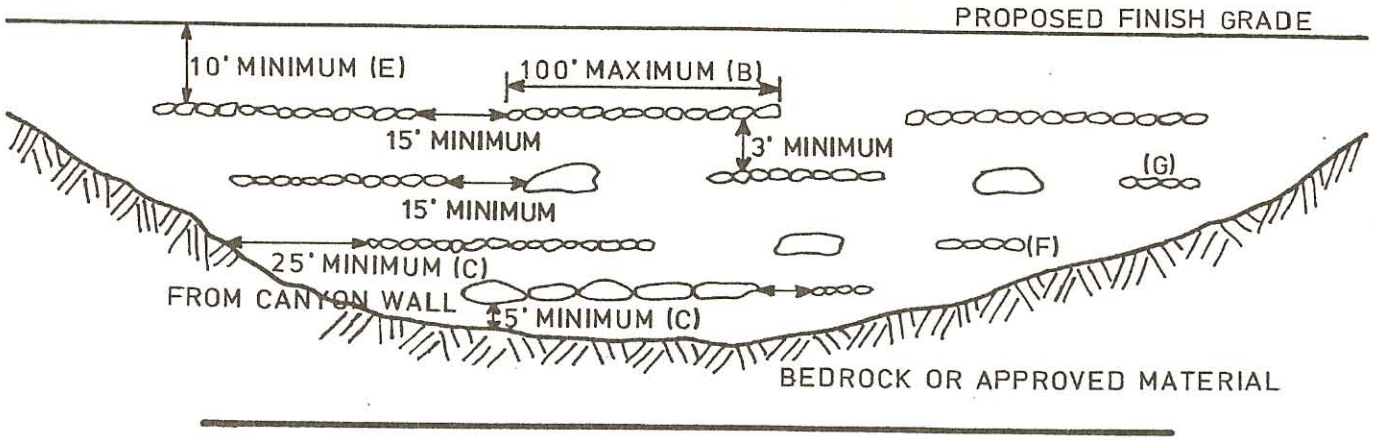
PLATE EG-15

OVERSIZE ROCK DISPOSAL

VIEW NORMAL TO SLOPE FACE



VIEW PARALLEL TO SLOPE FACE

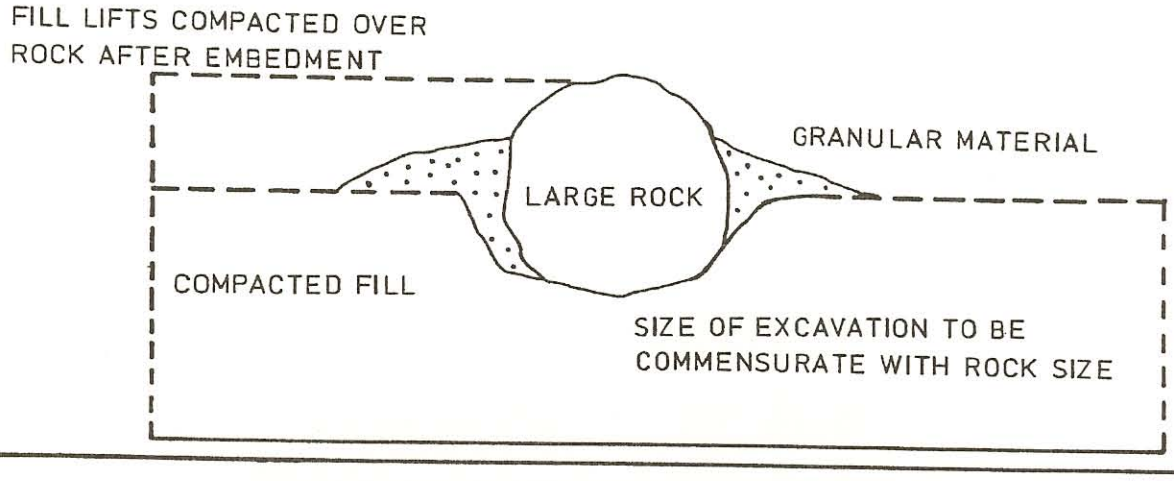


NOTE: (A) ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.
(B) HEIGHT AND WIDTH MAY VARY DEPENDING ON ROCK SIZE AND TYPE OF EQUIPMENT. LENGTH OF WINDROW SHALL BE NO GREATER THAN 100' MAXIMUM.
(C) IF APPROVED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST, WINDROWS MAY BE PLACED DIRECTLY ON COMPETENT 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.

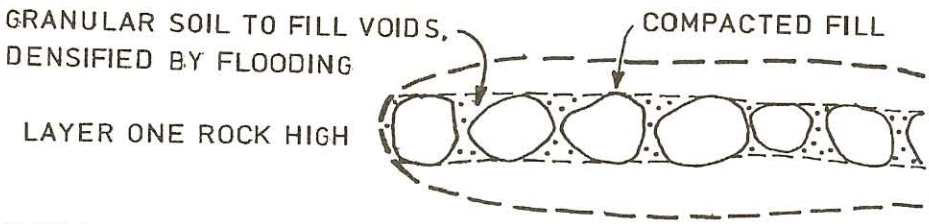
PLATE RD-1

ROCK DISPOSAL PITS

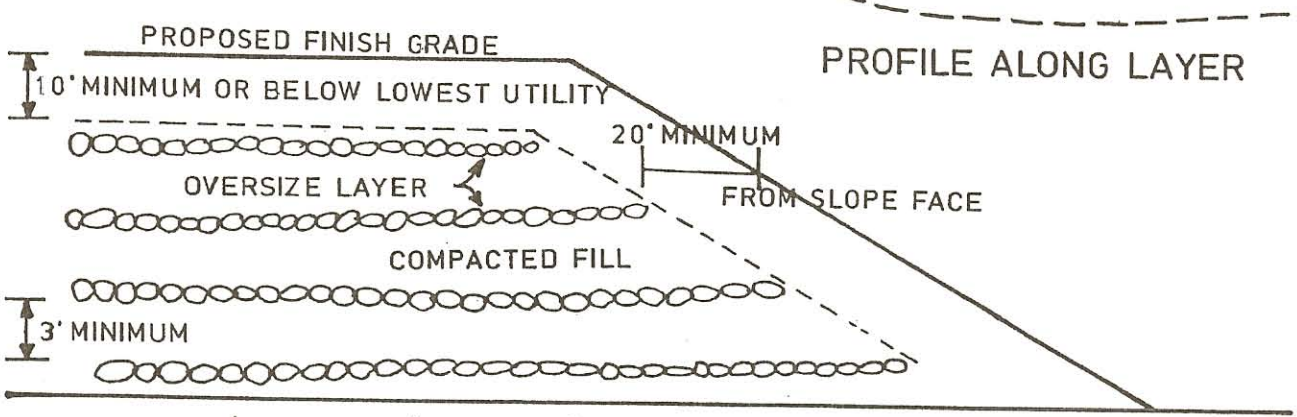
VIEWS ARE DIAGRAMMATIC ONLY. ROCK SHOULD NOT TOUCH AND VOIDS SHOULD BE COMPLETELY FILLED IN.



ROCK DISPOSAL LAYERS



PROFILE ALONG LAYER



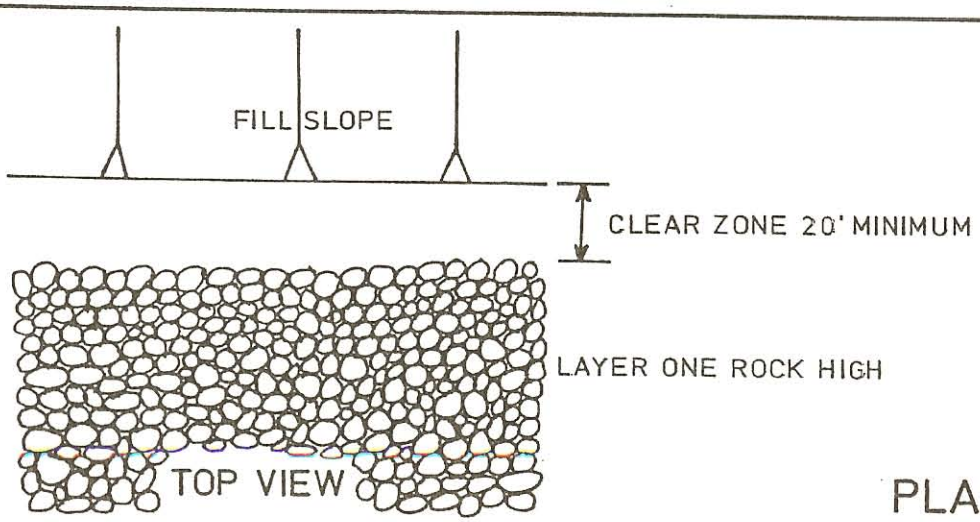
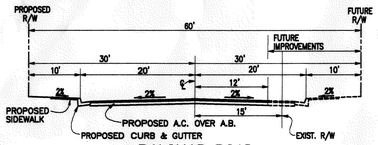
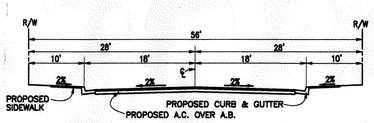


PLATE RD—2

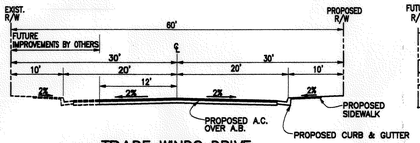
TENTATIVE TRACT MAP NO. 31687
AMENDMENT NO. 4
(SCHEDULE "A")



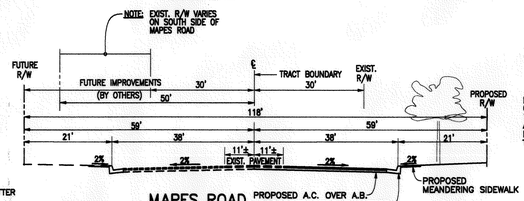
PALOMAR ROAD
(LOOKING NORTH)
PROPOSED STREET SECTION
(PER RIV. CO. STD. NO. 104-A)
NOT TO SCALE



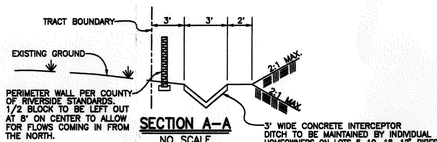
STREETS "A" THROUGH "E" STREETS
PROPOSED STREET SECTION
(PER RIV. CO. STD. NO. 104-A-MODIFIED)
NOT TO SCALE



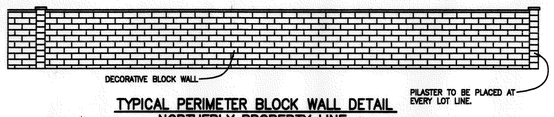
TRADE WINDS DRIVE
(LOOKING NORTH)
PROPOSED STREET SECTION
(PER RIV. CO. STD. NO. 104-A)
NOT TO SCALE



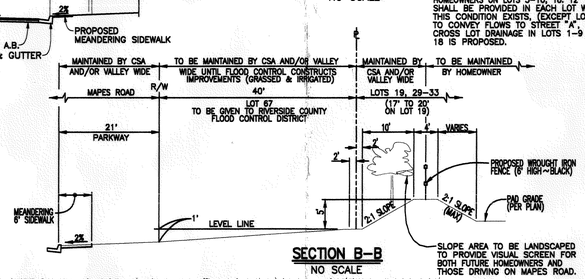
MAPES ROAD
(LOOKING WEST)
PROPOSED STREET SECTION
(PER RIV. CO. STD. NO. 101-MODIFIED)
NOT TO SCALE



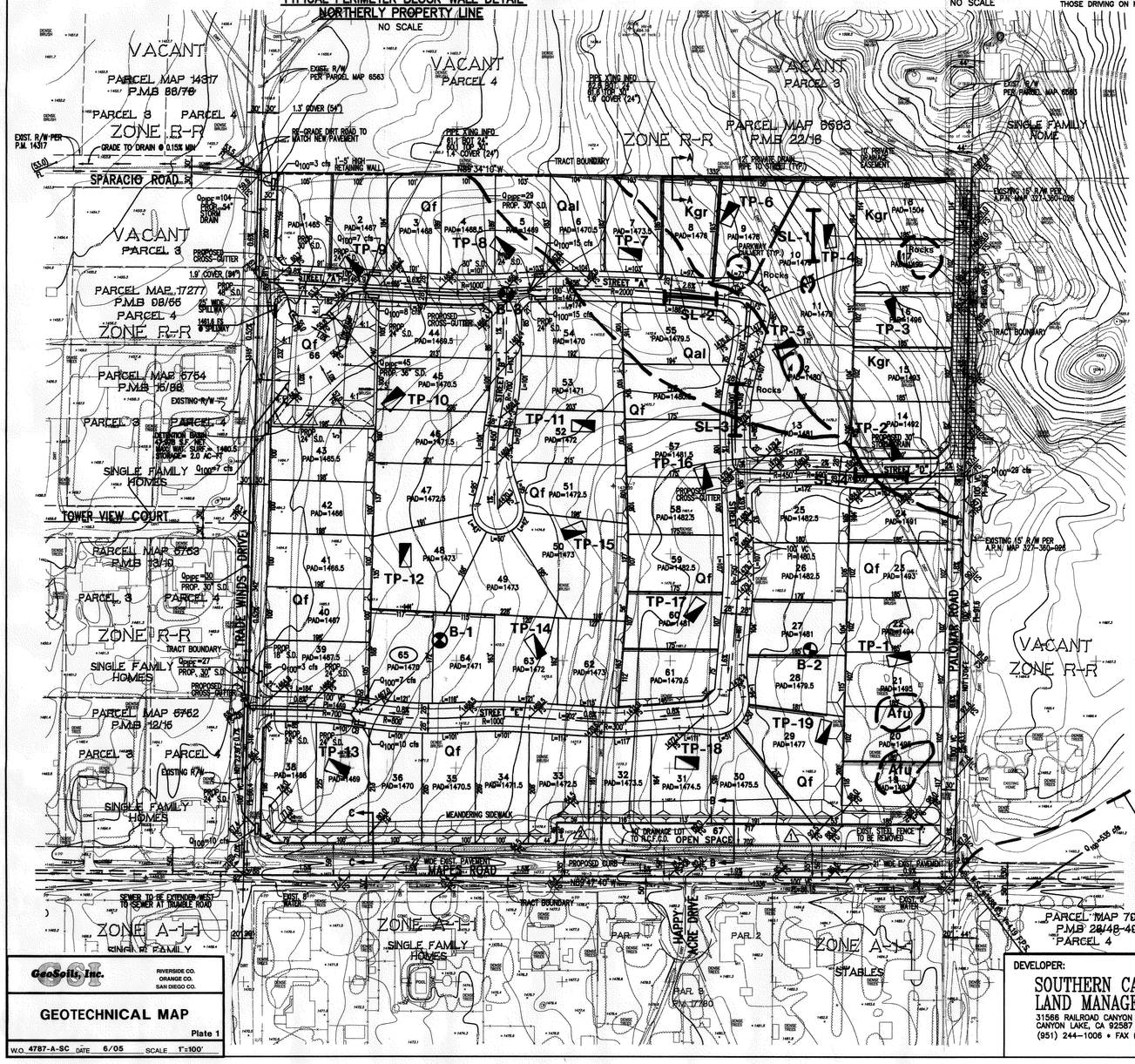
SECTION A-A
NO SCALE



TYPICAL PERIMETER BLOCK WALL DETAIL
NORTHERLY PROPERTY LINE
NO SCALE



SECTION B-B
NO SCALE



APPLICANT / LANDOWNER:

SOUTHERN CALIFORNIA LAND MANAGEMENT
31566 RAILROAD CANYON RD.
CANYON LAKE, CA 92587
(951) 244-1006 * FAX (951) 244-1007
CONTACT: BRIAN MERRITT

PREPARER:

CSL ENGINEERING, INC.
11651 STERLING AVENUE, SUITE E
RIVERSIDE, CALIFORNIA 92503
(951) 785-5122 * FAX (951) 785-5180

LEGAL DESCRIPTION:

THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 2, TOWNSHIP 5 SOUTH, RANGE 3 WEST SAN BERNARDINO BASE AND MERIDIAN.

ASSESSOR'S PARCEL No.:

327-340-017 & 018

ACREAGE:

NET AREA. . . . . 32.16 ACRES
ALL STREET DEDICATIONS. . . . . 8.01 ACRES
GROSS AREA 40.17 ACRES

No. OF PROPOSED LOTS:

65 LOTS RESIDENTIAL (1/2 ACRE GROSS)
1 LOT DEDICATED TO R.C.F.C.D. (LOT 67)
1 LOT FOR DETENTION BASIN PURPOSES (LOT 66)
67 TOTAL LOTS

PROPOSED MINIMUM LOT SIZE:

HALF-ACRE - 65 RESIDENTIAL LOTS

UTILITIES:

ELECTRIC : SOUTHERN CALIFORNIA EDISON
26100 MENIFEE ROAD
ROMOLAND, CALIFORNIA 92380

GAS : SOUTHERN CALIFORNIA GAS COMPANY
1981 WEST LUGONIA AVENUE
REDLANDS, CALIFORNIA 92373

WATER & SEWER : EASTERN MUNICIPAL WATER DISTRICT
2270 TRUMBLE ROAD
PERRIS, CALIFORNIA 92572-8300

TELEPHONE : VERIZON
150 JUANITA
HEMET, CA 92543

TELEVISION : COMCAST CABLE
1581 COMMERCE STREET
CORONA, CA 92880

SCHOOL DISTRICTS:

ELEMENTARY
ROMOLAND SCHOOL DISTRICT
25900 LEON ROAD
HOMELAND, CALIFORNIA 92548

SECONDARY
PERRIS UNION HIGH SCHOOL DISTRICT
155 E. 4TH STREET
PERRIS, CALIFORNIA 92570

EASEMENTS:

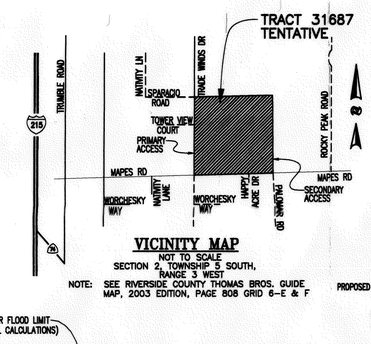
1. AN EASEMENT IN FAVOR OF CALIFORNIA ELECTRIC POWER COMPANY FOR POLELINES, CONDUITS & INCIDENTAL PURPOSES REC. IN BOOK 1139, PAGE 491 ON 1/16/50, O.R.
2. AN EASEMENT IN FAVOR OF CALIFORNIA ELECTRIC POWER COMPANY FOR POLELINES, CONDUITS & INCIDENTAL PURPOSES REC. IN BOOK 1139, PAGE 501 ON 1/16/50, O.R.

LEGEND

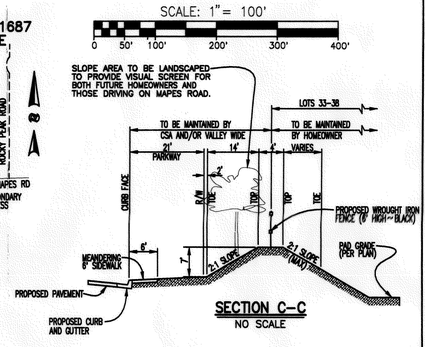
Afu	Artificial fill - undocumented
Qal	Quaternary alluvium
Qf	Quaternary fan deposits (Pleistocene-age fans)
Kgr	Cretaceous granitics
B-3	Approximate location of exploratory boring
TP-19	Approximate location of exploratory test pit
SL-4	Approximate location of seismic refraction survey line
	Area of potential street overexcavation for utilities due to hard rock

All locations are approximate





VICINITY MAP
NOT TO SCALE
SECTION 2, TOWNSHIP 5 SOUTH, RANGE 3 WEST
NOTE: SEE RIVERSIDE COUNTY THOMAS BROS. GUIDE MAP, 2003 EDITION, PAGE 808 GRID 6-E & F



SECTION C-C
NO SCALE

AMENDMENTS:

DATE	No.	DESCRIPTION
4/15/04	1	INCREASE PARK SIZE AND PROVIDE FOR FUTURE TENTATIVE TRACT 32179, REVISE LOT AND STREET CONFIGURATION TO PROVIDE AVERAGE 70' WIDTH, ADD LOT 138 (40' WIDE) FOR FUTURE FLOOD CHANNEL.
8/10/04	2	ADDED INFILTRATION SWALES ADJACENT TO LOTS 82-88, RECONFIGURED LOTS AND STREETS TO ACCOMMODATE INFILTRATION SWALES, MOVED PARK, REMOVED PROJECT REFERENCES TO NORTH WHICH IS TEMPORARILY ON HOLD, ETC.
10/12/04	3	CORRECT LOT AREAS, ADD SECTION E-E, ADD SEPERATE LOT FOR BASIN AND SLOPE.
2/14/05	4	REVISED MAP TO REFLECT 1/2 ACRE LOTS, INCLUDES REVISING LOT & STREET CONFIGURING, STORM DRAIN DESIGN, ETC.

ZONING & LAND USE:

SUBJECT PROPERTY
EXISTING ZONING . . . . . R-R
PROPOSED ZONING . . . . . R-R
EXISTING LAND USE . . . . . VACANT
PROPOSED LAND USE . . . . . SINGLE FAMILY RESIDENTIAL
EXISTING R.C.I.P. . . . . LOW DENSITY RESIDENTIAL (1/2 ACRE MIN.)

TOPOGRAPHY:

THE TOPOGRAPHY SHOWN HEREON IS BASED ON AERIAL TOPOGRAPHY PREPARED BY PSA TECHNOLOGIES FOR CSL ENGINEERING IN AUGUST 2003.

REFERENCE INFORMATION:

1. THIS TENTATIVE MAP INCLUDES ALL THE CONTIGUOUS OWNERSHIP OF THE LAND DIVIDER.
2. PRELIMINARY EARTHWORK CALCULATIONS INDICATE TRACT 31687 WILL BALANCE ON SITE. TRACT 31687 WILL GENERATE APPROXIMATELY 115,000 C.Y. RAW CUT AND 85,000 C.Y. RAW FILL AND IS ANTICIPATED TO BALANCE ON SITE WITH ANTICIPATED SHRINKAGES.
3. THIS SITE IS NOT WITHIN A SPECIFIC PLAN.
4. PERMISSION TO BE OBTAINED PRIOR TO GRADING OFFSITE IF NECESSARY.
5. TENTATIVE TRACT 31687 IS NOT LOCATED IN EITHER A GEOLOGICAL HAZARD AREA, LIQUEFACTION HAZARD AREA, OR A SPECIAL STUDIES ZONE.
6. TENTATIVE TRACT 31687 IS LOCATED IN ZONE C, PER FEMA PANEL 060245-1450D.
7. NO EXISTING STRUCTURES EXIST ON SITE.
8. NO FLAMMABLE/COMBUSTIBLE LIQUID STORAGE ARE PLANNED FOR THIS SITE.
9. IRRIGATION AND LANDSCAPE PLANS WILL BE DEFERRED TO A LATER TIME.
10. ALL SLOPES ARE 2:1 UNLESS OTHERWISE SHOWN.
11. NO CONCRETE CHANNELS ARE PROPOSED.
12. THIS SITE IS NOT SUBJECT TO OVERFLOW, INUNDATION OR FLOOD HAZARD.
13. THIS SITE IS IN CSA 146 & 152. THE DETENTION BASIN, (LOT 66), AS WELL AS OPEN SPACE LOT 67, SHALL BE MAINTAINED BY CSA OR VALLEY WIDE PARK AND RECREATION.
14. NO KNOWN EXISTING WELLS ON OR WITHIN 200 FEET OF SITE.
15. ALL STREETS ARE TO BE PUBLIC STREETS AND DEDICATED TO THE COUNTY.
16. DETENTION BASIN PROVIDES FOR APPROXIMATELY 2.0 ACRE-FT OF STORAGE.
17. LOWEST ELEVATION ONSITE IS 1459, HIGHEST ELEVATION ONSITE IS 1507.
18. A PERIMETER WALL WITH PILASTERS IS PROPOSED ALONG NORTHERLY PROJECT PERIMETER, (SEE TYPICAL PERIMETER BLOCK WALL DETAIL).

GeoSoils, Inc. — RIVERSIDE CO. ORANGE CO. SAN DIEGO CO.
GEOTECHNICAL MAP
Plate 1
W.O. 4787-A-SC DATE 6/05 SCALE 1"=100'

DEVELOPER:
SOUTHERN CALIFORNIA LAND MANAGEMENT
31566 RAILROAD CANYON RD. #643
CANYON LAKE, CA 92587
(951) 244-1006 * FAX (951) 244-1007

CSL ENGINEERING, INC.
11651 STERLING AVENUE, SUITE E
RIVERSIDE, CALIFORNIA 92503
(951) 785-5122 * FAX (951) 785-5180
PREPARED BY: R.C.E. NO. 25917 (EXP. 12/31/05)
RICHARD A. SCIANNI DATE:

TENTATIVE TRACT No. 31687
COUNTY OF RIVERSIDE
AMENDMENT NO. 4
SCHEDULE "A"

1 OF 1 SHTS

PREPARED FOR: SO. CAL. LAND MANAGEMENT | W.O. | DATE: APRIL, 2004. REV. AUG. 2004, FEB. 2005

JN620/620Tentative-Amd4.dwg/3-9-05/S-100

SUPPLEMENTAL 40-SCALE
GEOTECHNICAL GRADING PLAN REVIEW, TRACT 31687
ROMOLAND AREA, RIVERSIDE COUNTY, CALIFORNIA

FOR

GRIFFIN COMMUNITIES
110 NORTH LINCOLN AVENUE, SUITE 200
CORONA, CALIFORNIA 92882

W.O. 4787-A-SC OCTOBER 19, 2006

GeoSoils, Inc.

Geotechnical • Coastal • Geologic • Environmental

26590 Madison Avenue • Murrieta, California 92562 • (951) 677-9651 • FAX (951) 677-9301

October 19, 2006

W.O. 4787-A-SC
BGR 060348

Griffin Communities
110 North Lincoln Avenue, Suite 200
Corona, California 92882

Attention: Mr. Authur Levine

Subject: Supplemental 40-Scale Geotechnical Grading Plan Review, Tract 31687, Romoland Area, Riverside County, California

Dear Mr. Levine:

In accordance with your request and authorization, GeoSoils, Inc. (GSI), is providing this supplemental 40-scale grading plan review for the subject site. Our preliminary geotechnical report for the site (GSI, 2005), listed in Appendix A, evaluated such geologic and geotechnical items as removals of unsuitable and compressible soils, seismicity, and liquefaction potential. In general, the referenced report evaluated overall project feasibility from a soils engineering and geologic viewpoint and provided appropriate recommendations for development of the site. Unless specifically superceded by recommendations presented herein, the conclusions and recommendations contained in the referenced report by GSI (see Appendix A) remain pertinent and applicable, and should be appropriately implemented during planning, design, and construction. Owing to changes in the standards of practice, some of the recommendations provided previously may have changed somewhat, as summarized herein.

EXECUTIVE SUMMARY

Based on our previous preliminary investigation (GSI, 2005), review of the updated 40-scale plans by CSL Engineering, Inc. (CSL, 2006), and review of applicable geologic information for the site and site area, it is our opinion that the proposed site development is feasible from a geotechnical viewpoint, provided the recommendations presented herein, and in other applicable reports for the site (see Appendix A), are implemented during project planning, design, and construction, as appropriate. The primary geotechnical developmental considerations are summarized below:

- Removal of any artificial fill, colluvium/topsoil deposits, and near-surface weathered Quaternary fan deposits (Pleistocene-age alluvial fans) and/or weathered bedrock will be necessary prior to fill placement. For preliminary planning purposes, these

depths are estimated to be on the order of ±2 to ±6 feet, with localized deeper removals on the order of ±8 feet, or deeper. Variations from these thicknesses should be anticipated. Actual depths of removals will be evaluated in the field during grading by the soil engineer.

- It should be noted, that the Uniform Building Code/California Building Code ([UBC/CBC], International Conference of Building Officials [ICBO], 1997 and 2001) indicates that removals of unsuitable soils be performed across all areas to be graded, not just within the influence of the residential structure. Relatively deep removals may also necessitate a special zone of consideration, on perimeter/confining areas. This potential "perimeter" zone would be approximately equal to the depth of removals, if removals cannot be performed offsite. Thus, any settlement sensitive improvements (walls, curbs, flatwork, etc.), constructed within this potential zone may require deepened foundations, reinforcement, etc., or will retain some potential for settlement and associated distress. This will require proper disclosure to all homeowners and any homeowners association, as well as all interested/affected parties, if this condition exists at the conclusion of grading.

- Based on our review of the 40-scale grading plans by CSL (2006) for the 67-lot residential tract, generally minor cuts and fills within the building pad areas are proposed, on the order of up to ±10 and ±14 feet thick, respectively. Fill slopes and cut slopes are proposed up to about ±6 feet and ±10 feet in height, respectively, at inclinations of 2:1 (horizontal to vertical [h:v]), or flatter. In the detention basin area, cut slopes up to ±9 feet in height are proposed at inclinations of 2:1 (h:v) and 4:1 (h:v). Maximum proposed cut in the detention basin is on the order ±18 feet thick. Based on the current proposed configurations of cut and fill slopes, field mapping, sampling and laboratory testing, and our preliminary evaluation, the proposed cut and fill slopes are considered grossly and surficially stable; under normal conditions of care, maintenance, and rainfall. Keyways for fills-over-cut, and daylight cuts, should be properly constructed, as depicted in the General Earthwork and Grading Guidelines section of this report.

- Based upon our experience in this area and the seismic refraction data obtained, assuming a D9L, or equivalent, the granitic bedrock, where encountered, should be generally rippable (i.e., seismic velocities of less than about 6,000 feet per second [fps]) to depths ranging from about ±15 to greater than ±35 feet (GSI, 2005). However, there are localized areas (e.g., boulder outcrops, buried corestones, etc.) which may potentially require very difficult ripping to possible blasting. This should be considered during preliminary planning and cost estimation purposes. Further, this potential will likely exist at the conclusion of grading, and will need to be disclosed to all homeowners, any homeowners association, and all interested/affected parties with respect to any additional improvements.

- Using the 3,800 fps cut-off for non-rippable trenching, assuming a CAT 235 hoe, the granitic bedrock, if encountered, throughout much of the site should be generally

trenchable (i.e., seismic velocities of less than about 3,800 fps) to depths ranging from about ±14 to greater than ±35 feet (GSI, 2005). However, very difficult trenching to possible line-blasting may not be precluded during utility installation assuming a commercial rubber-tire backhoe, and should also be considered during preliminary planning and cost estimation purposes.

- Oversize materials (boulders, etc., greater than 12 inches in diameter) should be anticipated during grading and trenching. Many stockpiled boulders and/or boulder outcrops were mapped on the northeastern portion of the site. Excavation and placement difficulties, as well as possible offsite disposal of these materials should be considered. As per the Uniform Building Code/California Building Code ([UBC/CBC], International Conference of Building Officials [ICBO], 1997 and 2001) requirements, no oversize materials greater than 12 inches in diameter should be placed within 10 feet of finish grade. This may necessitate the need for scraper/dozer pits, if the oversized materials are not removed from the site, or reduced in size, prior to, or during grading.

- Preliminary laboratory testing and our experience on other nearby properties indicate the expansion potentials of the onsite soils are generally very low to low; however, soils exhibiting medium expansion potentials cannot be precluded from occurring onsite. Preliminary foundation recommendations for conventional and post-tension design are provided herein, for very low to medium expansive conditions.

- Typical samples of the site materials have been analyzed for soluble sulfate/corrosion potential. Based on preliminary laboratory testing results, which indicated 0.0052 percent by weight, the use of sulfate resistant (Type V) concrete is generally not anticipated for the site. In addition, based on the preliminary test results, the onsite soils are considered moderately alkaline and are moderately corrosive to ferrous metals in a saturated state. Accordingly, additional recommendations should be obtained from a consulting corrosion engineer, including recommendations for foundations, metals, and piping, etc., where such materials may come into contact with site soils.

- No groundwater was previously encountered onsite to a depth in excess of ±39½ feet below the ground surface. However, due to the relatively dense nature of the underlying bedrock/alluvial fan deposits, the possibility of local seepage may not be precluded, during or after site development, and should be anticipated. The need for subdrainage systems for the control of localized seepage and/or groundwater may not be precluded during grading or after development. This potential should be disclosed to all homeowners and any homeowners association, as well as any interested/affected parties.

- The potential for liquefaction, subsidence, or significant mass wasting within the site is considered low, provided our recommendations are properly implemented.

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

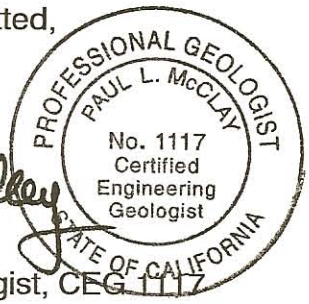
- Adverse geologic features that would preclude project feasibility were not encountered.

- The recommendations presented in this and GSI (2005) should be incorporated into the design and construction considerations of the project. A copy of this report should be provided to the design civil engineer. Two wet copies are typically provided by the design engineer to the governing agency.

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.



Paul L. McClay
Engineering Geologist, CEG 1117



David W. Skelly
Civil Engineer, RCE 47857

Bryan E. Voss
Staff Geologist

PLM/DWS/BEV/jk

Distribution: (6) Addressee (4 wet signed)

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Appendix A - References . . . . . Rear of Text
Appendix B - EQFAULT, EQSEARCH, and FRISKSP . . . . . Rear of Text
Appendix C - General Earthwork and Grading Guidelines . . . . . Rear of Text
Slope Stability Analysis . . . . . Rear of Text
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SUPPLEMENTAL 40-SCALE
GEOTECHNICAL GRADING PLAN REVIEW, TRACT 31687
ROMOLAND AREA, RIVERSIDE COUNTY, CALIFORNIA

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 our previous report (GSI, 2005) and aerial photographs for the site and site area (see Appendix A).

2. Transferring of geotechnical data (i.e., test pits, borings, etc.) to the current 40-scale plans by CSL Engineering, Inc. (CSL, 2006 [see Appendix A]), included herein as Plates 1 and 2.

3. Review and evaluation of the 40-scale rough grading plans by CSL Engineering, Inc. (CSL, 2006 [see Appendix A]).

4. Appropriate engineering and geologic analyses of data collected, updating of seismic design data, and preparation of this report and accompaniments.

PROPOSED DEVELOPMENT

The 40-scale plans prepared by CSL (2006) indicate that typical cut and fill grading techniques would be utilized to prepare the site for single-family residential development of 67 lots, with associated infrastructure, landscaping, and underground utilities. According to the plans, rough grading will create cut and fill slopes designed at inclinations of 2:1 (horizontal:vertical [h:v]), or flatter, attaining maximum heights of about ±6 and ±10 feet, respectively. The maximum thickness of proposed cuts and fills within the building pad areas are on the order of up to ±10 and ±14 feet, respectively. Maximum proposed cut in the detention basin is on the order ±18 feet. It is also our understanding 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 utilizing 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 currently unknown.

SITE RECONNAISSANCE

A reconnaissance of the site was performed on October 19, 2006. The site displays little change subsequent to our preliminary geotechnical investigation report(GSI, 2005).

GEOLOGY

In general, the site may be characterized as being underlain by colluvium, Quaternary-age alluvium, Quaternary-age fan deposits, and granitic bedrock. A complete description of these materials is provided in GSI (2005). Mappable units are included on Plates 1 and 2, herein.

FAULTING AND REGIONAL SEISMICITY

The site is situated in an area of active as well as potentially-active faults. The nearby San Jacinto fault zone is considered active and is included within an Alquist-Priolo Earthquake Fault Zone. Our review indicates that there are no known active faults crossing the site, and the site is not within a Fault-Rupture Hazard Zone (Hart and Bryant, 1997). During our review of aerial photographs (USDA, 1980), we did not observe photo lineaments or other features specifically indicative of faulting crossing the site.

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	APPROX. DISTANCE MILES (KM)	ABBREVIATED FAULT NAME	APPROX. DISTANCE MILES (KM)
Burnt Mountain	46.2 (74.3)	Palos Verdes	55.3 (89.0)
Chino - Central Avenue (Elsinore)	24.3 (39.1)	Pinto Mountain	32.7 (52.7)
Clamshell - Sawpit	53.1 (85.5)	Puente Hills Blind Thrust	42.1 (67.7)
Cleghorn	36.0 (58.0)	Raymond	55.4 (89.1)
Coronado Bank	55.4 (89.2)	Rose Canyon	46.5 (74.8)
Cucamonga	35.0 (56.4)	San Andreas - 1857 Rupture	41.4 (66.6)
Earthquake Valley	52.1 (83.9)	San Andreas - Coachella	41.5 (66.8)
Elsinore - Glen Ivy	13.4 (21.6)	San Andreas - Mojave	41.4 (66.6)
Elsinore - Julian	27.9 (44.9)	San Andreas - San Bernardino	23.5 (37.8)
Elsinore - Temecula	13.2 (21.3)	San Andreas - Southern	23.4 (37.6)
Emerson South - Copper Mountain	61.1 (98.3)	San Jacinto - Anza	14.4 (23.1)
Eureka Peak	49.3 (79.4)	San Jacinto - Coyote Creek	43.2 (69.5)
Helendale - South Lockhardt	45.5 (73.3)	San Jacinto - San Bernardino	18.4 (29.6)
Johnson Valley (Northern)	55.8 (89.8)	San Jacinto - San Jacinto Valley	9.6 (15.4)
Landers	50.8 (81.7)	San Joaquin Hills	32.7 (52.6)
Lenwood - Lockhart - Old Woman Springs	51.1 (82.3)	San Jose	39.4 (63.4)
Newport - Inglewood (L.A. Basin)	44.9 (72.3)	Sierra Madre	42.1 (67.8)

ABBREVIATED FAULT NAME	APPROX. DISTANCE MILES (KM)	ABBREVIATED FAULT NAME	APPROX. DISTANCE MILES (KM)
Newport - Inglewood (Offshore)	38.9 (62.6)	Upper Elysian Park Blind Thrust	57.8 (93.0)
North Frontal Fault Zone (East)	38.6 (62.4)	Verdugo	61.9 (99.6)
North Frontal Fault Zone (West)	33.2 (53.5)	Whittier	27.9 (44.9)

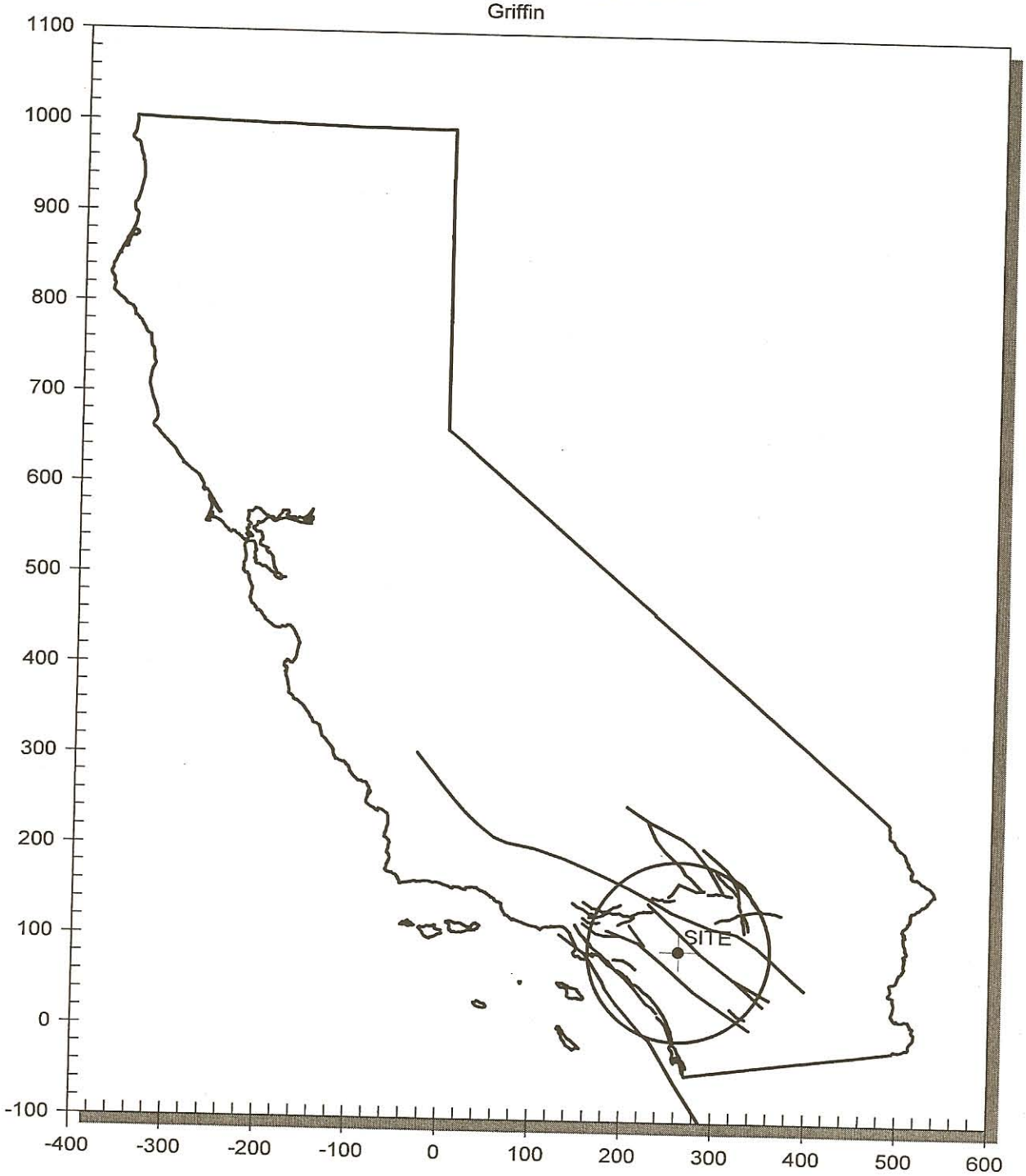
The possibility of ground shaking at the site may be considered similar to the southern California region as a whole. The relationship of the site location to these major mapped faults is indicated on the California Fault Map (see Figure 1). Our field observations and review of readily available geologic data indicate that known active faults do not cross the site.

The acceleration-attenuation relations of Bozorgnia, Campbell, and Niazi (1999), and Campbell and Bozorgnia (1997), have been incorporated into EQFAULT (Blake, 2000a). 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 Bozorgnia, Campbell, and Niazi (1999), and Campbell and Bozorgnia (1997). These acceleration-attenuation relations have been incorporated in EQFAULT, a computer program by Thomas F. Blake (2000a), which performs deterministic seismic hazard analyses using 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 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 0.24g to 0.48g.

Historical site seismicity was evaluated with the acceleration-attenuation relations of Bozorgnia, Campbell, and Niazi (1999), and the computer program EQSEARCH (Blake, 2000b, updated to June 2006). This program performs a search of historical earthquake records for magnitude 4.0 to 9.0 seismic events within a 100-mile radius, between the years 1800 to June 2006. 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 June 2006 was 0.45g. 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. Printouts from EQSEARCH are provided in Appendix B.

CALIFORNIA FAULT MAP

Griffin



W.O. 4787–A–SC

Figure 1

A probabilistic seismic hazards analysis was performed using FRISKSP (Blake, 2000c) 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 0.41g 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). Printouts from FRISKSP are also included in Appendix B.

Seismic Shaking Parameters

Based on the site conditions, Chapter 16 of the Uniform Building Code/California Building Code ([UBC/CBC], International Conference of Building Officials [ICBO], 1997 and 2001), the following seismic parameters are provided.

UBC/CBC TABLE/FIGURE DESIGNATION	FAULT PARAMETERS
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*)	1.0
Distance to Seismic Source (San Jacinto Valley fault)	9.6 mi. (15.4 km)
Seismic Source Type (per Table 16-U*)	B**
Upper Bound Earthquake (San Jacinto Valley fault)	M_W 6.9**
* Figure and table references from Chapter 16 of the UBC/CBC (1997 and 2001). ** ICBO (1998).	

GROUNDWATER

Seeps, springs, mottled soils, or other indications of a high groundwater level were not noted on the subject property during the time of our field investigation to depths in excess of ±39½ feet. Based on historic water well data acquired from the California Department of Water Resources (CDWR, 2004), "Water Data Library," groundwater levels in other nearby wells were previously measured at depths ranging from ±92 feet to in excess of +135 feet below the ground surface. However, perched groundwater onsite may occur in the bedrock and alluvial fan materials, or along jointing and/or fractures due to migration from adjacent drainage areas and development during and/or after periods of above

normal or heavy precipitation or irrigation. Thus, perched groundwater conditions may occur in the future, and should be anticipated. Should manifestations of perched conditions (i.e., seepage) develop in the future, GSI could assess the conditions and provide mitigative recommendations, as necessary. This potential should be disclosed to all homeowners and any homeowners association, as well as any interested/affected parties. Additional discussions of groundwater are presented within the conclusions section of this report.

CONCLUSIONS AND RECOMMENDATIONS

Based on our previous 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. Geologic hazards have been previously addressed in GSI, 2005. 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 review and engineering analysis (GSI, 2005), the potential for liquefaction and associated adverse effects of the underlying Quaternary-age alluvial fan deposits or bedrock is considered low, even with a future rise in groundwater levels. The site conditions will also be improved by removal and recompaction of low density near-surface soils. Therefore, as concluded in (GSI, 2005), it is our opinion that the liquefaction potential does not constitute a significant risk to site development.

4. In general and based upon the available data to date, groundwater is not expected to be a factor in development of the site. However, perched groundwater onsite may occur in the bedrock and alluvial fan materials, or along jointing and/or fractures due to migration from adjacent drainage areas and development during and/or after periods of above normal or heavy precipitation or irrigation. Thus, perched groundwater conditions may occur in the future, and should be anticipated. Should manifestations of perched conditions (i.e., seepage) develop in the future, GSI could assess the conditions and provide mitigative recommendations, as necessary.

5. Due to the 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.

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

Demolition/Grubbing

1. Any existing surface/subsurface structures, major vegetation, and any miscellaneous 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. If not removed by planned excavation, cavities or loose soils (including all previous exploratory borings and test pits, 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 artificial fill, topsoil/colluvium, alluvium, and near-surface weathered fan deposits and/or weathered bedrock should be removed to competent alluvial fan deposits or dense bedrock, as defined herein, (i.e., removal bottoms should be greater than, or equal to, 85 percent saturation, and/or greater than, or equal to, 105 pounds per cubic foot (pcf) dry density for in-place native materials), which has been demonstrated and proven to the controlling authorities as acceptable in the past to mitigate the potential for hydroconsolidation. For preliminary planning purposes, these depths are estimated to range from ±2 to ±6 feet across the site, with localized deeper removals on the order of ±8 feet deep, or deeper. Variations from these thicknesses should be anticipated. Actual depths of removals will be evaluated in the field during grading by the soil engineer.

2. It should be noted, that the Uniform Building Code/California Building Code ([UBC/CBC], International Conference of Building Officials [ICBO], 1997 and 2001) indicates that removals of unsuitable soils be performed across all areas to be graded, not just within the influence of the residential structure. Relatively deep removals may also necessitate a special zone of consideration, on perimeter/confining areas. This potential "perimeter" zone would be approximately

equal to the depth of removals, if removals cannot be performed offsite. Thus, any settlement sensitive improvements (walls, curbs, flatwork, etc.), constructed within this potential zone may require deepened foundations, reinforcement, etc., or will retain some potential for settlement and associated distress. This will require proper disclosure to all homeowners and any homeowners association, if this condition exists at the conclusion of grading.

3. Subsequent to the above removals, the upper 12 inches of the exposed fan deposits and/or granitic bedrock should be scarified, brought to at least optimum moisture content, and recompacted to a minimum relative compaction of 90 percent of the laboratory standard.

4. Existing topsoil/colluvium and alluvium, etc., and removed natural ground materials may be reused as compacted fill provided that major concentrations of vegetation and miscellaneous trash and debris are removed prior to or during 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. Subsequent to ground preparation, fill materials should be brought to at least optimum moisture content, 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 8 inches in diameter should be placed under the recommendations and supervision of the soils engineer and/or reduced in size and/or removed from the site. Should significant amounts of oversize rock be encountered, recommendations for rock fill placement are provided herein. As per UBC/CBC (ICBO, 1997 and 2001) requirements, no oversize materials greater that 12 inches in diameter should be 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 a greater sulfate and/or expansion value than the onsite materials encountered in this investigation.

Transition Areas/Overexcavation

In order to reduce the potential for differential settlements between cut and fill materials, materials of differing expansion potentials, or dense bedrock, the entire cut portion of

cut/fill transitions within proposed residential lots (per the UBC/CBC) should be overexcavated to a minimum depth of 3 feet below finish grade, or 2 feet below foundation elements, and/or a maximum ratio of fill thickness on the lot of 3:1 (h:v), whichever is more onerous, and replaced with compacted fill. Cut lots should be overexcavated. The subgrade should be sloped to drain to the street on overexcavated or cut lots.

ROCK PLACEMENT GUIDELINES

Rock Disposal

We anticipate that soils to be utilized as fill material for the subject tract may contain rock. Appropriately, the need for rock disposal may be necessary during grading operations on the site. Generally for the purpose of this report, the materials may be described as either 8 inches or less, greater than 8 and less than 36 inches, and greater than 36 inches. These three categories set the basic dimensions for where and how the materials are to be placed.

Materials 8 Inches in Diameter or Less:

Since imported rock fragments along with the overburden materials are anticipated to be a part of the materials used in the grading of the site, a criteria is needed to facilitate the placement of these materials within guidelines which would be workable during the rough grading, post-grading improvements, and serve as acceptable compacted fill.

1. Fines and rock fragments 8 inches or less in diameter may be placed as compacted fill cap materials within the building pads, slopes, and street areas as described below. The rock fragments and fines should be brought to at least optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard.

2. The purpose for the 8-inch diameter limits is to allow reasonable sized rock fragments into the fill under selected conditions (optimum moisture or above) surrounded with compacted fines. The 12-inch diameter size also allows a greater volume of the rock fragments to be handled during grading, while staying in reasonable limits for later onsite excavation equipment (backhoes and trenchers) to excavate footings and utility lines.

3. Fill materials 8 inches or less in diameter should be placed, but not limited to, within the upper 10 feet of proposed fill pads, the upper 3 feet of overexcavated cut areas of cut/fill transition pads, and the entire street right-of-way width, including the proposed overexcavated areas and replacement fill areas, from the depth of the lowest utility to subgrade, or to a depth of 10 feet below finish grade. Overexcavation is discussed earlier in this report.

Materials Greater Than 8 and Less Than 36 Inches in Diameter:

1. During the process of bedrock excavation, a significant amount of rock fragments or constituents larger than 8 inches in diameter may be generated. These significant amounts of oversized materials between greater than 8 and less than 36 inches in diameter may be incorporated into the fills utilizing a series of rock blankets.

2. Each rock blanket should consist of rock fragments of approximately greater than 8 and less than 36 inches in diameter along with fines generated from the proposed cuts and overburden materials from removal areas. The blankets should be limited to 24 to 36 inches in thickness and should be placed with granular fines which are flooded into and around the rock fragments.

3. Rock blankets should be restricted to areas which are at least 1 foot below the lowest utility invert within the street right-of-way, 10 feet below finish grade on the proposed fill lots, and a minimum of 20 horizontal feet from any fill slope surface.

4. Compaction may be achieved by utilizing wheel rolling methods with scrapers and water trucks, track-walking by bulldozers, and sheepsfoot tampers.

5. Each rock blanket should be completed with its surface compacted prior to placement of any subsequent rock blanket or rock windrow.

Materials Greater Than 36 Inches in Diameter:

1. Oversize rock greater than 36 inches in diameter should be placed in single rock windrows. The windrows should be at least 15 feet or an equipment width apart, whichever is greatest.

2. The void spaces between rocks in windrows should be filled with the more granular soils by flooding them into place.

3. A minimum vertical distance of 3 feet between soil fill and rock lift should be maintained. Also, the windrows should be staggered from lift to lift. Rock windrows should not be placed closer than 20 feet horizontally from the face of fill slopes.

4. Larger rocks too difficult to be placed into windrows may be individually placed into a dozer trench. Each trench should be excavated into the compacted fill or dense natural ground a minimum of 1 foot deeper than the size of the rock to be buried. After the rocks are placed in the trench (not immediately adjacent to each other), granular fill material should be flooded into the trench to fill the voids.

5. The oversize rock trenches should be no closer together than 15 feet at a particular elevation and at least 20 feet horizontally from any slope face. Trenches at higher

elevations should be staggered and there should be 4 feet of compacted fill between the top of one trench and the bottom of the next higher trench. Placement of rock into these trenches should be under the full-time inspection of the soils engineer.

6. Consideration should be given to using oversize materials in open space "greenbelt" areas that would be designated as non-structural fills.

SUBDRAINS

Subdrains may be necessary where local seepage along the contact between the proposed fill and underlying alluvial fan deposits and/or bedrock exist, or within the proposed fill along contrasting zones of permeabilities (e.g., sand vs. silt, or clay). Owing to the generally flat nature of the site, lack of canyons, lack of gradient at flowline elevations, and the lack of suitable cover (i.e., less than about 10 feet of fill), subdrains are generally not anticipated during grading, but may not be entirely precluded. If required, where removals are below the subdrain flowline, the removal materials may be reused as compacted fill provided they are granular, and at a moisture content of at least 2 percent over optimum moisture content (or 1.2 times optimum moisture content, whichever is greater). If necessary, actual locations of subdrains will be provided during grading, based on exposed conditions. The project civil engineer should locate and map any subdrain and outlet systems.

PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

The governing agency may retain the authority to approve the final structural design sections after subgrade elevations and actual Resistance Values (R-values) have been obtained at the conclusion of earthwork. Typically actual pavement sections will likely vary, therefore final pavement sections should be based on actual R-value testing performed during, or shortly after site grading for the street improvements, by the controlling authorities.

The preliminary pavement sections presented in the following table are based on assumed Traffic Indices (T.I.'s) for a short local street, a general local road, a residential collector, an industrial collector or secondary highway, and the guidelines presented in the latest revision to the California Department of Transportation "Highway Design Manual" fifth edition. It is our understanding that the minimum pavement section required by the County for a short local street is 3 inches of AC (asphaltic concrete) on 6 inches of Class 2 aggregate base for a T.I. of 5.0 to 6.0.

Based on the laboratory test results obtained R=15 and R=41), the following ranges for preliminary pavement design are presented.

PRELIMINARY PAVEMENT THICKNESS			
STREET CLASSIFICATION	STANDARD PAVEMENT DESIGNS		
TRAFFIC INDEX (T.I.)	R-VALUE RANGE	AC (INCHES)	CLASS 2 BASE ROCK [1] (INCHES)
Short Local Street 5.0	15 41	3.0 3.0*	8.0 6.0*
General Local Road 5.5	15 41	3.0 3.0	10.0 6.0*
Residential Collector 6.5	15 41	3.6* 3.6*	12.5 6.5
Industrial Collector or Secondary Highway 7.5	15 41	4.3* 4.3*	14.5 7.5

[1] Assumed R-values for base rock R=78 - Cal-Trans standard Class 2 base rock. Values for T.I. (Traffic Index= 5.0, 5.5, 6.5, and 7.5).
* Minimum required by the County of Riverside

The preliminary range of pavement sections provided above are intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. If the T.I., ADT (average daily traffic) or ADTT (average daily truck traffic) increases beyond that intended, as reflected by the T.I. used for design, increased maintenance, and repair could be required for the pavement section. Best management construction practices should be utilized during roadway construction.

SLOPE CONSIDERATIONS AND SLOPE DESIGN

All slopes should be designed and constructed in accordance with the minimum requirements of the UBC (ICBO, 1997), County, the recommendations in Appendix C, and the following:

1. Fill slopes should be designed at a 2:1 (h:v) gradients 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 C.

2. Cut slopes should be designed at gradients of 2:1 (h:v) and should not exceed ±20 feet in height. While stabilization of such slopes is not anticipated, locally adverse geologic conditions (e.g., daylighted joints/fractures or severely weathered bedrock or sandy alluvial fans) may be encountered which may require remedial grading or laying back of the slope to an angle flatter than the adverse geologic condition.

3. Local areas of highly to severely weathered fans or bedrock 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 fan deposits and/or bedrock materials. 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 observation.

4. Loose debris and fines remaining on the face of the cut slopes should be removed during grading. This can be accomplished by a slope board 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.

6. Cut slopes should be mapped by the project engineering geologist during grading to allow amendments to the recommendations should exposed conditions warrant alternation of the design or stabilization.

PRELIMINARY RECOMMENDATIONS - FOUNDATIONS

The foundation design and construction recommendations are based on laboratory testing and engineering analysis of onsite earth materials by GSI. Recommendations for foundation systems are provided in the following sections. The foundation systems may be used to support the proposed structure, 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 (ICBO, 1997).

The following foundation construction recommendations are presented as a minimum criteria from a soils engineering viewpoint. The onsite soils expansion potentials are generally in the very low to low (E.I. 0 to 50 range). However, medium expansive soils (E.I. 51 to 90 range) may be encountered during construction. For low expansive soils with a plasticity index greater than 15, and medium expansive soils, post-tensioned slab systems are recommended. Foundations underlain by these soils should be designed in accordance with the UBC, Section 1815 and/or 1816 (ICBO, 1997) and CBC (ICBO, 2001).

Conventional Foundations - Very Low to Low (E.I. 0 to 50) and Plasticity <15

The following foundation construction recommendations assume that the soils in the top 7 feet from finish grade will have a very low to low expansion potential (and plasticity less than 15). 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.

Foundation Design

1. Conventional spread and continuous footings may be used to support the proposed residential structure, provided they are founded entirely in properly compacted fill or other competent bearing material.

2. An allowable bearing value of 1,500 pounds per square foot (psf) 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 or bedrock. The bearing value may be increased by one third for seismic or other temporary loads. This value may be increased by 20 percent for each additional 12 inches in depth to a maximum of 2,500 psf. No increase in bearing value for increased footing width is recommended.

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 pcf with a maximum earth pressure of 2,500 psf.

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).

Construction

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 piers and columns should be founded at a minimum depth of 24 inches below the lowest adjacent ground surface. If low expansive soils are present within the top 7 feet, these elements should be tied together with a grade beam.

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 underlain with a vapor retarder consisting of a minimum of 10- or 15-mil, polyvinyl-chloride membrane with all laps sealed per the UBC (ICBO, 1997). This membrane should be covered with 2 inches of sand to aid in uniform curing of the concrete and mitigate puncturing of the vapor retarder. The vapor retarder should be underlain with 2 inches of sand. Sand used for slab underlayment should have a minimum sand equivalent of 30.

4. Concrete slabs, including garage slabs, should be a minimum of 4 inches thick, and minimally 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 provide 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 an actual, 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 retarder placement.

8. As an alternative, an engineered post-tension foundation system may be used.

9. 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.

10. The designers for any proposed subsurface structures or any other appurtenant structures should consider that excavation difficulties could be encountered in bedrock or rock fill blankets at depths greater than approximately 3 to 5 feet below proposed building pad grades.

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

Post-Tensioned Slab Systems - Low Expansion (E.I. 21-90) and Plasticity >15

This section of foundation design should be applied to soils having an E.I. of 21, or greater, and with a plasticity index of 15 or greater. Recommendations for using post-tensioned systems for very low expansive soils are also presented, as an option. The recommendations presented below should be followed in addition to those contained in the previous sections, as appropriate. The information and recommendations presented below in this section are not meant to supercede design by a registered structural engineer or civil engineer familiar with post-tensioned slab design. Post-tensioned slabs should be designed using sound engineering practice and be in accordance with local and/or national code requirements. Upon request, GSI can provide additional data/consultation regarding soil parameters as related to post-tensioned slab design.

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

Perimeter cut-off walls should be a minimum of 12 inches deep for very low to low expansive soils. The cut-off walls may be integrated into the slab design or independent of the slab and should be a minimum of 6 inches thick. Slabs should be a minimum actual thickness of 5 inches. The 10- or 15-mil thick vapor retarder should be covered with a 2-inch layer of sand to aid in uniform curing of the concrete; and it should be adequately sealed to provide a continuous retarder under the entire slab. A minimum 4 inches of sand should be placed below the visqueen. Sand used for slab underlayment should have a minimum sand equivalent of 30.

Specific soil presaturation is not required; however, the moisture content of the subgrade soils should be equal to, or greater than, the soils' optimum moisture content to a depth of 12 inches below grade, for very low to low expansive soils; and,

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 UBC, Section 1816 (ICBO, 1997), 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
Modulus of Subgrade Reaction (pci)	75
Moisture Velocity	0.7 inches/month

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 positive drainage that 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 UBC, Section 1816 (ICBO, 1997). 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 recommended.

E.I. OF SOIL SUBGRADE (per UBC/CBC)	VERY LOW EXPANSION (E.I. = 0 - 20)	LOW EXPANSION (E.I. = 21 - 50)	MEDIUM EXPANSION (E.I. =51 - 90)
e_m center lift	5.0 feet	5.0 feet	5.5 feet
e_m edge lift	2.5 feet	3.5 feet	4.0 feet
Y_m center lift	1.0 inch	1.7 inches	2.7 inches
Y_m edge lift	0.3 inch	0.75 inch	0.75 inch

Deepened footings/edges around the slab perimeter must be used to minimize non-uniform surface moisture migration (from an outside source) beneath the slab. An edge depth of 12 inches should be considered a minimum. 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 under conventional foundation methods should be adhered to during the design and construction phase of the project.

PRELIMINARY FOUNDATION SETTLEMENTS

In addition to designing slab systems (post-tension or other) for the soil conditions described herein, the estimated settlement and angular distortion values that an individual structure (including walls, spas, pools, or other settlement-sensitive improvements, etc.), 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 the minimum dimension of buildings; if, from a structural standpoint, a decreased or increased length over which the differential settlement is assumed to occur is justified, this change should be incorporated into the design.

The site is underlain at depth by Quaternary fan deposits and/or granitic bedrock. A preliminary evaluation of primary settlement and secondary compression within the area under the purview of this report has been conducted. The calculated estimate for the total settlement in approximately 2 inches over the life of the structure. Worst-case differential settlement has been calculated as 1 inch in 40 feet (i.e., at least 1 inch in a 40-foot span [1/480]).

Therefore, in addition to designing slab systems for the above soil conditions, the following settlement values should be utilized by the project structural engineer.

ESTIMATED TOTAL SETTLEMENT (Inches)	ESTIMATED DIFFERENTIAL SETTLEMENT (Inches)	ESTIMATED ANGULAR DISTORTION
2.0	1.0	1/480

Any post-construction settlement of the fill should be readily mitigated by proper foundation design, provided the design parameters, provided in this report, are properly utilized in final design of the residential 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 controlling authorities and/or the UBC/CBC (ICBO, 1997 and 2001). Alternatives to Post- Tensioning Institute methodology (i.e., "spanability") may be used if equivalent systems can be proposed which accommodate the angular distortions, expansion parameters, and settlements noted for the project. If alternatives to Post-Tensioning Institute are suggested by the structural consultant, this office should review the final foundation plans.

SOIL MOISTURE CONSIDERATIONS

It should be noted that the foundation construction recommendations provided above are not intended to preclude the transmission of water or vapor through the slab. Foundation systems and slabs shall not allow water or water vapor to enter into the structure so as to cause damage to another building component or to limit the installation of the type of flooring materials typically used for the particular application (State of California, 2006). Therefore, the following should be considered by the structural engineer/foundation/slab designer to mitigate the transmission of water or water vapor through the slab:

- Concrete slab underlayment should consist of 2 inches of sand (S.E. $\geq$30), underlain by a 10- to 15-mil vapor retarder (ASTM E-1745 - Class A or B type) shall be installed per the recommendations of the manufacturer, including all penetrations (i.e., pipe, ducting, rebar, etc.). The manufacturer shall provide instructions for lap sealing, including minimum width of lap, method of sealing, and either supply or specify suitable products for lap sealing (ASTM E-1745). The vapor retarder should be, in turn, underlain by 4 inches of pea gravel and/or fine to coarse washed clean gravel (80 to 100 percent greater than #4 sieve) to break the capillary rise of soil moisture.

- Concrete should have a maximum water/cement ratio of 0.50.

- Slabs should minimally be 5 inches thick.

- Additional recommendations regarding water or vapor transmission should be provided by the structural engineer/slab or foundation designer.

CTL Thompson (2005) stated "very few slabs emit moisture to the extent that it is identified as a problem. Most residential slabs-on-grade will allow the successful installation of carpet and resilient flooring. However, moisture problems on residential slabs-on-grade are not predictable. The homebuilder (and ultimately the buyer) must choose between the additional cost of installing a vapor retarder.." [system] "..and the potential risk of future moisture problems. Current literature suggests that a capillary break is adequate for slabs that are not to be covered with moisture sensitive flooring. However, to increase performance when a moisture sensitive covering is anticipated, the literature reviewed suggests that a vapor retarder is required."

Please be aware that the above should be implemented if the transmission of water or water vapor through the slab is undesirable. Should these recommendations not be implemented, then the potential for water or vapor to pass through the foundations and slabs and resultant distress cannot be precluded and should be disclosed to any homeowners and homeowners association.

WALL DESIGN PARAMETERS

Conventional Retaining Walls

The design parameters provided below assume that either non expansive soils (typically Class 2 permeable filter material or Class 3 aggregate base) or native onsite materials (up to and including an E.I. of 65) are used to backfill any retaining walls. The type of backfill (i.e., select or native), should be specified by the wall designer, and clearly shown on the plans. Building walls, below grade, should be water-proofed. The foundation system for the proposed retaining walls should be designed in accordance with the recommendations presented in this and preceding sections of this report, as appropriate. Footings should be embedded a minimum of 18 inches below adjacent grade (excluding landscape layer, 6 inches) and should be 24 inches in width. There should be no increase in bearing for footing width. Recommendations for specialty walls (i.e., crib, earthstone, geogrid, etc.) can be provided upon request, and would be based on site specific conditions.

Restrained Walls

Any 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 (EFP) 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 (2H) laterally from the corner.

Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 10 feet high. Design parameters for walls less than 3 feet in height may be superceded by City and/or County standard design. 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 due to traffic, structures, seismic events or adverse geologic conditions. When wall configurations are finalized, the appropriate loading conditions for superimposed loads can be provided upon request.

SURFACE SLOPE OF RETAINED MATERIAL (HORIZONTAL:VERTICAL)	EQUIVALENT FLUID WEIGHT P.C.F. (SELECT BACKFILL)	EQUIVALENT FLUID WEIGHT P.C.F. (NATIVE BACKFILL)
Level*	35	45
2 to 1	50	60
* Level backfill behind a retaining wall is defined as compacted earth materials, properly drained, without a slope for a distance of 2H behind the wall.		

Retaining Wall Backfill and Drainage

Positive drainage must be provided behind all retaining walls in the form of gravel wrapped in geofabric and outlets. A backdrain system is considered necessary for retaining walls that are 2 feet or greater in height. Details 1, 2, and 3, present the back drainage options discussed below. Backdrains should consist of a 4-inch diameter perforated PVC or ABS pipe encased in either Class 2 permeable filter material or ¾-inch to 1½-inch gravel wrapped in approved filter fabric (Mirafi 140 or equivalent). For low expansive backfill, the filter material should extend a minimum of 1 horizontal foot behind the base of the walls and upward at least 1 foot. For native backfill that has up to medium expansion potential, continuous Class 2 permeable drain materials should be used behind the wall. This material should be continuous (i.e., full height) behind the wall, and it should be constructed in accordance with the enclosed Detail 1 (Typical Retaining Wall Backfill and Drainage Detail). For limited access and confined areas, (panel) drainage behind the wall may be constructed in accordance with Detail 2 (Retaining Wall Backfill and Subdrain Detail Geotextile Drain). Materials with an E.I. potential of greater than 65 should not be used as backfill for retaining walls. For more onerous expansive situations, backfill and drainage behind the retaining wall should conform with Detail 3 (Retaining Wall And Subdrain Detail Clean Sand Backfill).

Outlets should consist of a 4-inch diameter solid PVC or ABS pipe spaced no greater than ±100 feet apart, with a minimum of two outlets, one on each end. The use of weep holes, only, in walls higher than 2 feet, is not recommended. The surface of the backfill should be sealed by pavement or the top 18 inches compacted with native soil (E.I. $\leq$90). Proper surface drainage should also be provided. For additional mitigation, consideration should be given to applying a water-proof membrane to the back of all retaining structures. The use of a waterstop should be considered for all concrete and masonry joints.

Wall/Retaining Wall Footing Transitions

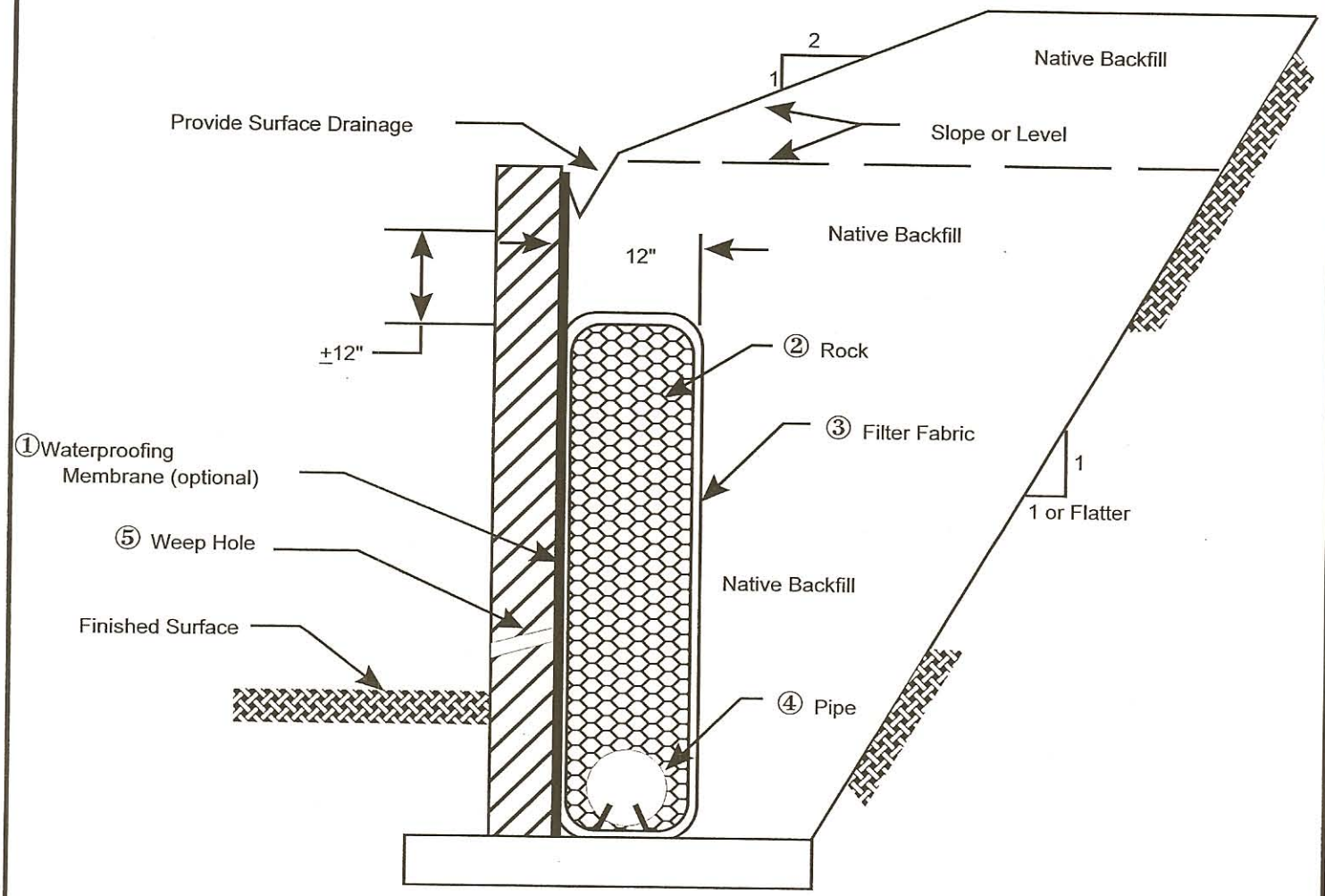
Site walls are anticipated to be founded on footings designed in accordance with the recommendations in this report. Should wall footings transition from cut to fill, the civil designer may specify either:

a) A minimum of a 2-foot overexcavation and recompaction of cut materials for a distance of 2H, from the point of transition.

b) Increase of the amount of reinforcing steel and wall detailing (i.e., expansion joints or crack control joints) such that a angular distortion of 1/360 for a distance of 2H on either side of the transition may be accommodated. Expansion joints should be placed no greater than 20 feet on-center, in accordance with the structural engineer's/wall designer's recommendations, regardless of whether or not transition conditions exist. Expansion joints should be sealed with a flexible, non-shrink grout.

DETAILS

N . T . S .



① **WATERPROOFING MEMBRANE (optional):**
Liquid boot or approved equivalent.

② **ROCK:**
3/4 to 1-1/2" (inches) rock.

③ **FILTER FABRIC:**
Mirafi 140N or approved equivalent; place fabric flap behind core.

④ **PIPE:**
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point (Perforations down).

⑤ **WEEP HOLE:**
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface (No weep holes for basement walls.).

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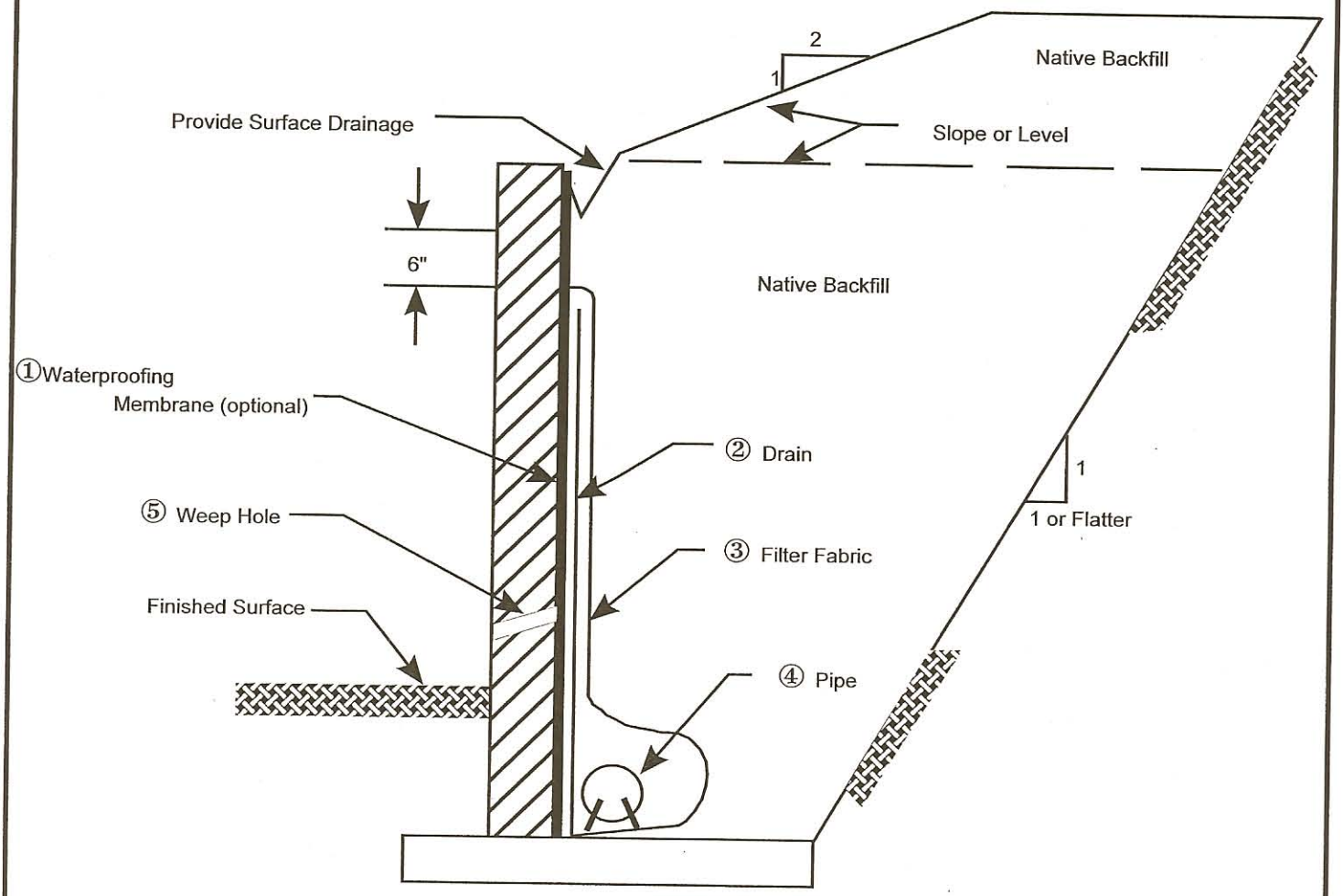
TYPICAL RETAINING WALL BACKFILL AND DRAINAGE DETAIL

DETAIL 1

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DETAILS

N . T . S .



① **WATERPROOFING MEMBRANE (optional):**
Liquid boot or approved equivalent.

② **DRAIN:**
Miradrain 6000 or J-drain 200 or equivalent for non-waterproofed walls.
Miradrain 6200 or J-drain 200 or equivalent for waterproofed walls (All Perforations down).

③ **FILTER FABRIC:**
Mirafi 140N or approved equivalent; place fabric flap behind core.

④ **PIPE:**
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point.

⑤ **WEEP HOLE:**
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface. (No weep holes for basement walls.)

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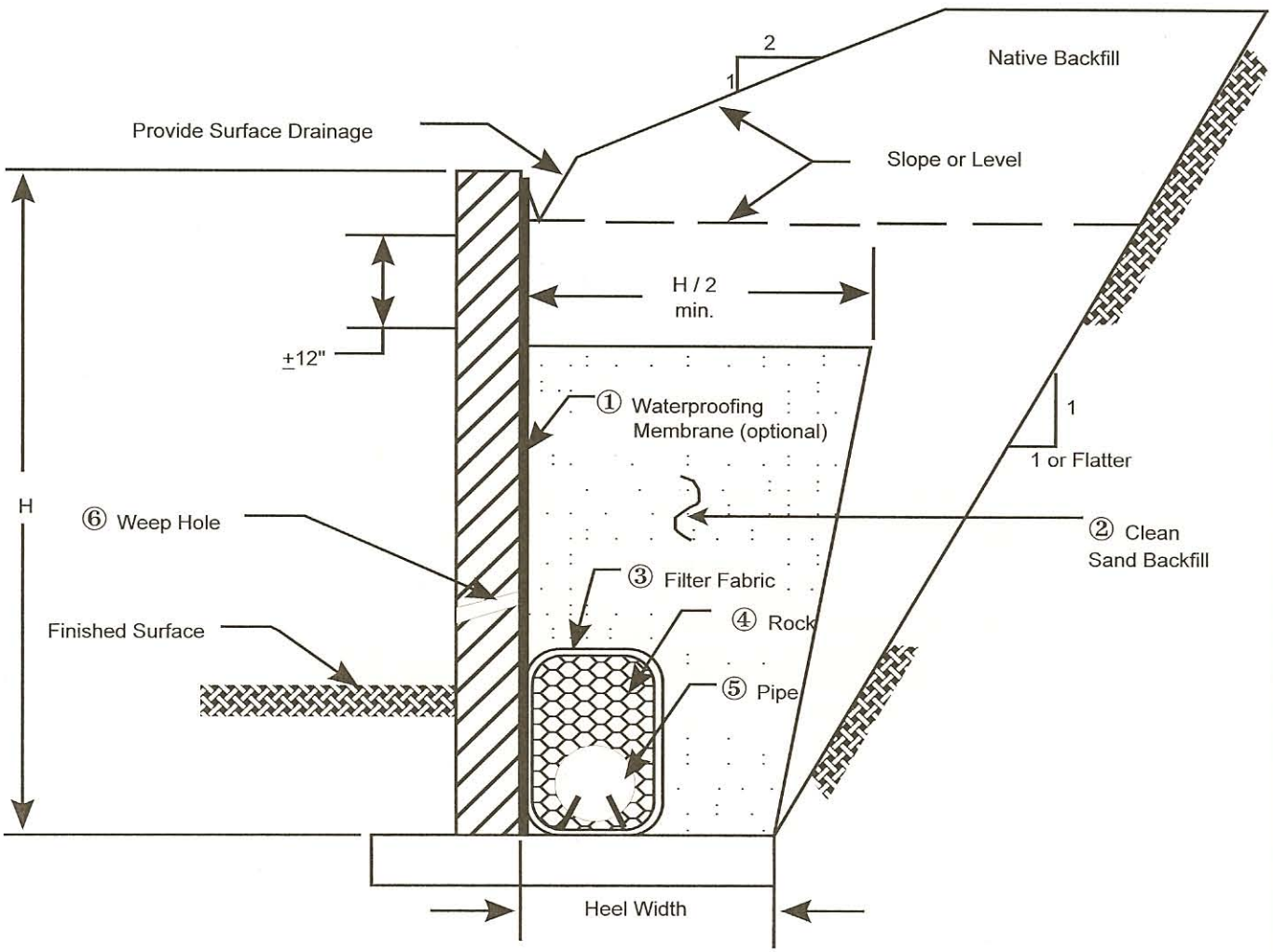
RETAINING WALL BACKFILL AND SUBDRAIN DETAIL GEOTEXTILE DRAIN

DETAIL 2

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DETAILS

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① **WATERPROOFING MEMBRANE (optional):**
Liquid boot or approved equivalent.

② **CLEAN SAND BACKFILL:**
Must have sand equivalent value of 30 or greater; can be densified by water jetting.

③ **FILTER FABRIC:**
Mirafi 140N or approved equivalent.

④ **ROCK:**
1 cubic foot per linear feet of pipe or 3/4 to 1-1/2" (inches) rock.

⑤ **PIPE:**
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point (Perforations down).

⑥ **WEEP HOLE:**
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface. (No weep holes for basement walls.)

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RETAINING WALL AND SUBDRAIN DETAIL
CLEAN SAND BACKFILL

DETAIL 3

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c) Embed the footings entirely into native formational material (i.e., deepened footings).

If transitions from cut to fill transect the wall footing alignment at an angle of less than 45 degrees (plan view), then the designer should follow recommendation "a" (above) and until such transition is between 45 and 90 degrees to the wall alignment.

TOP-OF-SLOPE WALLS/FENCES/IMPROVEMENTS

Slope Creep

Soils at the site may be expansive and therefore, may become desiccated when allowed to dry. Such soils are susceptible to surficial slope creep, especially with seasonal changes in moisture content. Typically in southern California, during the hot and dry summer period, these soils become desiccated and shrink, thereby developing surface cracks. The extent and depth of these shrinkage cracks depend on many factors such as the nature and expansivity of the soils, temperature and humidity, and extraction of moisture from surface soils by plants and roots. When seasonal rains occur, water percolates into the cracks and fissures, causing slope surfaces to expand, with a corresponding loss in soil density and shear strength near the slope surface. With the passage of time and several moisture cycles, the outer 3 to 5 feet of slope materials experience a very slow, but progressive, outward and downward movement, known as slope creep. For slope heights greater than 10 feet, this creep related soil movement will typically impact all rear yard flatwork and other secondary improvements that are located within about 15 feet from the top of slopes, such as swimming pools, concrete flatwork, etc., and in particular top of slope fences/walls. This influence is normally in the form of detrimental settlement, and tilting of the proposed improvements. The dessication/swelling and creep discussed above continues over the life of the improvements, and generally becomes progressively worse. Accordingly, the developer should provide this information to any homeowners and homeowners association.

Top of Slope Walls/Fences

Due to the potential for slope creep for slopes higher than about 10 feet, some settlement and tilting of the walls/fence with the corresponding distresses, should be expected. To mitigate the tilting of top of slope walls/fences, we recommend that the walls/fences be constructed on deepened foundations without any consideration for creep forces, where the expansion index of the materials comprising the outer 15 feet of the slope is less than 50, or a combination of grade beam and caisson foundations, for expansion indices greater than 50 comprising the slope, with creep forces taken into account. The grade beam should be at a minimum of 12 inches by 12 inches in cross section, supported by drilled caissons, 12 inches minimum in diameter, placed at a maximum spacing of 6 feet on center, and with a minimum embedment length of 7 feet below the bottom of the grade

beam. The strength of the concrete and grout should be evaluated by the structural engineer of record. The proper ASTM tests for the concrete and mortar should be provided along with the slump quantities. The concrete used should be appropriate to mitigate sulfate corrosion, as warranted. The design of the grade beam and caissons should be in accordance with the recommendations of the project structural engineer, and include the utilization of the following geotechnical parameters:

Creep Zone: 5-foot vertical zone below the slope face and projected upward parallel to the slope face.

Creep Load: The creep load projected on the area of the grade beam should be taken as an equivalent fluid approach, having a density of 60 pcf. For the caisson, it should be taken as a uniform 900 pounds per linear foot of caisson's depth, located above the creep zone.

Point of Fixity: Located a distance of 1.5 times the caisson's diameter, below the creep zone.

Passive Resistance: Passive earth pressure of 300 psf per foot of depth per foot of caisson diameter, to a maximum value of 4,500 psf may be used to determine caisson depth and spacing, provided that they meet or exceed the minimum requirements stated above. To determine the total lateral resistance, the contribution of the creep prone zone above the point of fixity, to passive resistance, should be disregarded.

Allowable Axial Capacity:

Shaft capacity : 350 psf applied below the point of fixity over the surface area of the shaft.

Tip capacity: 4,500 psf.

DRIVEWAY, FLATWORK, AND OTHER IMPROVEMENTS

The soil materials on site may be expansive. The effects of expansive soils are cumulative, and typically occur over the lifetime of any improvements. On relatively level areas, when the soils are allowed to dry, the dessication and swelling process tends to cause heaving and distress to flatwork and other improvements. The resulting potential for distress to improvements may be reduced, but not totally eliminated. To that end, it is recommended that the developer should notify any homeowners or homeowners association of this long-term potential for distress. To reduce the likelihood of distress, the following recommendations are presented for all exterior flatwork:

1. The subgrade area for concrete slabs should be compacted to achieve a minimum 90 percent relative compaction, and then be presoaked to 2 to 3 percentage points above (or 125 percent of) the soils' optimum moisture content, to a depth of 18 inches below subgrade elevation. If very low expansive soils are present, only optimum moisture content, or greater, is required and specific presoaking is not warranted. The moisture content of the subgrade should be proof tested within 72 hours prior to pouring concrete.

2. Concrete slabs should be cast over a non-yielding surface, consisting of a 4-inch layer of crushed rock, gravel, or clean sand, that should be compacted and level prior to pouring concrete. If very low expansive soils are present, the rock or gravel or sand may be deleted. The layer or subgrade should be wet-down completely prior to pouring concrete, to minimize loss of concrete moisture to the surrounding earth materials.

3. Exterior slabs should be a minimum of 4 inches thick. Driveway slabs and approaches should additionally have a thickened edge (12 inches) adjacent to all landscape areas, to help impede infiltration of landscape water under the slab. This is also recommended for the outboard edge of the driveway access to the detention basin.

4. The use of transverse and longitudinal control joints are recommended to help control slab cracking due to concrete shrinkage or expansion. Two ways to mitigate such cracking are: a) add a sufficient amount of reinforcing steel, increasing tensile strength of the slab; and, b) provide an adequate amount of control and/or expansion joints to accommodate anticipated concrete shrinkage and expansion.

   In order to reduce the potential for unsightly cracks, slabs should be reinforced at mid-height with a minimum of No. 3 bars placed at 18 inches on center, in each direction. If subgrade soils within the top 7 feet from finish grade are very low expansive soils (i.e., E.I. $\leq$20), then 6x6-W1.4xW1.4 welded-wire mesh may be substituted for the rebar, provided the reinforcement is placed on chairs, at slab mid-height. The exterior slabs should be scored or saw cut, ½ to ⅜ inches deep, often enough so that no section is greater than 10 feet by 10 feet. For sidewalks or narrow slabs, control joints should be provided at intervals of every 6 feet. The slabs should be separated from the foundations and sidewalks with expansion joint filler material.

5. No traffic should be allowed upon the newly poured concrete slabs until they have been properly cured to within 75 percent of design strength. Concrete compression strength should be a minimum of 2,500 psi.

6. Driveways, sidewalks, and patio slabs adjacent to the house should be separated from the house with thick expansion joint filler material. In areas directly adjacent

to a continuous source of moisture (i.e., irrigation, planters, etc.), all joints should be additionally sealed with flexible mastic.

7. Planters and walls should not be tied to the house.

8. Overhang structures should be supported on the slabs, or structurally designed with continuous footings tied in at least two directions. If very low expansion soils are present, footings need only be tied in one direction.

9. Any masonry landscape walls that are to be constructed throughout the property should be grouted and articulated in segments no more than 20 feet long. These segments should be keyed or doweled together.

10. Utilities should be enclosed within a closed utilidor (vault) or designed with flexible connections to accommodate differential settlement and expansive soil conditions.

11. Positive site drainage should be maintained at all times. Finish grade on the lots should provide a minimum of 1 to 2 percent fall to the street, as indicated herein. It should be kept in mind that drainage reversals could occur, including post-construction settlement, if relatively flat yard drainage gradients are not periodically maintained by the homeowner or homeowners association.

12. Air conditioning (A/C) units should be supported by slabs that are incorporated into the building foundation or constructed on a rigid slab with flexible couplings for plumbing and electrical lines. A/C waste water lines should be drained to a suitable non-erosive outlet.

13. Shrinkage cracks could become excessive if proper finishing and curing practices are not followed. Finishing and curing practices should be performed per the Portland Cement Association Guidelines. Mix design should incorporate rate of curing for climate and time of year, sulfate content of soils, corrosion potential of soils, and fertilizers used on site.

DEVELOPMENT CRITERIA

Slope Deformation

Compacted fill slopes designed using customary factors of safety for gross or surficial stability and constructed in general accordance with the design specifications should be expected to undergo some differential vertical heave or settlement in combination with differential lateral movement in the out-of-slope direction, after grading. This post-construction movement occurs in two forms: slope creep, and lateral fill extension (LFE). Slope creep is caused by alternate wetting and drying of the fill soils which results

in slow downslope movement. This type of movement is expected to occur throughout the life of the slope, and is anticipated to potentially affect improvements or structures (e.g., separations and/or cracking), placed near the top-of-slope, up to a maximum distance of approximately 15 feet from the top-of-slope, depending on the slope height. This movement generally results in rotation and differential settlement of improvements located within the creep zone. LFE occurs due to deep wetting from irrigation and rainfall on slopes comprised of expansive materials. Although some movement should be expected, long-term movement from this source may be minimized, but not eliminated, by placing the fill throughout the slope region, wet of the fill's optimum moisture content.

It is generally not practical to attempt to eliminate the effects of either slope creep or LFE. Suitable mitigative measures to reduce the potential of lateral deformation typically include: setback of improvements from the slope faces (per the 1997 UBC and/or adopted California Building Code), positive structural separations (i.e., joints) between improvements, and stiffening and deepening of foundations. Expansion joints in walls should be placed no greater than 20 feet on-center, and in accordance with the structural engineer's recommendations. All of these measures are recommended for design of structures and improvements. The ramifications of the above conditions, and recommendations for mitigation, should be provided to each homeowner and/or any homeowners association.

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 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 adversely affects site improvements, and causes perched groundwater conditions. Graded slopes constructed 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. Compaction to the face of fill slopes would tend to minimize short-term erosion until vegetation is established. Plants selected for landscaping should be light weight, deep rooted types that require little water and are capable of surviving the prevailing climate. Jute-type matting or other fibrous covers may aid in allowing the establishment of a sparse plant cover. Utilizing plants other than those recommended above will increase the potential for perched water, staining, mold, etc., to develop. A rodent control program to prevent burrowing should be implemented. Irrigation of natural (ungraded) slope areas is generally not recommended. These recommendations regarding plant type, irrigation practices, and rodent control should be provided to each homeowner. Over-steepening of slopes should be avoided during building construction activities and landscaping.

Drainage

Adequate lot surface drainage is a very important factor in reducing the likelihood of adverse performance of foundations, hardscape, and slopes. Surface drainage should be sufficient to prevent ponding of water anywhere on a lot, and especially near structures and tops of slopes. Lot surface drainage should be carefully taken into consideration during fine grading, landscaping, and building construction. Therefore, care should be taken that future landscaping or construction activities do not create adverse drainage conditions. Positive site drainage within lots and common areas should be provided and 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. In general, the area within 5 feet around a structure should slope away from the structure. We recommend that unpaved lawn and landscape areas have a minimum gradient of 1 percent sloping away from structures, and whenever possible, should be above adjacent paved areas. Consideration should be given to avoiding construction of planters adjacent to structures (buildings, pools, spas, etc.). Pad drainage should be directed toward the street or other approved area(s). Although not a geotechnical requirement, roof gutters, down spouts, or other appropriate means may be utilized 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.

Toe of Slope Drains/Toe Drains

Where significant slopes intersect pad areas, surface drainage down the slope allows for some seepage into the subsurface materials, sometimes creating conditions causing or contributing to perched and/or ponded water. Toe of slope/toe drains may be beneficial in the mitigation of this condition due to surface drainage. The general criteria to be utilized by the design engineer for evaluating the need for this type of drain is as follows:

- Is there a source of irrigation above or on the slope that could contribute to saturation of soil at the base of the slope?

- Are the slopes hard rock and/or impermeable, or relatively permeable, or; do the slopes already have or are they proposed to have subdrains (i.e., stabilization fills, etc.)?

- Are there cut-fill transitions (i.e., fill over bedrock), within the slope?

- Was the lot at the base of the slope overexcavated or is it proposed to be overexcavated? Overexcavated lots located at the base of a slope could accumulate subsurface water along the base of the fill cap.

- Are the slopes north facing? North facing slopes tend to receive less sunlight (less evaporation) relative to south facing slopes and are more exposed to the currently prevailing seasonal storm tracks.

- What is the slope height? It has been our experience that slopes with heights in excess of approximately 10 feet tend to have more problems due to storm runoff and irrigation than slopes of a lesser height.

- Do the slopes "toe out" into a residential lot or a lot where perched or ponded water may adversely impact its proposed use?

Based on these general criteria, the construction of toe drains may be considered by the design engineer along the toe of slopes, or at retaining walls in slopes, descending to the rear of such lots. Following are Detail 4 (Schematic Toe Drain Detail) and Detail 5 (Subdrain Along Retaining Wall Detail). Other drains may be warranted due to unforeseen conditions, homeowner irrigation, or other circumstances. Where drains are constructed during grading, including subdrains, the locations/elevations of such drains should be surveyed, and recorded on the final as-built grading plans by the design engineer. It is recommended that the above be disclosed to all interested parties, including homeowners and any homeowners association.

Erosion Control

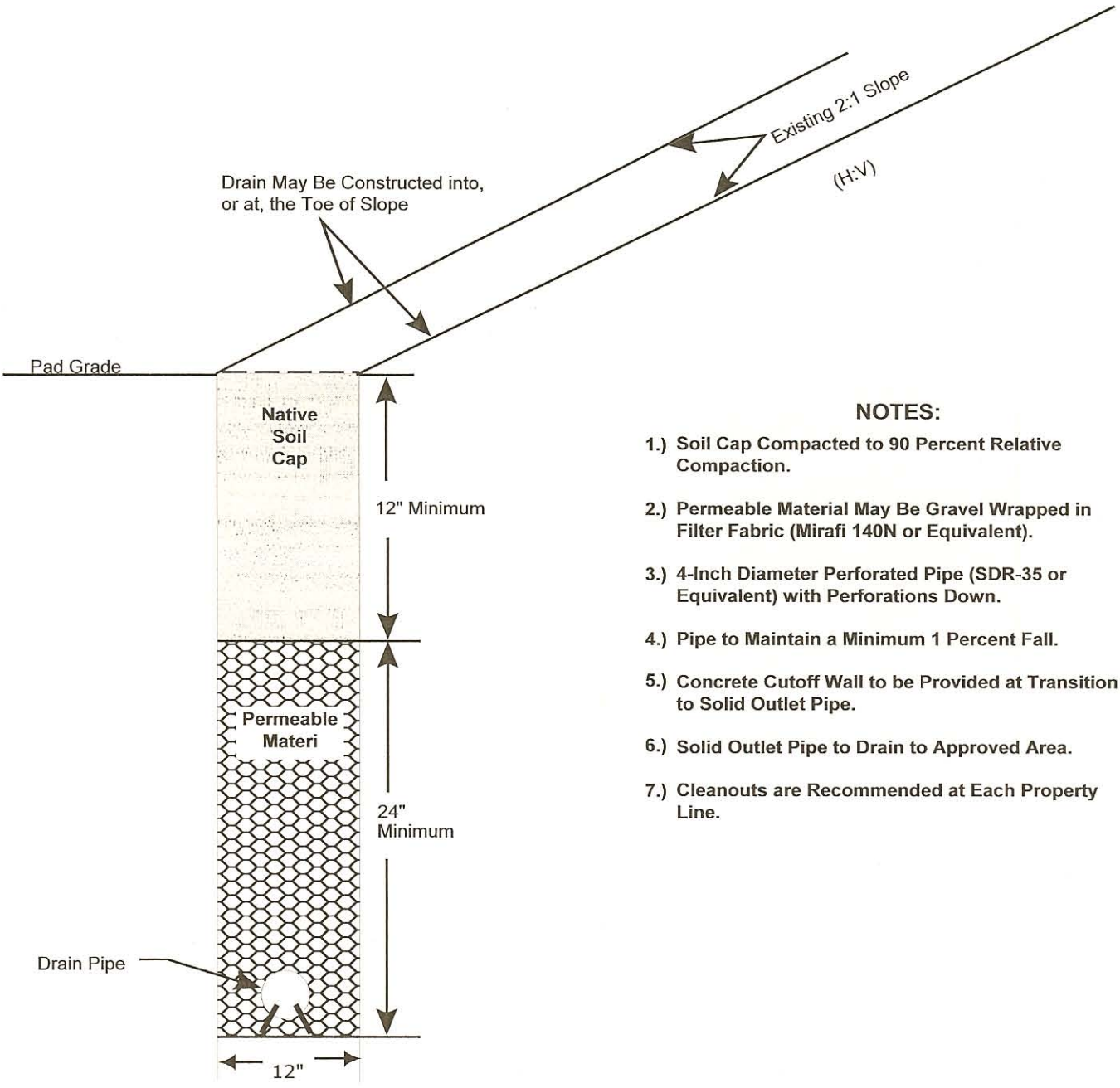
Cut and fill slopes will be subject to surficial erosion during and after grading. Onsite earth materials have a moderate to high erosion potential. This will need to be considered during project budgetary evaluation, especially for normal maintenance of the detention basin. Consideration should be given to providing hay bales and silt fences for the temporary control of surface water, from a geotechnical viewpoint.

Landscape Maintenance

Only the amount of irrigation necessary to sustain plant life should be provided. Over-watering the landscape areas will 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. If planters are constructed adjacent to structures, the sides and bottom of the planter should be provided with a moisture barrier to prevent penetration of irrigation water into the subgrade. Provisions should be made to drain the excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Graded slope areas should be planted with 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).

DETAILS
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SCHEMATIC TOE DRAIN DETAIL



NOTES:

1.) **Soil Cap Compacted to 90 Percent Relative Compaction.**

2.) **Permeable Material May Be Gravel Wrapped in Filter Fabric (Mirafi 140N or Equivalent).**

3.) **4-Inch Diameter Perforated Pipe (SDR-35 or Equivalent) with Perforations Down.**

4.) **Pipe to Maintain a Minimum 1 Percent Fall.**

5.) **Concrete Cutoff Wall to be Provided at Transition to Solid Outlet Pipe.**

6.) **Solid Outlet Pipe to Drain to Approved Area.**

7.) **Cleanouts are Recommended at Each Property Line.**

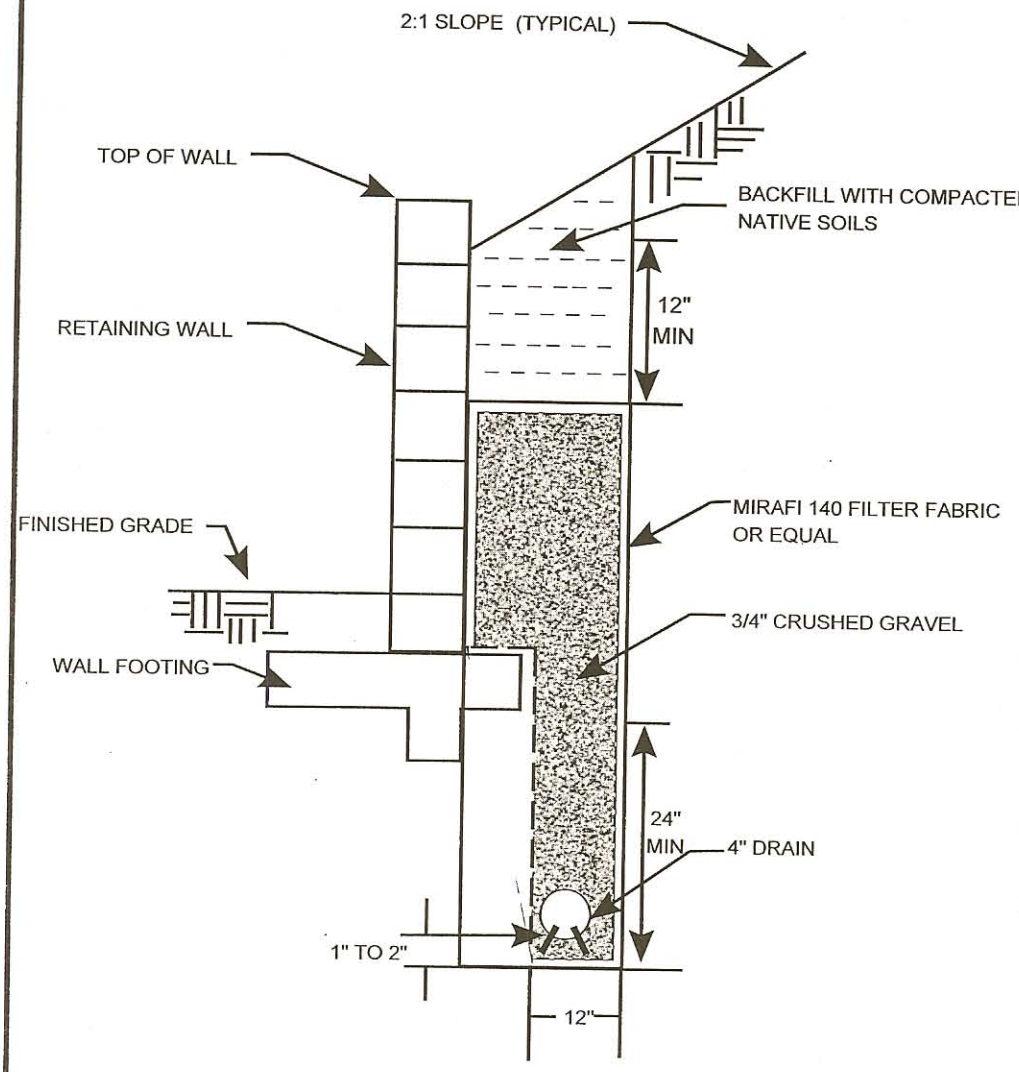
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SCHEMATIC TOE DRAIN DETAIL

DETAIL 4

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DETAILS
N . T . S .



NOTES:

1.) **Soil Cap Compacted to 90 Percent Relative Compaction.**

2.) **Permeable Material May Be Gravel Wrapped in Filter Fabric (Mirafi 140N or Equivalent).**

3.) **4-Inch Diameter Perforated Pipe (SDR-35 or Equivalent) with Perforations Down.**

4.) **Pipe to Maintain a Minimum 1 Percent Fall.**

5.) **Concrete Cutoff Wall to be Provided at Transition to Solid Outlet Pipe.**

6.) **Solid Outlet Pipe to Drain to Approved Area.**

7.) **Cleanouts are Recommended at Each Property Line.**

8.) **Compacted Effort Should Be Applied to Drain Rock.**

SUBDRAIN ALONG RETAINING WALL DETAIL
NOT TO SCALE

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SUBDRAIN ALONG RETAINING WALL DETAIL

DETAIL 5

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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.

Gutters and Downspouts

As previously discussed in the drainage section, the installation of gutters and downspouts should be considered to collect roof water that may otherwise infiltrate the soils adjacent to the structures. If utilized, the downspouts should be drained into PVC collector pipes or other non-erosive devices (e.g., paved swales or ditches; below grade, solid tight-lined PVC pipes; etc.), that will carry the water away from the house, to an appropriate outlet, in accordance with the recommendations of the design civil engineer. Downspouts and gutters are not a requirement; however, from a geotechnical viewpoint, provided that positive drainage is incorporated into project design (as discussed previously).

Subsurface and Surface Water

Subsurface and surface water 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 may not be precluded from occurring in the future due to site irrigation, poor drainage conditions, or damaged utilities, and should be anticipated. Should perched groundwater conditions develop, this office could assess the affected area(s) and provide the appropriate recommendations to mitigate the observed groundwater conditions. Groundwater conditions may change with the introduction of irrigation, rainfall, or other factors.

Site Improvements

If in the future, any additional improvements (e.g., pools, spas, etc.) are planned for the site, recommendations concerning the geological or geotechnical aspects of design and construction of said improvements could be provided upon request. Pools and/or spas should not be constructed without specific design and construction recommendations from GSI, and this construction recommendation should be provided to the homeowners, any homeowners association, and/or other interested parties. 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, flatwork, etc.

Tile Flooring

Tile flooring can crack, reflecting cracks in the concrete slab below the tile, although small cracks in a conventional slab may not be significant. Therefore, the designer should

consider additional steel reinforcement for concrete slabs-on-grade where tile will be placed. The tile installer should consider installation methods that reduce possible cracking of the tile such as slipsheets. Slipsheets or a vinyl crack isolation membrane (approved by the Tile Council of America/Ceramic Tile Institute) are recommended between tile and concrete slabs on grade.

Additional Grading

This office should be notified in advance of any fill placement, supplemental regrading of the site, or trench backfilling after rough grading has been completed. This includes completion of grading in the street, driveway approaches, driveways, parking areas, and 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 evaluate that the excavations have been 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/Temporary Construction Backcuts

Considering the nature of the onsite earth materials, it should be anticipated that caving or sloughing could be a factor in subsurface excavations and trenching. Shoring or excavating the trench walls/backcuts at the angle of repose (typically 25 to 45 degrees [except as specifically superceded within the text of this report]), should be anticipated. All excavations should be observed by an engineering geologist or soil engineer from GSI, prior to workers entering the excavation or trench, and minimally conform to CAL-OSHA, state, and local safety codes. Should adverse conditions exist, appropriate recommendations would be offered at that time. The above recommendations should be provided to any contractors and/or subcontractors, or homeowners, etc., that may perform such work.

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-inch to 18-inch) 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 evaluate 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 evaluate the desired results.

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

4. Utilities crossing grade beams, perimeter beams, or footings should either pass below the footing or grade beam utilizing a hardened collar or foam spacer, or pass through the footing or grade beam in accordance with the recommendations of the structural engineer.

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.
- During excavation.
- During placement of subdrains, toe drains, or other subdrainage devices, prior to placing fill and/or backfill.
- After excavation of building footings, retaining wall footings, and free standing walls footings, prior to the placement of reinforcing steel or concrete.
- Prior to pouring any slabs or flatwork, after presoaking/presaturation of building pads and other flatwork subgrade, before the placement of concrete, reinforcing steel, capillary break (i.e., sand, pea-gravel, etc.), or vapor retarders (i.e., visqueen, etc.).
- 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.

- During slope construction/repair.

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

- When any developer or homeowner improvements, such as flatwork, spas, pools, walls, etc., are constructed, prior to construction.

- A report of geotechnical observation and testing should be provided at the conclusion of each of the above stages, in order to provide concise and clear documentation of site work, and/or to comply with code requirements.

- GSI should review project sales documents to homeowners/homeowners associations for geotechnical aspects, including irrigation practices, the conditions outlined above, etc., prior to any sales. At that stage, GSI will provide homeowners maintenance guidelines which should be incorporated into such documents.

OTHER DESIGN PROFESSIONALS/CONSULTANTS

The design civil engineer, structural engineer, post-tension designer, architect, landscape architect, wall designer, etc., should review the recommendations provided herein, incorporate those recommendations into all their respective plans, and by explicit reference, make this report part of their project plans. This report presents minimum design criteria for the design of slabs, foundations and other elements possibly applicable to the project. These criteria should not be considered as substitutes for actual designs by the structural engineer/designer. Please note that the recommendations contained herein are not intended to preclude the transmission of water or vapor through the slab or foundation. The structural engineer/foundation and/or slab designer should provide recommendations to not allow water or vapor to enter into the structure so as to cause damage to another building component, or so as to limit the installation of the type of flooring materials typically used for the particular application.

The structural engineer/designer should analyze actual soil-structure interaction and consider, as needed, bearing, expansive soil influence, and strength, stiffness and deflections in the various slab, foundation, and other elements in order to develop appropriate, design-specific details. As conditions dictate, it is possible that other influences will also have to be considered. The structural engineer/designer should consider all applicable codes and authoritative sources where needed. If analyses by the structural engineer/designer result in less critical details than are provided herein as minimums, the minimums presented herein should be adopted. It is considered likely that some, more restrictive details will be required.

If the structural engineer/designer has any questions or requires further assistance, they should not hesitate to call or otherwise transmit their requests to GSI. In order to mitigate potential distress, the foundation and/or improvement's designer should confirm to GSI and the governing agency, in writing, that the proposed foundations and/or improvements can tolerate the amount of differential settlement and/or expansion characteristics and other design criteria specified herein.

PLAN REVIEW

Final project plans (precise grading, foundation, retaining wall, landscaping, etc.), should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations and/or further geotechnical studies may be warranted.

LIMITATIONS

The materials encountered on the project site and utilized for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during mass grading. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as our study is based upon our review and engineering analyses and laboratory data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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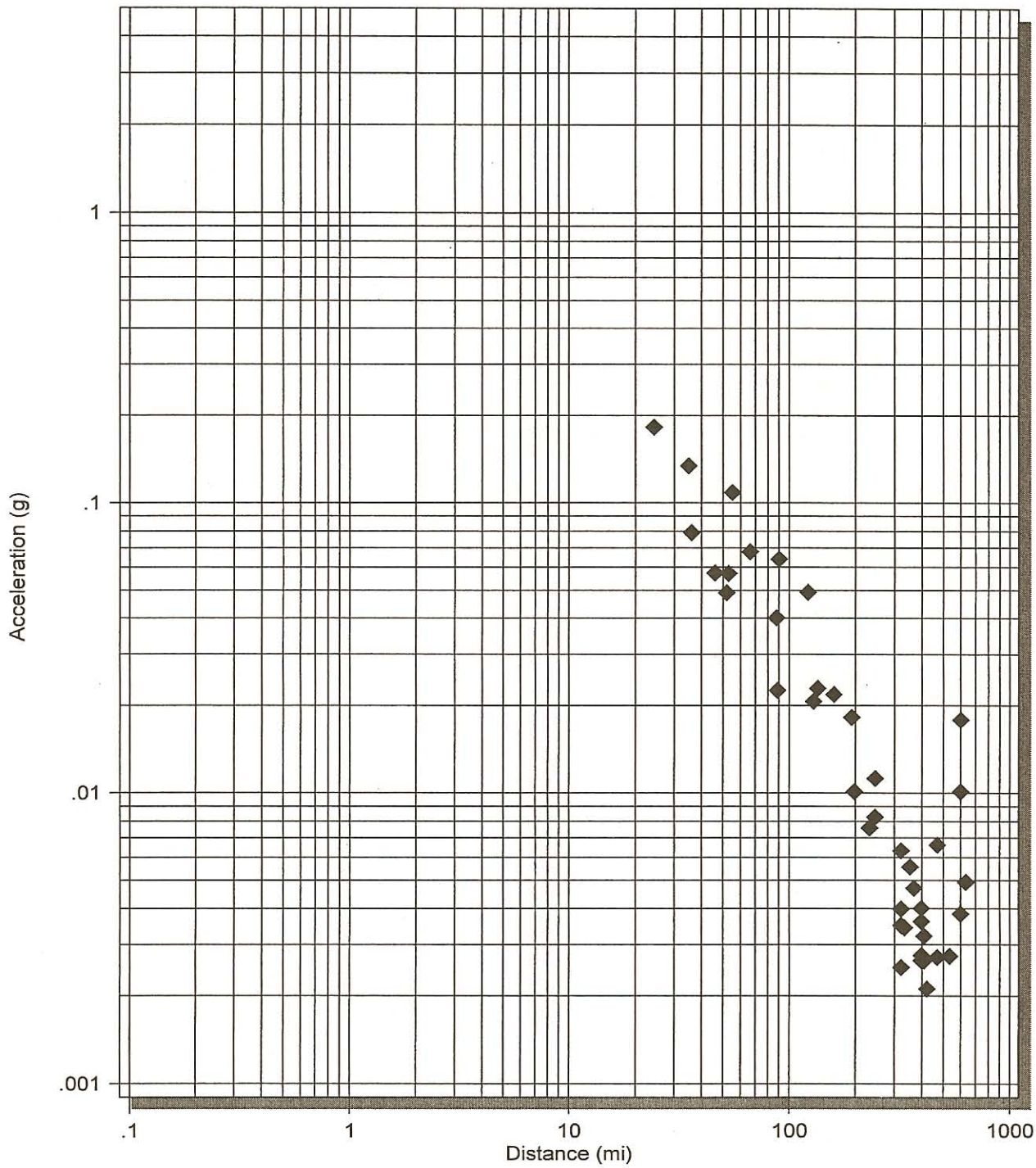
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APPENDIX B

EQFAULT, EQSEARCH, AND FRISKSP

MAXIMUM EARTHQUAKES

Griffin



W.O. 4787–A–SC

Plate B–1

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**************************
*                        *
*    E Q S E A R C H     *
*                        *
*      Version 3.00      *
*                        *
**************************

        ESTIMATION OF
    PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: W.O. 4787-A2-SC
                                        DATE: 10-03-2006

JOB NAME: Griffin

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT


MAGNITUDE RANGE:
   MINIMUM MAGNITUDE:  5.00
   MAXIMUM MAGNITUDE:  9.00

SITE COORDINATES:
   SITE LATITUDE:  33.7594
   SITE LONGITUDE:  117.1650

SEARCH DATES:
           START DATE:   1800
           END DATE:   2006

SEARCH RADIUS:
           62.0 mi
           99.8 km

ATTENUATION RELATION:   7) Bozorgnia Campbell Niazi (1999) Hor.-Pleist. Soil-Uncor.
   UNCERTAINTY (M=Median, S=Sigma): S       Number of Sigmas:  1.0
   ASSUMED SOURCE TYPE:  SS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND:   0  Depth Source:  A
   Basement Depth:  1.00 km     Campbell SSR:  0     Campbell SHR:  0
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km):  3.0
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EARTHQUAKE SEARCH RESULTS

Page 1

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	33.7500	117.0000	04/21/1918	223225.0	0.0	6.80	0.454	X	9.5(15.3)
DMG	33.7500	117.0000	06/06/1918	2232 0.0	0.0	5.00	0.117	VII	9.5(15.3)
DMG	33.8000	117.0000	12/25/1899	1225 0.0	0.0	6.40	0.343	IX	9.9(15.9)
DMG	33.9000	117.2000	12/19/1880	0 0 0.0	0.0	6.00	0.259	IX	9.9(15.9)
DMG	33.7000	117.4000	04/11/1910	757 0.0	0.0	5.00	0.076	VII	14.1(22.7)
DMG	33.7000	117.4000	05/15/1910	1547 0.0	0.0	6.00	0.173	VIII	14.1(22.7)
DMG	33.7000	117.4000	05/13/1910	620 0.0	0.0	5.00	0.076	VII	14.1(22.7)
DMG	33.7100	116.9250	09/23/1963	144152.6	16.5	5.00	0.075	VII	14.2(22.8)
DMG	34.0000	117.2500	07/23/1923	73026.0	0.0	6.25	0.163	VIII	17.3(27.9)
DMG	33.6990	117.5110	05/31/1938	83455.4	10.0	5.50	0.073	VII	20.3(32.7)
DMG	33.9500	116.8500	09/28/1946	719 9.0	0.0	5.00	0.043	VI	22.3(36.0)
MGI	34.1000	117.3000	07/15/1905	2041 0.0	0.0	5.30	0.049	VI	24.8(39.8)
MGI	33.8000	117.6000	04/22/1918	2115 0.0	0.0	5.00	0.037	V	25.1(40.4)
MGI	34.0000	117.5000	12/16/1858	10 0 0.0	0.0	7.00	0.181	VIII	25.4(40.9)
DMG	33.9760	116.7210	06/12/1944	104534.7	10.0	5.10	0.033	V	29.5(47.5)
DMG	33.9940	116.7120	06/12/1944	111636.0	10.0	5.30	0.037	V	30.6(49.2)
DMG	34.2000	117.1000	09/20/1907	154 0.0	0.0	6.00	0.065	VI	30.6(49.3)
DMG	34.1000	116.8000	10/24/1935	1448 7.6	0.0	5.10	0.030	V	31.5(50.6)
DMG	34.1800	116.9200	01/16/1930	034 3.6	0.0	5.10	0.029	V	32.2(51.9)
DMG	34.1800	116.9200	01/16/1930	02433.9	0.0	5.20	0.032	V	32.2(51.9)
GSP	34.1630	116.8550	06/28/1992	144321.0	6.0	5.30	0.034	V	33.0(53.2)
DMG	34.2000	117.4000	07/22/1899	046 0.0	0.0	5.50	0.039	V	33.3(53.5)
GSP	34.1950	116.8620	08/17/1992	204152.1	11.0	5.30	0.031	V	34.7(55.9)
DMG	34.1000	116.7000	02/07/1889	520 0.0	0.0	5.30	0.030	V	35.5(57.2)
PAS	33.9980	116.6060	07/08/1986	92044.5	11.7	5.60	0.038	V	36.0(58.0)
GSN	34.2030	116.8270	06/28/1992	150530.7	5.0	6.70	0.092	VII	36.2(58.3)
DMG	34.2670	116.9670	08/29/1943	34513.0	0.0	5.50	0.034	V	36.8(59.3)
GSP	33.5290	116.5720	06/12/2005	154146.5	14.0	5.20	0.026	V	37.6(60.5)
GSP	34.2390	116.8370	07/09/1992	014357.6	0.0	5.30	0.028	V	38.1(61.3)
GSP	34.2900	116.9460	02/10/2001	210505.8	9.0	5.10	0.023	IV	38.7(62.3)
GSP	34.1400	117.7000	02/28/1990	234336.6	5.0	5.20	0.024	IV	40.4(65.0)
GSP	33.5080	116.5140	10/31/2001	075616.6	15.0	5.10	0.021	IV	41.2(66.4)
DMG	34.2700	117.5400	09/12/1970	143053.0	8.0	5.40	0.027	V	41.3(66.4)
PAS	33.5010	116.5130	02/25/1980	104738.5	13.6	5.50	0.029	V	41.5(66.8)
DMG	34.3000	117.5000	07/22/1899	2032 0.0	0.0	6.50	0.065	VI	42.0(67.5)
DMG	34.0170	116.5000	07/25/1947	61949.0	0.0	5.20	0.023	IV	42.1(67.7)
DMG	34.0170	116.5000	07/24/1947	221046.0	0.0	5.50	0.029	V	42.1(67.7)
DMG	34.0170	116.5000	07/26/1947	24941.0	0.0	5.10	0.021	IV	42.1(67.7)
DMG	34.0170	116.5000	07/25/1947	04631.0	0.0	5.00	0.019	IV	42.1(67.7)
GSG	34.3100	116.8480	02/22/2003	121910.6	1.0	5.20	0.023	IV	42.1(67.8)
DMG	33.5000	116.5000	09/30/1916	211 0.0	0.0	5.00	0.019	IV	42.2(67.9)
GSP	34.3400	116.9000	11/27/1992	160057.5	1.0	5.30	0.024	V	42.9(69.0)
GSP	34.3690	116.8970	12/04/1992	020857.5	3.0	5.30	0.023	IV	44.8(72.1)
DMG	34.3000	117.6000	07/30/1894	512 0.0	0.0	6.00	0.040	V	44.9(72.2)
DMG	33.9330	116.3830	12/04/1948	234317.0	0.0	6.50	0.057	VI	46.4(74.7)
DMG	33.2000	116.7000	01/01/1920	235 0.0	0.0	5.00	0.017	IV	47.0(75.6)
DMG	33.6170	117.9670	03/11/1933	154 7.8	0.0	6.30	0.048	VI	47.1(75.8)
DMG	33.5750	117.9830	03/11/1933	518 4.0	0.0	5.20	0.019	IV	48.7(78.4)
GSP	34.1390	116.4310	06/28/1992	123640.6	10.0	5.10	0.017	IV	49.5(79.7)
GSP	34.1080	116.4040	06/29/1992	141338.8	9.0	5.40	0.021	IV	49.8(80.1)
DMG	33.6170	118.0170	03/14/1933	19 150.0	0.0	5.10	0.017	IV	49.9(80.3)
DMG	34.3700	117.6500	12/08/1812	15 0 0.0	0.0	7.00	0.076	VII	50.5(81.2)
MGI	33.2000	116.6000	10/12/1920	1748 0.0	0.0	5.30	0.019	IV	50.5(81.3)

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
GSP	33.9610	116.3180	04/23/1992	045023.0	12.0	6.10	0.037	V	50.5(81.3)
GSP	34.0640	116.3610	09/15/1992	084711.3	9.0	5.20	0.018	IV	50.6(81.5)
MGI	34.0000	118.0000	12/25/1903	1745 0.0	0.0	5.00	0.015	IV	50.7(81.5)
DMG	33.6830	118.0500	03/11/1933	658 3.0	0.0	5.50	0.022	IV	51.1(82.2)
GSP	33.9020	116.2840	07/24/1992	181436.2	9.0	5.00	0.015	IV	51.5(82.8)
GSN	34.2010	116.4360	06/28/1992	115734.1	1.0	7.60	0.119	VII	51.7(83.2)
GSP	34.0290	116.3210	08/21/1993	014638.4	9.0	5.00	0.015	IV	51.8(83.4)
DMG	34.2000	117.9000	08/28/1889	215 0.0	0.0	5.50	0.022	IV	51.9(83.6)
DMG	33.7000	118.0670	03/11/1933	51022.0	0.0	5.10	0.016	IV	52.0(83.6)
DMG	33.7000	118.0670	03/11/1933	85457.0	0.0	5.10	0.016	IV	52.0(83.6)
GSP	33.8760	116.2670	06/29/1992	160142.8	1.0	5.20	0.017	IV	52.1(83.9)
DMG	34.0670	116.3330	05/18/1940	72132.7	0.0	5.00	0.014	IV	52.2(84.0)
DMG	34.0670	116.3330	05/18/1940	55120.2	0.0	5.20	0.017	IV	52.2(84.0)
DMG	33.7500	118.0830	03/11/1933	910 0.0	0.0	5.10	0.016	IV	52.7(84.8)
DMG	33.7500	118.0830	03/11/1933	323 0.0	0.0	5.00	0.014	IV	52.7(84.8)
DMG	33.7500	118.0830	03/11/1933	2 9 0.0	0.0	5.00	0.014	IV	52.7(84.8)
DMG	33.7500	118.0830	03/11/1933	230 0.0	0.0	5.10	0.016	IV	52.7(84.8)
DMG	33.7500	118.0830	03/13/1933	131828.0	0.0	5.30	0.018	IV	52.7(84.8)
DMG	33.0000	117.3000	11/22/1800	2130 0.0	0.0	6.50	0.048	VI	53.0(85.3)
MGI	33.0000	117.0000	09/21/1856	730 0.0	0.0	5.00	0.014	IV	53.3(85.7)
GSP	34.3410	116.5290	06/28/1992	124053.5	6.0	5.20	0.016	IV	54.2(87.2)
DMG	34.0830	116.3000	05/18/1940	5 358.5	0.0	5.40	0.019	IV	54.4(87.5)
DMG	33.3430	116.3460	04/28/1969	232042.9	20.0	5.80	0.026	V	55.2(88.8)
DMG	33.7830	118.1330	10/02/1933	91017.6	0.0	5.40	0.018	IV	55.6(89.4)
DMG	33.4000	116.3000	02/09/1890	12 6 0.0	0.0	6.30	0.038	V	55.6(89.5)
GSP	34.2680	116.4020	06/16/1994	162427.5	3.0	5.00	0.013	III	56.0(90.2)
PAS	34.0610	118.0790	10/01/1987	144220.0	9.5	5.90	0.027	V	56.4(90.7)
GSP	34.3320	116.4620	07/01/1992	074029.9	9.0	5.40	0.018	IV	56.4(90.8)
PAS	34.3270	116.4450	03/15/1979	21 716.5	2.5	5.20	0.015	IV	56.9(91.5)
DMG	33.4080	116.2610	03/25/1937	1649 1.8	10.0	6.00	0.029	V	57.4(92.3)
PAS	34.0730	118.0980	10/04/1987	105938.2	8.2	5.30	0.016	IV	57.7(92.8)
MGI	34.1000	118.1000	07/11/1855	415 0.0	0.0	6.30	0.036	V	58.5(94.1)
GSP	34.2620	118.0020	06/28/1991	144354.5	11.0	5.40	0.017	IV	59.1(95.2)

****

-END OF SEARCH- 86 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2006

LENGTH OF SEARCH TIME: 207 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 9.5 MILES (15.3 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 7.6

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.454 g

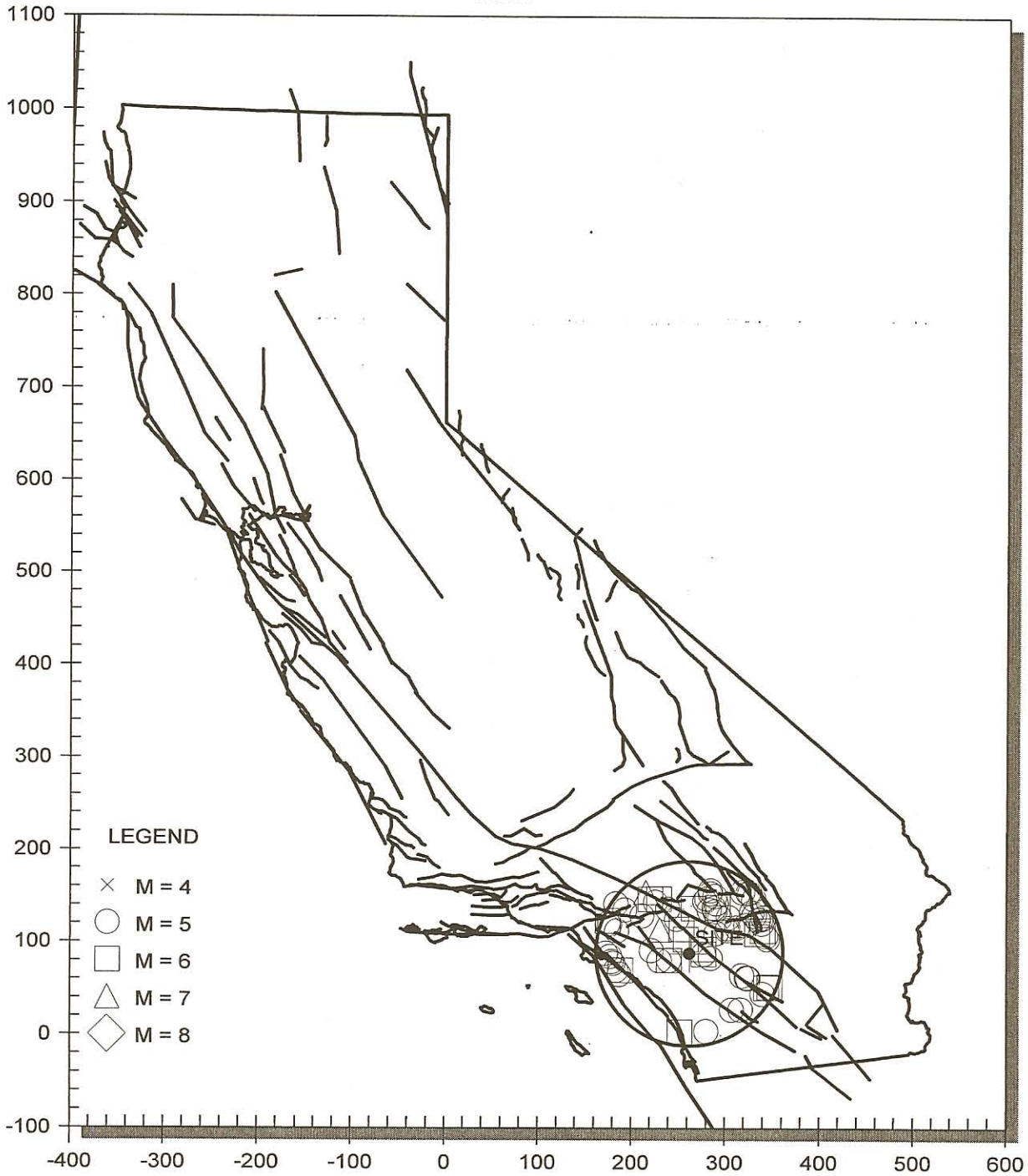
COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
a-value= 1.177
b-value= 0.357
beta-value= 0.821

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	86	0.41546
4.5	86	0.41546
5.0	86	0.41546
5.5	29	0.14010
6.0	19	0.09179
6.5	8	0.03865
7.0	3	0.01449
7.5	1	0.00483

EARTHQUAKE EPICENTER MAP

Griffin

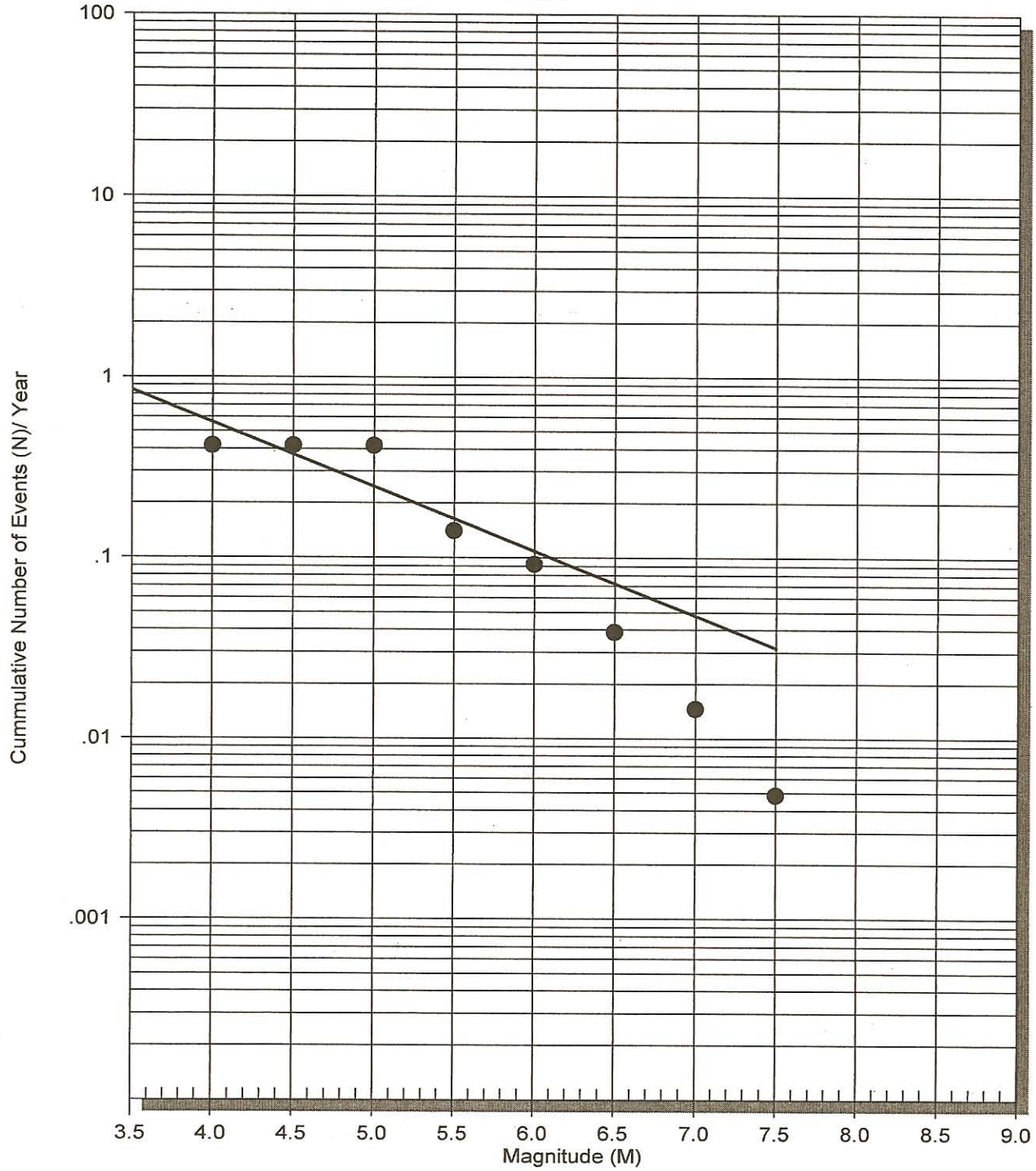


W.O. 4787–A–SC

Plate B–5

EARTHQUAKE RECURRENCE CURVE

Griffin



W.O. 4787–A–SC

Plate B–6

APPENDIX C

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 supercede the provisions contained hereafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new or revised recommendations which could supercede 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 general 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 remedial removals, clean-outs, prepared ground to receive fill, key excavations, and subdrain installation should be observed and documented by the project engineering geologist and/or soil engineer prior to placing and fill. It is the contractor'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. Random or representative field compaction tests should be performed in accordance with test methods ASTM designation D-1556, D-2937 or D-2922, and D-3017,

at intervals of approximately ±2 feet of fill height or approximately every 1,000 cubic yards 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 a geotechnical consultant, 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 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. In-place existing fill, soil, alluvium, colluvium, or rock materials, determined by the soil engineer or engineering geologist as being unsuitable, should be removed prior to any 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 to 8 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 greater than 6 to 8 inches in depth, it may be necessary to remove the excess and place the material in lifts restricted to about 6 to 8 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 forms 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, hollows, 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 [h:v]), 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 toes 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 approved 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 offsite, or placed in accordance with recommendations of the soil engineer in areas designated as suitable for rock disposal. Per the UBC/CBC, oversized material should not be placed within 10 feet vertically of finish grade (elevation) or within 20 feet horizontally of slope faces (any variation will require prior approval from the governing agency).

To facilitate future trenching, rock (or oversized material) should not be placed within 10 feet from finish grade, the range of foundation excavations, future utilities, or underground construction unless specifically approved by the soil engineer and/or the developer's 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 it's physical properties and suitability for use onsite. 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 about 6 to 8 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 conditioning, 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 the maximum density as determined by ASTM test designation D-1557, 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.

In general, per the UBC/CBC, fill slopes should be designed and constructed at a gradient of 2:1 (h:v), or flatter. 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 (h:v), prior approval from the governing agency, specific material types, a higher minimum relative compaction, special reinforcement, and special grading procedures will 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 evaluate compaction, the slopes should be grid-rolled to

achieve compaction to the slope face. Final testing should be used to evaluate compaction after grid rolling.

5. Where testing indicates less than adequate compaction, the contractor will be responsible to rip, water, mix, and recompact the slope material as necessary to achieve compaction. Additional testing should be performed to evaluate 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, especially the outlets, 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 refilling 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 excavation of cut slopes commence.

If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the engineering geologist and soil engineer should investigate, evaluate, and make appropriate recommendations for mitigation of these conditions. 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 contractor's 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 fill 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 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 contractor's 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 beacons, 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 technician's safety. Efforts will be made to coordinate locations with the grading contractor's authorized representative, and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractor's authorized representative (supervisor, grade checker, dump man, operator, etc.) should direct excavation of the pit and safety during the test period. Of paramount concern should be the soil technician's safety, and obtaining enough tests to represent the fill.

Test pits should be excavated so that the spoil pile is placed away from 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 decreases 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 operational 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 technician's safety is jeopardized or compromised as a result of the contractor's 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 contractor's representative will be contacted in an effort to affect a solution. However, in the interim, no further testing will be performed until the situation is rectified. Any fill placed 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 bring this to the technician's attention and notify this office. Effective communication and coordination between the contractor's representative and the soil technician is strongly encouraged in order to implement the above safety plan.

Trench and Vertical Excavation

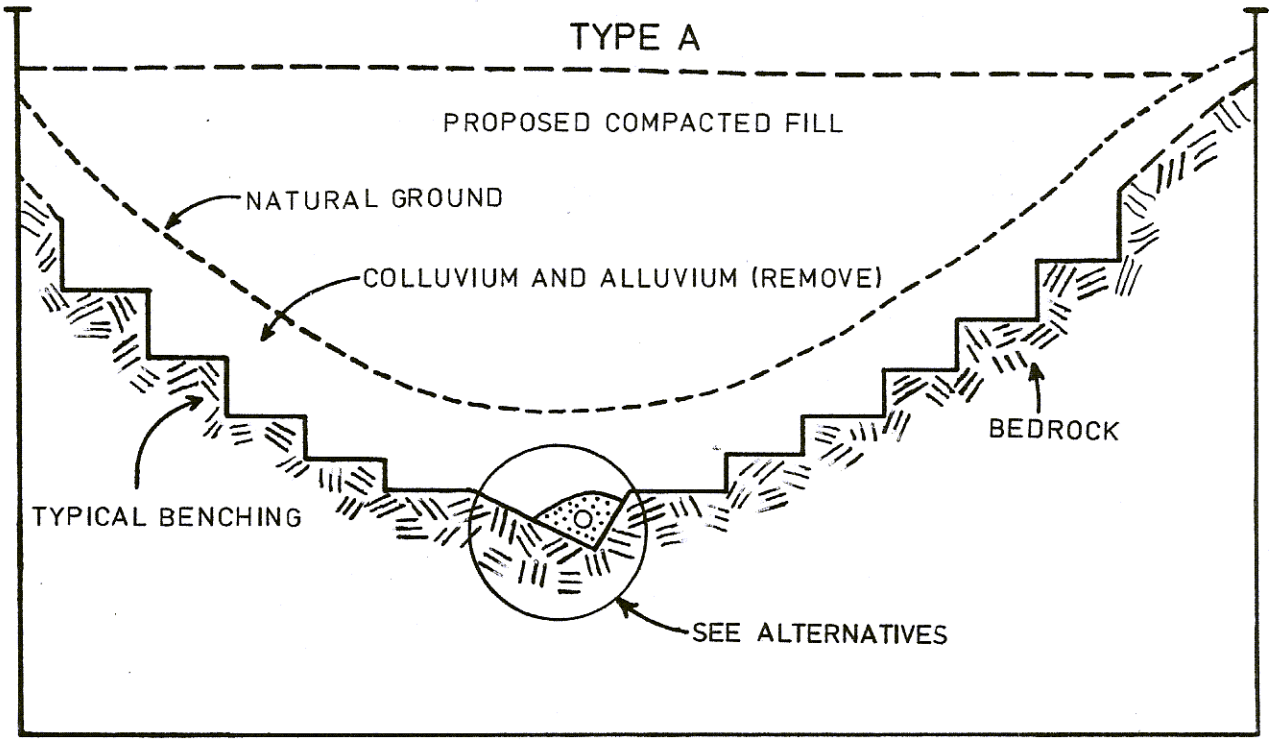
It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Our personnel are directed not to enter any excavation or vertical cut which: 1) is 5 feet or deeper unless shored or laid back; 2) displays any evidence of instability, has any loose rock or other debris which could fall into the trench; or 3) displays any other evidence of any unsafe conditions regardless of depth.

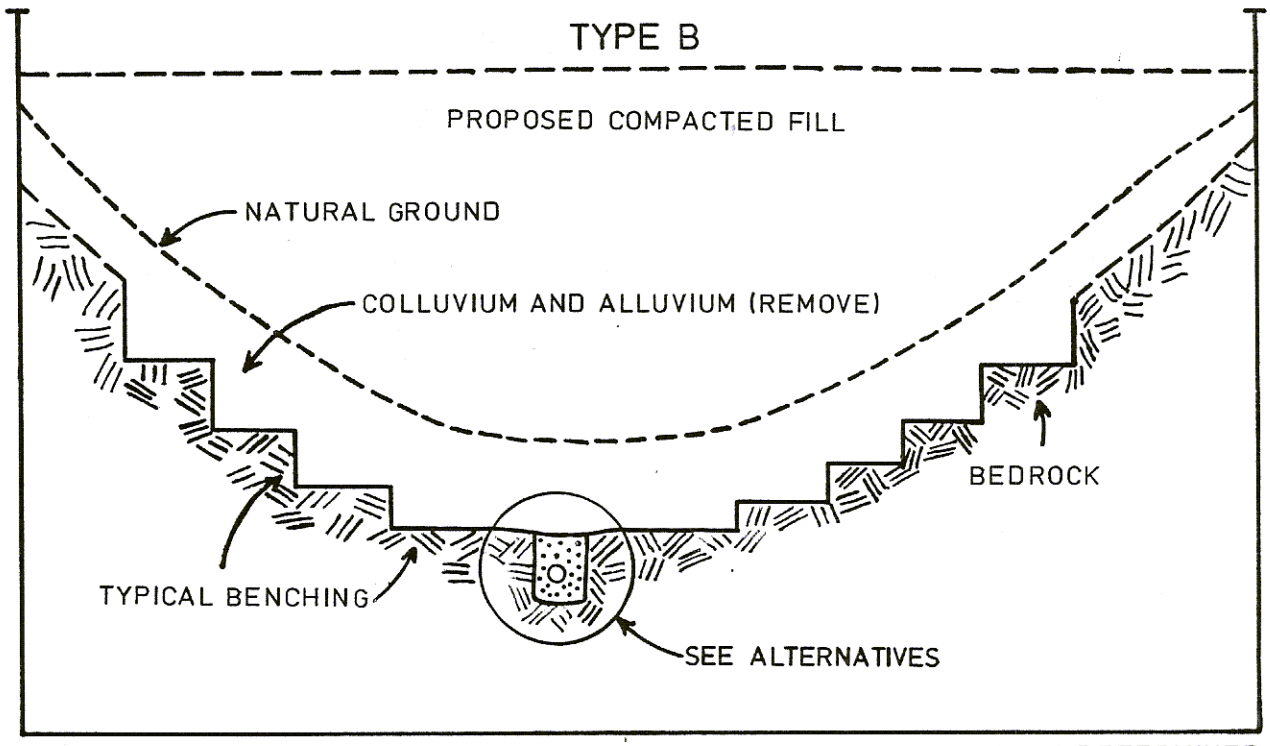
All trench excavations or vertical cuts in excess of 5 feet deep, which any person enters, should be shored or laid back. Trench access should be provided in accordance with CAL-OSHA and/or state and local standards. Our personnel are directed not to enter any trench by being lowered or "riding down" 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 contractor's representative will be contacted in an effort to affect 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 controlling authorities.

CANYON SUBDRAIN DETAIL



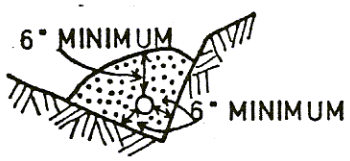


NOTE: ALTERNATIVES, LOCATION AND EXTENT OF SUBDRAINS SHOULD BE DETERMINED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST DURING GRADING.

PLATE EG–1

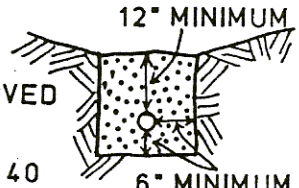
CANYON SUBDRAIN ALTERNATE DETAILS

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

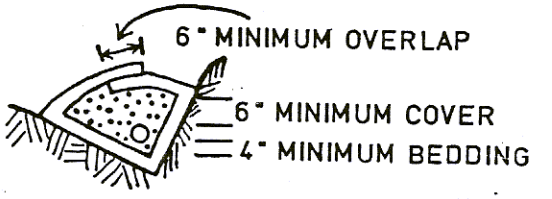


B—1

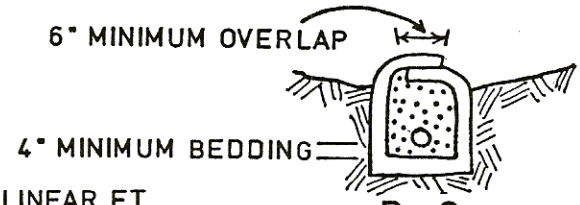
FILTER MATERIAL

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

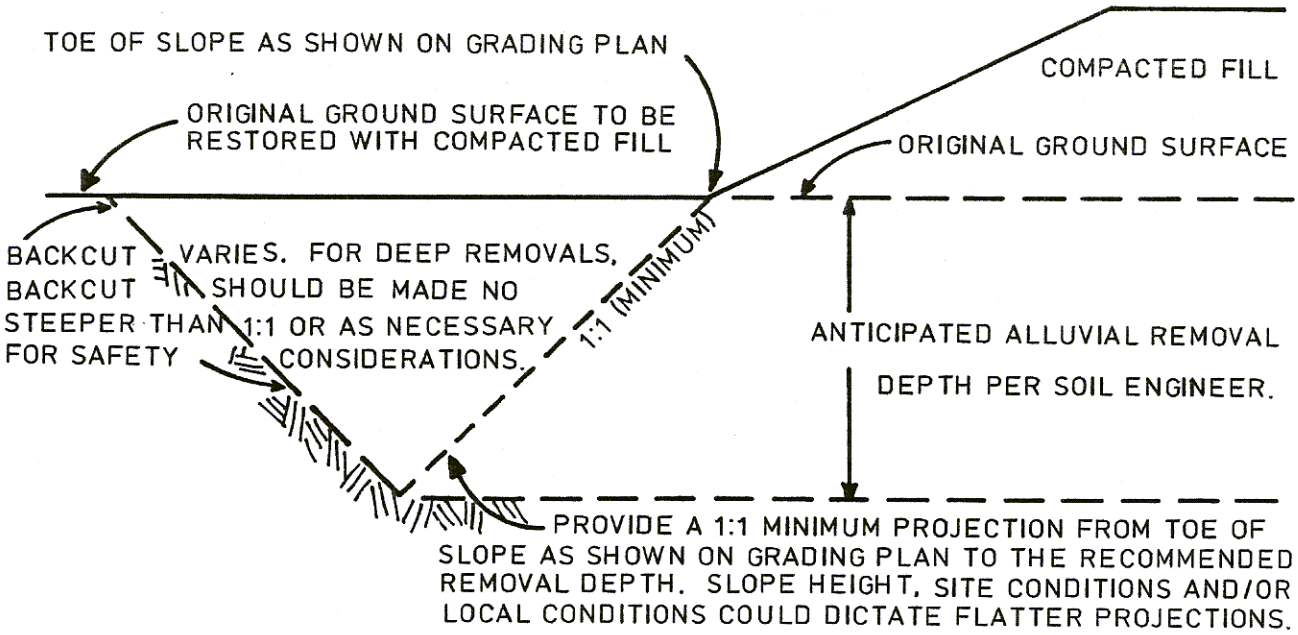


B—2

GRAVEL MATERIAL 9 FT³/LINEAR FT.
PERFORATED PIPE: SEE ALTERNATE 1
GRAVEL: CLEAN 3/4 INCH ROCK OR APPROVED SUBSTITUTE
FILTER FABRIC: MIRAFI 140 OR APPROVED SUBSTITUTE

PLATE EG—2

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON



REMOVAL ADJACENT TO EXISTING FILL

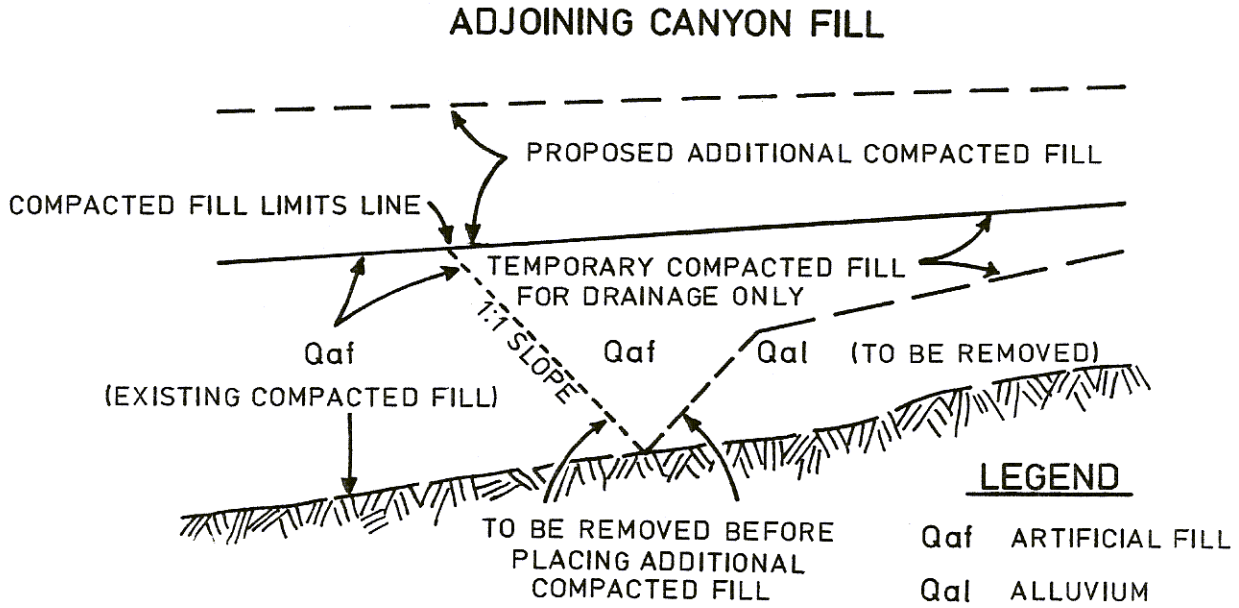


PLATE EG–3

TYPICAL STABILIZATION / BUTTRESS FILL DETAIL

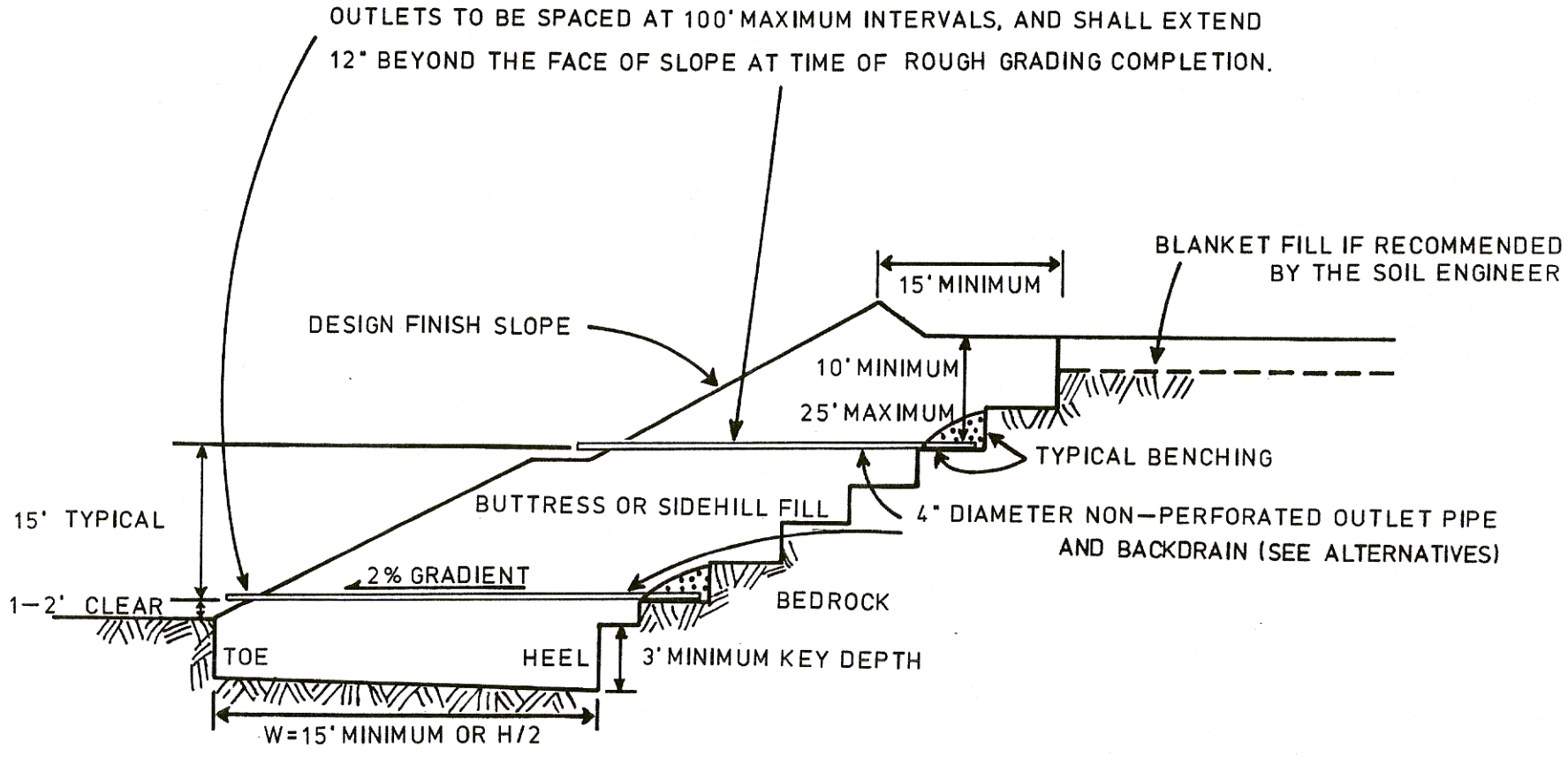
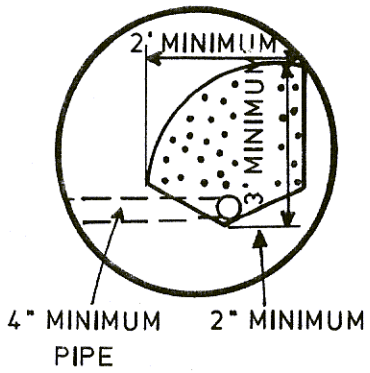
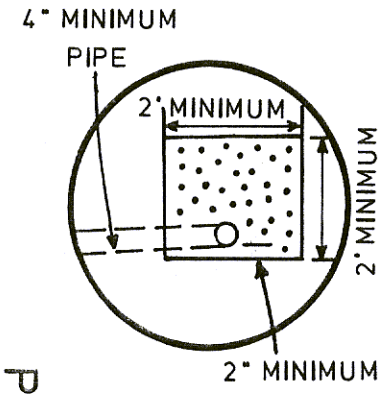


PLATE EG—4

TYPICAL STABILIZATION / BUTTRESS SUBDRAIN DETAIL





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

ALTERNATIVE IN LIEU OF FILTER MATERIAL: 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.

MINIMUM 4" DIAMETER PIPE: 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.

FILTER MATERIAL 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

GRAVEL SHALL BE OF THE FOLLOWING SPECIFICATION OR AN APPROVED EQUIVALENT:

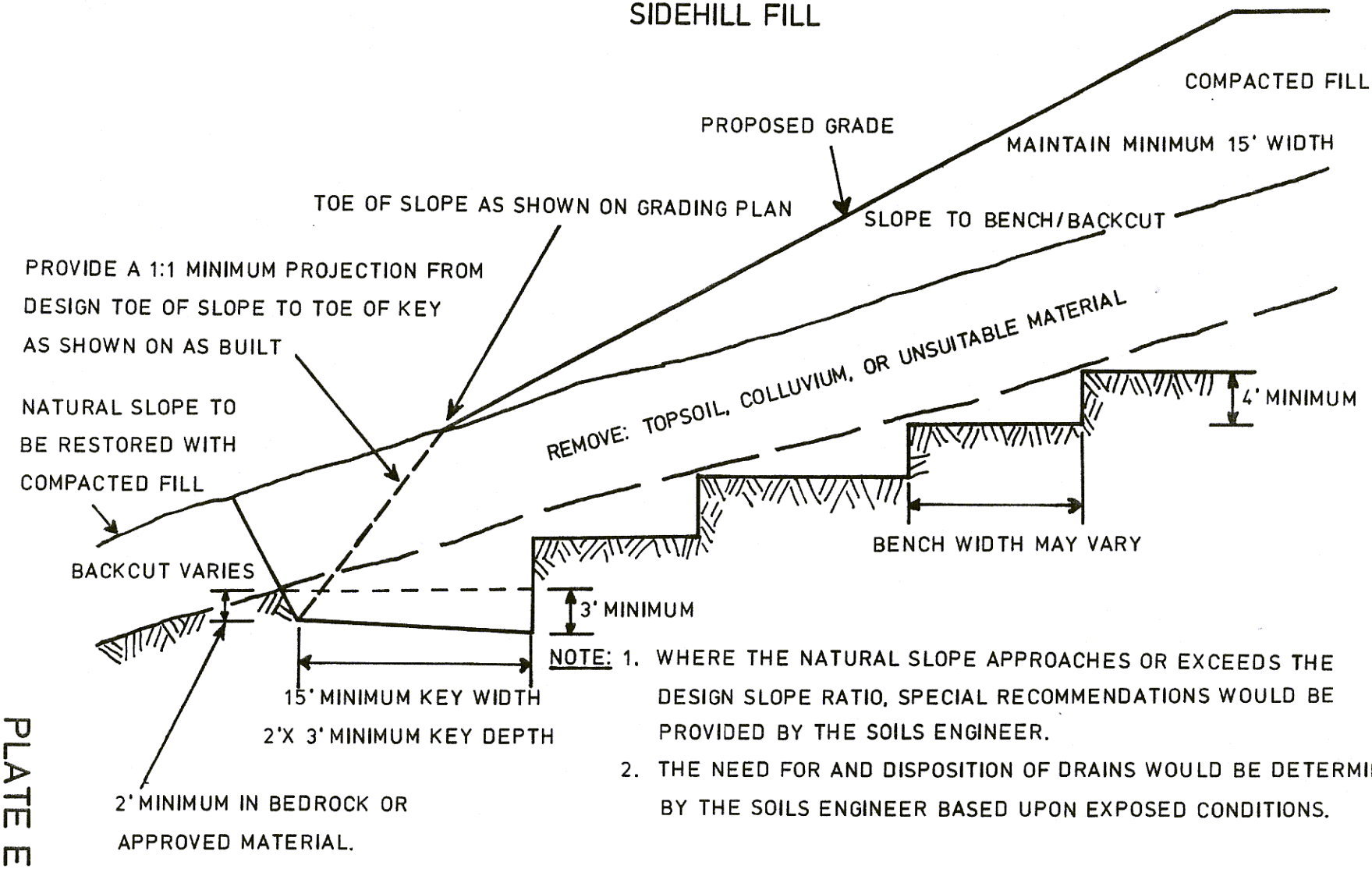
SIEVE SIZE	PERCENT PASSING
1 1/2 INCH	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT: MINIMUM OF 50

PLATE EG—5

FILL OVER NATURAL DETAIL

SIDEHILL FILL

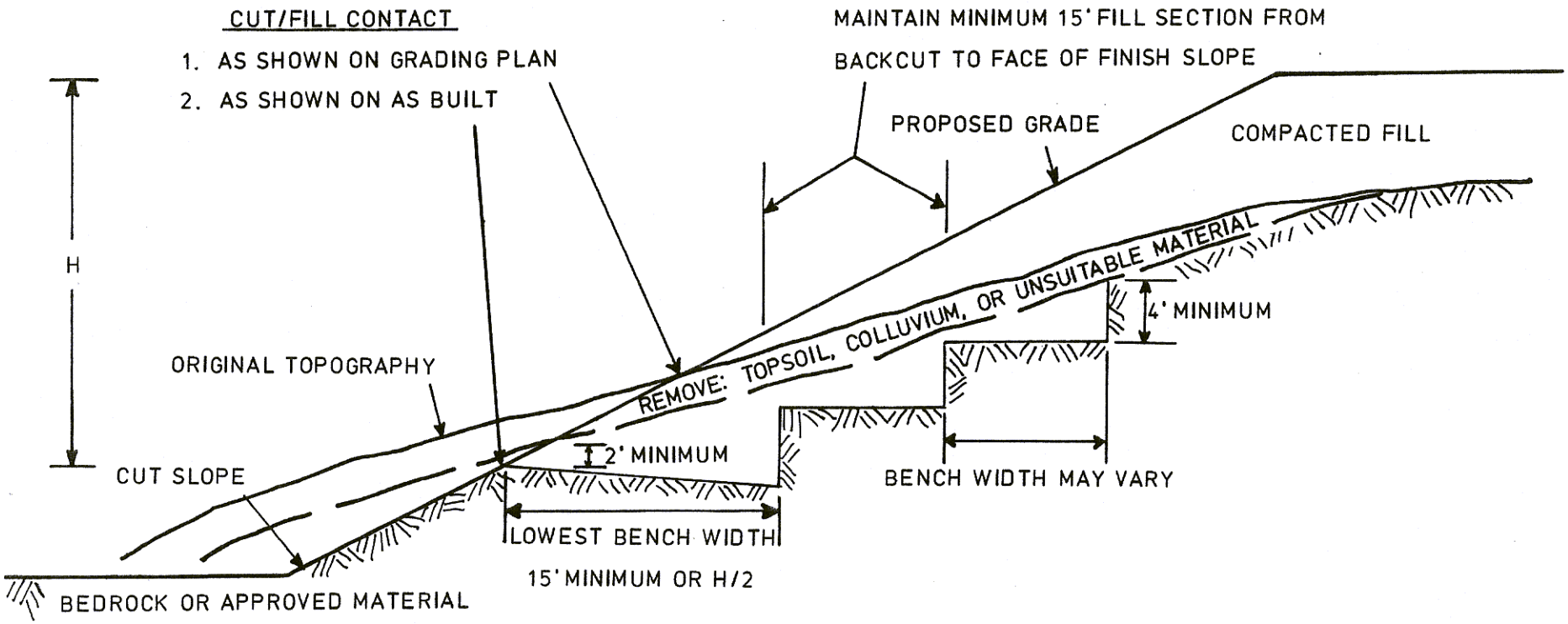


NOTE: 1. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WOULD BE PROVIDED BY THE SOILS ENGINEER.

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

PLATE EG-6

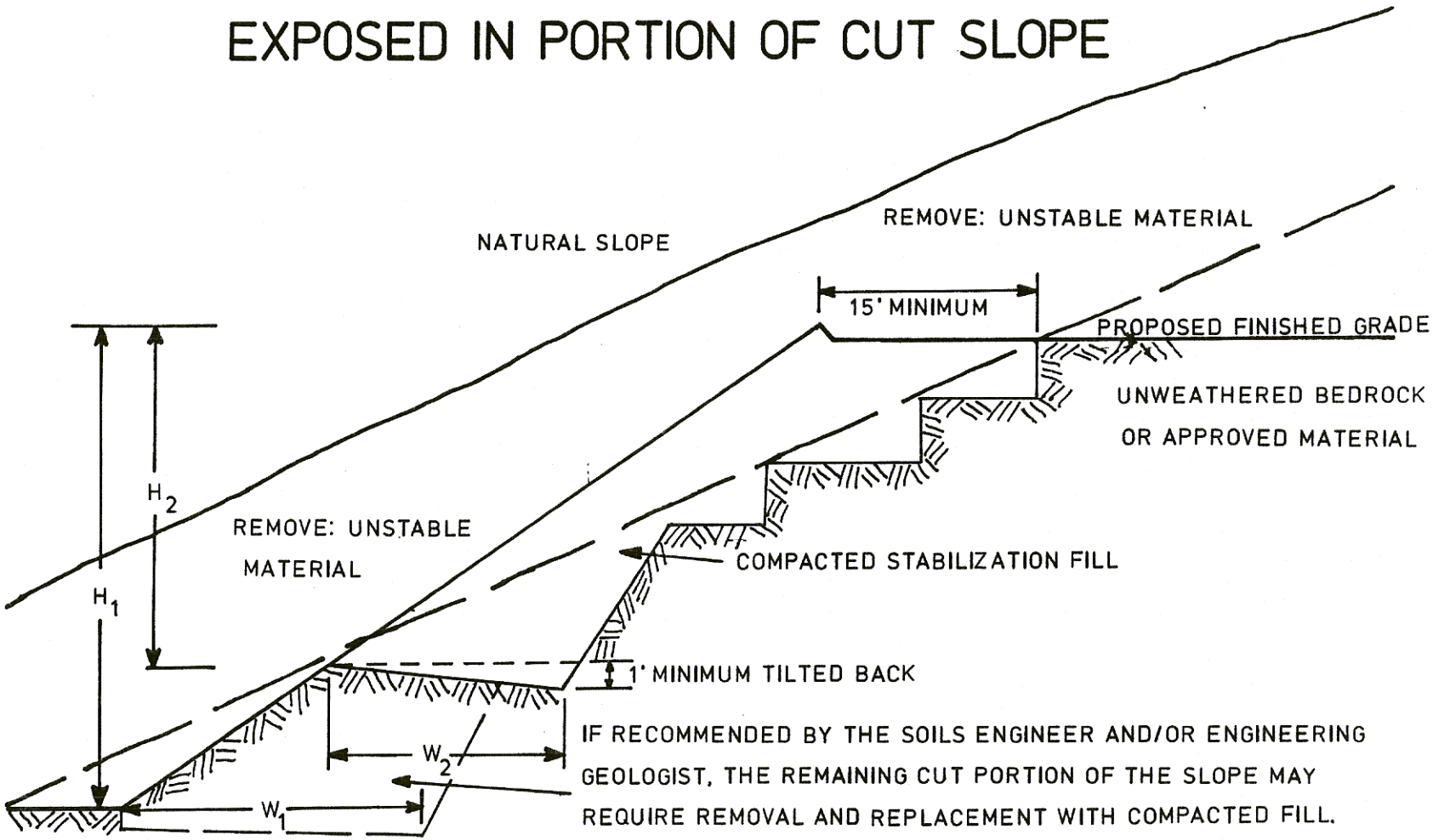
FILL OVER CUT DETAIL



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

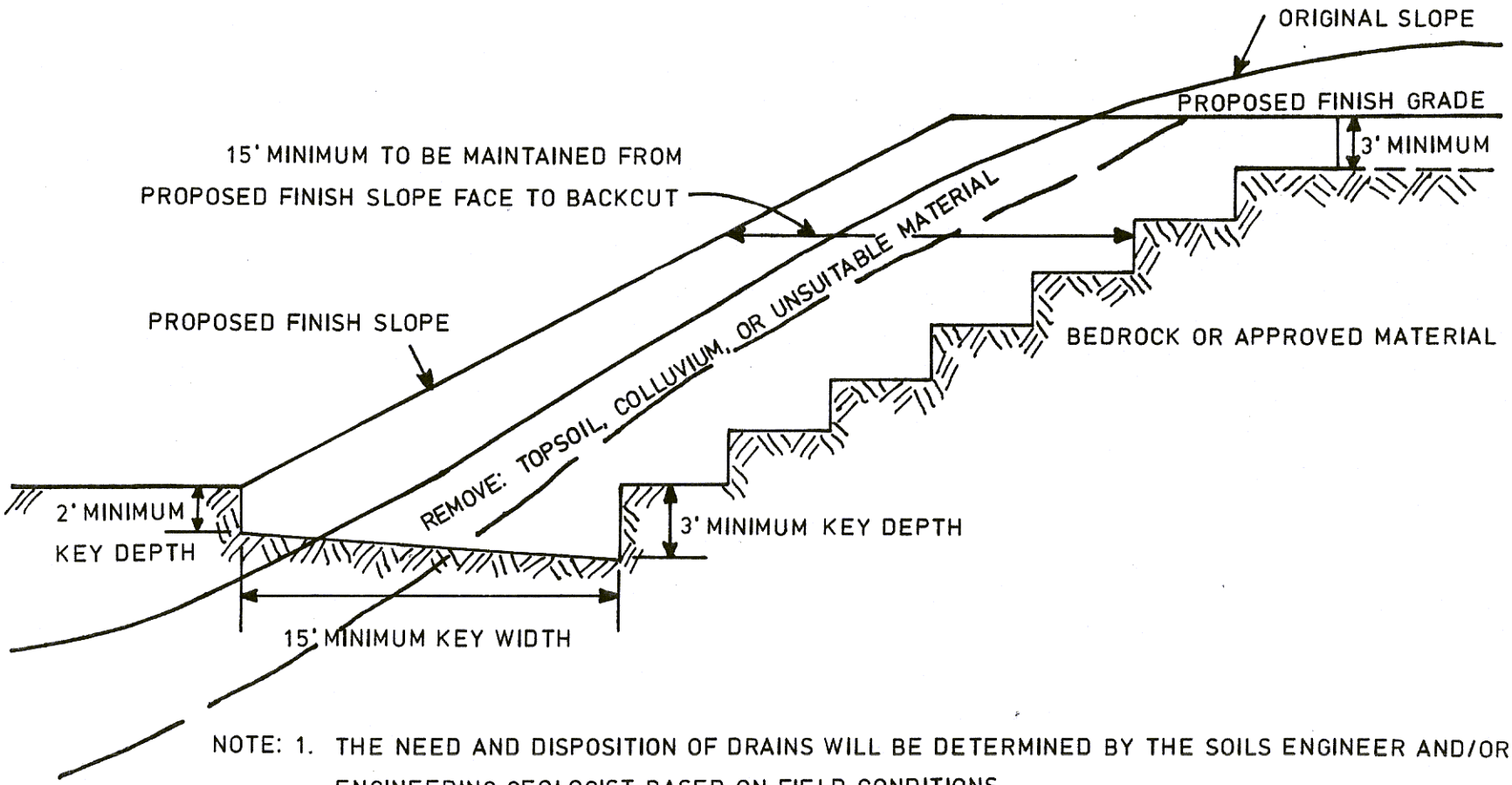
STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE



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

2. "W" 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

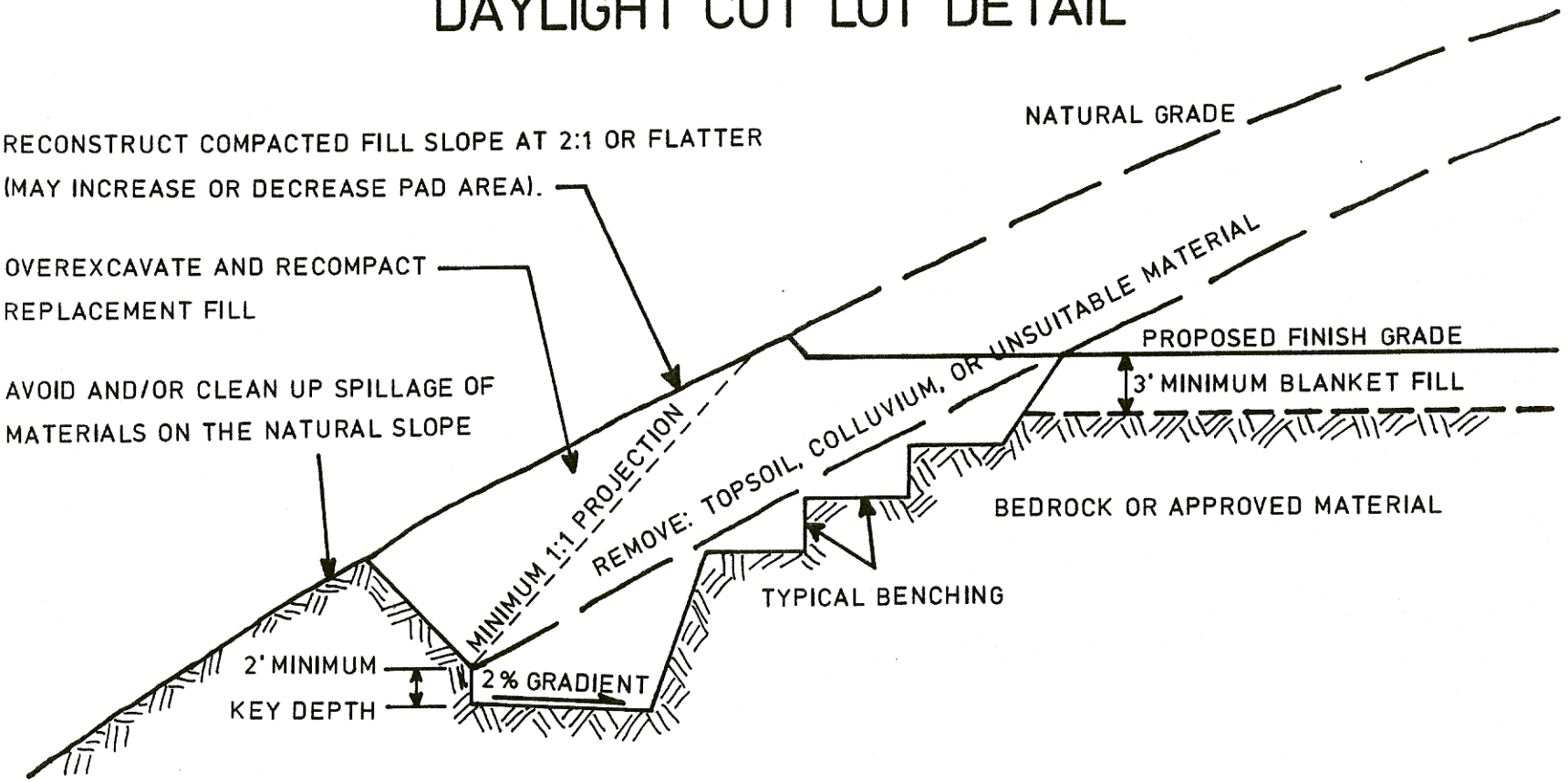


NOTE: 1. THE NEED AND DISPOSITION OF DRAINS WILL BE DETERMINED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST BASED ON FIELD CONDITIONS.

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



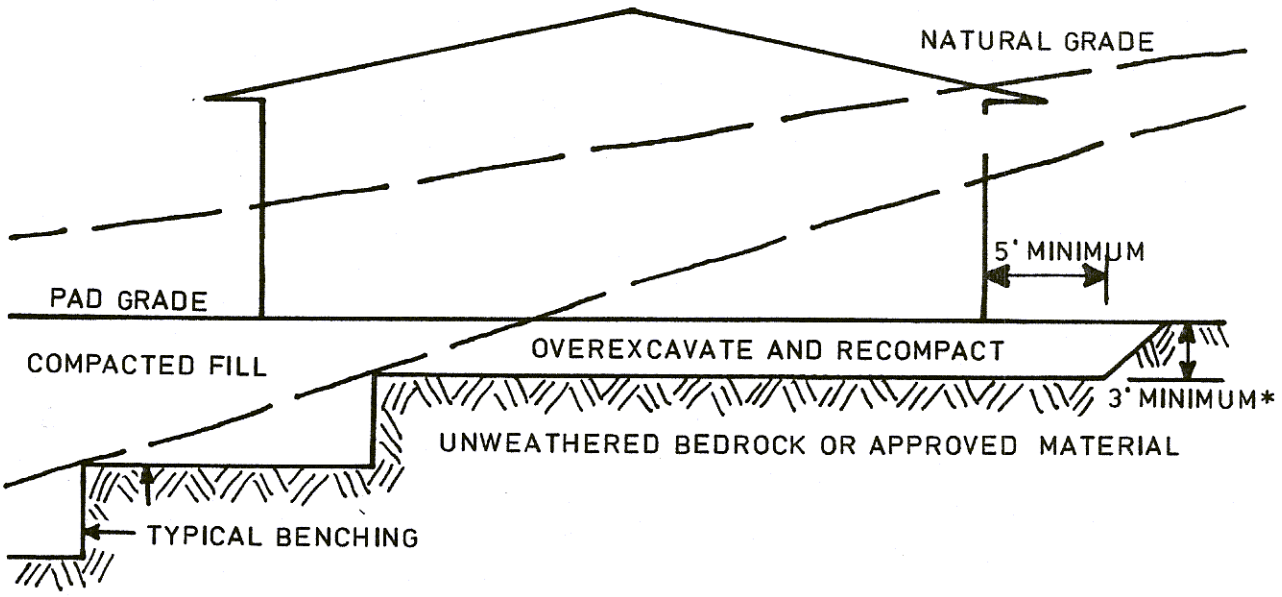
NOTE: 1. SUBDRAIN AND KEY WIDTH REQUIREMENTS WILL BE DETERMINED BASED ON EXPOSED SUBSURFACE CONDITIONS AND THICKNESS OF OVERBURDEN.

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

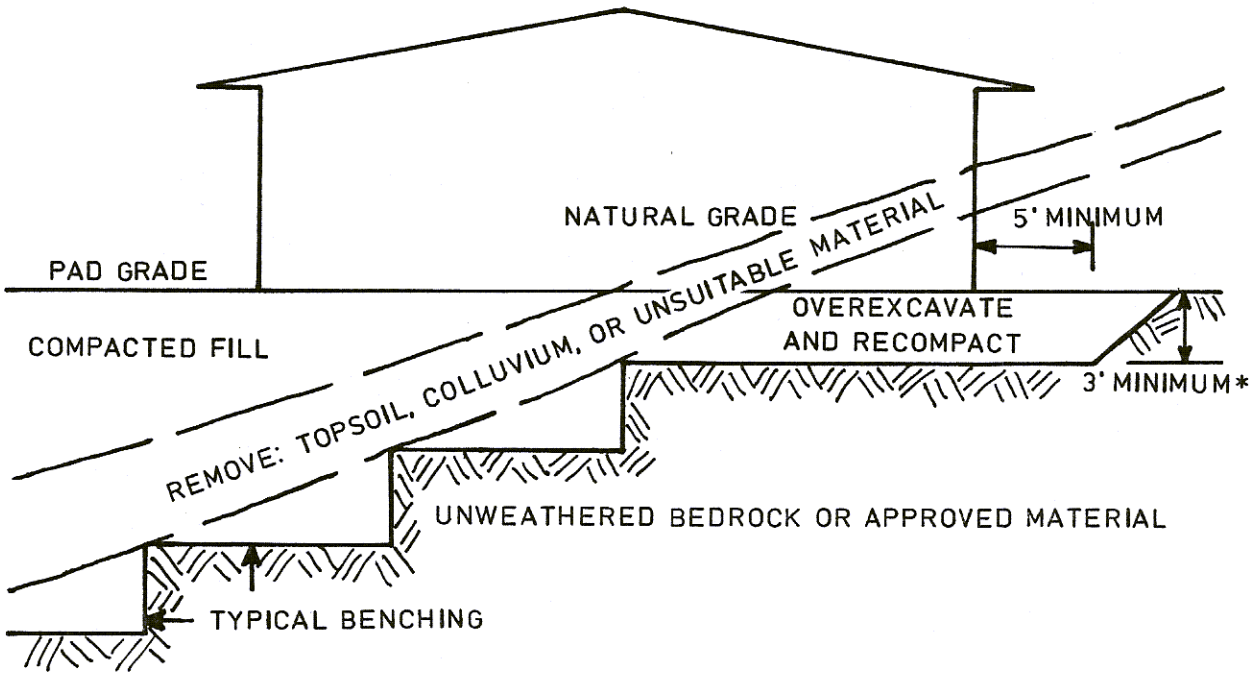
PLATE EG—10

TRANSITION LOT DETAIL

CUT LOT (MATERIAL TYPE TRANSITION)



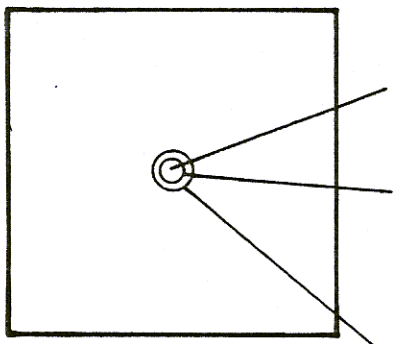
CUT–FILL LOT (DAYLIGHT TRANSITION)



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

PLATE EG–11

SETTLEMENT PLATE AND RISER DETAIL

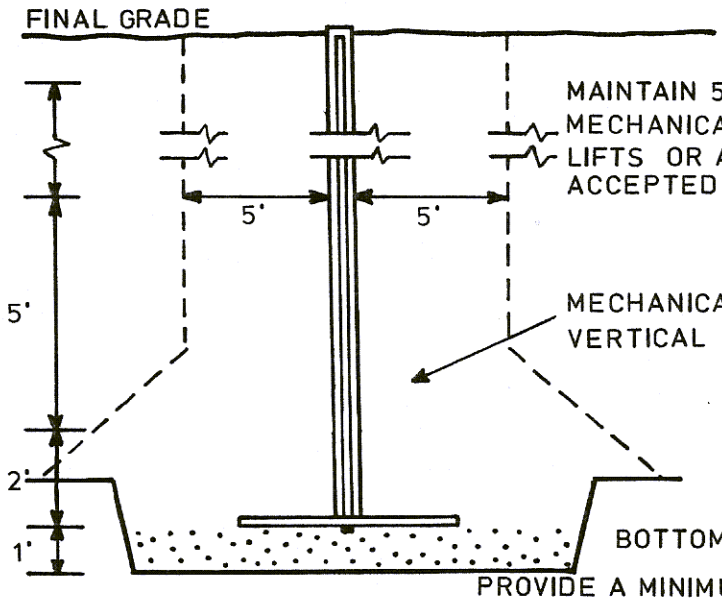


2'X 2'X 1/4" STEEL PLATE

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.



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.

PLATE EG—14

TYPICAL SURFACE SETTLEMENT MONUMENT

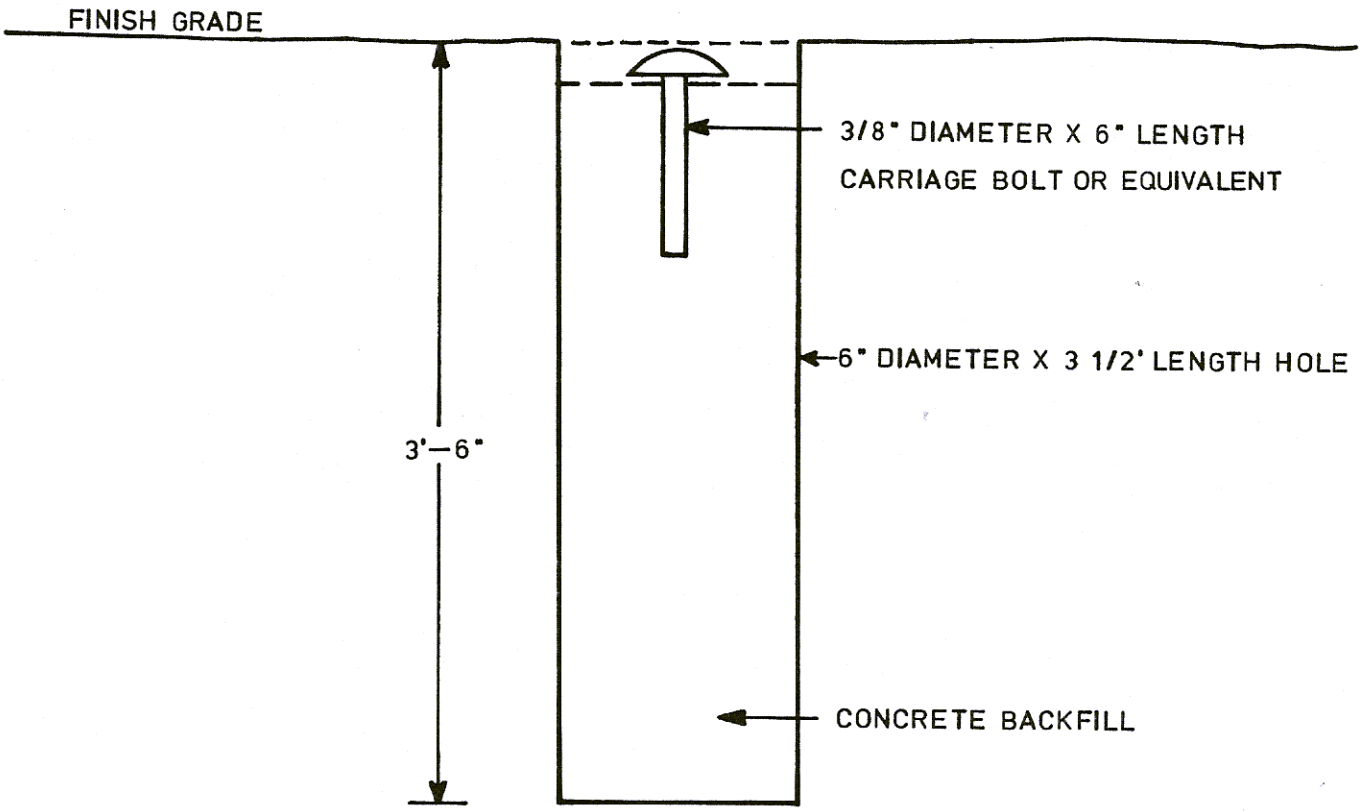
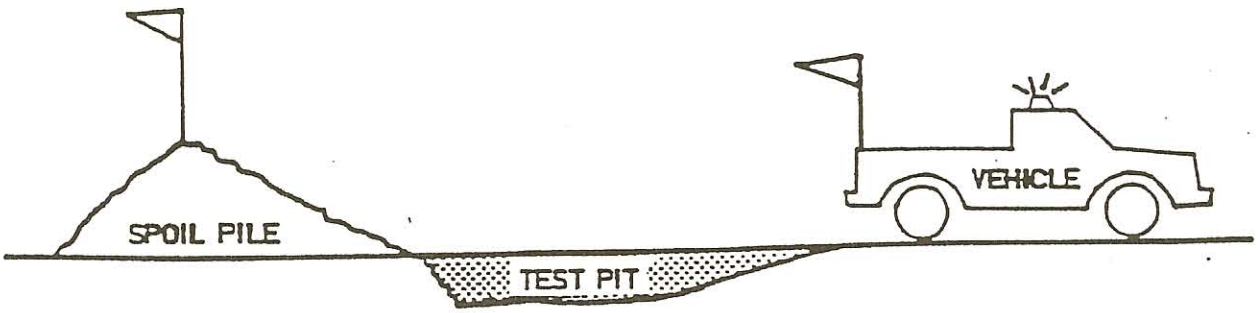


PLATE EG—15

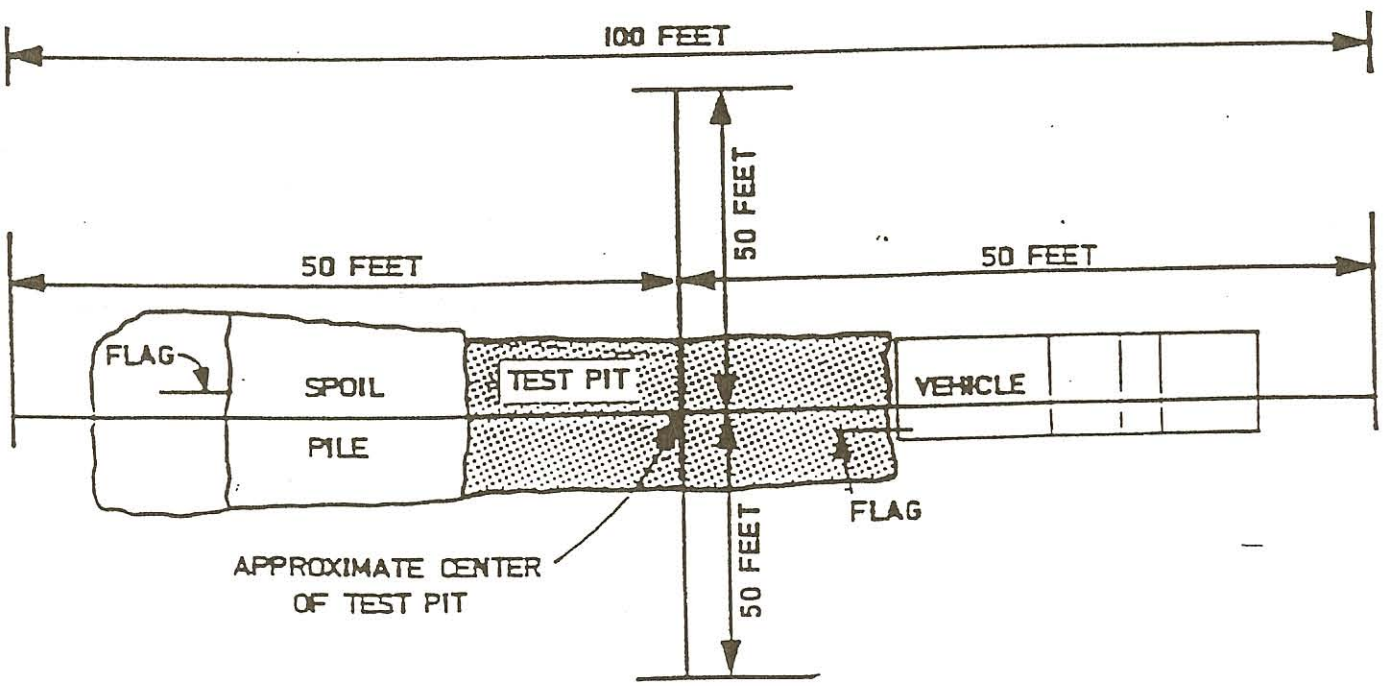
TEST PIT SAFETY DIAGRAM

SIDE VIEW



(NOT TO SCALE)

TOP VIEW

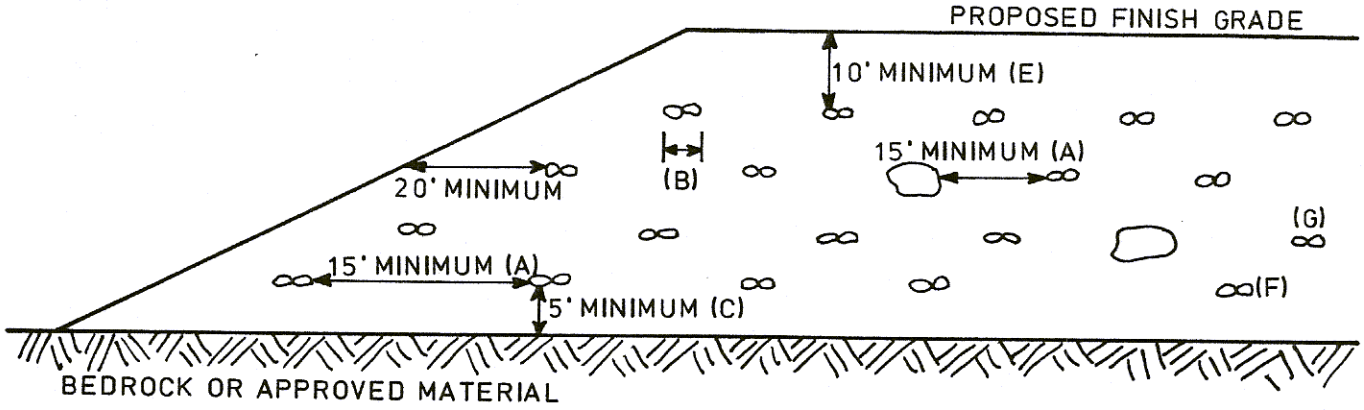


(NOT TO SCALE)

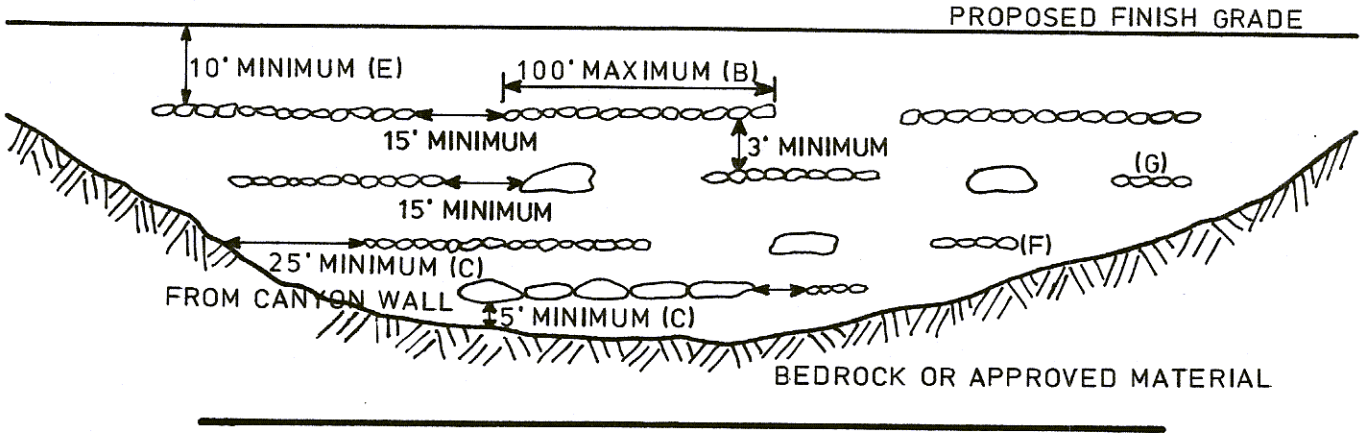
PLATE EG—16

OVERSIZE ROCK DISPOSAL

VIEW NORMAL TO SLOPE FACE



VIEW PARALLEL TO SLOPE FACE

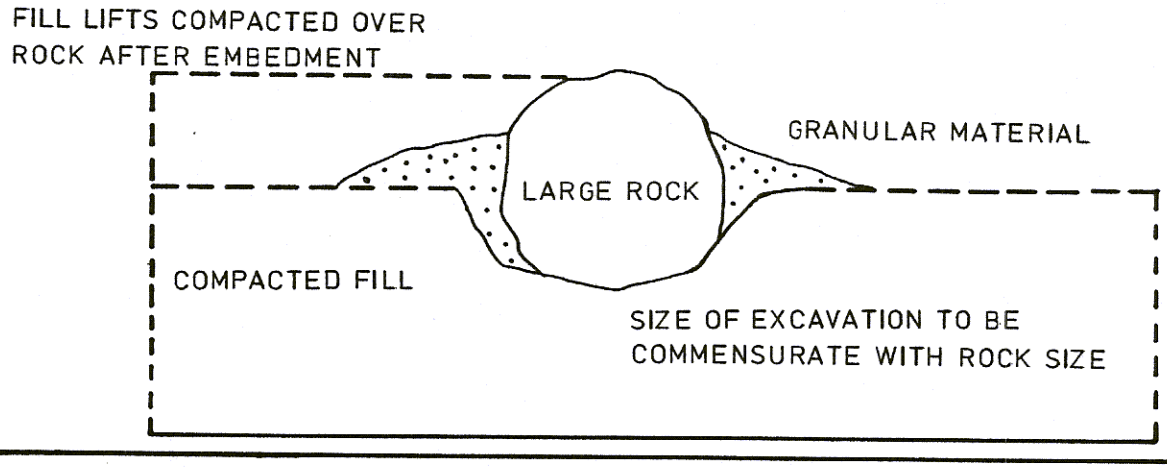


NOTE: (A) ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.
(B) HEIGHT AND WIDTH MAY VARY DEPENDING ON ROCK SIZE AND TYPE OF EQUIPMENT. LENGTH OF WINDROW SHALL BE NO GREATER THAN 100' MAXIMUM.
(C) IF APPROVED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST, WINDROWS MAY BE PLACED DIRECTLY ON COMPETENT 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.

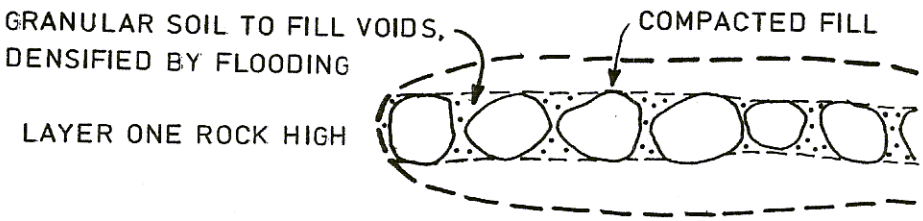
PLATE RD-1

ROCK DISPOSAL PITS

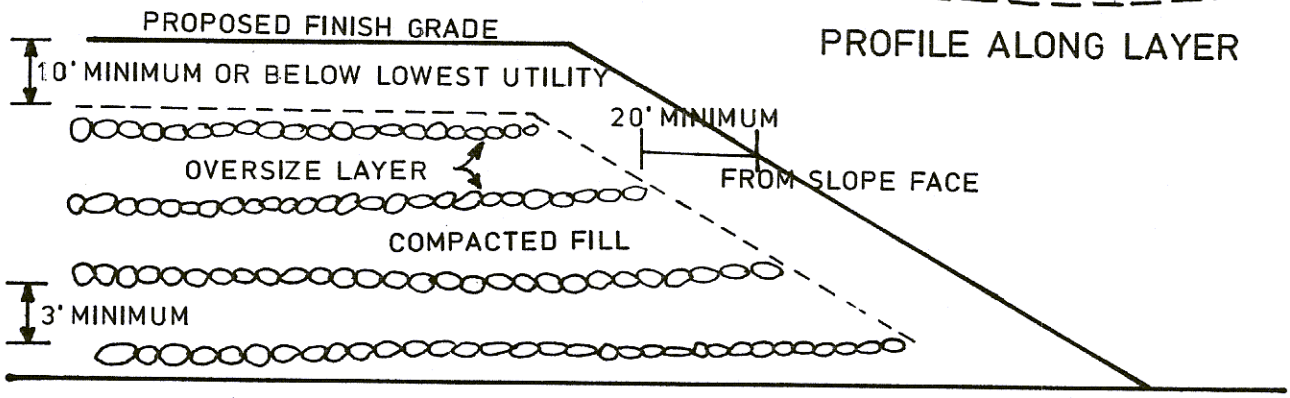
VIEWS ARE DIAGRAMMATIC ONLY. ROCK SHOULD NOT TOUCH AND VOIDS SHOULD BE COMPLETELY FILLED IN.

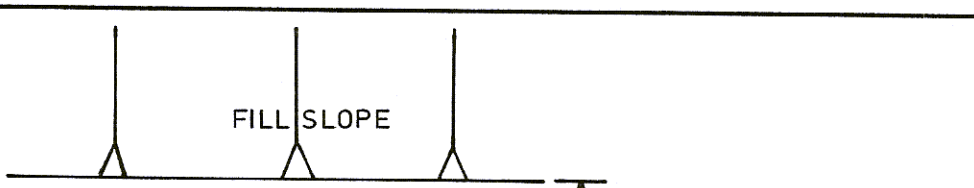


ROCK DISPOSAL LAYERS



PROFILE ALONG LAYER





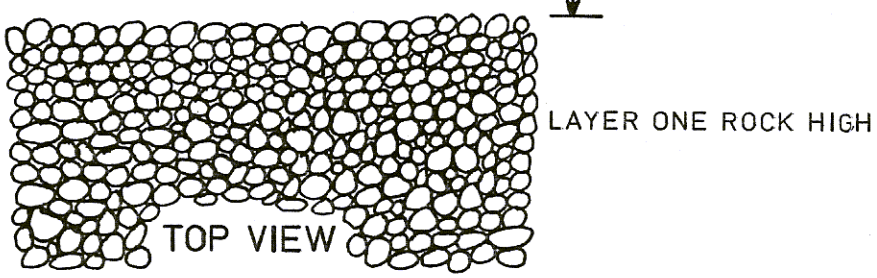
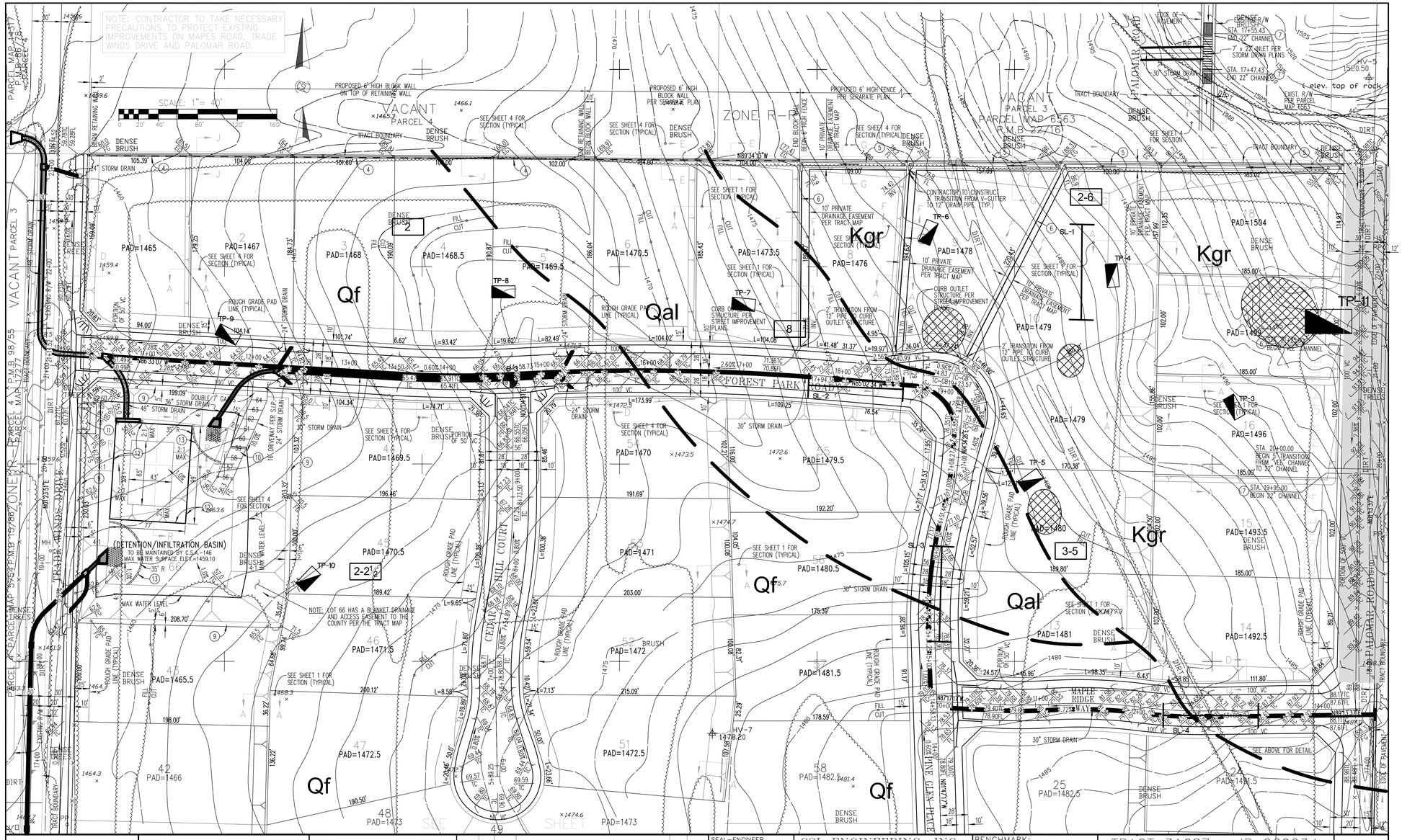
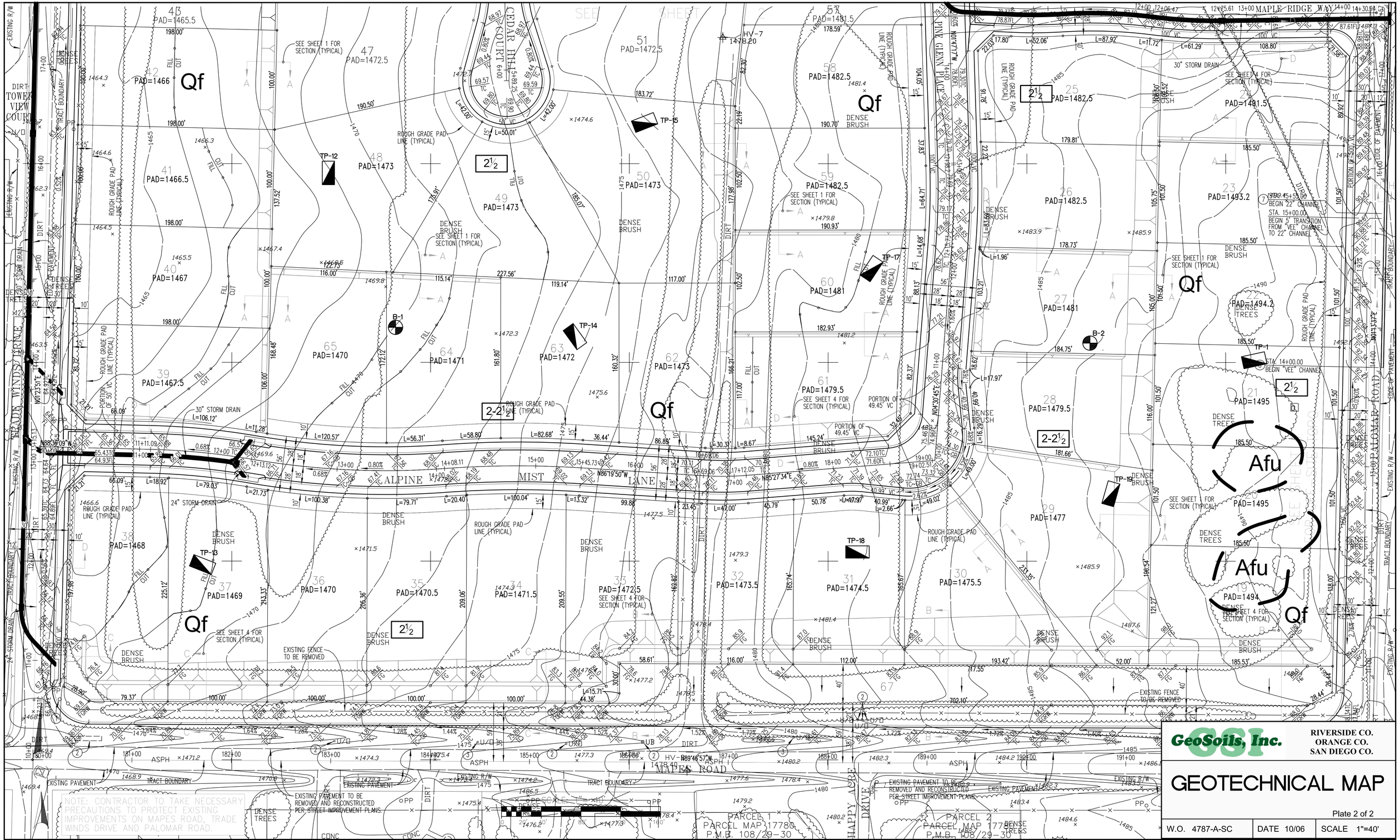


PLATE RD—2


NOTE: CONTRACTOR TO TAKE NECESSARY PRECAUTIONS TO PROTECT EXISTING IMPROVEMENTS ON MAPES ROAD, TRADE WINDS DRIVE AND PALOMAR ROAD.
SCALE: 1" = 40'
VACANT PARCEL 4
VACANT PARCEL 3 PARCEL MAP 6563 P.M.B. 22/16
ZONE R-1
FOREST PARK COURT
CEDAR HILL COURT
TRADE WINDS DRIVE
PALOMAR ROAD
MAPLE RIDGE WAY
(DETENTION/INFILTRATION BASIN) TO BE MAINTAINED BY C.S.A. -146 MAX. WATER SURFACE ELEV.=1459.10
NOTE: LOT 66 HAS A BLANKET DRAINAGE AND ACCESS EASEMENT TO THE COUNTY PER THE TRACT MAP
Kgr
Qf
Qal
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
SL-1
SL-2
SL-3
SL-4
2-6
3-5
2-2 1/2
PAD=1465
PAD=1467
PAD=1468
PAD=1468.5
PAD=1469.5
PAD=1470.5
PAD=1473.5
PAD=1476
PAD=1478
PAD=1479
PAD=1480
PAD=1481
PAD=1481.5
PAD=1482.5
PAD=1504
PAD=1496
PAD=1493.5
PAD=1492.5
PAD=1491.5
PAD=1480.5
PAD=1471
PAD=1470
PAD=1469.5
PAD=1470.5
PAD=1471.5
PAD=1465.5
PAD=1466
PAD=1472.5
PAD=1473
PAD=1472
PAD=1482.5
PAD=1479.5
HV-5 1520.50 (elev. top of rock)
HV-7 1478.20
TRACT BOUNDARY
EXIST R/W PER PARCEL MAP 6563
PROPOSED 6' HIGH BLOCK WALL ON TOP OF RETAINING WALL
PROPOSED 6' HIGH BLOCK WALL PER SEPARATE PLAN
PROPOSED 6' HIGH FENCE PER SEPARATE PLAN
SEE SHEET 4 FOR SECTION (TYPICAL)
SEE SHEET 1 FOR SECTION (TYPICAL)
DENSE BRUSH
ROUGH GRADE PAD LINE (TYPICAL)
CONTRACTOR TO CONSTRUCT TRANSITION FROM V-GUTTER TO 12" DRAIN PIPE (TYP.)
10' PRIVATE DRAINAGE EASEMENT PER TRACT MAP
CURB OUTLET STRUCTURE PER STREET IMPROVEMENT PLANS
2' TRANSITION FROM 12" PIPE TO CURB OUTLET STRUCTURE
24" STORM DRAIN
30" STORM DRAIN
36" STORM DRAIN
48" STORM DRAIN
16" DRIVEWAY PER S.P. 24" STORM DRAIN
BEGIN 22' CHANNEL
END 22' CHANNEL
7' x 22' INLET PER STORM DRAIN PLANS
30" STORM DRAIN
BEGIN 22' TRANSITIONS FROM V-DEP. CHANNEL TO 22' CHANNEL
BEGIN 22' CHANNEL
SEE ABOVE FOR DETAIL
EDGE OF PAVEMENT
TOP OF SLOPE
TOE OF SLOPE
DIRT
DENSE TREES
MAX WATER LEVEL
SEE STORM DRAIN
SEE SHEET 4 FOR SECTION
SEE SHEET 1 FOR SECTION
SEE SHEET 1 FOR SECTION (TYPICAL)
SEE SHEET 4 FOR SECTION (TYPICAL)
SEE SHEET 1 FOR SECTION (TYPICAL)
SEE SHEET 1 FOR SECTION (TYPICAL)
SEE SHEET 1



GeoSoils, Inc.

RIVERSIDE CO.
ORANGE CO.
SAN DIEGO CO.

GEOTECHNICAL MAP

Plate 2 of 2

W.O. 4787-A-SC	DATE 10/06	SCALE 1"=40'

SOILS ENGINEER:

GEO SOILS, INC.
26590 MADISON AVENUE
MURRIETA, CALIFORNIA 92563
(951) 677-9651 * FAX: (951) 677-9301

OWNER / DEVELOPER:

GRIFFIN COMMUNITIES

110 NORTH LINCOLN, 2ND FLOOR
CORONA, CA 92882
(951) 898-1234 * FAX: (951) 739-6145

NOTE:
WORK CONTAINED WITHIN THESE PLANS SHALL NOT COMMENCE UNTIL AN ENCROACHMENT PERMIT AND/OR A GRADING PERMIT HAS BEEN ISSUED.

THE PRIVATE ENGINEER SIGNING THESE PLANS IS RESPONSIBLE FOR ASSURING THE ACCURACY AND ACCEPTABILITY OF THE DESIGN IN HEREON. IN THE EVENT OF DESCREPANCIES ARISING AFTER COUNTY APPROVAL OR DURING CONSTRUCTION, THE PRIVATE ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL BY THE COUNTY.

MARK	BY	DATE	REVISIONS	APPR.	DATE
				ENGINEER	COUNTY

SEAL–ENGINEER

REGISTERED PROFESSIONAL ENGINEER RICHARD A. SCIANNI No. 25917 Exp. 12/31/07 CIVIL STATE OF CALIFORNIA

CSL ENGINEERING, INC.

11651 STERLING AVENUE, SUITE E
RIVERSIDE, CALIFORNIA 92503
(951) 785-5122 * FAX (951) 785-5180

PREPARED BY: RICHARD A. SCIANNI

R.C.E. NO. 25917 (EXP. 12/31/07)

DATE:

BENCHMARK:
RIVERSIDE COUNTY BENCH MARK: M-16-3. 1.0 MILES WEST ALONG ELLIS AVENUE FROM THE INTERSECTION OF ELLIS AVENUE AND ANTELOPE ROAD; 48.0 FEET SOUTHWEST OF POWER POLE #1796300-E AND IN THE CENTER LINE OF ELLIS STREET; A 1" IRON PIPE IN A CAP WELL MONUMENT AND MARKED COUNTY SURVEYOR. ELEV. 1412.490

SCALE: H: 1"=40' V: N/A

TRACT 31687 IP 060034

COUNTY OF RIVERSIDE
ROUGH GRADING PLAN
PLAN SHEET

SHEET NO. 3 OF 4 SHTS

FOR: GRIFFIN COMMUNITIES

W.O.

BGR: 060348

JN738/738_RGP_3.dwg/08-21-06/S:40

APPENDIX C

“AS-GRADED” LABORATORY TEST RESULTS

Table 1 - Laboratory Tests on Soil Samples

Geosoils, Inc
Griffin, Tract 31687
Your #4748-B-SC, SA #07-0544LAB
16-Apr-07

Sample ID			Lot 63 Rep (Lots 62-63)	Lot 65 Rep (Lots 64-65)
Resistivity		**Units**		
as-received		ohm-cm	372,000	64,000
saturated		ohm-cm	1,200	2,880
pH			7.2	8.0
Electrical Conductivity		mS/cm	0.28	0.24
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	89	118
magnesium	Mg^{2+}	mg/kg	21	29
sodium	Na^{1+}	mg/kg	182	120
potassium	K^{1+}	mg/kg	15	27
Anions				
carbonate	CO_3^{2-}	mg/kg	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	177	259
flouride	F^{1-}	mg/kg	0.5	2.0
chloride	Cl^{1-}	mg/kg	91	35
sulfate	SO_4^{2-}	mg/kg	253	114
phosphate	PO_4^{3-}	mg/kg	7.5	35
Other Tests				
ammonium	NH_4^{1+}	mg/kg	ND	3.2
nitrate	NO_3^{1-}	mg/kg	116.4	33.9
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

W.O. 8978-A1-IE
Plate C-1

431 West Baseline Road · Claremont, CA 91711
Phone: 909.626.0967 · Fax: 909.626.3316

Table 1 - Laboratory Tests on Soil Samples

GeoSoils, Inc.
Griffin, Tract 31687
Your #4787-B-SC, SA #07-0593LAB
24-Apr-07

Sample ID			Lot 9 Rep (Lots 9-10)	Lot 12 Rep (Lots 11-13)	Lot 15 Rep (Lots 14-16)	Lot 17 Rep (Lots 17-18)	Lot 23 Rep (Lots 22-24)
Resistivity		**Units**					
as-received		ohm-cm	24,400	12,000	30,400	24,800	56,000
saturated		ohm-cm	2,480	1,680	1,320	1,800	1,280
pH			7.8	7.5	7.8	7.8	7.6
Electrical Conductivity		mS/cm	0.10	0.20	0.25	0.13	0.29
Chemical Analyses							
Cations							
calcium	Ca^{2+}	mg/kg	27	69	45	25	80
magnesium	Mg^{2+}	mg/kg	3.5	14	8.2	4.6	17
sodium	Na^{1+}	mg/kg	81	125	201	106	179
potassium	K^{1+}	mg/kg	4.8	13.0	6.3	5.7	6.8
Anions							
carbonate	CO_3^{2-}	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	159	226	207	186	204
flouride	F^{1-}	mg/kg	ND	ND	1.9	1.7	1.3
chloride	Cl^{1-}	mg/kg	17	51	56	31	66
sulfate	SO_4^{2-}	mg/kg	48	125	239	88	361
phosphate	PO_4^{3-}	mg/kg	6.9	17	2.0	1.5	1.3
Other Tests							
ammonium	NH_4^{1+}	mg/kg	ND	1.7	ND	ND	ND
nitrate	NO_3^{1-}	mg/kg	26.5	95.1	151.2	34.9	50.6
sulfide	S^{2-}	qual	na	na	na	na	na
Redox		mV	na	na	na	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

W.O. 8978-A1-IE
Plate C-2

Table 1 - Laboratory Tests on Soil Samples

GeoSoils, Inc.
Griffin, Tract 31687
Your #4787-B-SC, SA #07-0593LAB
24-Apr-07

Sample ID			Lot 20 Rep (Lots 19-21)	Lot 26 Rep (Lots 25-27)	Lot 28 Rep (Lots 28-29)	Lot 30 Rep (Lots 30-32)	Lot 34 Rep (Lots 33-35)
Resistivity		**Units**					
as-received		ohm-cm	26,400	60,000	40,000	40,000	18,800
saturated		ohm-cm	1,080	4,800	1,280	2,640	1,440
pH			7.6	7.7	7.4	7.8	7.6
Electrical Conductivity		mS/cm	0.28	0.15	0.30	0.10	0.20
Chemical Analyses							
Cations							
calcium	Ca^{2+}	mg/kg	72	76	59	19	48
magnesium	Mg^{2+}	mg/kg	15	18	14	3.9	10
sodium	Na^{1+}	mg/kg	178	57	243	96	153
potassium	K^{1+}	mg/kg	8.9	29	14	4.8	11
Anions							
carbonate	CO_3^{2-}	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	207	281	378	204	305
flouride	F^{1-}	mg/kg	3.8	1.2	0.9	2.2	1.0
chloride	Cl^{1-}	mg/kg	82	12	63	12	41
sulfate	SO_4^{2-}	mg/kg	320	48	203	65	134
phosphate	PO_4^{3-}	mg/kg	1.4	30	2.2	3.6	5.7
Other Tests							
ammonium	NH_4^{1+}	mg/kg	ND	2.9	2.6	ND	1.8
nitrate	NO_3^{1-}	mg/kg	67.2	25.0	27.2	6.7	32.6
sulfide	S^{2-}	qual	na	na	na	na	na
Redox		mV	na	na	na	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

W.O. 8978-A1-IE
Plate C-3

Table 1 - Laboratory Tests on Soil Samples

GeoSoils, Inc.
Griffin, Tract 31687
Your #4787-B-SC, SA #07-0593LAB
24-Apr-07

Sample ID			Lot 37 Rep (Lots 36-38)	Lot 40 Rep (Lots 39-41)	Lot 42 Rep (Lots 42-43)	Lot 45 Rep (Lots 44-45)	Lot 47 Rep (Lots 46-47)
Resistivity		**Units**					
as-received		ohm-cm	104,000	52,000	22,400	30,400	48,000
saturated		ohm-cm	1,040	2,680	1,400	2,240	1,560
pH			7.4	7.6	7.5	7.5	7.6
Electrical Conductivity		mS/cm	0.27	0.20	0.27	0.17	0.19
Chemical Analyses							
Cations							
calcium	Ca^{2+}	mg/kg	56	67	96	41	34
magnesium	Mg^{2+}	mg/kg	12	14	20	8.2	6.8
sodium	Na^{1+}	mg/kg	216	130	155	110	145
potassium	K^{1+}	mg/kg	16	16	17	12	11
Anions							
carbonate	CO_3^{2-}	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	506	302	287	210	226
flouride	F^{1-}	mg/kg	1.5	0.9	0.7	ND	1.1
chloride	Cl^{1-}	mg/kg	83	14	57	21	52
sulfate	SO_4^{2-}	mg/kg	116	99	232	88	113
phosphate	PO_4^{3-}	mg/kg	1.1	8.4	6.8	2.1	2.0
Other Tests							
ammonium	NH_4^{1+}	mg/kg	0.6	5.1	4.8	3.3	0.5
nitrate	NO_3^{1-}	mg/kg	89.3	4.8	19.3	8.5	47.7
sulfide	S^{2-}	qual	na	na	na	na	na
Redox		mV	na	na	na	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
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431 West Baseline Road · Claremont, CA 91711
Phone: 909.626.0967 · Fax: 909.626.3316

Table 1 - Laboratory Tests on Soil Samples

GeoSoils, Inc.
Griffin, Tract 31687
Your #4787-B-SC, SA #07-0593LAB
24-Apr-07

Sample ID			Lot 49 Rep (Lots 48-50)	Lot 56 Rep (Lots 55-57)	Lot 58 Rep (Lots 58-59)	Lot 60 Rep (Lots 60-61)
Resistivity		**Units**				
as-received		ohm-cm	23,200	92,000	30,400	17,600
saturated		ohm-cm	2,080	1,680	880	1,080
pH			7.6	7.0	7.5	7.3
Electrical Conductivity		mS/cm	0.16	0.29	0.38	0.25
Chemical Analyses						
Cations						
calcium	Ca^{2+}	mg/kg	24	118	95	66
magnesium	Mg^{2+}	mg/kg	4.5	29	20	14
sodium	Na^{1+}	mg/kg	137	130	235	176
potassium	K^{1+}	mg/kg	7.6	37	12	17
Anions						
carbonate	CO_3^{2-}	mg/kg	ND	ND	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	207	323	244	375
flouride	F^{1-}	mg/kg	1.4	1.1	1.2	0.7
chloride	Cl^{1-}	mg/kg	22	37	156	81
sulfate	SO_4^{2-}	mg/kg	119	159	324	115
phosphate	PO_4^{3-}	mg/kg	5.8	11	1.5	2.6
Other Tests						
ammonium	NH_4^{1+}	mg/kg	ND	9.6	0.8	1.6
nitrate	NO_3^{1-}	mg/kg	16.8	13.5	141.3	96.4
sulfide	S^{2-}	qual	na	na	na	na
Redox		mV	na	na	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

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APPENDIX D

GSI, 2007 AND TABLE 1 - FIELD DENSITY TEST RESULTS

AS-GRADED GEOTECHNICAL REPORT OF GRADING
MODEL LOTS 62 THROUGH 65
TRACT 31687, ROMOLAND AREA
RIVERSIDE COUNTY, CALIFORNIA

FOR

GRIFFIN COMMUNITIES
110 NORTH LINCOLN AVENUE, SUITE 200
CORONA, CALIFORNIA 92882

W.O. 4787-B-SC MAY 14, 2007

GeoSoils, Inc.

Geotechnical • Coastal • Geologic • Environmental

26590 Madison Avenue • Murrieta, California 92562 • (951) 677-9651 • FAX (951) 677-9301

May 14, 2007

W.O. 4787-B-SC

Griffin Communities
110 North Lincoln Avenue, Suite 200
Corona, California 92882

Attention: Mr. Arthur Levine

Subject: As-Graded Geotechnical Report of Grading, Model Lots 62 through 65, Tract 31687, Romoland Area, Riverside County, California

Dear Mr. Levine:

This report presents a summary of the geotechnical testing and observation services provided by GeoSoils, Inc. (GSI) during the rough grading phase of the development for Model Lots 62 through 65, Tract 31687, Romoland Area, Riverside County, California. Rough grading (under the purview of this report) within the tract began in March, 2007 and was generally completed in April, 2007. Based on the observations and testing performed by GSI, it is our opinion that the subject building pads appear suitable for their intended use. Unless specifically superceded by recommendations presented herein, the recommendations and conclusions contained in the referenced reports (see Appendix A) remain pertinent and applicable, and should be appropriately implemented.

PURPOSE OF EARTHWORK

The purpose of grading was to provide relatively level building pads for proposed wood-frame residential structures (one- to two-stories). Building loads are assumed to be typical for these types of relatively light improvements. Typical cut/fill grading techniques were utilized to attain the desired graded configurations.

ENGINEERING GEOLOGY

The geotechnical conditions exposed during the process of grading were observed by representatives from our firm. Observations during the process of rough grading include removals and fill placement, along with the general grading procedures of the contractor.

Earth materials encountered during earthwork construction at the subject tract included topsoil/colluvium, and Cretaceous-age Granitic Bedrock, as discussed in the approved referenced report by GSI. Adverse geologic structures were not observed.

GROUNDWATER

Regional groundwater was not encountered during grading in this portion of the tract and should not affect the proposed site development, provided our recommendations are implemented. No significant canyons were present beneath the subject lots, there was generally not sufficient fill cover (more than ±10 feet), and/or there were no outlets with a flowline gradient at removal bottoms. Therefore, subdrains were not placed within the tract. Due to the contrasting nature of the onsite earth materials, the possibility of future, localized perched water conditions and minor seepage cannot be precluded, and should be anticipated. This potential would increase on cut or shallow fill lots. Should such conditions become apparent within the project in the future, additional recommendations for mitigation may be provided upon request. This potential should be disclosed to all homeowners and any homeowners association and/or all other interested parties.

EARTHWORK CONSTRUCTION

Earthwork operations have been completed in general accordance with recommendations provided in the field based upon conditions exposed and/or in accordance with the recommendations provided within the referenced reports by GSI.

Preparation of Existing Ground

1. Deleterious material, such as concentrated organic matter and miscellaneous debris, were stripped from the surface and disposed of offsite, prior to placing any fill.

2. Compressible colluvium and weathered older alluvial deposits were removed to the depths recommended in the approved referenced reports by GSI and/or as recommended in the field during grading based on conditions exposed, in all areas to receive fills. The minimum acceptable testing criteria for remedial removals was a dry density of 105 pounds per cubic foot (pcf) and/or 85 percent saturation.

3. Subsequent to the above removals, the exposed subsoils were scarified to a depth of about 12 inches, moisture conditioned, as necessary, to at least optimum moisture content, then compacted to a minimum relative compaction of 90 percent of the laboratory standard.

4. Processing of natural ground was observed by a representative of GSI.

Fill Placement

1. Fill consisted of onsite soils that were placed in 4- to 8-inch lifts, watered, and mixed to achieve at least optimum moisture conditions, and compacted to a minimum relative compaction of 90 percent of the laboratory standard using typical earthmoving equipment. Field testing results are presented in the enclosed Table 1.

2. Where necessary, fills placed on surfaces steeper than 5:1 (horizontal to vertical [h:v]) as indicated by pre-existing topography, were keyed and benched into competent older alluvial deposits and/or granitic bedrock.

3. The approximate as-graded minimum and maximum depths of fill for each lot are presented in enclosed Table 2.

4. Where grading resulted in the occurrence of cut/fill transitions or materials of differing soil characteristics were encountered, the cut portions of such lots were overexcavated to a minimum depth of approximately 36 inches. The exposed subsoils were then scarified, recompacted, and brought to the proposed grade with compacted fill. The ratio of maximum to minimum fill thickness (i.e., fill thickness variation) was maintained at 3:1 (h:v) by using overexcavation as explained in the previous approved geotechnical reports (Appendix A).

Slopes

1. All 2:1 (h:v) slopes are considered surficially and grossly stable and should remain so under normal conditions of care, maintenance, and rainfall. The potential for some erosion on slopes or unfinished or undeveloped building pads may be mitigated through suitable landscaping and strict adherence to the Development Criteria section of this report. All slopes should be landscaped as soon as possible.

2. Compaction on the faces of the fill slopes was achieved by back-rolling and/or track walking.

3. Pre-wetting of pads that remain undeveloped may be necessary. There is a potential for erosion of pads that are left undeveloped.

Field Testing

1. Field density tests were performed using sand-cone method ASTM D-1556 and nuclear (densometer) methods ASTM D-2922 and D-3017. Field testing results at the subject lots are presented in the enclosed Table 1. The approximate locations of the field density tests are presented on the enclosed Plate 1, which uses the 40-scale grading plans prepared by CSL Engineering, Inc., as base maps.

2. Field density tests were taken at periodic intervals and selected locations to check the compactive effort provided by the contractor. Where test results indicated less than optimum moisture content, or less than 90 percent relative compaction, the contractor was notified and the area was reworked until retesting indicated at least optimum moisture and a minimum relative compaction of 90 percent were attained. Based upon the grading operations observed, the test results presented herein are considered representative of the compacted fill.

3. Visual classification, supplemented by laboratory testing, was the basis for evaluating which maximum density value to use for a given density test.

LABORATORY TESTING

Moisture-Density Relations

The laboratory maximum dry density and optimum moisture content for the major soil types were determined according to test method ASTM D-1557. The following table presents the results:

SOIL TYPE	MAXIMUM DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
A - Silty Sand, Dark Brown	130.0	9.0
B - Silty Sand, Brown	133.0	8.0
D - Silty Sand, Reddish Brown	136.0	8.0
E - Silty Sand, Brown	134.0	10.0

Expansion Index

Expansion Index (E.I.) tests were performed for the typical foundation soil types exposed at pad grade in general accordance with Standard #18-2 of the Uniform Building Code ([UBC], International Conference of Building Officials [ICBO], 1997). The E.I. test results of samples varied from 8 to 14. Therefore, the expansive potential of the soils for the these lots may be classified as very low (i.e., E.I. between 0 and 20). The expansion indices for the lots within the tract are indicated on the enclosed Table 2.

Corrosion Analysis

Representative samples of the site materials have been analyzed for soluble sulfates. The water soluble sulfate (SO_4) in soil tests varied from 0.0114 to 0.0253 percentage by weight. Therefore, all lots are classified as negligible to sulfate exposure in accordance with Table 19-A-4 of the UBC (ICBO, 1997). Therefore, sulfate-resistant concrete or a modified water-cement ratio is not required, from a geotechnical standpoint.

Typical samples of soil materials have been analyzed for corrosion potential, via saturated resistivity and pH testing. Based upon the test results, the pH varied from 7.2 to 8.0 (neutral to moderately alkaline) and saturated resistivities varied from 1,200 ohm-cm to 2,880 ohm-cm. Such resistivities are corrosive to moderately corrosive to exposed ferrous metals in a saturated state. It is our understanding that standard concrete cover over reinforcing steel is usually appropriate for these conditions; however, a corrosion engineer should be consulted to provide specific recommendations regarding foundations and piping, etc. Although the site soils are categorized as being corrosive to moderately corrosive to ferrous metals in a saturated state, no exposure of the conditions stated in Table 19-A-2 of the UBC are found within the subject lots. The laboratory testing data, including chloride test results, is provided in Appendix B.

SETTLEMENT

Settlement-sensitive structures should be designed for the combination of site specific soil parameters and as-graded conditions. Based on these conditions, Lots 62 through 65 should be designed for static and seismic settlements of 1 inch in 40 feet each, respectively. The calculated estimate for the total settlement is approximately 2 inches over the life of the structure. Worst-case differential settlement has been calculated as 1 inch in 40 feet (i.e. at least 1 inch in a 40-foot span [1/480]). These values are consistent with the design parameters provided in the County approved documentation for this project (GSI, 2006). The structures should be evaluated and designed for the combination of the soil parameters presented above and the settlement values provided. Assuming that the consolidation of the fill is essentially completed, the secondary compression included in the values above will occur over the life of the structures. As indicated in GSI (2006), the project structural engineer should verify that the settlement data provided by GSI have been incorporated into the foundation and slab designs for the project.

SEISMIC SHAKING PARAMETERS

Based on the site conditions, Chapter 16 of the UBC (ICBO, 1997) seismic parameters are provided in the following table:

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*)	1.0
Distance to Seismic Source (B fault)	9.6 mi. (15.4 km)
Seismic Source Type (per Table 16-U*)	B
Upper Bound Earthquake (San Jacinto - San Jacinto Valley fault)	M_W 6.9**
PHSA (10% probability of exceedance in 50 years)	0.41g
* Figure and table references from Chapter 16 of the UBC (ICBO, 1997). ** ICBO (1998)	

A probabilistic horizontal acceleration of 0.41g should be utilized as the design basis site acceleration (i.e., 10 percent probability of exceedance in 50 years - 475-year return period) per the approved reports (Appendix A).

RECOMMENDATIONS - FOUNDATIONS

General

The foundation design and construction recommendations are based on laboratory testing and engineering analysis of onsite earth materials by GSI. Recommendations for conventional and post-tension foundation systems are provided in the following sections, and are not intended to preclude the transmission of water or water vapor through the foundations or slabs. The foundation systems may be used to support the proposed structures, provided they are founded in competent bearing material, and designed in accordance with this report. The proposed foundation systems should be minimally designed and constructed in accordance with the guidelines contained in the UBC (ICBO, 1997), and presented herein (i.e., differential static and seismic settlement in 40 feet).

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 (psf) 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 compacted fill. Isolated, square footings should extend a minimum of 18 inches into the compacted fill. The bearing value may be increased by one-third for seismic or other temporary loads. This value may be increased by 20 percent for each additional 12 inches in depth to a maximum of 2,000 psf. No increase in bearing value for increased footing width is recommended.

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 (pcf) with a maximum earth pressure of 2,500 psf.

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

6. The above criteria assumes that hydrostatic pressure is not allowed to build up behind retaining walls. Positive drainage must be provided behind all retaining walls in the form of pipe and gravel wrapped in filter fabric with adequate exit pipes, weep holes, or omission of mortar from the lower course head joints as discussed in a later section of this report.

7. All footings should maintain a minimum 7-foot horizontal distance 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).

Construction

The following foundation construction recommendations are presented as a minimum criteria from a soils engineering viewpoint. The expansion potentials of the subject lots have been tested to be generally in the very low range. Accordingly, the following foundation construction recommendations are for soils in the top 3 feet of finish grade which will have a very low expansion potential. 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.

Expansion Classification - Very Low (E.I. 0 to 20)

1. Continuous exterior footings should be founded at minimum depths of 12 and 18 inches below the lowest adjacent ground surface, for one- or two-story floor loads, respectively, and in accordance with the minimum requirements of the UBC

(ICBO, 1997). The structural engineer should review and approve these recommendations. Continuous interior footings may be founded at a minimum depth of 12 inches below the lowest adjacent ground surface. Footings should be a minimum of 12 inches wide, or as evaluated by the structural engineer. All footings should have one No. 4 reinforcing bar placed at the top and one No. 4 reinforcing bar placed at the bottom of each footing.

2. Isolated interior or exterior piers and columns should be founded at a minimum depth of 24 inches below the lowest adjacent ground surface excluding the landscape zone (top 6 inches) and minimally comply with the UBC (ICBO, 1997).

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

4. Concrete slabs in residential and garage areas should be underlain with a vapor retarder consisting of a minimum of 10- or 15-mil, polyvinyl-chloride membrane with all laps sealed per the UBC (ICBO, 1997). This membrane should be covered with 2 inches of sand to aid in uniform curing of the concrete and mitigate puncturing of the vapor retarder. The vapor retarder should be underlain with 2 inches of sand. Sand used for slab underlayment should have a minimum sand equivalent of 30.

5. Concrete slabs, including garage slabs, should be a minimum of 4 inches thick, and reinforced with No. 3 reinforcement bars placed on 18-inch centers, in two horizontally perpendicular directions (i.e., long axis and short axis). The design engineer should determine the actual thickness of concrete slabs based upon proposed loading and use. 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.

6. 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.

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

8. 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 retarder placement. Depending upon the length of time between finish grading and actual foundation construction, onsite soils may be anticipated to dry out within the upper 12 to 18 inches. This may necessitate additional moisture conditioning prior to foundation construction.

9. As an alternative, an engineered post-tension foundation system may be used.

10. 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.

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

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.

SOIL MOISTURE CONSIDERATIONS

It should be noted that the foundation construction recommendations provided herein were not intended to preclude the transmission of water or vapor through the slab. As indicated in California Civil Code Sections 895 et seq., foundation systems and slabs shall not allow water or water vapor to enter into the structure so as to cause damage to another building component, or, so as to limit the installation of the type of flooring materials typically used for the particular application (State of California, 2006).

Therefore, mitigation for the transmission of water or water vapor through the slab, should be accomplished via methods which should be provided/recommended by the structural design engineer and/or architect or foundation/slab designer. A number of options may be considered for this purpose. Varying levels of performance will be achieved depending on the materials and slab section selected. These may include some or a combination of the following depending upon the level of moisture protection desired:

- Concrete slabs may be thickened to a minimum of 5 inches thick for very low expansive soil conditions, and be minimally reinforced as provided in GSI (2006). All slab reinforcement should be supported to provide proper mid-slab height positioning during placement of the concrete. "Hooking" of reinforcement is not an acceptable method of positioning. Increase of concrete slab thickness would tend to reduce moisture vapor transmission though slabs. Increasing the compressive strength may also aid in limiting moisture migration through the slab.

- Concrete slab underlayment should consist of a 10-mil to 15-mil vapor retarder, or equivalent, with all laps sealed per the UBC/CBC (ICBO, 1997 and 2001) and the manufacturer's recommendation. The vapor retarder should comply with the ASTM E-1745 Class A or B criteria and be installed per the recommendations of the manufacturer, including all penetrations (i.e., pipe, ducting, rebar, etc.). The manufacturer should and can provide instructions for lap sealing, including minimum width of lap, method of sealing, and either supply or specify suitable products for lap sealing (ASTM E-1745).

- In order to break the capillary rise of soil moisture, the vapor retarder can be underlain by 2 inches of fine or coarse, washed, clean gravel (80 to 100 percent greater than #4 sieve) and be overlain by at least 2 inches of clean, washed sand (SE $\geq$30) to aid in concrete curing. Where very low expansive soils are exposed on the pad, a 15 mil vapor retarder may be used without the 2-inch layer of coarse gravel.

- Concrete should have a maximum water/cement ratio of 0.50.

- Where slab concrete compressive strength is increased, admixtures used, and water/cement ratios are adjusted, the structural consultant should also make changes to the concrete in the grade beams and footings in kind so that the concrete used in the foundation and slabs are designed and/or treated for more uniform moisture protection. The moisture vapor protection selected by the builder should be consistent with the intended level of performance as well as the type of floor covering.

- The use of a penetrating slab surface sealer may be considered in rooms where permeable floor tile or wood will be used. In all planned floorings, the waterproofing specialist should review the manufacturer's recommendations and adjust installation as needed. Homeowner(s) should be advised which areas are suitable for tile or wood floors.

- Final recommendations regarding water or vapor transmission should be provided by the architect/structural engineer/slab or foundation designer.

Please be aware that the above are some of the various methods by which moisture penetration through the foundation systems and/or slab may be reduced. Such methods should be implemented if the transmission of water or water vapor through the slab is undesirable. Full disclosure of the methods utilized on this project and their limitations (if any) for water or vapor transmission through the foundations system or slabs should be provided to all interested parties, in writing. The method and ultimately the performance level selected for vapor transmission may conflict with the type of future floor covering selected by the homeowner. This should be disclosed to the homeowner(s). Regardless of the performance level selected and/or mitigation chosen, some limited moisture/moisture vapor transmission through the slab should be anticipated.

POST-TENSIONED SLAB DESIGN

For post-tension designs on Lots 62 to 65, the recommendations presented below should be followed in addition to those contained in the previous sections. The recommendations presented below should be followed in addition to those contained in the previous sections, as appropriate. The information and recommendations presented below in this section are not meant to supercede design by a registered structural engineer or civil engineer familiar with post-tensioned slab design. Post-tensioned slabs should be designed using sound engineering practice and be in accordance with local and/or national code requirements. Upon request, GSI can provide additional data/consultation regarding soil parameters as related to post-tensioned slab design.

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

Perimeter cut-off walls should be a minimum of 12 inches deep for very low expansive soils. The cut-off walls may be integrated into the slab design or independent of the slab. The cut-off walls should be a minimum of 6 inches in width. Minimum slab thickness of 5 inches is recommended for post-tension designs.

Specific soil presaturation is not required if very low expansive soils are exposed at finish grade. The moisture content of the slab subgrade soils should, however, be equal to, or greater than, the soil's optimum moisture content to a depth of 18 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 (pci).

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 the slab. The potential for differential uplift can be evaluated using the 1997 UBC 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
Modulus of Subgrade Reaction (pci)	75
Moisture Velocity	0.7 inches/month

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 positive drainage that 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 UBC Section 1816. The values may not be appropriate to account for possible differential settlement of the slab due to other factors (see previous discussions). If a stiffer slab is desired, higher values of ym may be warranted.

EXPANSION INDEX OF SOIL SUBGRADE	VERY LOW EXPANSION (E.I. = 0-20)
e_m center lift	5.0 feet
e_m edge lift	2.5 feet
y_m center lift	1.0 inch
y_m edge lift	0.3 inch

Deepened footings/edges around the slab perimeter must be used to minimize non-uniform surface moisture migration (from an outside source) beneath the slab. An edge depth of 12 inches should be considered a minimum. The bottom of the deepened footing/edge should be designed to resist tension, using cable or reinforcement per the structural engineer. Slab underlayment should be as discussed in the previous section. Other applicable recommendations presented under conventional foundation and the California Foundation Slab Method should be adhered to during the design and construction phase of the project.

WALL DESIGN PARAMETERS

Conventional Retaining Walls

The design parameters provided below assume that either non expansive soils (typically Class 2 permeable filter material or Class 3 aggregate base) or native onsite materials (up to and including an E.I. of 65) are used to backfill any retaining walls. The type of backfill (i.e., select or native), should be specified by the wall designer, and clearly shown on the plans. Building walls, below grade, should be water-proofed. The foundation system for the proposed retaining walls should be designed in accordance with the recommendations presented in this and preceding sections of this report, as appropriate. Footings should be embedded a minimum of 18 inches below adjacent grade (excluding landscape layer, 6 inches) and should be 24 inches in width. There should be no increase in bearing for footing width. Recommendations for specialty walls (i.e., crib, earthstone, geogrid, etc.) can be provided upon request, and would be based on site specific conditions.

Restrained Walls

Any 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 (EFP) of 65 pounds per cubic foot (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 (2H) laterally from the corner.

Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 10 feet high. Design parameters for walls less than 3 feet in height may be superceded by City and/or County standard design. 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 due to traffic, structures, seismic events or adverse geologic conditions. When wall configurations are finalized, the appropriate loading conditions for superimposed loads can be provided upon request.

Retaining walls that are greater than 6 feet in exposed height and within 5 feet of residences or main access streets of the project should also be minimally designed with a seismic surcharge of 10H, where "H" is the height of the retained soil from the bottom of the footing (excluding shear key), to the top of the backfill. This should be applied as a uniform pressure to the active wall loads and achieve a seismic overturning factor-of-safety of 1.1.

SURFACE SLOPE OF RETAINED MATERIAL (HORIZONTAL:VERTICAL)	EQUIVALENT FLUID WEIGHT P.C.F. (SELECT BACKFILL)	EQUIVALENT FLUID WEIGHT P.C.F. (NATIVE BACKFILL)
Level*	35	45
2 to 1	55	65
* Level backfill behind a retaining wall is defined as compacted earth materials, properly drained, without a slope for a distance of 2H behind the wall.		

Retaining Wall Backfill and Drainage

Positive drainage must be provided behind all retaining walls in the form of gravel wrapped in geofabric and outlets. A backdrain system is considered necessary for retaining walls that are 2 feet or greater in height. Details 1, 2, and 3, present the back drainage options discussed below. Backdrains should consist of a 4-inch diameter perforated PVC or ABS pipe encased in either Class 2 permeable filter material or ¾-inch to 1½-inch gravel wrapped in approved filter fabric (Mirafi 140 or equivalent). For low expansive backfill, the filter material should extend a minimum of 1 horizontal foot behind the base of the walls and upward at least 1 foot. For native backfill that has up to medium expansion potential, continuous Class 2 permeable drain materials should be used behind the wall. This material should be continuous (i.e., full height) behind the wall, and it should be constructed in accordance with the enclosed Detail 1 (Typical Retaining Wall Backfill and Drainage Detail). For limited access and confined areas, (panel) drainage behind the wall may be constructed in accordance with Detail 2 (Retaining Wall Backfill and Subdrain Detail Geotextile Drain). Materials with an E.I. potential of greater than 65 should not be used as backfill for retaining walls. For more onerous expansive situations, backfill and drainage behind the retaining wall should conform with Detail 3 (Retaining Wall And Subdrain Detail Clean Sand Backfill).

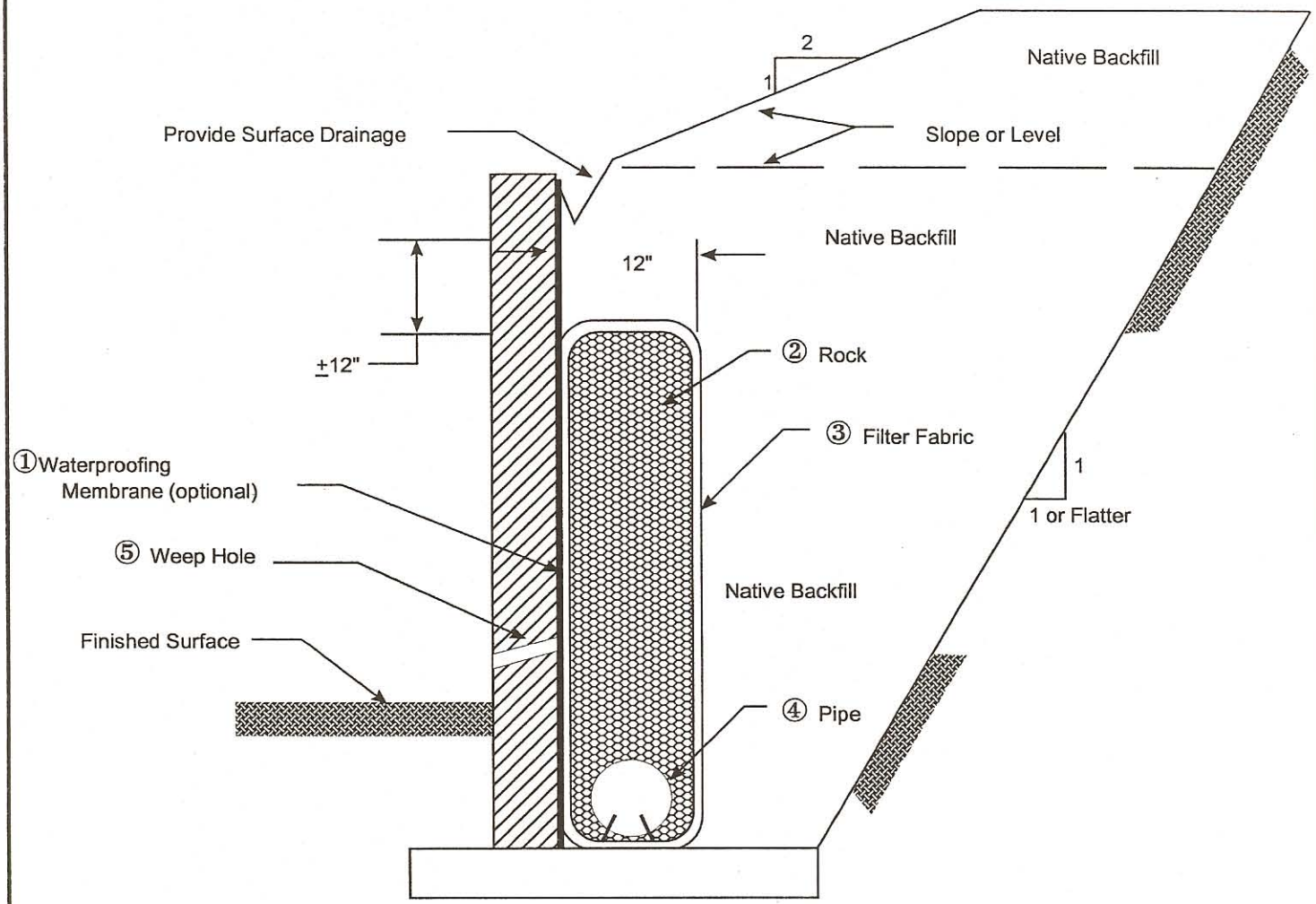
Outlets should consist of a 4-inch diameter solid PVC or ABS pipe spaced no greater than ±100 feet apart, with a minimum of two outlets, one on each end. The use of weep holes, only, in walls higher than 2 feet, is not recommended. The surface of the backfill should be sealed by pavement or the top 18 inches compacted with native soil (E.I. $\leq$90). Proper surface drainage should also be provided. For additional mitigation, consideration should be given to applying a water-proof membrane to the back of all retaining structures. The use of a waterstop should be considered for all concrete and masonry joints.

Wall/Retaining Wall Footing Transitions

Site walls are anticipated to be founded on footings designed in accordance with the recommendations in this report. Should wall footings transition from cut to fill, the civil designer may specify either:

DETAILS

N . T . S .



① WATERPROOFING MEMBRANE (optional):
Liquid boot or approved equivalent.

② ROCK:
3/4 to 1-1/2" (inches) rock.

③ FILTER FABRIC:
Mirafi 140N or approved equivalent; place fabric flap behind core.

④ PIPE:
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point (Perforations down).

⑤ WEEP HOLE:
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface (No weep holes for basement walls.).

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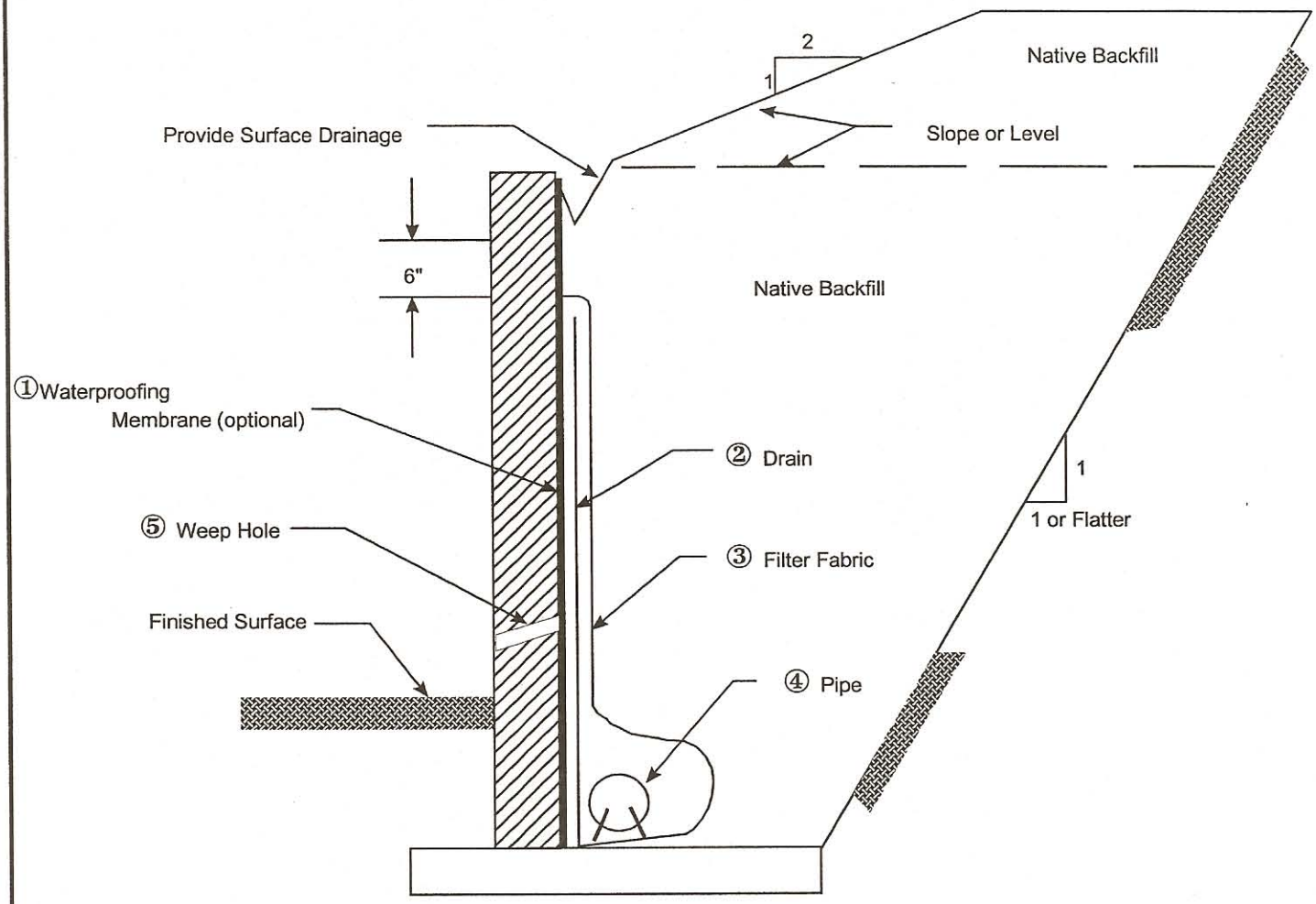
TYPICAL RETAINING WALL BACKFILL AND DRAINAGE DETAIL

DETAIL 1

Geotechnical • Coastal • Geologic • Environmental

DETAILS

N . T . S .



① WATERPROOFING MEMBRANE (optional):
Liquid boot or approved equivalent.

② DRAIN:
Miradrain 6000 or J-drain 200 or equivalent for non-waterproofed walls.
Miradrain 6200 or J-drain 200 or equivalent for waterproofed walls (All Perforations down).

③ FILTER FABRIC:
Mirafi 140N or approved equivalent; place fabric flap behind core.

④ PIPE:
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point.

⑤ WEEP HOLE:
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface. (No weep holes for basement walls.)

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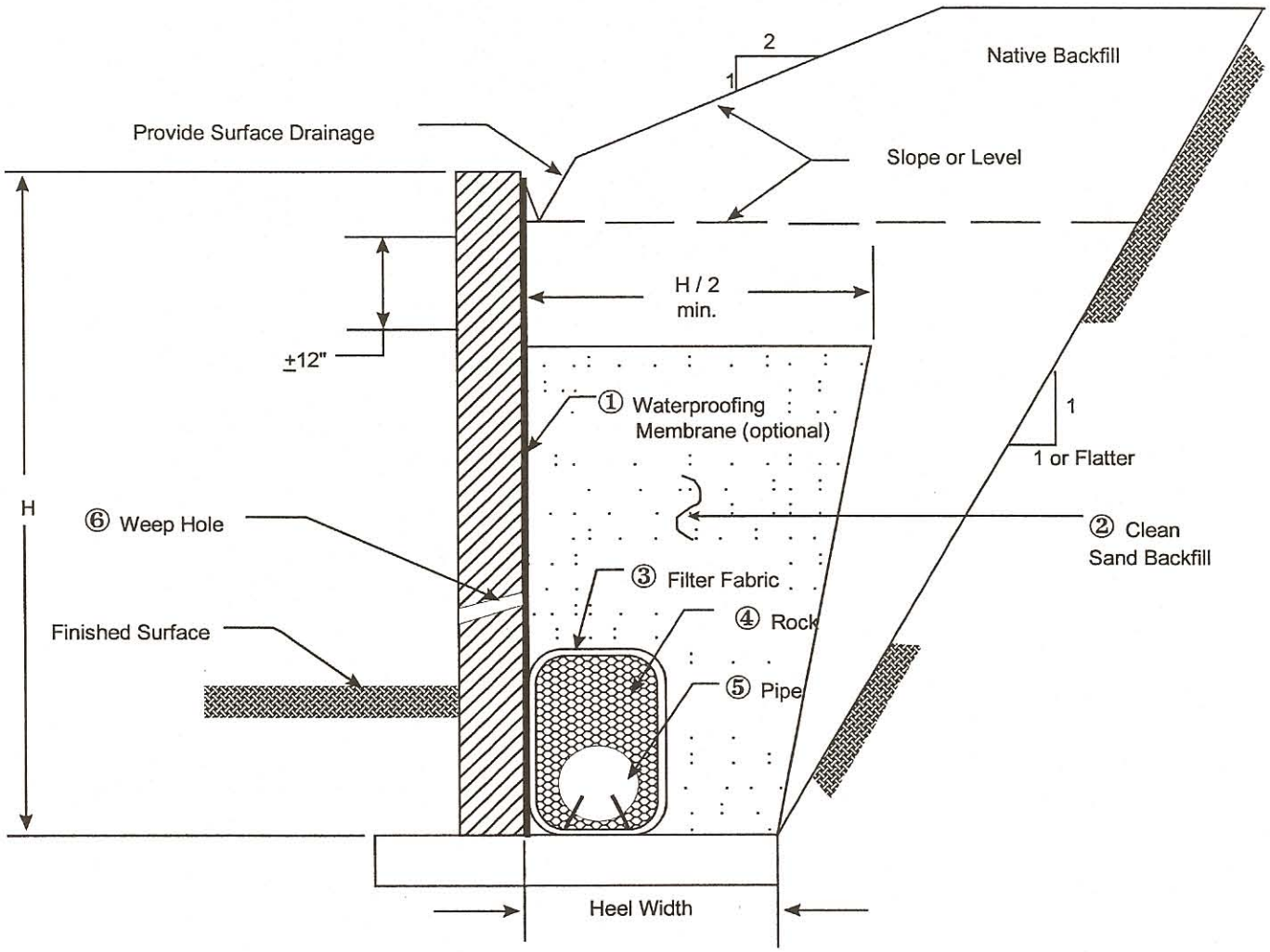
RETAINING WALL BACKFILL AND SUBDRAIN DETAIL GEOTEXTILE DRAIN

DETAIL 2

Geotechnical • Coastal • Geologic • Environmental

DETAILS

N . T . S .



① WATERPROOFING MEMBRANE (optional):
Liquid boot or approved equivalent.

② CLEAN SAND BACKFILL:
Must have sand equivalent value of 30 or greater; can be densified by water jetting.

③ FILTER FABRIC:
Mirafi 140N or approved equivalent.

④ ROCK:
1 cubic foot per linear feet of pipe or 3/4 to 1-1/2" (inches) rock.

⑤ PIPE:
4" (inches) diameter perforated PVC. schedule 40 or approved alternative with minimum of 1% gradient to proper outlet point (Perforations down).

⑥ WEEP HOLE:
Minimum 2" (inches) diameter placed at 20' (feet) on centers along the wall, and 3" (inches) above finished surface. (No weep holes for basement walls.)

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RETAINING WALL AND SUBDRAIN DETAIL CLEAN SAND BACKFILL

DETAIL 3

Geotechnical • Coastal • Geologic • Environmental

a) A minimum of a 2-foot overexcavation and recompaction of cut materials for a distance of 2H, from the point of transition.

b) Increase of the amount of reinforcing steel and wall detailing (i.e., expansion joints or crack control joints) such that a angular distortion of 1/360 for a distance of 2H on either side of the transition may be accommodated. Expansion joints should be placed no greater than 20 feet on-center, in accordance with the structural engineer's/wall designer's recommendations, regardless of whether or not transition conditions exist. Expansion joints should be sealed with a flexible, non-shrink grout.

c) Embed the footings entirely into native formational material (i.e., deepened footings).

If transitions from cut to fill transect the wall footing alignment at an angle of less than 45 degrees (plan view), then the designer should follow recommendation "a" (above) and until such transition is between 45 and 90 degrees to the wall alignment.

TOP-OF-SLOPE WALLS/FENCES/IMPROVEMENTS

Slope Creep

Soils at the site may be expansive and therefore, may become desiccated when allowed to dry. Such soils are susceptible to surficial slope creep, especially with seasonal changes in moisture content. Typically in southern California, during the hot and dry summer period, these soils become desiccated and shrink, thereby developing surface cracks. The extent and depth of these shrinkage cracks depend on many factors such as the nature and expansivity of the soils, temperature and humidity, and extraction of moisture from surface soils by plants and roots. When seasonal rains occur, water percolates into the cracks and fissures, causing slope surfaces to expand, with a corresponding loss in soil density and shear strength near the slope surface. With the passage of time and several moisture cycles, the outer 3 to 5 feet of slope materials experience a very slow, but progressive, outward and downward movement, known as slope creep. For slope heights greater than 10 feet, this creep related soil movement will typically impact all rear yard flatwork and other secondary improvements that are located within about 15 feet from the top of slopes, such as swimming pools, concrete flatwork, etc., and in particular top of slope fences/walls. This influence is normally in the form of detrimental settlement, and tilting of the proposed improvements. The dessication/swelling and creep discussed above continues over the life of the improvements, and generally becomes progressively worse. Accordingly, the developer should provide this information to any homeowners and homeowners association and all interested/affected parties.

Top of Slope Walls/Fences

Due to the potential for slope creep for slopes higher than about 10 feet, some settlement and tilting of the walls/fence with the corresponding distresses, should be expected. To mitigate the tilting of top of slope walls/fences, we recommend that the walls/fences be constructed on deepened foundations without any consideration for creep forces, where the expansion index of the materials comprising the outer 15 feet of the slope is less than 50. The strength of the concrete and grout should be evaluated by the structural engineer of record. The proper ASTM tests for the concrete and mortar should be provided along with the slump quantities. The concrete used should be appropriate to mitigate sulfate corrosion, as warranted.

DRIVEWAY, FLATWORK, AND OTHER IMPROVEMENTS

The soil materials on site may be expansive. The effects of expansive soils are cumulative, and typically occur over the lifetime of any improvements. On relatively level areas, when the soils are allowed to dry, the dessication and swelling process tends to cause heaving and distress to flatwork and other improvements. The resulting potential for distress to improvements may be reduced, but not totally eliminated. To that end, it is recommended that the developer should notify any homeowners or homeowners association of this long-term potential for distress. To reduce the likelihood of distress, the following recommendations are presented for all exterior flatwork:

1. The subgrade area for concrete slabs should be compacted to achieve a minimum 90 percent relative compaction, and then be presoaked to 2 to 3 percentage points above (or 125 percent of) the soils' optimum moisture content, to a depth of 18 inches below subgrade elevation. If very low expansive soils are present, only optimum moisture content, or greater, is required and specific presoaking is not warranted. The moisture content of the subgrade should be proof tested within 72 hours prior to pouring concrete.

2. Concrete slabs should be cast over a non-yielding surface, consisting of a 4-inch layer of crushed rock, gravel, or clean sand, that should be compacted and level prior to pouring concrete. Since very low expansive soils are prevalent onsite, the rock or gravel or sand may be deleted in most cases (see Table 2). The layer or subgrade should be wet-down completely prior to pouring concrete, to minimize loss of concrete moisture to the surrounding earth materials.

3. Exterior slabs should be a minimum of 4 inches thick. Driveway slabs and approaches should additionally have a thickened edge (12 inches) adjacent to all landscape areas, to help impede infiltration of landscape water under the slab.

4. The use of transverse and longitudinal control joints are recommended to help control slab cracking due to concrete shrinkage or expansion. Two ways to mitigate such cracking are: a) add a sufficient amount of reinforcing steel, increasing tensile strength of the slab; and, b) provide an adequate amount of control and/or expansion joints to accommodate anticipated concrete shrinkage and expansion.

   In order to reduce the potential for unsightly cracks, slabs should be reinforced at mid-height with a minimum of No. 3 bars placed at 18 inches on center, in each direction. If subgrade soils within the top 7 feet from finish grade are very low expansive soils (i.e., E.I. $\leq$20), then 6x6-W1.4xW1.4 welded-wire mesh may be substituted for the rebar, provided the reinforcement is placed on chairs, at slab mid-height. The exterior slabs should be scored or saw cut, ½ to ⅜ inches deep, often enough so that no section is greater than 10 feet by 10 feet. For sidewalks or narrow slabs, control joints should be provided at intervals of every 6 feet. The slabs should be separated from the foundations and sidewalks with expansion joint filler material.

5. No traffic should be allowed upon the newly poured concrete slabs until they have been properly cured to within 75 percent of design strength. Concrete compression strength should be a minimum of 2,500 psi.

6. Driveways, sidewalks, and patio slabs adjacent to the house should be separated from the house with thick expansion joint filler material. In areas directly adjacent to a continuous source of moisture (i.e., irrigation, planters, etc.), all joints should be additionally sealed with flexible mastic.

7. Planters and walls should not be tied to the house.

8. Overhang structures should be supported on the slabs, or structurally designed with continuous footings tied in at least two directions. If very low expansion soils are present, footings need only be tied in one direction.

9. Any masonry landscape walls that are to be constructed throughout the property should be grouted and articulated in segments no more than 20 feet long. These segments should be keyed or doweled together.

10. Utilities should be enclosed within a closed utilidor (vault) or designed with flexible connections to accommodate differential settlement and expansive soil conditions.

11. Positive site drainage should be maintained at all times. Finish grade on the lots should provide a minimum of 1 to 2 percent fall to the street, as indicated herein. It should be kept in mind that drainage reversals could occur, including post-construction settlement, if relatively flat yard drainage gradients are not periodically maintained by the homeowner or homeowners association.

12. Air conditioning (A/C) units should be supported by slabs that are incorporated into the building foundation or constructed on a rigid slab with flexible couplings for plumbing and electrical lines. A/C waste water lines should be drained to a suitable non-erosive outlet.

13. Shrinkage cracks could become excessive if proper finishing and curing practices are not followed. Finishing and curing practices should be performed per the Portland Cement Association Guidelines. Mix design should incorporate rate of curing for climate and time of year, sulfate content of soils, corrosion potential of soils, and fertilizers used on site.

DEVELOPMENT CRITERIA

Slope Deformation

Compacted fill slopes designed using customary factors of safety for gross or surficial stability and constructed in general accordance with the design specifications should be expected to undergo some differential vertical heave or settlement in combination with differential lateral movement in the out-of-slope direction, after grading. This post-construction movement occurs in two forms: slope creep, and lateral fill extension (LFE). Slope creep is caused by alternate wetting and drying of the fill soils which results in slow downslope movement. This type of movement is expected to occur throughout the life of the slope, and is anticipated to potentially affect improvements or structures (e.g., separations and/or cracking), placed near the top-of-slope, up to a maximum distance of approximately 15 feet from the top-of-slope, depending on the slope height. This movement generally results in rotation and differential settlement of improvements located within the creep zone. LFE occurs due to deep wetting from irrigation and rainfall on slopes comprised of expansive materials. Although some movement should be expected, long-term movement from this source may be minimized, but not eliminated, by placing the fill throughout the slope region, wet of the fill's optimum moisture content.

It is generally not practical to attempt to eliminate the effects of either slope creep or LFE. Suitable mitigative measures to reduce the potential of lateral deformation typically include: setback of improvements from the slope faces (per the 1997 UBC and/or adopted California Building Code), positive structural separations (i.e., joints) between improvements, and stiffening and deepening of foundations. Expansion joints in walls should be placed no greater than 20 feet on-center, and in accordance with the structural engineer's recommendations. All of these measures are recommended for design of structures and improvements. The ramifications of the above conditions, and recommendations for mitigation, should be provided to each homeowner and/or any homeowners association.

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 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 adversely affects site improvements, and causes perched groundwater conditions. Graded slopes constructed 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. Compaction to the face of fill slopes would tend to minimize short-term erosion until vegetation is established. Plants selected for landscaping should be light weight, deep rooted types that require little water and are capable of surviving the prevailing climate. Jute-type matting or other fibrous covers may aid in allowing the establishment of a sparse plant cover. Utilizing plants other than those recommended above will increase the potential for perched water, staining, mold, etc., to develop. A rodent control program to prevent burrowing should be implemented. Irrigation of natural (ungraded) slope areas is generally not recommended. These recommendations regarding plant type, irrigation practices, and rodent control should be provided to each homeowner. Over-steepening of slopes should be avoided during building construction activities and landscaping.

Drainage

Adequate lot surface drainage is a very important factor in reducing the likelihood of adverse performance of foundations, hardscape, and slopes. Surface drainage should be sufficient to prevent ponding of water anywhere on a lot, and especially near structures and tops of slopes. Lot surface drainage should be carefully taken into consideration during fine grading, landscaping, and building construction. Therefore, care should be taken that future landscaping or construction activities do not create adverse drainage conditions. Positive site drainage within lots and common areas should be provided and 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. In general, the area within 5 feet around a structure should slope away from the structure. We recommend that unpaved lawn and landscape areas have a minimum gradient of 1 percent sloping away from structures, and whenever possible, should be above adjacent paved areas. Consideration should be given to avoiding construction of planters adjacent to structures (buildings, pools, spas, etc.). Pad drainage should be directed toward the street or other approved area(s). Although not a geotechnical requirement, roof gutters, down spouts, or other appropriate means may be utilized 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.

Toe of Slope Drains/Toe Drains

Where significant slopes intersect pad areas, surface drainage down the slope allows for some seepage into the subsurface materials, sometimes creating conditions causing or contributing to perched and/or ponded water. Toe of slope/toe drains may be beneficial in the mitigation of this condition due to surface drainage. The general criteria to be utilized by the design engineer for evaluating the need for this type of drain is as follows:

- Is there a source of irrigation above or on the slope that could contribute to saturation of soil at the base of the slope?

- Are the slopes hard rock and/or impermeable, or relatively permeable, or; do the slopes already have or are they proposed to have subdrains (i.e., stabilization fills, etc.)?

- Are there cut-fill transitions (i.e., fill over bedrock), within the slope?

- Was the lot at the base of the slope overexcavated or is it proposed to be overexcavated? Overexcavated lots located at the base of a slope could accumulate subsurface water along the base of the fill cap.

- Are the slopes north facing? North facing slopes tend to receive less sunlight (less evaporation) relative to south facing slopes and are more exposed to the currently prevailing seasonal storm tracks.

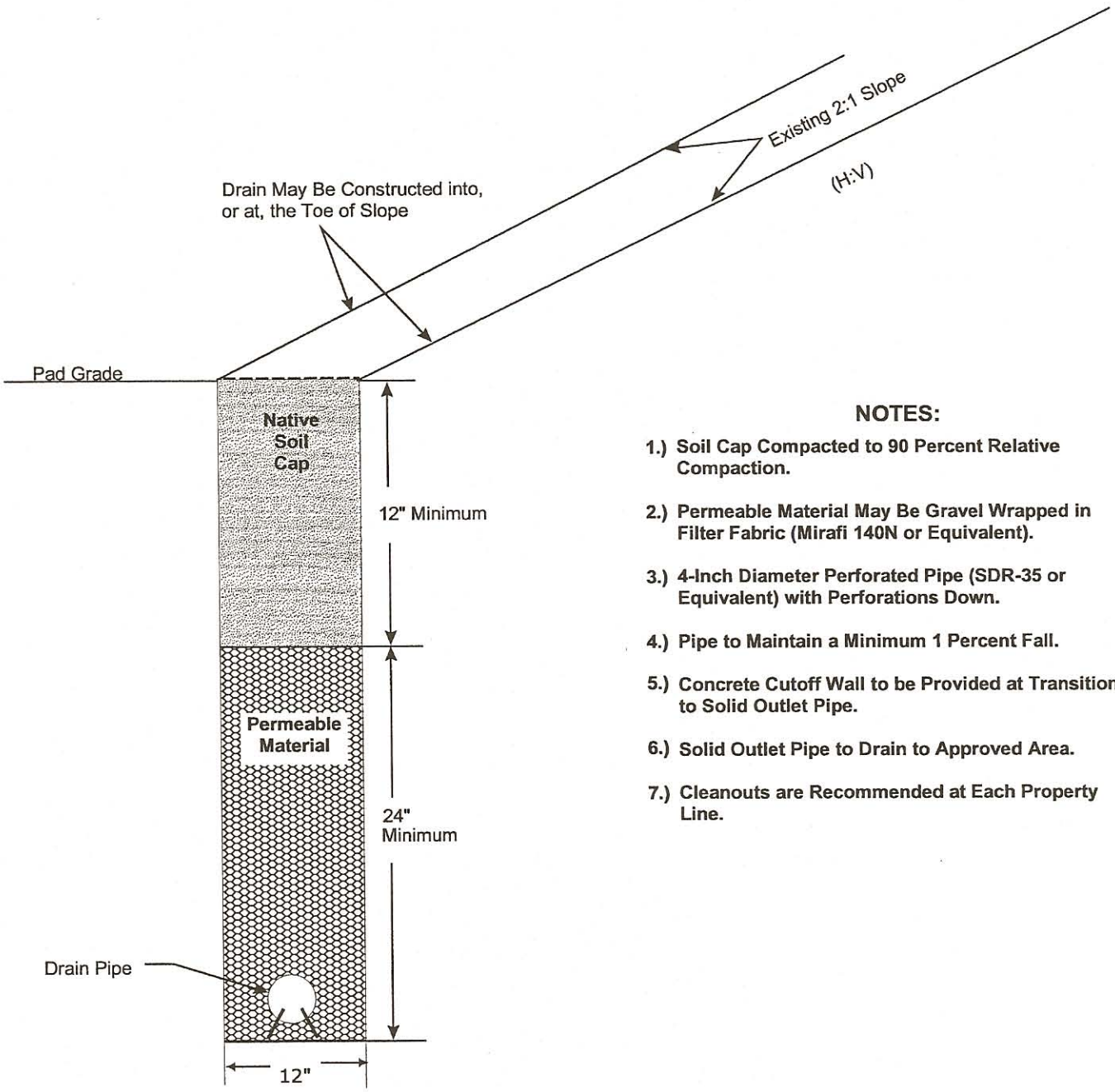
- What is the slope height? It has been our experience that slopes with heights in excess of approximately 10 feet tend to have more problems due to storm runoff and irrigation than slopes of a lesser height.

- Do the slopes "toe out" into a residential lot or a lot where perched or ponded water may adversely impact its proposed use?

Based on these general criteria, the construction of toe drains may be considered by the design engineer along the toe of slopes, or at retaining walls in slopes, descending to the rear of such lots. Following are Detail 4 (Schematic Toe Drain Detail) and Detail 5 (Subdrain Along Retaining Wall Detail). Other drains may be warranted due to unforeseen conditions, homeowner irrigation, or other circumstances. Where drains are constructed during grading, including subdrains, the locations/elevations of such drains should be surveyed, and recorded on the final as-built grading plans by the design engineer. It is recommended that the above be disclosed to all interested parties, including homeowners and any homeowners association.

DETAILS
N . T . S .

SCHEMATIC TOE DRAIN DETAIL



NOTES:

1.) **Soil Cap Compacted to 90 Percent Relative Compaction.**

2.) **Permeable Material May Be Gravel Wrapped in Filter Fabric (Mirafi 140N or Equivalent).**

3.) **4-Inch Diameter Perforated Pipe (SDR-35 or Equivalent) with Perforations Down.**

4.) **Pipe to Maintain a Minimum 1 Percent Fall.**

5.) **Concrete Cutoff Wall to be Provided at Transition to Solid Outlet Pipe.**

6.) **Solid Outlet Pipe to Drain to Approved Area.**

7.) **Cleanouts are Recommended at Each Property Line.**

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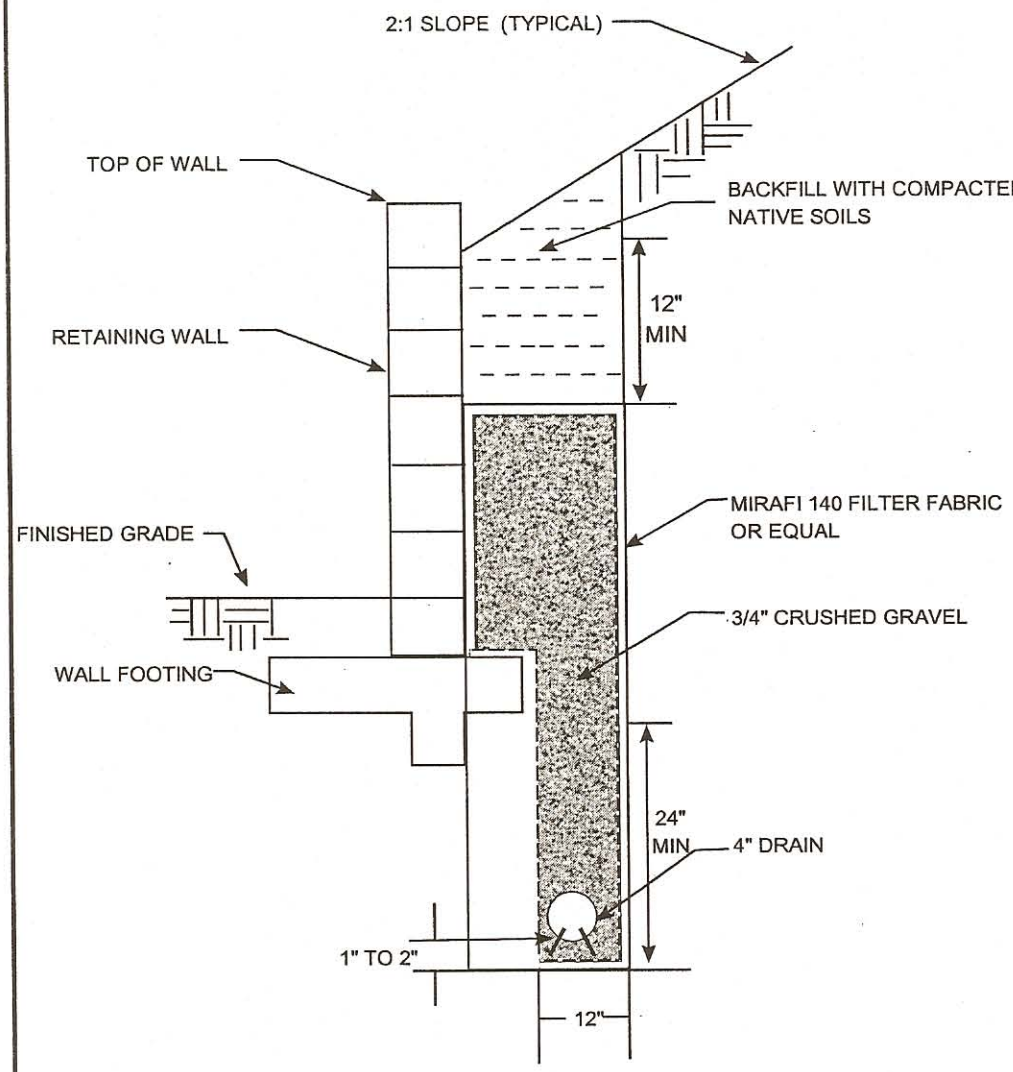
SCHEMATIC TOE DRAIN DETAIL

DETAIL 4

Geotechnical • Coastal • Geologic • Environmental

DETAILS

N . T . S .



SUBDRAIN ALONG RETAINING WALL DETAIL

NOT TO SCALE

NOTES:

1.) **Soil Cap Compacted to 90 Percent Relative Compaction.**

2.) **Permeable Material May Be Gravel Wrapped in Filter Fabric (Mirafi 140N or Equivalent).**

3.) **4-Inch Diameter Perforated Pipe (SDR-35 or Equivalent) with Perforations Down.**

4.) **Pipe to Maintain a Minimum 1 Percent Fall.**

5.) **Concrete Cutoff Wall to be Provided at Transition to Solid Outlet Pipe.**

6.) **Solid Outlet Pipe to Drain to Approved Area.**

7.) **Cleanouts are Recommended at Each Property Line.**

8.) **Compacted Effort Should Be Applied to Drain Rock.**

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SUBDRAIN ALONG RETAINING WALL DETAIL

DETAIL 5

Geotechnical • Coastal • Geologic • Environmental

Erosion Control

Cut and fill slopes will be subject to surficial erosion during and after grading. Onsite earth materials have a moderate to high erosion potential. Consideration should be given to providing hay bales and silt fences for the temporary control of surface water, from a geotechnical viewpoint.

Landscape Maintenance

Only the amount of irrigation necessary to sustain plant life should be provided. Over-watering the landscape areas will 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. If planters are constructed adjacent to structures, the sides and bottom of the planter should be provided with a moisture retarder to prevent penetration of irrigation water into the subgrade. Provisions should be made to drain the excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Graded slope areas should be planted with 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.

Gutters and Downspouts

As previously discussed in the drainage section, the installation of gutters and downspouts should be considered to collect roof water that may otherwise infiltrate the soils adjacent to the structures. If utilized, the downspouts should be drained into PVC collector pipes or other non-erosive devices (e.g., paved swales or ditches; below grade, solid tight-lined PVC pipes; etc.), that will carry the water away from the house, to an appropriate outlet, in accordance with the recommendations of the design civil engineer. Downspouts and gutters are not a requirement; however, from a geotechnical viewpoint, provided that positive drainage is incorporated into project design (as discussed previously).

Subsurface and Surface Water

Subsurface and surface water 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 may not be precluded from occurring in the future due to site irrigation, poor

drainage conditions, or damaged utilities, and should be anticipated. Should perched groundwater conditions develop, this office could assess the affected area(s) and provide the appropriate recommendations to mitigate the observed groundwater conditions. Groundwater conditions may change with the introduction of irrigation, rainfall, or other factors.

Site Improvements

If in the future, any additional improvements (e.g., pools, spas, etc.) are planned for the site, recommendations concerning the geological or geotechnical aspects of design and construction of said improvements could be provided upon request. Pools and/or spas should not be constructed without specific design and construction recommendations from GSI, and this construction recommendation should be provided to the homeowners, any homeowners association, and/or other interested parties. 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, flatwork, etc.

Tile Flooring

Tile flooring can crack, reflecting cracks in the concrete slab below the tile, although small cracks in a conventional slab may not be significant. Therefore, the designer should consider additional steel reinforcement for concrete slabs-on-grade where tile will be placed. The tile installer should consider installation methods that reduce possible cracking of the tile such as slipsheets. Slipsheets or a vinyl crack isolation membrane (approved by the Tile Council of America/Ceramic Tile Institute) are recommended between tile and concrete slabs on grade.

Additional Grading

This office should be notified in advance of any fill placement, supplemental regrading of the site, or trench backfilling after rough grading has been completed. This includes completion of grading in the street, driveway approaches, driveways, parking areas, and 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 evaluate that the excavations have been 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/Temporary Construction Backcuts

Considering the nature of the onsite earth materials, it should be anticipated that caving or sloughing could be a factor in subsurface excavations and trenching. Shoring or excavating the trench walls/backcuts at the angle of repose (typically 25 to 45 degrees [except as specifically superceded within the text of this report]), should be anticipated. All excavations should be observed by an engineering geologist or soil engineer from GSI, prior to workers entering the excavation or trench, and minimally conform to CAL-OSHA, state, and local safety codes. Should adverse conditions exist, appropriate recommendations would be offered at that time. The above recommendations should be provided to any contractors and/or subcontractors, or homeowners, etc., that may perform such work.

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-inch to 18-inch) 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 evaluate 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 evaluate the desired results.

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

4. Utilities crossing grade beams, perimeter beams, or footings should either pass below the footing or grade beam utilizing a hardened collar or foam spacer, or pass through the footing or grade beam in accordance with the recommendations of the structural engineer.

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.
- During excavation.
- During placement of subdrains, toe drains, or other subdrainage devices, prior to placing fill and/or backfill.
- After excavation of building footings, retaining wall footings, and free standing walls footings, prior to the placement of reinforcing steel or concrete.
- Prior to pouring any slabs or flatwork, after presoaking/presaturation of building pads and other flatwork subgrade, before the placement of concrete, reinforcing steel, capillary break (i.e., sand, pea-gravel, etc.), or vapor retarders (i.e., visqueen, etc.).
- 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.
- During slope construction/repair.
- When any unusual soil conditions are encountered during any construction operations, subsequent to the issuance of this report.
- When any developer or homeowner improvements, such as flatwork, spas, pools, walls, etc., are constructed, prior to construction.
- A report of geotechnical observation and testing should be provided at the conclusion of each of the above stages, in order to provide concise and clear documentation of site work, and/or to comply with code requirements.
- GSI should review project sales documents to homeowners/homeowners associations for geotechnical aspects, including irrigation practices, the conditions outlined above, etc., prior to any sales. At that stage, GSI will provide homeowners maintenance guidelines which should be incorporated into such documents.

OTHER DESIGN PROFESSIONALS/CONSULTANTS

The design civil engineer, structural engineer, post-tension designer, architect, landscape architect, wall designer, etc., should review the recommendations provided herein, incorporate those recommendations into all their respective plans, and by explicit reference, make this report part of their project plans. This report presents minimum design criteria for the design of slabs, foundations and other elements possibly applicable to the project. These criteria should not be considered as substitutes for actual designs by the structural engineer/designer. Please note that the recommendations contained herein are not intended to preclude the transmission of water or vapor through the slab or foundation. The structural engineer/foundation and/or slab designer should provide recommendations to not allow water or vapor to enter into the structure so as to cause damage to another building component, or so as to limit the installation of the type of flooring materials typically used for the particular application.

The structural engineer/designer should analyze actual soil-structure interaction and consider, as needed, bearing, expansive soil influence, and strength, stiffness and deflections in the various slab, foundation, and other elements in order to develop appropriate, design-specific details. As conditions dictate, it is possible that other influences will also have to be considered. The structural engineer/designer should consider all applicable codes and authoritative sources where needed. If analyses by the structural engineer/designer result in less critical details than are provided herein as minimums, the minimums presented herein should be adopted. It is considered likely that some, more restrictive details will be required.

If the structural engineer/designer has any questions or requires further assistance, they should not hesitate to call or otherwise transmit their requests to GSI. In order to mitigate potential distress, the foundation and/or improvement's designer should confirm to GSI and the governing agency, in writing, that the proposed foundations and/or improvements can tolerate the amount of differential settlement and/or expansion characteristics and other design criteria specified herein.

PLAN REVIEW

Final project plans (grading, precise grading, foundation, retaining wall, landscaping, etc.), should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations and/or further geotechnical studies may be warranted.

LIMITATIONS

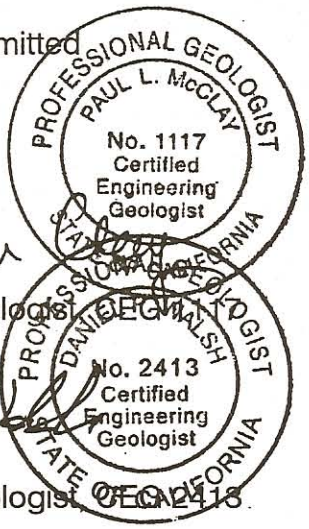
The materials encountered on the project site and utilized for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during mass grading. Site conditions may vary due to seasonal changes or other factors.

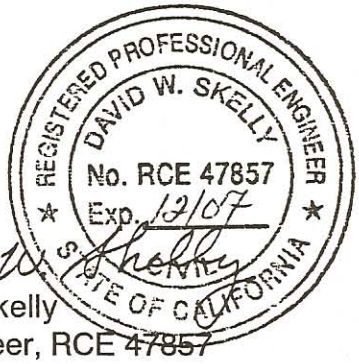
Inasmuch as our study is based upon our review and engineering analyses and laboratory data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion 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.





Paul L. McClay
Engineering Geologist, CEG 1117

David W. Skelly
Civil Engineer, RCE 47857

Daniel P. Walsh
Engineering Geologist, CEG 2413

PLM/DWS/DPW/jh/ps

Enclosures: Table 1 - Field Density Test Results
Table 2 - Lot Summary - Geotechnical Conditions
Appendix A - References
Appendix B - Laboratory Data
Plate 1- As-Graded Geotechnical Map

Distribution: (4) Addressee

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
BT-260	3/23/2007	Lot 64	31687	1466.5	12.9	117.0		ND	
BT-261	3/23/2007	Lot 65	31687	1465.5	8.9	120.2		ND	
BT-265	3/23/2007	Lot 65	31687	1462.5	9.2	119.0		ND	
BT-266	3/23/2007	Lot 65	31687	1464.5	11.3	120.0		ND	
BT-267	3/23/2007	Lot 64	31687	1467.5	11.8	116.9		ND	
BT-268	3/23/2007	Lot 64	31687	1466.5	5.9	114.9		ND	
292	3/27/2007	Lot 65	31687	1465.0	9.3	119.3	91.8	ND	A
296	3/27/2007	Lot 64	31687	1467.0	9.6	120.6	90.7	SC	B
302	3/27/2007	Lot 64	31687	1468.0	9.7	123.1	90.5	ND	D
BT-309	3/28/2007	Lot 63	31687	1468.5	12.0	116.1		ND	
BT-310	3/28/2007	Lot 63	31687	1467.5	8.9	121.5		ND	
BT-315	3/28/2007	Lot 62	31687	1469.5	10.7	114.5		ND	
BT-316	3/28/2007	Lot 62	31687	1468.5	9.9	105.8		ND	
317	3/28/2007	Lot 65	31687	1467.0	9.5	121.2	91.1	ND	B
330	3/29/2007	Lot 65	31687	1467.0	11.6	117.3	90.2	ND	A
331	3/29/2007	Lot 64	31687	1469.0	9.6	124.5	93.6	ND	B
350	3/30/2007	Lot 62	31687	1470.0	9.0	122.6	92.2	ND	B
351	3/30/2007	Lot 63	31687	1469.0	8.0	121.4	91.3	ND	B
352	3/30/2007	Lot 64	31687	1470.0	10.9	118.3	91.0	ND	A
355	3/30/2007	Lot 65	31687	1468.0	10.8	121.5	90.7	ND	E
377	4/2/2007	Lot 64	31687	1470.0	13.2	120.4	90.5	ND	B
378	4/2/2007	Lot 63	31687	1471.0	9.1	126.0	92.6	ND	D
381	4/2/2007	Lot 62	31687	1471.0	9.3	120.5	90.6	SC	B
509	4/13/2007	Lot 62	31687	FG	8.8	124.9	93.9	ND	B
510	4/13/2007	Lot 63	31687	FG	10.4	118.9	91.5	ND	A
511	4/13/2007	Lot 64	31687	FG	8.3	122.0	91.7	ND	B
512	4/13/2007	Lot 65	31687	FG	9.9	126.3	92.9	ND	D

LEGEND

BT = Botom Test
FG = Finish Grade
ND = Nuclear Densometer Test
SC = Sand Cone Test

Table 2

LOT SUMMARY - GEOTECHNICAL CONDITIONS

LOT NUMBER	MINIMUM DEPTH OF FILL (ft)	MAXIMUM DEPTH OF FILL (ft)	EXPANSION POTENTIAL (per UBC)		SOLUBLE SULFATE		CHLORIDE CONTENT (mg/kg)	PLASTICITY INDEX	pH	pH CLASS.	RESISTIVITY (ohm-cm)	CORROSIVE CATEGORY
			EXPANSION INDEX	UBC CLASS.	CONTENT (% by Wt)	UBC CLASS.						
62	3	5	14	Very Low	0.0253	Negligible	91	N/A	7.2	Neutral	1,200	Corrosive
63	3	5	14	Very Low	0.0253	Negligible	91	N/A	7.2	Neutral	1,200	Corrosive
64	3	6	8	Very Low	0.0114	Negligible	35	N/A	8.0	Moderately Alkaline	2,880	Moderately Corrosive
65	3½	7	8	Very Low	0.0114	Negligible	35	N/A	8.0	Moderately Alkaline	2,880	Moderately Corrosive

*N/A = Not Applicable

GeoSoils, Inc.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

CSL Engineering, 2006, Rough grading plan for Tract 31687, County of Riverside, 40-scale plans, dated August 21.

GeoSoils, Inc., 2006, Supplemental 40-scale geotechnical grading plan review, Tract 31687, Romoland Area, Riverside County, California, W.O. 4787-A-SC, dated October 19.

_____, 2005, Preliminary geotechnical investigation and rippability assessment, TentativeTract No. 31687, Romoland Area, Riverside County, California, W.O. 4787-A-SC, dated June 30.

International Conference of Building Officials, 2001, California building code, California code of regulations title 24, part 2, volume 1 and 2.

_____, 1997, Uniform building code: Whittier, California, vol. 1, 2, and 3.

State of California, 2006, Civil Code, Sections 895 et seq.

APPENDIX B

LABORATORY DATA

Table 1 - Laboratory Tests on Soil Samples

Geosoils, Inc
Griffin, Tract 31687
Your #4748-B-SC, SA #07-0544LAB
16-Apr-07

Sample ID			Lot 63 Rep (Lots 62-63)	Lot 65 Rep (Lots 64-65)
Resistivity		**Units**		
as-received		ohm-cm	372,000	64,000
saturated		ohm-cm	1,200	2,880
pH			7.2	8.0
Electrical Conductivity		mS/cm	0.28	0.24
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	89	118
magnesium	Mg^{2+}	mg/kg	21	29
sodium	Na^{1+}	mg/kg	182	120
potassium	K^{1+}	mg/kg	15	27
Anions				
carbonate	CO_3^{2-}	mg/kg	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	177	259
flouride	F^{1-}	mg/kg	0.5	2.0
chloride	Cl^{1-}	mg/kg	91	35
sulfate	SO_4^{2-}	mg/kg	253	114
phosphate	PO_4^{3-}	mg/kg	7.5	35
Other Tests				
ammonium	NH_4^{1+}	mg/kg	ND	3.2
nitrate	NO_3^{1-}	mg/kg	116.4	33.9
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

LEGEND

Afc	Artificial fill - compacted
Qf	Quaternary fan deposits
	Approximate location of geologic contact
1466.4	Approximate elevation (in feet MSL) of remedial removal bottom
X-512	Approximate location of removal bottom field density test
BT-260	Approximate location of field density test

Approximate limits of area under the purview of this report

ALL LOCATIONS ARE APPROXIMATE

NOTE: CONTRACTOR TO TAKE NECESSARY PRECAUTIONS TO PROTECT EXISTING IMPROVEMENTS ON MAPES ROAD, TRADE WINDS DRIVE AND PALOMAR ROAD.

SCALE 1"=40'

SOILS ENGINEER:
GEO SOILS, INC.
26590 MADISON AVENUE
MURRIETA, CALIFORNIA 92563
(951) 677-9651 * FAX: (951) 677-9301

OWNER / DEVELOPER:
GRIFFIN COMMUNITIES
110 NORTH LINCOLN, 2ND FLOOR
CORONA, CA 92882
(951) 898-1234 * FAX: (951) 739-6145

NOTE:
WORK CONTAINED WITHIN THESE PLANS SHALL NOT COMMENCE UNTIL AN ENCROACHMENT PERMIT AND/OR A GRADING PERMIT HAS BEEN ISSUED.

THE PRIVATE ENGINEER SIGNING THESE PLANS IS RESPONSIBLE FOR ASSURING THE ACCURACY AND ACCEPTABILITY OF THE DESIGN IN HEREON. IN THE EVENT OF DESCREPANCIES ARISING AFTER COUNTY APPROVAL OR DURING CONSTRUCTION, THE PRIVATE ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL BY THE COUNTY.

MARK	BY	DATE	REVISIONS	APPR.	DATE
				ENGINEER	COUNTY

SEAL-ENGINEER
REGISTERED PROFESSIONAL ENGINEER
RICHARD A. SCIANNI
No. 25917
Exp. 12/31/07
CIVIL
STATE OF CALIFORNIA

CSL ENGINEERING, INC.
11651 STERLING AVENUE, SUITE E
RIVERSIDE, CALIFORNIA 92503
(951) 785-5122 * FAX (951) 785-5180

PREPARED BY: RICHARD A. SCIANNI
R.C.E. NO. 25917 (EXP. 12/31/07)
DATE:

BENCHMARK:
RIVERSIDE COUNTY BENCH MARK: M-16-3. 1.0 MILES WEST ALONG ELLIS AVENUE FROM THE INTERSECTION OF ELLIS AVENUE AND ANTELOPE ROAD; 48.0 FEET SOUTHWEST OF POWER POLE #1796300-E AND IN THE CENTER LINE OF ELLIS STREET; A 1" IRON PIPE IN A CAP WELL MONUMENT AND MARKED COUNTY SURVEYOR. ELEV. 1412.490

SCALE: H: 1"=40' V: N/A

GeoSoils, Inc.
RIVERSIDE CO.
ORANGE CO.
SAN DIEGO CO.

AS-GRADED GEOTECHNICAL MAP

Plate 1 of 1

W.O. 4787-B-SC	DATE 05/07	SCALE 1"=40'

TRACT 31687 IP 060034

COUNTY OF RIVERSIDE
ROUGH GRADING PLAN
PLAN SHEET

SHEET NO. 3 OF 4 SHTS

FOR: GRIFFIN COMMUNITIES

W.O. BGR: 060348

JN738/738_RGP_3.dwg/08-21-06/S:40

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
BT-1	2/28/07	Lot 14	31687	1477.7	9.4	117.4		ND	
BT-2	2/28/07	Lot 14	31687	1476.7	16.1	108.6		ND	
BT-3	2/28/07	Lot 15	31687	1477.7	5.4	129.2		ND	
BT-4	2/28/07	Lot 16	31687	1481.0	8.7	120.8		ND	
BT-5	2/28/07	Lot 16	31687	1484.4	4.7	120.1		ND	
BT-6	2/28/07	Lot 16	31687	1484.2	5.2	131.1		ND	
BT-7	2/28/07	Lot 15	31687	1486.2	5.2	119.7		ND	
BT-8	2/28/07	Lot 14	31687	1479.3	4.5	123.5		ND	
BT-9	3/1/07	Lot 16	31687	1487.0	11.0	120.0	92.3	ND	A
10	3/1/07	Lot 15	31687	1484.0	10.6	122.9	92.4	ND	B
11	3/1/07	Lot 14	31687	1481.0	11.1	119.1	91.6	ND	A
12	3/1/07	Lot 14	31687	1482.0	10.0	118.4	91.0	ND	A
BT-13	3/1/07	Lot 18	31687	1488.5	3.9	133.6		ND	
14	3/1/07	Lot 14	31687	1482.0	13.2	117.3	90.2	ND	A
15	3/1/07	Lot 15	31687	1483.0	12.3	121.4	91.2	ND	B
16	3/1/07	Lot 16	31687	1485.0	8.6	119.8	90.0	ND	B
17	3/1/07	Lot 15	31687	1487.0	10.5	120.6	90.7	SC	B
18	3/1/07	Lot 16	31687	1488.0	11.1	121.0	90.9	SC	B
BT-19	3/2/07	Lot 23	31687	1482.0	8.5	118.6		ND	
BT-20	3/2/07	Lot 24	31687	1479.0	12.6	108.4		ND	
BT-21	3/2/07	Lot 23	31687	1479.0	6.5	111.6		ND	
BT-22	3/2/07	Lot 24	31687	1481.5	11.6	108.7		ND	
23	3/2/07	Lot 18	31687	1492.0	10.5	118.6	91.2	ND	A
24	3/2/07	Lot 17	31687	1490.0	11.1	124.0	91.1	ND	D
25	3/2/07	Lot 18	31687	1494.0	8.3	121.0	90.9	ND	B
26	3/2/07	Lot 16	31687	1486.0	11.5	118.1	90.8	ND	A
27	3/2/07	Lot 15	31687	1485.0	12.8	122.6	90.1	ND	D
28	3/2/07	Lot 18	31687	1488.0	9.0	124.4	91.4	SC	D
29	3/2/07	Lot 17	31687	1487.0	11.1	117.1	90.1	SC	A
30	3/2/07	Lot 18	31687	1489.0	10.8	124.0	91.1	ND	D
31	3/2/07	Lot 17	31687	1490.0	8.0	123.2	92.6	ND	B
32	3/2/07	Lot 14	31687	1483.0	10.3	118.2	90.9	ND	A
33	3/5/07	Lot 17	31687	1485.0	9.6	127.1	95.6	ND	B
34	3/5/07	Lot 16	31687	1491.0	10.7	122.7	90.2	ND	D
35	3/5/07	Lot 14	31687	1484.0	13.7	120.0	92.3	ND	A
36	3/5/07	Lot 24	31687	1482.0	12.8	121.1	93.1	ND	A
37	3/5/07	Lot 15	31687	1478.0	11.2	124.0	91.1	ND	D
BT-38	3/5/07	Lot 20	31687	1481.5	5.3	115.4		ND	
BT-39	3/5/07	Lot 20	31687	1484.5	6.4	114.5		ND	
BT-40	3/5/07	Lot 21	31687	1485.0	2.7	113.0		ND	
BT-41	3/5/07	Lot 22	31687	1486.0	8.6	123.1		ND	
BT-42	3/5/07	Lot 22	31687	1485.5	5.9	122.6		ND	
BT-43	3/5/07	Lot 21	31687	1483.0	7.8	118.1		ND	
44	3/5/07	Lot 17	31687	1490.0	9.1	118.3	91.0	ND	A
45	3/5/07	Lot 16	31687	1485.0	9.9	117.6	90.5	ND	A
46	3/5/07	Lot 18	31687	1478.0	10.7	125.6	92.3	ND	D
47	3/5/07	Lot 14	31687	1478.0	10.0	121.4	91.3	SC	B
48	3/5/07	Lot 15	31687	1481.0	10.5	118.1	90.8	SC	A
49	3/5/07	Adjacent Lot 24	31687	1483.0	8.9	128.1	94.1	ND	D

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
50	3/5/07	Lot 23	31687	1484.0	10.2	125.5	92.2	ND	D
51	3/5/07	Lot 24	31687	1482.0	11.9	123.5	90.8	ND	D
52	3/6/07	Lot 16	31687	1490.0	12.8	121.8	91.5	ND	B
53	3/6/07	Lot 18	31687	1496.0	8.0	130.8	96.1	ND	D
54	3/6/07	Lot 14	31687	1488.0	8.3	124.1	91.2	ND	D
55	3/6/07	Lot 15	31687	1489.0	12.6	117.7	90.5	ND	A
56	3/6/07	Lot 17	31687	1493.0	12.0	119.0	91.5	ND	A
57	3/6/07	Lot 18	31687	1488.0	10.1	119.7	92.0	ND	A
58	3/6/07	Lot 16	31687	1487.0	11.5	119.2	91.6	ND	A
59	3/6/07	Lot 14	31687	1480.0	10.2	121.5	91.3	SC	B
60	3/6/07	Adjacent Lot 14	31687	1480.0	11.4	118.8	91.3	SC	A
61	3/6/07	Lot 17	31687	1488.0	12.1	120.7	90.7	ND	B
62	3/6/07	Lot 24	31687	1483.0	9.7	113.6	85.4	ND	B
62	3/6/07	Lot 24	31687	1483.0	11.9	120.7	90.7	ND	B
63	3/6/07	Lot 24	31687	1484.0	11.5	125.8	92.5	ND	D
64	3/6/07	Lot 23	31687	1486.0	11.1	121.5	91.3	ND	B
BT-65	3/7/07	Lot 61	31687	1475.5	7.1	120.5		ND	
BT-66	3/7/07	Lot 60	31687	1476.0	9.5	116.1		ND	
67	3/7/07	Lot 15	31687	1484.0	12.4	120.4	90.5	ND	B
68	3/7/07	Lot 14	31687	1487.0	11.5	123.2	92.6	ND	B
69	3/7/07	Lot 24	31687	1485.0	10.4	120.6	90.6	ND	B
70	3/7/07	Lot 18	31687	1491.0	10.7	124.7	91.7	ND	D
71	3/7/07	Lot 16	31687	1487.0	8.1	126.3	91.8	ND	D
72	3/7/07	Lot 18	31687	1494.0	10.0	122.6	92.2	SC	B
73	3/7/07	Lot 23	31687	1487.0	11.1	119.3	91.7	SC	A
74	3/7/07	Lot 16	31687	1493.0	9.6	126.9	93.3	ND	D
75	3/7/07	Lot 17	31687	1494.0	11.2	119.7	92.0	ND	A
76	3/7/07	Lot 15	31687	1491.0	9.9	127.0	93.3	ND	D
77	3/7/07	Lot 23	31687	1488.0	10.3	121.1	91.0	ND	B
78	3/8/07	Lot 14	31687	1484.0	12.5	120.0	92.3	ND	A
79	3/8/07	Lot 15	31687	1491.0	10.3	122.7	92.2	ND	B
80	3/8/07	Lot 24	31687	1486.0	12.0	118.5	91.1	ND	A
81	3/8/07	Lot 23	31687	1485.0	10.7	122.7	92.2	ND	B
82	3/8/07	Lot 22	31687	1485.0	12.6	121.8	91.5	ND	B
83	3/8/07	Lot 23	31687	1487.0	11.3	122.5	90.0	ND	D
84	3/8/07	Lot 24	31687	1488.0	8.3	122.2	91.8	ND	B
85	3/8/07	Lot 22	31687	1486.0	11.6	121.9	91.6	ND	B
86	3/8/07	Lot 21	31687	1486.0	10.1	119.9	90.1	ND	B
87	3/8/07	Lot 17	31687	1495.0	13.3	118.8	91.4	SC	A
88	3/8/07	Lot 16	31687	1493.0	9.6	124.1	91.2	SC	D
89	3/8/07	Lot 14	31687	1489.0	9.5	119.0	91.5	ND	A
BT-90	3/9/07	Lot 61	31687	1473.0	9.3	119.3		ND	
BT-91	3/9/07	Lot 60	31687	1474.5	10.2	122.0		ND	
BT-92	3/9/07	Lot 59	31687	1471.5	5.7	111.4		ND	
BT-93	3/9/07	Lot 58	31687	1470.5	7.8	123.2		ND	
BT-94	3/9/07	Lot 57	31687	1470.5	9.9	116.5		ND	
BT-95	3/9/07	Lot 56	31687	1469.5	8.8	110.8		ND	
BT-96	3/9/07	Lot 55	31687	1469.5	9.0	114.8		ND	
BT-97	3/9/07	Lot 55	31687	1470.5	4.5	134.7		ND	

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
BT-98	3/9/07	Lot 58	31687	1473.5	4.6	114.4		ND	
BT-99	3/9/07	Lot 57	31687	1473.5	10.1	118.4		ND	
BT-100	3/9/07	Lot 56	31687	1471.5	6.7	132.2		ND	
BT-101	3/9/07	Lot 59	31687	1472.0	7.8	118.1		ND	
102	3/9/07	Lot 20	31687	1787.0	10.3	122.5	90.7	ND	C
103	3/9/07	Lot 22	31687	1488.0	8.1	121.1	91.0	ND	B
104	3/9/07	Lot 23	31687	1489.0	11.8	121.7	91.5	ND	B
105	3/9/07	Lot 24	31687	1490.0	11.3	124.4	92.1	ND	C
106	3/9/07	Lot 17	31687	1496.0	9.0	118.2	90.9	ND	A
107	3/9/07	Lot 15	31687	1492.0	12.1	121.6	91.4	ND	B
108	3/9/07	Lot 14	31687	1488.0	12.8	117.0	90.0	ND	A
109	3/9/07	Lot 16	31687	1494.0	9.0	121.7	91.5	SC	B
110	3/9/07	Lot 21	31687	1486.0	9.2	121.4	91.2	ND	B
111	3/9/07	Lot 20	31687	1488.0	10.4	123.7	93.0	ND	B
112	3/9/07	Lot 22	31687	1489.0	8.1	121.8	91.5	SC	B
113	3/9/07	Lot 23	31687	1490.0	11.1	119.1	91.6	SC	A
114	3/12/07	Lot 17	31687	1496.0	11.2	117.3	90.2	ND	A
115	3/12/07	Lot 18	31687	1498.0	10.4	125.2	92.0	ND	D
116	3/12/07	Lot 15	31687	1490.0	11.1	123.4	90.7	ND	D
117	3/12/07	Lot 16	31687	1494.0	11.7	122.4	92.0	ND	B
118	3/12/07	Lot 14	31687	1490.0	11.1	120.8	90.8	SC	B
119	3/12/07	Lot 16	31687	1495.0	9.5	124.3	91.3	ND	D
120	3/12/07	Lot 17	31687	1498.0	10.7	122.8	90.2	ND	D
121	3/12/07	Lot 18	31687	1500.0	10.5	123.9	91.1	ND	D
122	3/12/07	Lot 18	31687	1502.0	10.4	123.1	90.5	ND	D
123	3/12/07	Lot 23	31687	1490.0	10.6	124.9	91.8	ND	D
124	3/12/07	Lot 22	31687	1488.0	11.4	123.9	91.1	ND	D
125	3/12/07	Lot 21	31687	1487.0	10.9	126.6	93.0	ND	D
126	3/12/07	Lot 20	31687	1487.0	10.8	120.1	90.3	SC	B
BT-127	3/13/07	Lot 19	31687	1482.0	9.7	117.7		ND	
BT-128	3/13/07	Lot 19	31687	1479.5	3.4	112.5		ND	
BT-129	3/13/07	Lot 67	31687	1481.5	10.2	121.5		ND	
130	3/13/07	Lot 61	31687	1475.0	10.6	121.1	91.0	ND	B
131	3/13/07	Lot 59	31687	1474.0	9.7	122.1	93.9	ND	A
132	3/13/07	Lot 57	31687	1472.0	11.6	124.0	93.2	ND	B
133	3/13/07	Lot 55	31687	1472.0	10.1	123.8	91.0	ND	D
134	3/13/07	Lot 19	31687	1484.0	10.4	120.1	92.4	ND	A
135	3/13/07	Lot 21	31687	1489.0	10.0	123.8	93.1	ND	B
136	3/13/07	Lot 67	31687	1484.0	10.8	118.4	91.1	ND	A
137	3/14/07	Lot 20	31687	1489.0	11.2	125.4	92.9	ND	C
138	3/14/07	Lot 22	31687	1491.0	10.6	123.9	91.8	ND	C
139	3/14/07	Lot 19	31687	1481.0	8.5	124.2	92.0	ND	C
140	3/14/07	Lot 23	31687	1492.0	9.0	122.6	90.8	ND	C
141	3/14/07	Lot 19	31687	1485.0	9.3	125.3	92.8	ND	C
142	3/14/07	Lot 21	31687	1491.0	9.7	126.1	93.4	ND	C
143	3/14/07	Lot 67	31687	1486.0	8.6	122.0	91.7	ND	B
144	3/15/07	Lot 22	31687	1492.0	8.5	120.9	90.9	ND	B
145	3/15/07	Lot 21	31687	1492.0	10.3	127.2	93.5	ND	D
146	3/15/07	Lot 20	31687	1491.0	13.1	118.0	90.8	ND	A

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
147	3/15/07	Lot 19	31687	1487.0	9.6	127.4	93.6	ND	D
BT-148	3/15/07	Adjacent Lot 30	31687	1478.5	11.4	121.3		ND	
BT-149	3/15/07	Adjacent Lot 30	31687	1478.5	12.5	111.6		ND	
BT-150	3/15/07	Lot 67	31687	1479.0	12.0	122.8		ND	
151	3/15/07	Lot 21	31687	1493.0	8.6	121.9	90.3	ND	C
152	3/15/07	Lot 20	31687	1492.0	8.8	124.6	92.3	ND	C
153	3/15/07	Lot 19	31687	1489.0	8.7	122.2	90.5	SC	C
154	3/15/07	Lot 56	31687	1473.0	12.2	122.7	92.2	SC	B
155	3/15/07	Lot 58	31687	1474.0	10.1	125.8	92.5	ND	D
156	3/15/07	Lot 57	31687	1472.0	9.0	118.4	91.0	ND	A
157	3/15/07	Lot 59	31687	1473.0	10.2	121.2	91.1	ND	B
BT-158	3/16/07	Lot 29	31687	1475.0	10.2	121.6		ND	
BT-159	3/16/07	Lot 30	31687	1473.0	4.9	111.9		ND	
BT-160	3/16/07	Lot 29	31687	1473.5	9.4	118.6		ND	
BT-161	3/16/07	Lot 28	31687	1474.5	7.8	118.2		ND	
BT-162	3/16/07	Lot 28	31687	1474.5	7.6	107.6		ND	
BT-163	3/16/07	Lot 27	31687	1476.5	4.9	110.4		ND	
BT-164	3/16/07	Lot 27	31687	1476.5	13.1	111.6		ND	
BT-165	3/16/07	Lot 26	31687	1477.5	7.1	112.7		ND	
BT-166	3/16/07	Lot 26	31687	1477.5	12.3	111.6		ND	
BT-167	3/16/07	Lot 25	31687	1478.5	10.9	117.0		ND	
BT-168	3/16/07	Lot 25	31687	1478.5	11.6	108.1		ND	
BT-169	3/16/07	Lot 13	31687	1476.5	14.8	110.6		ND	
BT-170	3/16/07	Lot 13	31687	1472.5	12.5	115.5		ND	
BT-171	3/16/07	Lot 13	31687	1474.5	4.3	126.1		ND	
BT-172	3/16/07	Lot 12	31687	1473.5	6.6	129.3		ND	
BT-173	3/16/07	Lot 12	31687	1475.5	3.6	133.1		ND	
BT-174	3/16/07	Lot 11	31687	1474.5	5.4	116.6		ND	
BT-175	3/16/07	Lot 10	31687	1474.5	4.1	132.7		ND	
BT-176	3/16/07	Lot 10	31687	1475.5	3.9	127.4		ND	
BT-177	3/16/07	Lot 9	31687	1473.5	3.6	136.3		ND	
BT-178	3/16/07	Lot 8	31687	1471.5	4.1	115.9		ND	
BT-179	3/16/07	Lot 8	31687	1472.5	8.6	120.9		ND	
BT-180	3/16/07	Lot 9	31687	1473.5	6.9	119.5		ND	
181	3/16/07	Lot 59	31687	1473.0	8.0	124.0	91.1	ND	D
182	3/16/07	Lot 60	31687	1474.0	10.2	125.1	91.9	ND	D
183	3/16/07	Lot 61	31687	1476.0	9.0	120.4	90.5	ND	B
184	3/16/07	Lot 60	31687	1475.0	10.2	123.1	90.5	SC	D
185	3/16/07	Lot 61	31687	1476.0	11.1	126.0	92.6	SC	D
186	3/16/07	Lot 19	31687	1489.0	8.5	123.7	91.6	ND	C
187	3/16/07	Lot 19	31687	1489.0	9.6	120.9	90.9	ND	B
188	3/16/07	Lot 29	31687	1477.0	10.4	122.4	92.0	ND	B
189	3/16/07	Lot 30	31687	1478.0	12.5	117.8	90.6	ND	A
190	3/16/07	Lot 67	31687	1479.0	10.7	118.8	91.3	ND	A
191	3/16/07	Lot 20	31687	1493.0	8.4	121.3	91.2	ND	B
192	3/19/07	Lot 55	31687	1473.0	9.8	120.5	90.6	ND	B
193	3/19/07	Lot 56	31687	1474.0	11.3	118.7	91.3	ND	A
194	3/19/07	Lot 57	31687	1475.0	10.2	121.1	91.0	ND	B
195	3/19/07	Lot 19	31687	1491.0	9.5	122.7	90.2	ND	D

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
196	3/19/07	Lot 30	31687	1481.0	11.8	120.2	90.3	ND	B
197	3/19/07	Lot 67	31687	1482.0	10.5	122.3	91.9	ND	B
198	3/19/07	Lot 67	31687	1484.0	10.0	122.4	92.0	SC	B
199	3/19/07	Lot 19	31687	1493.0	12.9	122.3	92.0	ND	B
200	3/19/07	Lot 19	31687	1495.0	10.9	120.8	90.8	ND	B
201	3/19/07	Lot 29	31687	1488.0	10.5	118.1	90.8	ND	A
202	3/20/07	Lot 19	31687	1496.0	11.1	117.3	90.2	ND	A
203	3/20/07	Lot 19	31687	1497.0	10.7	120.6	90.6	ND	B
204	3/20/07	Lot 29	31687	1490.0	11.1	120.2	90.3	ND	B
205	3/20/07	Lot 30	31687	1486.0	9.9	118.1	90.8	ND	A
206	3/20/07	Lot 61	31687	1478.0	10.6	121.2	91.1	ND	B
207	3/20/07	Lot 60	31687	1477.0	9.0	124.2	91.3	ND	D
208	3/20/07	Lot 58	31687	1478.0	12.4	123.6	90.8	ND	D
209	3/20/07	Lot 59	31687	1478.0	12.4	119.3	91.7	ND	A
210	3/20/07	Lot 55	31687	1475.0	12.4	119.9	90.2	ND	B
211	3/20/07	Lot 56	31687	1476.0	11.5	119.1	91.6	ND	A
212	3/20/07	Lot 57	31687	1477.0	10.1	123.4	90.7	ND	D
213	3/20/07	Lot 57	31687	1476.0	11.3	119.9	90.1	ND	B
214	3/20/07	Lot 58	31687	1477.0	13.2	118.4	91.0	ND	A
215	3/20/07	Lot 59	31687	1479.0	10.5	125.7	92.4	SC	D
216	3/20/07	Lot 60	31687	1479.0	10.2	121.8	91.6	SC	B
217	3/21/07	Lot 55	31687	1477.0	11.6	119.5	91.9	ND	A
218	3/21/07	Lot 56	31687	1478.0	8.0	122.5	92.1	ND	B
219	3/21/07	Lot 57	31687	1479.0	11.7	120.4	90.5	ND	B
BT-220	3/21/07	Lot 29	31687	1471.5	12.9	118.6		ND	
BT-221	3/21/07	Lot 29	31687	1471.5	9.2	113.0		ND	
BT-222	3/21/07	Lot 30	31687	1469.5	11.8	112.7		ND	
BT-223	3/21/07	Lot 31	31687	1468.5	10.4	124.7		ND	
BT-224	3/21/07	Lot 31	31687	1468.5	11.9	116.7		ND	
BT-225	3/21/07	Lot 31	31687	1468.5	11.5	120.6		ND	
BT-226	3/21/07	Lot 30	31687	1470.5	9.4	112.9		ND	
BT-227	3/21/07	Lot 30	31687	1469.5	12.2	116.4		ND	
BT-228	3/21/07	Lot 29	31687	1471.5	10.5	115.9		ND	
229	3/21/07	Lot 58	31687	1479.0	8.5	123.0	90.4	ND	D
230	3/21/07	Lot 57	31687	1480.0	9.6	114.6	85.5	ND	E
231	3/21/07	Lot 56	31687	1479.0	9.6	114.6	88.1	ND	A
232	3/21/07	Lot 13	31687	1474.0	11.1	115.1	86.5	ND	B
233	3/21/07	Lot 12	31687	1476.0	11.2	124.5	91.5	ND	D
234	3/21/07	Lot 10	31687	1476.0	10.4	118.7	91.3	ND	A
230	3/22/07	Lot 57	31687	1480.0	11.1	122.8	91.6	ND	E
231	3/22/07	Lot 56	31687	1479.0	9.6	117.8	90.6	ND	A
232	3/22/07	Lot 13	31687	1474.0	10.2	120.1	90.3	ND	B
235	3/22/07	Lot 9	31687	1476.0	9.7	121.0	90.9	ND	B
236	3/22/07	Lot 11	31687	1476.0	12.4	120.4	90.5	ND	B
237	3/22/07	Lot 13	31687	1475.0	11.9	121.0	90.9	ND	B
238	3/22/07	Lot 10	31687	1477.0	12.7	117.3	90.2	ND	A
239	3/22/07	Lot 8	31687	1474.0	11.9	122.0	91.7	ND	B
BT-240	3/22/07	Lot 6	31687	1466.5	7.3	112.0		ND	
BT-241	3/22/07	Lot 5	31687	1464.5	10.8	114.5		ND	

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
BT-242	3/22/07	Lot 4	31687	1461.5	6.2	114.2		ND	
BT-243	3/22/07	Lot 3	31687	1458.5	10.5	115.6		ND	
BT-244	3/22/07	Lot 3	31687	1459.0	12.0	110.3		ND	
BT-245	3/22/07	Lot 4	31687	1463.5	7.8	124.5		ND	
BT-246	3/22/07	Lot 5	31687	1463.5	6.3	131.7		ND	
BT-247	3/22/07	Lot 6	31687	1466.0	6.6	122.6		ND	
BT-248	3/22/07	Lot 44	31687	1462.5	10.1	117.1		ND	
BT-249	3/22/07	Lot 45	31687	1462.5	8.8	113.4		ND	
BT-250	3/22/07	Lot 46	31687	1463.5	14.6	107.8		ND	
BT-251	3/22/07	Lot 46	31687	1459.5	13.2	111.9		ND	
BT-252	3/22/07	Lot 45	31687	1459.5	6.6	121.5		ND	
BT-253	3/22/07	Lot 44	31687	1458.5	9.2	119.3		ND	
BT-254	3/22/07	Lot 44	31687	1460.0	8.9	118.5		ND	
255	3/22/07	Lot 26	31687	1479.0	10.8	122.9	91.7	ND	E
256	3/22/07	Lot 27	31687	1477.0	11.7	120.6	90.6	ND	B
257	3/22/07	Lot 29	31687	1473.0	12.2	122.4	91.3	ND	E
258	3/22/07	Lot 30	31687	1471.0	12.5	118.7	91.3	ND	A
BT-259	3/23/07	Lot 47	31687	1460.5	8.0	120.3		ND	
BT-260	3/23/07	Lot 64	31687	1466.5	12.9	117.0		ND	
BT-261	3/23/07	Lot 65	31687	1465.5	8.9	120.2		ND	
BT-262	3/23/07	Lot 48	31687	1465.5	10.3	119.4		ND	
BT-263	3/23/07	Lot 47	31687	1464.5	10.1	113.7		ND	
BT-264	3/23/07	Lot 48	31687	1461.5	9.3	117.5		ND	
BT-265	3/23/07	Lot 65	31687	1462.5	9.2	119.0		ND	
BT-266	3/23/07	Lot 65	31687	1464.5	11.3	120.0		ND	
BT-267	3/23/07	Lot 64	31687	1467.5	11.8	116.9		ND	
BT-268	3/23/07	Lot 64	31687	1466.5	5.9	114.9		ND	
BT-269	3/23/07	Lot 49	31687	1464.5	12.1	114.5		ND	
270	3/23/07	Lot 46	31687	1461.0	11.6	121.2	91.1	ND	B
271	3/23/07	Lot 45	31687	1463.0	10.6	120.8	90.8	ND	B
272	3/23/07	Lot 44	31687	1463.0	12.1	118.7	91.3	ND	A
273	3/23/07	Lot 3	31687	1460.0	10.9	121.9	91.6	ND	B
274	3/23/07	Lot 4	31687	1462.0	11.1	122.2	91.8	ND	B
275	3/26/07	Lot 45	31687	1462.0	12.1	120.3	90.5	ND	B
276	3/26/07	Lot 44	31687	1463.0	10.2	119.8	90.0	ND	B
277	3/26/07	Lot 4	31687	1463.0	12.0	122.8	91.6	ND	E
278	3/26/07	Lot 46	31687	1461.0	12.5	120.4	90.5	ND	B
279	3/26/07	Lot 44	31687	1461.0	11.1	123.2	91.9	ND	E
280	3/26/07	Lot 3	31687	1460.0	11.2	124.4	92.8	ND	E
281	3/26/07	Lot 9	31687	1482.0	11.6	117.2	90.1	ND	A
282	3/26/07	Lot 10	31687	1485.0	10.7	119.9	90.1	ND	B
283	3/26/07	Lot 46	31687	1463.0	8.6	123.7	90.9	ND	D
284	3/26/07	Lot 44	31687	1460.0	10.4	117.4	90.3	ND	A
285	3/26/07	Lot 45	31687	1461.0	10.5	120.7	90.8	SC	B
286	3/26/07	Lot 45	31687	1463.0	12.4	120.5	90.6	SC	B
287	3/26/07	Lot 4	31687	1464.0	9.1	125.6	92.4	ND	D
288	3/26/07	Lot 44	31687	1462.0	11.1	123.4	92.0	ND	E
289	3/27/07	Lot 13	31687	1477.0	10.1	125.8	92.5	ND	D
290	3/27/07	Lot 12	31687	1470.0	8.7	124.4	91.4	ND	D

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
291	3/27/07	Lot 11	31687	1478.0	9.1	124.1	91.2	ND	D
292	3/27/07	Lot 65	31687	1465.0	9.3	119.3	91.7	ND	A
293	3/27/07	Lot 48	31687	1464.0	11.4	119.4	91.8	ND	A
294	3/27/07	Lot 48	31687	1463.0	11.3	122.0	91.0	ND	E
295	3/27/07	Lot 47	31687	1464.0	12.3	118.7	91.3	ND	A
296	3/27/07	Lot 64	31687	1467.0	9.6	120.6	90.6	SC	B
297	3/27/07	Lot 49	31687	1466.0	8.7	123.8	91.0	SC	D
298	3/27/07	Lot 46	31687	1467.0	11.6	122.0	91.7	ND	B
299	3/27/07	Lot 45	31687	1466.0	12.5	119.3	91.7	ND	A
300	3/27/07	Lot 44	31687	1464.0	10.6	123.3	92.0	ND	E
301	3/27/07	Lot 4	31687	1464.0	11.1	126.5	93.0	ND	D
302	3/27/07	Lot 64	31687	1468.0	9.7	123.1	90.5	ND	D
303	3/28/07	Lot 47	31687	1466.0	8.5	126.0	92.6	ND	D
304	3/28/07	Lot 48	31687	1467.0	12.3	122.3	91.2	ND	E
305	3/28/07	Lot 45	31687	1464.0	12.1	117.5	90.3	ND	A
306	3/28/07	Lot 44	31687	1463.0	10.5	123.2	90.9	ND	E
BT-307	3/28/07	Lot 7	31687	1466.0	4.7	125.3		ND	
BT-308	3/28/07	Lot 7	31687	1470.5	5.7	132.2		ND	
BT-309	3/28/07	Lot 63	31687	1468.5	12.0	116.1		ND	
BT-310	3/28/07	Lot 63	31687	1467.5	8.9	121.5		ND	
BT-311	3/28/07	Lot 49	31687	1467.0	11.7	112.0		ND	
BT-312	3/28/07	Lot 50	31687	1469.5	10.9	109.1		ND	
BT-313	3/28/07	Lot 49	31687	1468.5	7.6	124.1		ND	
BT-314	3/28/07	Lot 50	31687	1469.5	7.3	114.4		ND	
BT-315	3/28/07	Lot 62	31687	1469.5	10.7	114.5		ND	
BT-316	3/28/07	Lot 62	31687	1468.5	9.9	105.8		ND	
317	3/28/07	Lot 65	31687	1467.0	9.5	121.2	91.1	ND	B
318	3/28/07	Lot 48	31687	1466.0	11.0	122.9	91.7	ND	E
319	3/28/07	Lot 47	31687	1464.0	11.3	120.4	90.5	ND	B
320	3/28/07	Lot 46	31687	1465.0	10.5	121.5	90.7	SC	E
321	3/28/07	Lot 13	31687	1479.0	10.7	121.5	91.3	SC	B
322	3/28/07	Lot 12	31687	1479.0	9.7	118.6	91.2	SC	A
323	3/28/07	Lot 3	31687	1463.0	9.3	118.1	90.8	SC	A
324	3/28/07	Lot 4	31687	1464.0	9.6	117.9	90.6	SC	A
325	3/29/07	Lot 46	31687	1467.0	9.3	127.3	93.6	ND	D
326*	3/29/07	Lot 47	31687	1466.0	11.8	114.8	88.3	ND	A
326A	3/29/07	Lot 47	31687	1466.0	10.7	118.1	90.8	ND	A
327	3/29/07	Lot 48	31687	1468.0	10.4	126.2	92.7	ND	D
328	3/29/07	Lot 45	31687	1466.0	10.3	117.5	90.3	ND	A
329	3/29/07	Lot 44	31687	1465.0	9.6	118.1	90.8	ND	A
330	3/29/07	Lot 65	31687	1467.0	11.6	117.3	90.2	ND	A
331	3/29/07	Lot 64	31687	1469.0	9.6	124.5	93.6	ND	B
332	3/29/07	Lot 49	31687	1469.0	9.8	120.9	90.9	ND	B
333	3/29/07	Lot 49	31687	1468.0	10.0	124.0	92.5	ND	E
334	3/29/07	Lot 50	31687	1469.0	11.6	120.0	90.2	ND	B
335	3/29/07	Lot 48	31687	1466.0	10.0	121.6	90.7	SC	E
336	3/29/07	Lot 47	31687	1467.0	9.6	120.8	90.8	SC	B
337	3/29/07	Lot 8	31687	1474.0	9.4	117.6	90.4	ND	A
BT-338	3/30/07	Lot 1	31687	1455.5	7.1	115.1		ND	

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
BT-339	3/30/07	Lot 2	31687	1457.0	12.4	117.5		ND	
BT-340	3/30/07	Lot 2	31687	1457.0	11.8	118.8		ND	
BT-341	3/30/07	Lot 1	31687	1455.5	9.1	115.7		ND	
BT-342	3/30/07	Lot 43	31687	1459.5	11.1	117.1		ND	
BT-343	3/30/07	Lot 42	31687	1459.5	10.9	120.0		ND	
BT-344	3/30/07	Lot 41	31687	1462.5	7.2	121.2		ND	
BT-345	3/30/07	Lot 40	31687	1462.5	8.8	126.5		ND	
BT-346	3/30/07	Lot 40	31687	1463.5	8.4	115.7		ND	
BT-347	3/30/07	Lot 41	31687	1462.5	5.9	106.9		ND	
BT-348	3/30/07	Lot 42	31687	1461.5	10.6	116.8		ND	
BT-349	3/30/07	Lot 43	31687	1459.5	11.2	112.3		ND	
350	3/30/07	Lot 62	31687	1470.0	9.0	122.6	92.1	ND	B
351	3/30/07	Lot 63	31687	1469.0	8.0	121.4	91.2	ND	B
352	3/30/07	Lot 64	31687	1470.0	10.9	118.3	91.0	ND	A
353	3/30/07	Lot 48	31687	1470.0	12.9	119.6	92.0	ND	A
354	3/30/07	Lot 46	31687	1469.0	9.6	120.7	90.7	ND	B
355	3/30/07	Lot 65	31687	1468.0	10.8	121.5	90.6	ND	E
356	3/30/07	Lot 48	31687	1468.0	9.1	120.1	90.3	ND	B
357	3/30/07	Lot 47	31687	1469.0	9.5	128.3	94.3	ND	D
358	3/30/07	Lot 45	31687	1468.0	10.0	120.7	90.0	SC	E
359	3/30/07	Lot 44	31687	1467.0	9.3	123.9	91.1	SC	D
360	3/30/07	Lot 50	31687	1470.0	10.7	117.4	90.3	ND	A
361	3/30/07	Lot 49	31687	1469.0	12.3	119.1	91.6	ND	A
362	3/30/07	Lot 18	31687	1504.0	8.2	122.7	92.2	ND	B
363	3/30/07	Lot 17	31687	1499.0	9.8	128.2	94.3	ND	D
364	3/30/07	Lot 16	31687	1496.0	8.5	123.0	92.5	ND	B
365	3/30/07	Lot 15	31687	1495.5	8.5	119.3	91.8	ND	A
366	3/30/07	Lot 14	31687	1492.5	8.8	126.6	93.1	ND	D
BT-367	4/2/07	Lot 34	31687	1470.0	10.1	116.6		ND	
BT-368	4/2/07	Lot 35	31687	1469.5	7.5	125.3		ND	
BT-369	4/2/07	Lot 36	31687	1469.5	6.1	114.2		ND	
370	4/2/07	Lot 28	31687	1476.0	10.8	122.5	90.0	ND	D
371	4/2/07	Lot 26	31687	1478.0	9.6	126.6	93.0	ND	D
372	4/2/07	Lot 25	31687	1479.0	10.1	129.1	94.9	ND	D
373	4/2/07	Lot 48	31687	1470.0	10.5	118.9	91.4	ND	A
374	4/2/07	Lot 47	31687	1470.0	11.1	119.6	92.0	ND	A
375	4/2/07	Lot 46	31687	1469.0	11.9	122.1	91.8	ND	B
376	4/2/07	Lot 44	31687	1468.0	14.9	117.3	90.2	ND	A
377	4/2/07	Lot 64	31687	1470.0	13.2	120.4	90.5	ND	B
378	4/2/07	Lot 63	31687	1471.0	9.1	126.0	92.6	ND	D
379	4/2/07	Lot 49	31687	1470.0	8.3	122.8	90.2	ND	D
380	4/2/07	Lot 50	31687	1471.0	11.1	121.9	91.7	SC	B
381	4/2/07	Lot 62	31687	1471.0	9.3	120.5	90.6	SC	B
BT-382	4/3/07	Lot 37	31687	1467.5	9.6	1262.0		ND	
383	4/3/07	Slope Lot 10	31687	1494.0	10.6	121.8	91.5	ND	B
384	4/3/07	Slope Lot 10	31687	1490.0	9.9	127.6	93.8	ND	D
385	4/3/07	Slope Lot 11	31687	1485.0	9.6	119.9	90.1	ND	B
386	4/3/07	Slope Lot 12	31687	1488.0	9.1	118.7	91.3	ND	A
387	4/3/07	Lot 49	31687	1471.0	9.7	119.0	91.5	ND	A

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
388	4/3/07	Lot 50	31687	1472.0	12.5	118.2	90.9	ND	A
BT-389	4/3/07	Lot 31	31687	1476.5	5.8	117.8		ND	
BT-390	4/3/07	Lot 32	31687	1474.5	9.6	120.5		ND	
BT-391	4/3/07	Lot 33	31687	1473.5	6.9	117.4		ND	
392	4/3/07	Lot 46	31687	1470.0	9.3	127.0	93.4	ND	D
393	4/3/07	Lot 47	31687	1471.0	12.5	119.1	91.6	ND	A
394	4/3/07	Lot 48	31687	1472.0	12.1	120.9	90.9	ND	B
395	4/3/07	Lot 45	31687	1469.0	10.5	119.5	91.9	SC	A
396	4/3/07	Lot 44	31687	1468.0	9.6	122.5	92.1	SC	B
397	4/3/07	Lot 19	31687	1494.0	8.1	118.4	91.1	ND	A
398	4/3/07	Lot 20	31687	1495.0	9.3	127.2	93.5	ND	D
399	4/3/07	Lot 21	31687	1495.0	8.6	125.6	92.3	ND	D
400	4/3/07	Lot 22	31687	1494.5	8.5	131.2	97.1	ND	C
401	4/3/07	Lot 23	31687	1493.5	9.8	130.1	96.3	ND	C
402	4/3/07	Lot 24	31687	1491.5	8.0	124.7	91.6	ND	D
403	4/4/07	Lot 32	31687	1475.0	9.7	124.4	91.4	ND	D
404	4/4/07	Lot 33	31687	1474.0	9.7	123.9	91.1	ND	D
405	4/4/07	Lot 45	31687	1472.0	10.2	124.1	92.6	ND	E
406	4/4/07	Lot 29	31687	1475.0	8.0	120.3	90.4	ND	B
BT-407	4/4/07	Lot 37	31687	1465.5	11.2	122.4		ND	
BT-408	4/4/07	Lot 36	31687	1466.5	8.0	125.0		ND	
BT-409	4/4/07	Lot 35	31687	1467.5	8.7	121.7		ND	
BT-410	4/4/07	Lot 34	31687	1468.5	10.4	118.7		ND	
BT-411	4/4/07	Lot 33	31687	1469.5	7.3	126.1		ND	
BT-412	4/4/07	Lot 32	31687	1468.5	8.7	110.6		ND	
BT-413	4/4/07	Lot 32	31687	1469.5	10.1	127.1		ND	
BT-414	4/4/07	Lot 33	31687	1469.5	10.1	124.9		ND	
BT-415	4/4/07	Lot 34	31687	1467.5	9.3	116.7		ND	
BT-416	4/4/07	Lot 35	31687	1467.5	11.7	119.8		ND	
BT-417	4/4/07	Lot 36	31687	1466.5	7.8	119.6		ND	
BT-418	4/4/07	Lot 37	31687	1466.0	10.3	120.5		ND	
BT-419	4/4/07	Lot 38	31687	1463.5	10.3	121.7		ND	
420	4/4/07	Lot 25	31687	1481.0	9.2	118.5	91.1	ND	A
421	4/4/07	Lot 27	31687	1479.0	9.2	122.4	92.0	ND	B
422	4/4/07	Lot 28	31687	1477.0	8.0	123.9	91.1	ND	D
423	4/4/07	Lot 36	31687	1474.0	8.6	124.1	91.9	ND	C
424	4/4/07	Lot 34	31687	1476.0	11.2	123.4	90.7	ND	D
425	4/4/07	Lot 33	31687	1478.0	9.3	121.9	90.2	ND	C
BT-426	4/4/07	Lot 38	31687	1464.5	9.0	121.1		ND	
427	4/4/07	Lot 37	31687	1475.0	8.7	123.0	91.1	SC	C
428	4/4/07	Lot 35	31687	1477.0	9.6	124.3	93.5	SC	B
429	4/4/07	Lot 33	31687	1480.0	10.1	124.1	91.3	ND	D
430	4/5/07	Lot 32	31687	1477.0	10.2	121.6	91.4	ND	B
431	4/5/07	Lot 34	31687	1480.0	9.8	121.9	91.6	ND	B
432	4/5/07	Lot 36	31687	1477.0	11.7	119.8	92.1	ND	A
433	4/5/07	Lot 37	31687	1475.0	12.1	117.9	90.6	ND	A
434	4/5/07	Lot 33	31687	1470.0	9.7	128.7	94.6	ND	D
435	4/5/07	Lot 34	31687	1468.0	13.1	119.6	92.0	ND	A
436	4/5/07	Lot 36	31687	1467.0	10.1	119.5	91.9	ND	A

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
437	4/5/07	Lot 37	31687	1466.0	13.5	118.5	91.1	ND	A
438*	4/6/07	Lot 26	31687	1481.0	9.7	110.6	85.0	ND	A
438A	4/6/07	Lot 26	31687	1481.0	10.1	118.3	91.0	ND	A
439	4/6/07	Lot 32	31687	1470.0	10.5	125.0	91.9	ND	D
440	4/6/07	Lot 35	31687	1468.0	10.8	121.2	91.1	ND	B
441	4/6/07	Lot 38	31687	1466.0	10.2	123.6	92.9	ND	B
442	4/6/07	Lot 38	31687	1470.0	11.1	122.2	91.1	ND	S
443	4/6/07	Lot 28	31687	1478.0	9.0	121.8	91.5	ND	B
444	4/6/07	Lot 27	31687	1480.0	10.3	117.5	90.3	ND	A
445	4/6/07	Lot 38	31687	1474.0	9.7	121.1	91.0	ND	B
446	4/6/07	Lot 30	31687	1473.0	9.8	122.2	91.8	ND	B
447	4/6/07	Lot 31	31687	1471.0	10.2	120.8	90.8	ND	B
448	4/6/07	Lot 29	31687	1473.0	8.6	122.8	92.3	ND	B
449	4/6/07	Lot 31	31687	1472.0	8.7	122.6	92.1	SC	B
450	4/6/07	Lot 38	31687	1466.0	9.3	117.0	90.0	ND	A
451	4/9/07	Lot 33	31687	1471.0	9.9	120.5	90.6	ND	B
452	4/9/07	Lot 36	31687	1469.0	12.0	117.5	90.3	ND	A
453	4/9/07	Lot 37	31687	1468.0	11.9	121.8	91.5	ND	B
454	4/9/07	Lot 34	31687	1470.0	12.1	121.6	91.4	ND	B
BT-455	4/9/07	Lot 51	31687	1469.5	9.5	122.9		ND	
BT-456	4/9/07	Lot 54	31687	1467.5	11.3	119.9		ND	
BT-457	4/9/07	Lot 53	31687	1467.5	10.1	116.2		ND	
BT-458	4/9/07	Lot 52	31687	1468.5	6.7	115.8		ND	
BT-459	4/9/07	Lot 51	31687	1469.5	10.3	107.8		ND	
BT-460	4/9/07	Lot 52	31687	1468.5	11.8	118.0		ND	
BT-461	4/9/07	Lot 53	31687	1467.5	6.9	115.1		ND	
BT-462	4/9/07	Lot 54	31687	1466.5	8.5	110.7		ND	
463	4/9/07	Lot 31	31687	1472.0	9.8	122.5	94.2	ND	A
464	4/9/07	Lot 30	31687	1472.0	9.2	118.0	90.8	ND	A
465	4/9/07	Lot 30	31687	1474.0	8.7	123.1	90.5	ND	D
466	4/9/07	Lot 29	31687	1475.0	11.9	119.8	90.0	ND	B
467	4/9/07	Lot 35	31687	1469.0	10.8	121.6	90.7	SC	E
468	4/9/07	Lot 38	31687	1467.0	11.1	119.8	90.0	SC	B
469	4/10/07	Lot 31	31687	1479.0	11.6	118.5	91.2	ND	A
BT-470	4/10/07	Lot 39	31687	1464.5	7.6	115.2		ND	
BT-471	4/10/07	Lot 39	31687	1461.8	9.7	116.2		ND	
472	4/10/07	Lot 32	31687	1482.0	9.1	117.3	90.2	ND	A
473	4/10/07	Lot 31	31687	1484.0	11.6	119.1	91.6	ND	A
474	4/10/07	Lot 31	31687	1486.0	9.1	117.6	90.4	ND	A
475	4/11/07	Lot 13	31687	FG	8.2	122.4	92.1	ND	B
476	4/11/07	Lot 12	31687	FG	8.4	121.5	91.4	ND	B
477	4/11/07	Lot 11	31687	FG	8.1	119.9	90.1	ND	B
478	4/11/07	Lot 10	31687	FG	8.7	128.6	94.5	ND	D
479	4/11/07	Lot 9	31687	FG	9.1	122.3	90.6	ND	C
480	4/11/07	Lot 55	31687	FG	8.0	123.7	90.9	ND	D
481	4/11/07	Lot 56	31687	FG	8.2	124.6	91.6	ND	D
482	4/11/07	Lot 57	31687	FG	8.6	122.4	92.1	ND	B
483	4/11/07	Lot 58	31687	FG	8.7	124.5	91.6	ND	D
484	4/11/07	Lot 59	31687	FG	8.3	125.3	92.2	ND	D

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
485	4/11/07	Lot 60	31687	FG	8.4	127.6	93.8	ND	D
486	4/11/07	Lot 61	31687	FG	10.2	117.9	90.7	ND	A
487	4/12/07	Lot 25	31687	1488.0	8.7	121.6	91.4	ND	B
488	4/12/07	Lot 26	31687	1486.0	9.3	119.9	92.2	ND	A
489	4/12/07	Lot 27	31687	1487.0	9.1	124.7	91.7	ND	D
490	4/12/07	Lot 28	31687	1490.0	9.2	121.9	91.6	ND	B
491	4/12/07	Lot 29	31687	1483.0	10.1	120.8	90.8	ND	B
492	4/12/07	Lot 28	31687	FG	8.2	125.3	94.2	ND	B
493	4/12/07	Lot 27	31687	FG	9.1	123.0	92.5	ND	B
494	4/12/07	Lot 26	31687	FG	8.1	120.8	90.8	ND	B
495	4/12/07	Lot 25	31687	FG	9.0	123.2	92.6	ND	B
496	4/12/07	Lot 39	31687	1463.0	8.8	124.2	91.3	ND	D
497	4/12/07	Lot 41	31687	1464.0	9.0	119.7	92.0	ND	A
498	4/12/07	Lot 42	31687	1461.0	9.9	120.6	90.6	ND	B
499	4/12/07	Lot 66	31687	1461.0	9.0	118.9	91.4	ND	A
500	4/12/07	Lot 40	31687	1463.0	9.3	121.5	91.3	ND	B
501	4/13/07	Lot 50	31687	FG	9.2	124.3	93.5	ND	B
502	4/13/07	Lot 49	31687	FG	8.1	123.3	92.7	ND	B
503	4/13/07	Lot 48	31687	FG	9.1	118.9	91.4	ND	A
504	4/13/07	Lot 47	31687	FG	9.0	123.6	92.9	ND	B
505	4/13/07	Lot 46	31687	FG	8.4	122.6	92.2	ND	B
506	4/13/07	Lot 45	31687	FG	9.2	125.9	92.6	ND	D
507	4/13/07	Lot 44	31687	FG	9.4	121.9	91.6	ND	B
508	4/13/07	Lot 66	31687	1459.0	12.6	119.9	90.1	ND	B
509	4/13/07	Lot 62	31687	FG	8.8	124.9	93.9	ND	B
510	4/13/07	Lot 63	31687	FG	10.4	118.9	91.4	ND	A
511	4/13/07	Lot 64	31687	FG	8.3	122.0	91.8	ND	B
512	4/13/07	Lot 65	31687	FG	9.9	126.3	92.8	ND	D
513	4/13/07	Lot 29	31687	1476.0	9.4	118.6	91.2	ND	A
514	4/16/07	Lot 30	31687	1475.0	8.7	124.0	91.2	ND	D
515	4/16/07	Lot 31	31687	1473.0	9.2	117.5	90.4	ND	A
516	4/16/07	Lot 32	31687	1472.0	10.3	125.1	93.3	ND	E
517	4/16/07	Lot 40	31687	1465.0	9.2	121.1	91.0	ND	B
518	4/16/07	Lot 42	31687	1464.0	10.5	119.6	92.0	ND	A
519	4/16/07	Lot 43	31687	1462.0	8.6	122.5	92.1	ND	B
520	4/16/07	Lot 39	31687	1464.0	8.6	124.5	91.6	ND	D
521	4/16/07	Lot 41	31687	1463.0	9.6	125.3	92.2	ND	D
522	4/17/07	Lot 29	31687	FG	9.9	131.3	96.5	ND	D
523	4/17/07	Lot 30	31687	FG	9.0	117.2	90.1	ND	A
524	4/17/07	Lot 31	31687	FG	9.0	122.9	92.4	ND	B
525	4/17/07	Lot 32	31687	FG	8.3	119.8	90.1	ND	B
526	4/17/07	Lot 33	31687	FG	8.6	130.4	95.8	ND	D
527	4/17/07	Lot 34	31687	FG	8.9	119.7	90.0	ND	B
528	4/17/07	Lot 35	31687	FG	8.6	127.0	93.3	ND	D
529	4/18/07	Lot 36	31687	FG	8.8	123.5	92.8	ND	B
530	4/18/07	Lot 37	31687	FG	8.9	122.6	92.1	ND	B
531	4/18/07	Lot 67	31687	1476.0	9.0	125.7	92.4	SC	D
532	4/18/07	Lot 67	31687	1479.0	8.7	121.8	91.5	SC	B
533	4/18/07	Lot 38	31687	FG	9.1	120.8	90.8	ND	B

Table 1

FIELD DENSITY TEST RESULTS

TEST NO.	DATE	TEST LOCATION	TRACT NO.	ELEV OR DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	REL COMP (%)	TEST METHOD	SOIL TYPE
534	4/18/07	Lot 41	31687	1464.0	10.2	121.0	90.9	ND	B
535	4/18/07	Lot 40	31687	1465.0	9.7	118.0	90.7	ND	A
536	4/18/07	Lot 39	31687	1466.0	9.0	125.5	92.3	ND	D
537	4/19/07	Lot 41	31687	1465.0	9.8	119.2	91.6	ND	A
538	4/19/07	Lot 42	31687	1463.0	9.7	119.4	91.8	ND	A
539	4/19/07	Lot 43	31687	1463.0	10.6	118.8	91.3	ND	A
540	4/19/07	Lot 66	31687	1461.0	8.8	119.9	90.1	ND	B
541	4/19/07	Lot 66	31687	1463.0	9.1	121.1	91.0	ND	B
542	4/20/07	Lot 42	31687	1465.0	9.2	118.5	91.2	ND	A
543	4/20/07	Lot 43	31687	1464.0	10.2	126.3	92.9	ND	D
544	4/20/07	Lot 66	31687	1460.0	9.1	122.1	91.8	ND	B
545	4/20/07	Lot 59	31687	FG	9.7	117.2	90.2	ND	A
546	4/20/07	Lot 40	31687	FG	9.9	119.2	91.7	ND	A
547	4/20/07	Lot 41	31687	FG	8.4	122.0	91.7	ND	B
548	4/20/07	Lot 42	31687	FG	10.3	125.5	92.2	ND	D
549	4/20/07	Lot 43	31687	FG	10.1	121.0	90.9	ND	B
550	4/25/07	Lot 67	31687	1479.0	11.1	118.8	91.3	ND	A
551	4/25/07	Lot 67	31687	1482.0	9.1	124.6	91.6	ND	D
552	4/25/07	Lot 67	31687	1480.0	8.9	122.1	91.8	ND	B
553	4/27/07	Adjacent Lot 4	31687	1463.0	9.9	119.3	91.7	ND	A
554	4/27/07	Adjacent Lot 66	31687	1460.0	8.2	121.1	91.0	ND	B
555	4/27/07	Adjacent Lot 1	31687	1458.0	8.1	124.6	91.6	ND	D
556	4/30/07	Foresrt Park Rd	31687	1462.0	8.8	124.0	91.8	ND	C
557	5/1/07	Lot 1	31687	1458.0	8.6	124.1	91.2	ND	D
558	5/2/07	Lot 2	31687	1459.0	8.4	124.4	91.4	ND	D

LEGEND

* = Failing Test
A = Retest
BT = Bottom Test
FG = Finish Grade
ND = Nuclear Densometer Test
SC = Sand Cone Test

APPENDIX E

SETTLEMENT ANALYSIS AND SEISMIC GROUND MOTION VALUES

STATIC SETTLEMENTS

ROCSCIENCE



Single-Family Residential Project, Romoland Area
GSI
Report Creation Date: 2026/02/17, 13:54:10

2ft of top compacted soil

W.O. 8978-A1-IE
Plate E-2

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W.O. 8978-A1-IE
Plate E-3

Settle3 Analysis Information

Single-Family Residential Project, Romoland Area

Project Settings

Document Name	8978-A 2ft-top
Project Title	Single-Family Residential Project, Romoland Area
Company	GSI
Date Created	2/17/2026, 11:51:30 AM
Last saved with Settle3 version	5.027
Stress Computation Method	Boussinesq
Stress Units	Imperial, stress as ksf
Settlement Units	inches

Advanced Settings

Start of secondary consolidation (% of primary)	95
Min. stress for secondary consolidation (% of initial)	1
Reset time when load changes for secondary consolidation	No
Minimum settlement ratio for subgrade modulus	0.9
Use average poisson's ratio to calculate layered stresses	
Update Cv in each time step (improves consolidation accuracy)	
Ignore negative effective stresses in settlement calculations	
Add field points to load edges	

Soil Profile

Layer Option	Horizontal Soil Layers
Vertical Axis	Depth below ground surface

W.O. 8978-A1-IE
Plate E-4

Results

Time taken to compute: 0 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.372152
Total Consolidation Settlement [in]	0	0
Virgin Consolidation Settlement [in]	0	0
Recompression Consolidation Settlement [in]	0	0
Immediate Settlement [in]	0	0.372152
Loading Stress ZZ [ksf]	0	12.5002
Loading Stress XX [ksf]	-0.155185	8.7686
Loading Stress YY [ksf]	-0.159038	8.74803
Total Stress ZZ [ksf]	0	12.7554
Total Stress XX [ksf]	0	8.8751
Total Stress YY [ksf]	0	8.85453
Modulus of Subgrade Reaction (Total) [ksf/ft]	0	267.687
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	0	267.687
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	0
Total Strain	0	0.0140628
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.00625	12.7544
Over-consolidation Ratio	1	1
Void Ratio	0	0
Hydroconsolidation Settlement [in]	0	0
Undrained Shear Strength	0	0.0675719

Loads

1. Rectangular Load: "Rectangular Load 1"

Length	40 ft
Width	1 ft
Rotation angle	0 degrees
Load Type	Flexible
Area of Load	40 ft2
Load	2 ksf
Depth	1 ft
Installation Stage	Stage 1

Coordinates

X [ft]	Y [ft]
-9.577	11.322
30.423	11.322
30.423	12.322
-9.577	12.322

2. Rectangular Load: "Square"

Length	2 ft
Width	2 ft
Rotation angle	0 degrees
Load Type	Flexible
Area of Load	4 ft2
Load	12.5 ksf
Depth	2 ft
Installation Stage	Stage 1

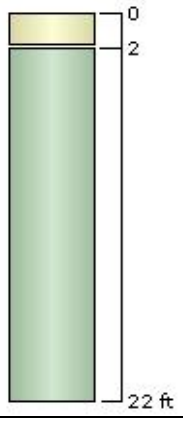
Coordinates

X [ft]	Y [ft]
8.874	1.769
10.874	1.769
10.874	3.769
8.874	3.769

W.O. 8978-A1-IE
Plate E-6

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Compacted Colluvium/Topsoil	2	0
2	Quaternary deposit	20	2



W.O. 8978-A1-IE
Plate E-7

Soil Properties

Property	Compacted Colluvium/Topsoil	Quaternary deposit
Color		
Unit Weight [kips/ft3]	0.125	0.13
K0	0.455	0.426
Immediate Settlement	Enabled	Enabled
Es [ksf]	400	1000
Esur [ksf]	400	1000
Undrained Su A [kips/ft2]	0	0
Undrained Su S	0.2	0.2
Undrained Su m	0.8	0.8

ROCSCIENCE



Single-Family Residential Project, Romoland Area
GSI
Report Creation Date: 2026/02/17, 13:59:25

6ft of top compacted soil

W.O. 8978-A1-IE
Plate E-9

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W.O. 8978-A1-IE
Plate E-10

Settle3 Analysis Information

Single-Family Residential Project, Romoland Area

Project Settings

Document Name	8978-A 6ft-top
Project Title	Single-Family Residential Project, Romoland Area
Company	GSI
Date Created	2/17/2026, 11:51:30 AM
Last saved with Settle3 version	5.027
Stress Computation Method	Boussinesq
Stress Units	Imperial, stress as ksf
Settlement Units	inches

Advanced Settings

Start of secondary consolidation (% of primary)	95
Min. stress for secondary consolidation (% of initial)	1
Reset time when load changes for secondary consolidation	No
Minimum settlement ratio for subgrade modulus	0.9
Use average poisson's ratio to calculate layered stresses	
Update Cv in each time step (improves consolidation accuracy)	
Ignore negative effective stresses in settlement calculations	
Add field points to load edges	

Soil Profile

Layer Option	Horizontal Soil Layers
Vertical Axis	Depth below ground surface

W.O. 8978-A1-IE
Plate E-11

Results

Time taken to compute: 0.094265 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.775051
Total Consolidation Settlement [in]	0	0
Virgin Consolidation Settlement [in]	0	0
Recompression Consolidation Settlement [in]	0	0
Immediate Settlement [in]	0	0.775051
Loading Stress ZZ [ksf]	0	12.5002
Loading Stress XX [ksf]	-0.157708	8.7686
Loading Stress YY [ksf]	-0.159038	8.74803
Total Stress ZZ [ksf]	0	12.7555
Total Stress XX [ksf]	0	8.88235
Total Stress YY [ksf]	0	8.86178
Modulus of Subgrade Reaction (Total) [ksf/ft]	0	211.921
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	0	211.921
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	0
Total Strain	0	0.0312001
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.00625	12.7413
Over-consolidation Ratio	1	1
Void Ratio	0	0
Hydroconsolidation Settlement [in]	0	0
Undrained Shear Strength	0	0.0661092

Loads

1. Rectangular Load: "Rectangular Load 1"

Length	40 ft
Width	1 ft
Rotation angle	0 degrees
Load Type	Flexible
Area of Load	40 ft2
Load	2 ksf
Depth	1 ft
Installation Stage	Stage 1

Coordinates

X [ft]	Y [ft]
-9.577	11.322
30.423	11.322
30.423	12.322
-9.577	12.322

2. Rectangular Load: "Square"

Length	2 ft
Width	2 ft
Rotation angle	0 degrees
Load Type	Flexible
Area of Load	4 ft2
Load	12.5 ksf
Depth	2 ft
Installation Stage	Stage 1

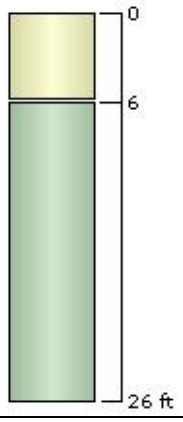
Coordinates

X [ft]	Y [ft]
8.874	1.769
10.874	1.769
10.874	3.769
8.874	3.769

W.O. 8978-A1-IE
Plate E-13

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Compacted Colluvium/Topsoil	6	0
2	Quaternary deposit	20	6



W.O. 8978-A1-IE
Plate E-14

Soil Properties

Property	Compacted Colluvium/Topsoil	Quaternary deposit
Color		
Unit Weight [kips/ft3]	0.125	0.13
K0	0.455	0.426
Immediate Settlement	Enabled	Enabled
Es [ksf]	400	1000
Esur [ksf]	400	1000
Undrained Su A [kips/ft2]	0	0
Undrained Su S	0.2	0.2
Undrained Su m	0.8	0.8

W.O. 8978-A1-IE
Plate E-15

SEISMIC GROUND MOTION VALUES

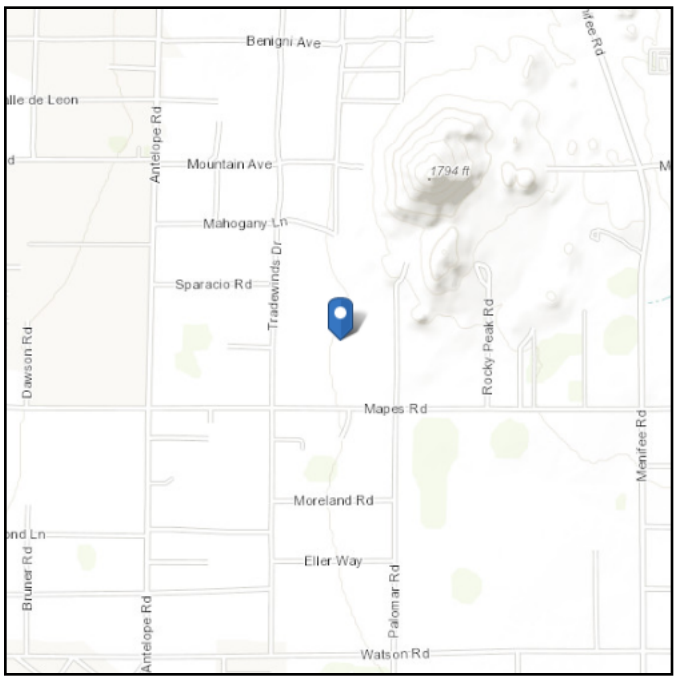
W.O. 8978-A1-IE
Plate E-16

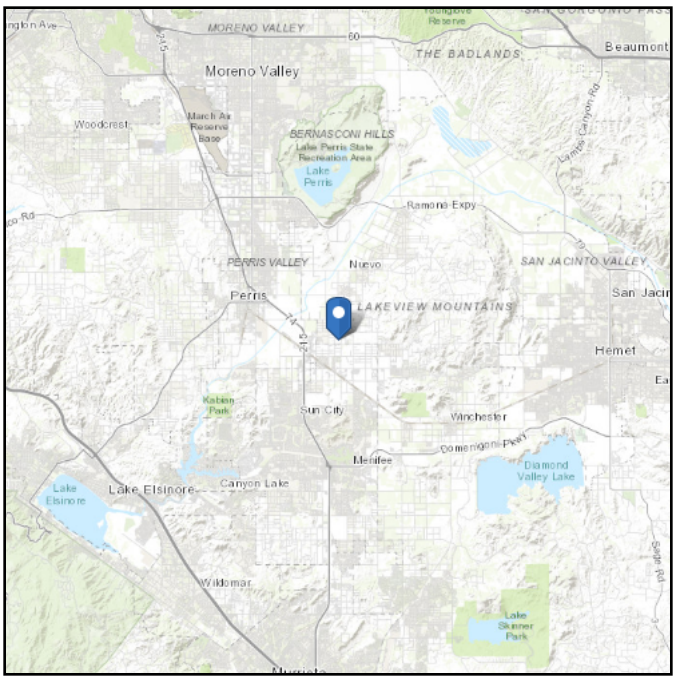
ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: Default

Latitude: 33.7596
Longitude: -117.1649
Elevation: 1485.3087973133445 ft (NAVD 88)





W.O. 8978-A1-IE
Plate E-17

Seismic

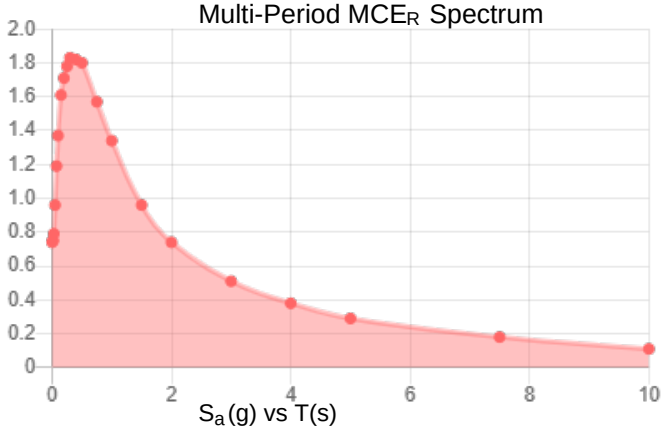
Site Soil Class: Default

Results:

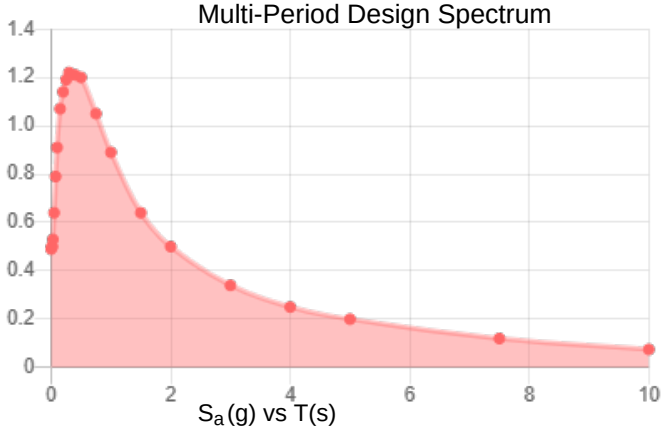
PGA_M :	0.58	T_L :	8
S_{MS} :	1.65	S_S :	1.5
S_{M1} :	1.37	S_1 :	0.54
S_{DS} :	1.1	V_{S30} :	260
S_{D1} :	0.91		

Seismic Design Category: D

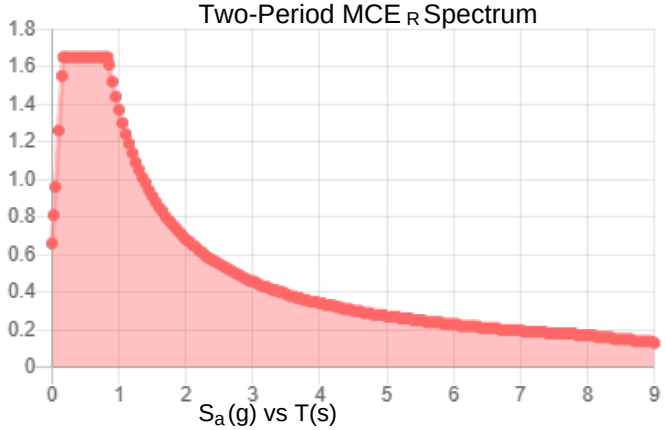
Multi-Period MCE_R Spectrum



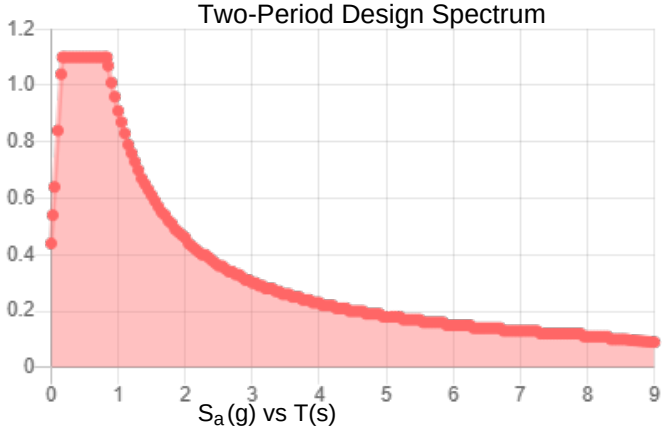
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

W.O. 8978-A1-IE
Plate E-18

Data Accessed: Tue Feb 17 2026

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

W.O. 8978-A1-IE
Plate E-19

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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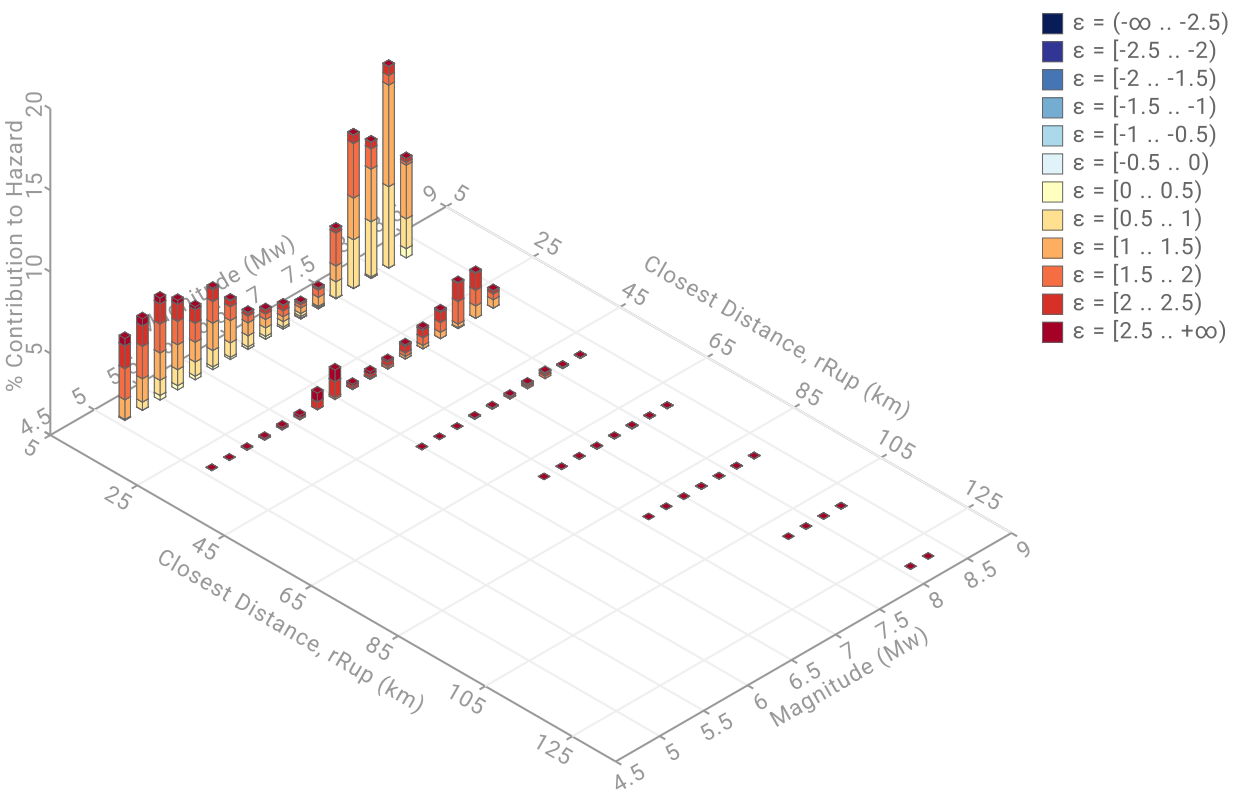
In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE Hazard Tool.

W.O. 8978-A1-IE
Plate E-20

DEAGGREGATION ANALYSIS

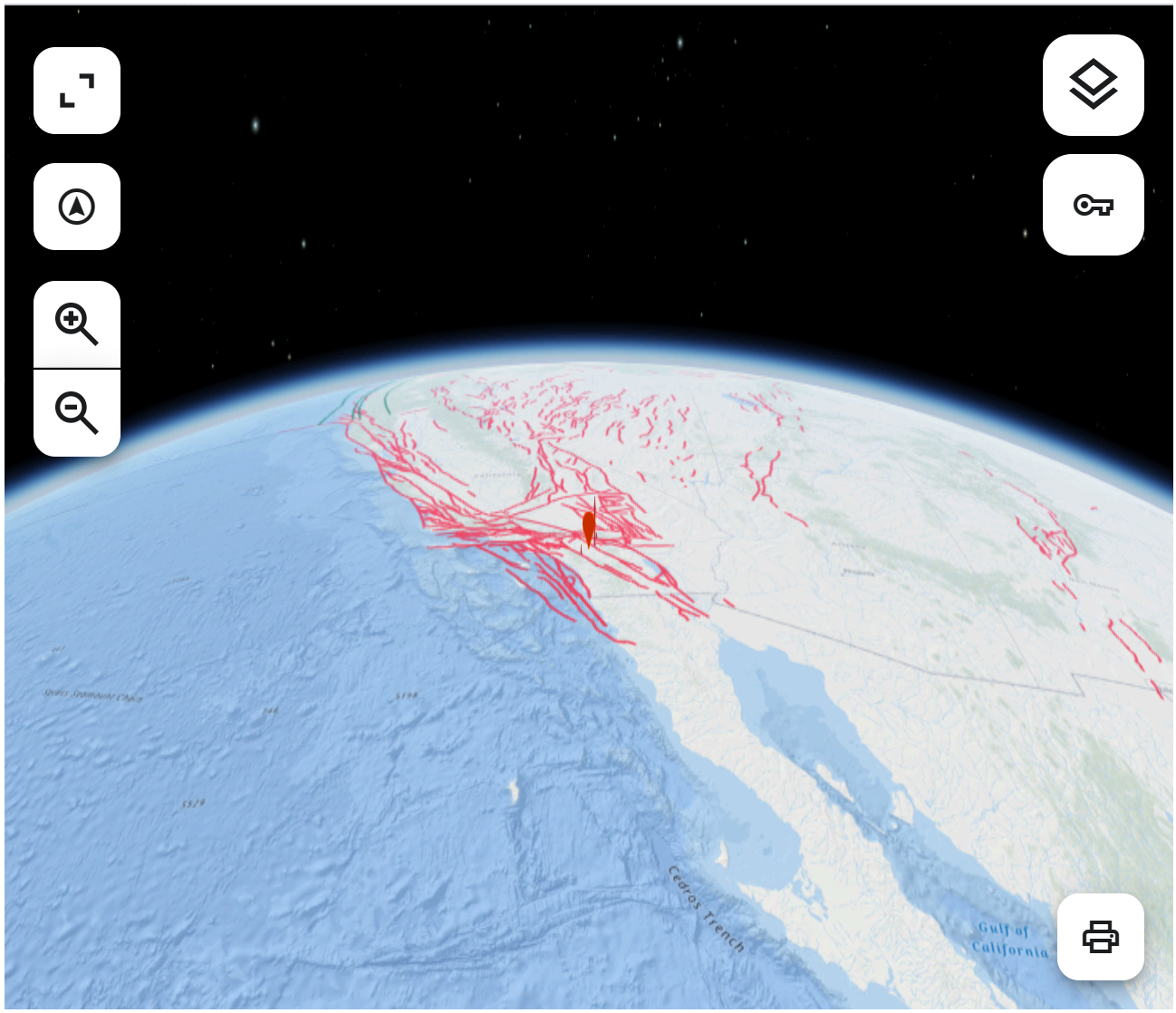
Disaggregation Report

Disaggregation



W.O. 8978-A1-IE
Plate E-22

Geographical Disaggregation



Esri, GEBCO, Garmin, NaturalVue | California State Parks, Esri, TomTom, Garmin, FAO, ... Powered by Esri

Parameter Summary

Model: NSHM Conterminous U.S. 2018

Latitude: 33.7596 °

Longitude: -117.1649 °

Site Class: D (Vs30 260)

Intensity Measure Type: PGA

Return Period: 2475 (2% in 50)

Component: Total

W.O. 8978-A1-IE
Plate E-23

Disaggregation Summary: Total

Disaggregation targets

Return period : 2475 yrs

Exceedance rate : 4.040e-4 yr^{-1}

PGA ground motion : 7.144e-1 g

Recovered targets

Return period : 2428.4725 yrs

Exceedance rate : 4.118e-4 yr^{-1}

Totals

Binned : 100 %

Residual : 0 %

Trace : 0.15 %

Mean (over all sources)

m : 6.96

r : 16.11 km

ε_0 : 1.47 σ

Mode (largest m-r bin)

m : 8.1

r : 15.84 km

ε_0 : 1.11 σ

Contribution : 12.35 %

Mode (largest m-r-ε_0 bin)

m : 8.11

r : 15.83 km

ε_0 : 1.32 σ

Contribution : 6.22 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km

m : min = 4.4, max = 9.4, Δ = 0.2

ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0 : [-∞ .. -2.5)

ε1 : [-2.5 .. -2.0)

ε2 : [-2.0 .. -1.5)

ε3 : [-1.5 .. -1.0)

ε4 : [-1.0 .. -0.5)

ε5 : [-0.5 .. 0.0)

ε6 : [0.0 .. 0.5)

ε7 : [0.5 .. 1.0)

ε8 : [1.0 .. 1.5)

ε9 : [1.5 .. 2.0)

ε10 : [2.0 .. 2.5)

ε11 : [2.5 .. +∞]

W.O. 8978-A1-IE
Plate E-24

Disaggregation Contributions: Total

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UCERF3 Fault Model 3.2	FaultSystem							28.98
San Jacinto (stepover) (1)		15.83	7.97	1.16	117.033°W	33.851°N	50.25	17.26
Elsinore (stepover) (1)		19.35	7.53	1.52	117.312°W	33.636°N	224.70	3.65
San Andreas (San Bernardino, south) (3)		37.62	7.93	1.91	117.002°W	34.069°N	23.54	3.01
UCERF3 Fault Model 3.1	FaultSystem							28.87
San Jacinto (stepover) (1)		15.83	7.97	1.16	117.033°W	33.851°N	50.25	17.31
Elsinore (stepover) (1)		19.35	7.50	1.54	117.312°W	33.636°N	224.70	3.55
San Andreas (San Bernardino, south) (3)		37.62	7.93	1.91	117.002°W	34.069°N	23.54	2.98
UCERF3 Fault Model 3.1 (opt)	Grid							21.08
UCERF3 Fault Model 3.2 (opt)	Grid							21.06

W.O. 8978-A1-IE
Plate E-25

Application Metadata

Application: Disaggregation
URL: https://earthquake.usgs.gov/nshmp/hazard/disagg

Repository: nshmp-apps
Version: 21.4.1
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-apps

Repository : nshmp-haz
Version: 2.8.2
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-haz

Repository : nshmp-lib
Version: 1.7.15
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-lib

Repository : nshm-conus
Version: 5.2.4
URL: https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus.git

February 17, 2026, 03:00 PM

W.O. 8978-A1-IE
Plate E-26

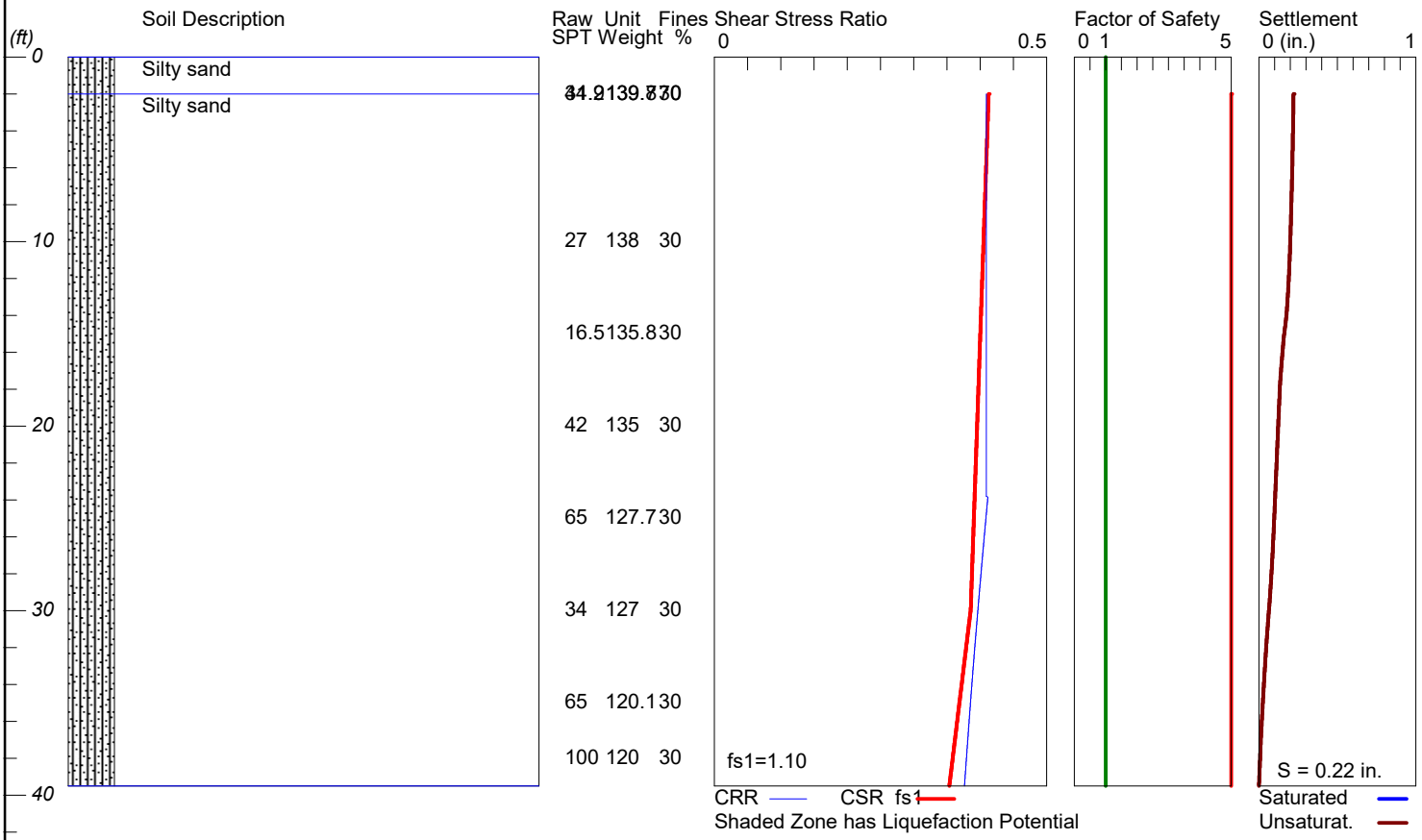
SEISMIC SETTLEMENTS

SEISMIC ANALYSIS

Romoland

Hole No.=B-1 Water Depth=80 ft Surface Elev.=0

Magnitude=8.11
Acceleration=0.58g



LiquefyPro CivilTech Software USA www.civiltech.com

****
ANALYSIS SUMMARY

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www.civiltech.com

****
Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 2/17/2026 3:33:26 PM

Input File Name: C:\Users\GSI-10\Desktop\Liquefaction\8987\B-1.liq
Title: Romoland
Subtitle:

Surface Elev.=0
Hole No.=B-1
Depth of Hole= 39.50 ft
Water Table during Earthquake= 80.00 ft
Water Table during In-Situ Testing= 80.00 ft
Max. Acceleration= 0.58 g
Earthquake Magnitude= 8.11

Input Data:
Surface Elev.=0
Hole No.=B-1
Depth of Hole=39.50 ft
Water Table during Earthquake= 80.00 ft
Water Table during In-Situ Testing= 80.00 ft
Max. Acceleration=0.58 g
Earthquake Magnitude=8.11
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu/Seed
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:
Depth SPT gamma Fines

ft		pcf	%
2.00	31.20	139.70	70.00
2.02	44.90	139.80	30.00
10.00	27.00	138.00	30.00
15.00	16.50	135.80	30.00
20.00	42.00	135.00	30.00
25.00	65.00	127.70	30.00
30.00	34.00	127.00	30.00
35.00	65.00	120.10	30.00
38.00	100.00	120.00	30.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.22 in.
Total Settlement of Saturated and Unsaturated Sands=0.22 in.
Differential Settlement=0.110 to 0.146 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
2.00	0.41	0.41	5.00	0.00	0.22	0.22
2.05	0.41	0.41	5.00	0.00	0.22	0.22
2.10	0.41	0.41	5.00	0.00	0.22	0.22
2.15	0.41	0.41	5.00	0.00	0.22	0.22
2.20	0.41	0.41	5.00	0.00	0.22	0.22
2.25	0.41	0.41	5.00	0.00	0.22	0.22
2.30	0.41	0.41	5.00	0.00	0.22	0.22
2.35	0.41	0.41	5.00	0.00	0.22	0.22
2.40	0.41	0.41	5.00	0.00	0.22	0.22
2.45	0.41	0.41	5.00	0.00	0.22	0.22
2.50	0.41	0.41	5.00	0.00	0.22	0.22
2.55	0.41	0.41	5.00	0.00	0.22	0.22
2.60	0.41	0.41	5.00	0.00	0.22	0.22
2.65	0.41	0.41	5.00	0.00	0.22	0.22
2.70	0.41	0.41	5.00	0.00	0.22	0.22
2.75	0.41	0.41	5.00	0.00	0.22	0.22
2.80	0.41	0.41	5.00	0.00	0.22	0.22
2.85	0.41	0.41	5.00	0.00	0.22	0.22
2.90	0.41	0.41	5.00	0.00	0.22	0.22
2.95	0.41	0.41	5.00	0.00	0.22	0.22
3.00	0.41	0.41	5.00	0.00	0.22	0.22
3.05	0.41	0.41	5.00	0.00	0.22	0.22
3.10	0.41	0.41	5.00	0.00	0.22	0.22
3.15	0.41	0.41	5.00	0.00	0.22	0.22
3.20	0.41	0.41	5.00	0.00	0.22	0.22
3.25	0.41	0.41	5.00	0.00	0.22	0.22
3.30	0.41	0.41	5.00	0.00	0.22	0.22
3.35	0.41	0.41	5.00	0.00	0.22	0.22

3.40	0.41	0.41	5.00	0.00	0.22	0.22
3.45	0.41	0.41	5.00	0.00	0.22	0.22
3.50	0.41	0.41	5.00	0.00	0.22	0.22
3.55	0.41	0.41	5.00	0.00	0.22	0.22
3.60	0.41	0.41	5.00	0.00	0.22	0.22
3.65	0.41	0.41	5.00	0.00	0.22	0.22
3.70	0.41	0.41	5.00	0.00	0.22	0.22
3.75	0.41	0.41	5.00	0.00	0.22	0.22
3.80	0.41	0.41	5.00	0.00	0.22	0.22
3.85	0.41	0.41	5.00	0.00	0.22	0.22
3.90	0.41	0.41	5.00	0.00	0.22	0.22
3.95	0.41	0.41	5.00	0.00	0.22	0.22
4.00	0.41	0.41	5.00	0.00	0.22	0.22
4.05	0.41	0.41	5.00	0.00	0.22	0.22
4.10	0.41	0.41	5.00	0.00	0.22	0.22
4.15	0.41	0.41	5.00	0.00	0.22	0.22
4.20	0.41	0.41	5.00	0.00	0.22	0.22
4.25	0.41	0.41	5.00	0.00	0.22	0.22
4.30	0.41	0.41	5.00	0.00	0.22	0.22
4.35	0.41	0.41	5.00	0.00	0.22	0.22
4.40	0.41	0.41	5.00	0.00	0.22	0.22
4.45	0.41	0.41	5.00	0.00	0.22	0.22
4.50	0.41	0.41	5.00	0.00	0.22	0.22
4.55	0.41	0.41	5.00	0.00	0.22	0.22
4.60	0.41	0.41	5.00	0.00	0.22	0.22
4.65	0.41	0.41	5.00	0.00	0.22	0.22
4.70	0.41	0.41	5.00	0.00	0.22	0.22
4.75	0.41	0.41	5.00	0.00	0.22	0.22
4.80	0.41	0.41	5.00	0.00	0.22	0.22
4.85	0.41	0.41	5.00	0.00	0.22	0.22
4.90	0.41	0.41	5.00	0.00	0.22	0.22
4.95	0.41	0.41	5.00	0.00	0.21	0.21
5.00	0.41	0.41	5.00	0.00	0.21	0.21
5.05	0.41	0.41	5.00	0.00	0.21	0.21
5.10	0.41	0.41	5.00	0.00	0.21	0.21
5.15	0.41	0.41	5.00	0.00	0.21	0.21
5.20	0.41	0.41	5.00	0.00	0.21	0.21
5.25	0.41	0.41	5.00	0.00	0.21	0.21
5.30	0.41	0.41	5.00	0.00	0.21	0.21
5.35	0.41	0.41	5.00	0.00	0.21	0.21
5.40	0.41	0.41	5.00	0.00	0.21	0.21
5.45	0.41	0.41	5.00	0.00	0.21	0.21
5.50	0.41	0.41	5.00	0.00	0.21	0.21
5.55	0.41	0.41	5.00	0.00	0.21	0.21
5.60	0.41	0.41	5.00	0.00	0.21	0.21
5.65	0.41	0.41	5.00	0.00	0.21	0.21
5.70	0.41	0.41	5.00	0.00	0.21	0.21
5.75	0.41	0.41	5.00	0.00	0.21	0.21
5.80	0.41	0.41	5.00	0.00	0.21	0.21
5.85	0.41	0.41	5.00	0.00	0.21	0.21

5.90	0.41	0.41	5.00	0.00	0.21	0.21
5.95	0.41	0.41	5.00	0.00	0.21	0.21
6.00	0.41	0.41	5.00	0.00	0.21	0.21
6.05	0.41	0.41	5.00	0.00	0.21	0.21
6.10	0.41	0.41	5.00	0.00	0.21	0.21
6.15	0.41	0.41	5.00	0.00	0.21	0.21
6.20	0.41	0.41	5.00	0.00	0.21	0.21
6.25	0.41	0.41	5.00	0.00	0.21	0.21
6.30	0.41	0.41	5.00	0.00	0.21	0.21
6.35	0.41	0.41	5.00	0.00	0.21	0.21
6.40	0.41	0.41	5.00	0.00	0.21	0.21
6.45	0.41	0.41	5.00	0.00	0.21	0.21
6.50	0.41	0.41	5.00	0.00	0.21	0.21
6.55	0.41	0.41	5.00	0.00	0.21	0.21
6.60	0.41	0.41	5.00	0.00	0.21	0.21
6.65	0.41	0.41	5.00	0.00	0.21	0.21
6.70	0.41	0.41	5.00	0.00	0.21	0.21
6.75	0.41	0.41	5.00	0.00	0.21	0.21
6.80	0.41	0.41	5.00	0.00	0.21	0.21
6.85	0.41	0.41	5.00	0.00	0.21	0.21
6.90	0.41	0.41	5.00	0.00	0.21	0.21
6.95	0.41	0.41	5.00	0.00	0.21	0.21
7.00	0.41	0.41	5.00	0.00	0.21	0.21
7.05	0.41	0.41	5.00	0.00	0.21	0.21
7.10	0.41	0.41	5.00	0.00	0.21	0.21
7.15	0.41	0.41	5.00	0.00	0.21	0.21
7.20	0.41	0.41	5.00	0.00	0.21	0.21
7.25	0.41	0.41	5.00	0.00	0.21	0.21
7.30	0.41	0.41	5.00	0.00	0.21	0.21
7.35	0.41	0.41	5.00	0.00	0.21	0.21
7.40	0.41	0.41	5.00	0.00	0.21	0.21
7.45	0.41	0.41	5.00	0.00	0.21	0.21
7.50	0.41	0.41	5.00	0.00	0.21	0.21
7.55	0.41	0.41	5.00	0.00	0.21	0.21
7.60	0.41	0.41	5.00	0.00	0.21	0.21
7.65	0.41	0.41	5.00	0.00	0.21	0.21
7.70	0.41	0.41	5.00	0.00	0.21	0.21
7.75	0.41	0.41	5.00	0.00	0.21	0.21
7.80	0.41	0.41	5.00	0.00	0.21	0.21
7.85	0.41	0.41	5.00	0.00	0.21	0.21
7.90	0.41	0.41	5.00	0.00	0.21	0.21
7.95	0.41	0.41	5.00	0.00	0.21	0.21
8.00	0.41	0.41	5.00	0.00	0.21	0.21
8.05	0.41	0.41	5.00	0.00	0.21	0.21
8.10	0.41	0.41	5.00	0.00	0.21	0.21
8.15	0.41	0.41	5.00	0.00	0.21	0.21
8.20	0.41	0.41	5.00	0.00	0.21	0.21
8.25	0.41	0.41	5.00	0.00	0.21	0.21
8.30	0.41	0.41	5.00	0.00	0.21	0.21
8.35	0.41	0.41	5.00	0.00	0.21	0.21

8.40	0.41	0.41	5.00	0.00	0.21	0.21
8.45	0.41	0.41	5.00	0.00	0.21	0.21
8.50	0.41	0.41	5.00	0.00	0.20	0.20
8.55	0.41	0.41	5.00	0.00	0.20	0.20
8.60	0.41	0.41	5.00	0.00	0.20	0.20
8.65	0.41	0.41	5.00	0.00	0.20	0.20
8.70	0.41	0.41	5.00	0.00	0.20	0.20
8.75	0.41	0.41	5.00	0.00	0.20	0.20
8.80	0.41	0.41	5.00	0.00	0.20	0.20
8.85	0.41	0.41	5.00	0.00	0.20	0.20
8.90	0.41	0.41	5.00	0.00	0.20	0.20
8.95	0.41	0.41	5.00	0.00	0.20	0.20
9.00	0.41	0.41	5.00	0.00	0.20	0.20
9.05	0.41	0.41	5.00	0.00	0.20	0.20
9.10	0.41	0.41	5.00	0.00	0.20	0.20
9.15	0.41	0.41	5.00	0.00	0.20	0.20
9.20	0.41	0.41	5.00	0.00	0.20	0.20
9.25	0.41	0.41	5.00	0.00	0.20	0.20
9.30	0.41	0.41	5.00	0.00	0.20	0.20
9.35	0.41	0.41	5.00	0.00	0.20	0.20
9.40	0.41	0.41	5.00	0.00	0.20	0.20
9.45	0.41	0.41	5.00	0.00	0.20	0.20
9.50	0.41	0.41	5.00	0.00	0.20	0.20
9.55	0.41	0.41	5.00	0.00	0.20	0.20
9.60	0.41	0.41	5.00	0.00	0.20	0.20
9.65	0.41	0.41	5.00	0.00	0.20	0.20
9.70	0.41	0.41	5.00	0.00	0.20	0.20
9.75	0.41	0.41	5.00	0.00	0.20	0.20
9.80	0.41	0.41	5.00	0.00	0.20	0.20
9.85	0.41	0.41	5.00	0.00	0.20	0.20
9.90	0.41	0.41	5.00	0.00	0.20	0.20
9.95	0.41	0.41	5.00	0.00	0.20	0.20
10.00	0.41	0.41	5.00	0.00	0.20	0.20
10.05	0.41	0.40	5.00	0.00	0.20	0.20
10.10	0.41	0.40	5.00	0.00	0.20	0.20
10.15	0.41	0.40	5.00	0.00	0.20	0.20
10.20	0.41	0.40	5.00	0.00	0.20	0.20
10.25	0.41	0.40	5.00	0.00	0.20	0.20
10.30	0.41	0.40	5.00	0.00	0.20	0.20
10.35	0.41	0.40	5.00	0.00	0.20	0.20
10.40	0.41	0.40	5.00	0.00	0.20	0.20
10.45	0.41	0.40	5.00	0.00	0.20	0.20
10.50	0.41	0.40	5.00	0.00	0.20	0.20
10.55	0.41	0.40	5.00	0.00	0.20	0.20
10.60	0.41	0.40	5.00	0.00	0.20	0.20
10.65	0.41	0.40	5.00	0.00	0.20	0.20
10.70	0.41	0.40	5.00	0.00	0.20	0.20
10.75	0.41	0.40	5.00	0.00	0.20	0.20
10.80	0.41	0.40	5.00	0.00	0.20	0.20
10.85	0.41	0.40	5.00	0.00	0.20	0.20

10.90	0.41	0.40	5.00	0.00	0.20	0.20
10.95	0.41	0.40	5.00	0.00	0.20	0.20
11.00	0.41	0.40	5.00	0.00	0.20	0.20
11.05	0.41	0.40	5.00	0.00	0.20	0.20
11.10	0.41	0.40	5.00	0.00	0.20	0.20
11.15	0.41	0.40	5.00	0.00	0.19	0.19
11.20	0.41	0.40	5.00	0.00	0.19	0.19
11.25	0.41	0.40	5.00	0.00	0.19	0.19
11.30	0.41	0.40	5.00	0.00	0.19	0.19
11.35	0.41	0.40	5.00	0.00	0.19	0.19
11.40	0.41	0.40	5.00	0.00	0.19	0.19
11.45	0.41	0.40	5.00	0.00	0.19	0.19
11.50	0.41	0.40	5.00	0.00	0.19	0.19
11.55	0.41	0.40	5.00	0.00	0.19	0.19
11.60	0.41	0.40	5.00	0.00	0.19	0.19
11.65	0.41	0.40	5.00	0.00	0.19	0.19
11.70	0.41	0.40	5.00	0.00	0.19	0.19
11.75	0.41	0.40	5.00	0.00	0.19	0.19
11.80	0.41	0.40	5.00	0.00	0.19	0.19
11.85	0.41	0.40	5.00	0.00	0.19	0.19
11.90	0.41	0.40	5.00	0.00	0.19	0.19
11.95	0.41	0.40	5.00	0.00	0.19	0.19
12.00	0.41	0.40	5.00	0.00	0.19	0.19
12.05	0.41	0.40	5.00	0.00	0.19	0.19
12.10	0.41	0.40	5.00	0.00	0.19	0.19
12.15	0.41	0.40	5.00	0.00	0.19	0.19
12.20	0.41	0.40	5.00	0.00	0.19	0.19
12.25	0.41	0.40	5.00	0.00	0.19	0.19
12.30	0.41	0.40	5.00	0.00	0.19	0.19
12.35	0.41	0.40	5.00	0.00	0.19	0.19
12.40	0.41	0.40	5.00	0.00	0.19	0.19
12.45	0.41	0.40	5.00	0.00	0.19	0.19
12.50	0.41	0.40	5.00	0.00	0.19	0.19
12.55	0.41	0.40	5.00	0.00	0.19	0.19
12.60	0.41	0.40	5.00	0.00	0.19	0.19
12.65	0.41	0.40	5.00	0.00	0.19	0.19
12.70	0.41	0.40	5.00	0.00	0.19	0.19
12.75	0.41	0.40	5.00	0.00	0.19	0.19
12.80	0.41	0.40	5.00	0.00	0.19	0.19
12.85	0.41	0.40	5.00	0.00	0.18	0.18
12.90	0.41	0.40	5.00	0.00	0.18	0.18
12.95	0.41	0.40	5.00	0.00	0.18	0.18
13.00	0.41	0.40	5.00	0.00	0.18	0.18
13.05	0.41	0.40	5.00	0.00	0.18	0.18
13.10	0.41	0.40	5.00	0.00	0.18	0.18
13.15	0.41	0.40	5.00	0.00	0.18	0.18
13.20	0.41	0.40	5.00	0.00	0.18	0.18
13.25	0.41	0.40	5.00	0.00	0.18	0.18
13.30	0.41	0.40	5.00	0.00	0.18	0.18
13.35	0.41	0.40	5.00	0.00	0.18	0.18

13.40	0.41	0.40	5.00	0.00	0.18	0.18
13.45	0.41	0.40	5.00	0.00	0.18	0.18
13.50	0.41	0.40	5.00	0.00	0.18	0.18
13.55	0.41	0.40	5.00	0.00	0.18	0.18
13.60	0.41	0.40	5.00	0.00	0.18	0.18
13.65	0.41	0.40	5.00	0.00	0.18	0.18
13.70	0.41	0.40	5.00	0.00	0.18	0.18
13.75	0.41	0.40	5.00	0.00	0.18	0.18
13.80	0.41	0.40	5.00	0.00	0.18	0.18
13.85	0.41	0.40	5.00	0.00	0.18	0.18
13.90	0.41	0.40	5.00	0.00	0.18	0.18
13.95	0.41	0.40	5.00	0.00	0.18	0.18
14.00	0.41	0.40	5.00	0.00	0.18	0.18
14.05	0.41	0.40	5.00	0.00	0.17	0.17
14.10	0.41	0.40	5.00	0.00	0.17	0.17
14.15	0.41	0.40	5.00	0.00	0.17	0.17
14.20	0.41	0.40	5.00	0.00	0.17	0.17
14.25	0.41	0.40	5.00	0.00	0.17	0.17
14.30	0.41	0.40	5.00	0.00	0.17	0.17
14.35	0.41	0.40	5.00	0.00	0.17	0.17
14.40	0.41	0.40	5.00	0.00	0.17	0.17
14.45	0.41	0.40	5.00	0.00	0.17	0.17
14.50	0.41	0.40	5.00	0.00	0.17	0.17
14.55	0.41	0.40	5.00	0.00	0.17	0.17
14.60	0.41	0.40	5.00	0.00	0.17	0.17
14.65	0.41	0.40	5.00	0.00	0.17	0.17
14.70	0.41	0.40	5.00	0.00	0.17	0.17
14.75	0.41	0.40	5.00	0.00	0.16	0.16
14.80	0.41	0.40	5.00	0.00	0.16	0.16
14.85	0.41	0.40	5.00	0.00	0.16	0.16
14.90	0.41	0.40	5.00	0.00	0.16	0.16
14.95	0.41	0.40	5.00	0.00	0.16	0.16
15.00	0.41	0.40	5.00	0.00	0.16	0.16
15.05	0.41	0.40	5.00	0.00	0.16	0.16
15.10	0.41	0.40	5.00	0.00	0.16	0.16
15.15	0.41	0.40	5.00	0.00	0.16	0.16
15.20	0.41	0.40	5.00	0.00	0.16	0.16
15.25	0.41	0.40	5.00	0.00	0.16	0.16
15.30	0.41	0.40	5.00	0.00	0.16	0.16
15.35	0.41	0.40	5.00	0.00	0.16	0.16
15.40	0.41	0.40	5.00	0.00	0.16	0.16
15.45	0.41	0.40	5.00	0.00	0.16	0.16
15.50	0.41	0.40	5.00	0.00	0.16	0.16
15.55	0.41	0.40	5.00	0.00	0.15	0.15
15.60	0.41	0.40	5.00	0.00	0.15	0.15
15.65	0.41	0.40	5.00	0.00	0.15	0.15
15.70	0.41	0.40	5.00	0.00	0.15	0.15
15.75	0.41	0.40	5.00	0.00	0.15	0.15
15.80	0.41	0.40	5.00	0.00	0.15	0.15
15.85	0.41	0.40	5.00	0.00	0.15	0.15

15.90	0.41	0.40	5.00	0.00	0.15	0.15
15.95	0.41	0.40	5.00	0.00	0.15	0.15
16.00	0.41	0.40	5.00	0.00	0.15	0.15
16.05	0.41	0.40	5.00	0.00	0.15	0.15
16.10	0.41	0.40	5.00	0.00	0.15	0.15
16.15	0.41	0.40	5.00	0.00	0.15	0.15
16.20	0.41	0.40	5.00	0.00	0.15	0.15
16.25	0.41	0.40	5.00	0.00	0.15	0.15
16.30	0.41	0.40	5.00	0.00	0.15	0.15
16.35	0.41	0.40	5.00	0.00	0.15	0.15
16.40	0.41	0.40	5.00	0.00	0.15	0.15
16.45	0.41	0.40	5.00	0.00	0.15	0.15
16.50	0.41	0.40	5.00	0.00	0.15	0.15
16.55	0.41	0.40	5.00	0.00	0.14	0.14
16.60	0.41	0.40	5.00	0.00	0.14	0.14
16.65	0.41	0.40	5.00	0.00	0.14	0.14
16.70	0.41	0.40	5.00	0.00	0.14	0.14
16.75	0.41	0.40	5.00	0.00	0.14	0.14
16.80	0.41	0.40	5.00	0.00	0.14	0.14
16.85	0.41	0.40	5.00	0.00	0.14	0.14
16.90	0.41	0.40	5.00	0.00	0.14	0.14
16.95	0.41	0.40	5.00	0.00	0.14	0.14
17.00	0.41	0.40	5.00	0.00	0.14	0.14
17.05	0.41	0.40	5.00	0.00	0.14	0.14
17.10	0.41	0.40	5.00	0.00	0.14	0.14
17.15	0.41	0.40	5.00	0.00	0.14	0.14
17.20	0.41	0.40	5.00	0.00	0.14	0.14
17.25	0.41	0.40	5.00	0.00	0.14	0.14
17.30	0.41	0.40	5.00	0.00	0.14	0.14
17.35	0.41	0.40	5.00	0.00	0.14	0.14
17.40	0.41	0.40	5.00	0.00	0.14	0.14
17.45	0.41	0.40	5.00	0.00	0.14	0.14
17.50	0.41	0.40	5.00	0.00	0.14	0.14
17.55	0.41	0.40	5.00	0.00	0.14	0.14
17.60	0.41	0.40	5.00	0.00	0.14	0.14
17.65	0.41	0.40	5.00	0.00	0.14	0.14
17.70	0.41	0.40	5.00	0.00	0.13	0.13
17.75	0.41	0.40	5.00	0.00	0.13	0.13
17.80	0.41	0.40	5.00	0.00	0.13	0.13
17.85	0.41	0.40	5.00	0.00	0.13	0.13
17.90	0.41	0.40	5.00	0.00	0.13	0.13
17.95	0.41	0.40	5.00	0.00	0.13	0.13
18.00	0.41	0.40	5.00	0.00	0.13	0.13
18.05	0.41	0.40	5.00	0.00	0.13	0.13
18.10	0.41	0.40	5.00	0.00	0.13	0.13
18.15	0.41	0.40	5.00	0.00	0.13	0.13
18.20	0.41	0.40	5.00	0.00	0.13	0.13
18.25	0.41	0.40	5.00	0.00	0.13	0.13
18.30	0.41	0.40	5.00	0.00	0.13	0.13
18.35	0.41	0.40	5.00	0.00	0.13	0.13

18.40	0.41	0.40	5.00	0.00	0.13	0.13
18.45	0.41	0.40	5.00	0.00	0.13	0.13
18.50	0.41	0.40	5.00	0.00	0.13	0.13
18.55	0.41	0.40	5.00	0.00	0.13	0.13
18.60	0.41	0.40	5.00	0.00	0.13	0.13
18.65	0.41	0.40	5.00	0.00	0.13	0.13
18.70	0.41	0.40	5.00	0.00	0.13	0.13
18.75	0.41	0.40	5.00	0.00	0.13	0.13
18.80	0.41	0.40	5.00	0.00	0.13	0.13
18.85	0.41	0.40	5.00	0.00	0.13	0.13
18.90	0.41	0.40	5.00	0.00	0.13	0.13
18.95	0.41	0.40	5.00	0.00	0.13	0.13
19.00	0.41	0.40	5.00	0.00	0.13	0.13
19.05	0.41	0.40	5.00	0.00	0.13	0.13
19.10	0.41	0.40	5.00	0.00	0.13	0.13
19.15	0.41	0.40	5.00	0.00	0.13	0.13
19.20	0.41	0.40	5.00	0.00	0.13	0.13
19.25	0.41	0.40	5.00	0.00	0.13	0.13
19.30	0.41	0.40	5.00	0.00	0.13	0.13
19.35	0.41	0.40	5.00	0.00	0.13	0.13
19.40	0.41	0.40	5.00	0.00	0.13	0.13
19.45	0.41	0.40	5.00	0.00	0.13	0.13
19.50	0.41	0.40	5.00	0.00	0.13	0.13
19.55	0.41	0.40	5.00	0.00	0.12	0.12
19.60	0.41	0.40	5.00	0.00	0.12	0.12
19.65	0.41	0.40	5.00	0.00	0.12	0.12
19.70	0.41	0.40	5.00	0.00	0.12	0.12
19.75	0.41	0.40	5.00	0.00	0.12	0.12
19.80	0.41	0.40	5.00	0.00	0.12	0.12
19.85	0.41	0.40	5.00	0.00	0.12	0.12
19.90	0.41	0.40	5.00	0.00	0.12	0.12
19.95	0.41	0.40	5.00	0.00	0.12	0.12
20.00	0.41	0.40	5.00	0.00	0.12	0.12
20.05	0.41	0.40	5.00	0.00	0.12	0.12
20.10	0.41	0.40	5.00	0.00	0.12	0.12
20.15	0.41	0.40	5.00	0.00	0.12	0.12
20.20	0.41	0.40	5.00	0.00	0.12	0.12
20.25	0.41	0.40	5.00	0.00	0.12	0.12
20.30	0.41	0.40	5.00	0.00	0.12	0.12
20.35	0.41	0.40	5.00	0.00	0.12	0.12
20.40	0.41	0.39	5.00	0.00	0.12	0.12
20.45	0.41	0.39	5.00	0.00	0.12	0.12
20.50	0.41	0.39	5.00	0.00	0.12	0.12
20.55	0.41	0.39	5.00	0.00	0.12	0.12
20.60	0.41	0.39	5.00	0.00	0.12	0.12
20.65	0.41	0.39	5.00	0.00	0.12	0.12
20.70	0.41	0.39	5.00	0.00	0.12	0.12
20.75	0.41	0.39	5.00	0.00	0.12	0.12
20.80	0.41	0.39	5.00	0.00	0.12	0.12
20.85	0.41	0.39	5.00	0.00	0.12	0.12

20.90	0.41	0.39	5.00	0.00	0.12	0.12
20.95	0.41	0.39	5.00	0.00	0.12	0.12
21.00	0.41	0.39	5.00	0.00	0.12	0.12
21.05	0.41	0.39	5.00	0.00	0.12	0.12
21.10	0.41	0.39	5.00	0.00	0.12	0.12
21.15	0.41	0.39	5.00	0.00	0.12	0.12
21.20	0.41	0.39	5.00	0.00	0.12	0.12
21.25	0.41	0.39	5.00	0.00	0.12	0.12
21.30	0.41	0.39	5.00	0.00	0.12	0.12
21.35	0.41	0.39	5.00	0.00	0.12	0.12
21.40	0.41	0.39	5.00	0.00	0.12	0.12
21.45	0.41	0.39	5.00	0.00	0.12	0.12
21.50	0.41	0.39	5.00	0.00	0.12	0.12
21.55	0.41	0.39	5.00	0.00	0.11	0.11
21.60	0.41	0.39	5.00	0.00	0.11	0.11
21.65	0.41	0.39	5.00	0.00	0.11	0.11
21.70	0.41	0.39	5.00	0.00	0.11	0.11
21.75	0.41	0.39	5.00	0.00	0.11	0.11
21.80	0.41	0.39	5.00	0.00	0.11	0.11
21.85	0.41	0.39	5.00	0.00	0.11	0.11
21.90	0.41	0.39	5.00	0.00	0.11	0.11
21.95	0.41	0.39	5.00	0.00	0.11	0.11
22.00	0.41	0.39	5.00	0.00	0.11	0.11
22.05	0.41	0.39	5.00	0.00	0.11	0.11
22.10	0.41	0.39	5.00	0.00	0.11	0.11
22.15	0.41	0.39	5.00	0.00	0.11	0.11
22.20	0.41	0.39	5.00	0.00	0.11	0.11
22.25	0.41	0.39	5.00	0.00	0.11	0.11
22.30	0.41	0.39	5.00	0.00	0.11	0.11
22.35	0.41	0.39	5.00	0.00	0.11	0.11
22.40	0.41	0.39	5.00	0.00	0.11	0.11
22.45	0.41	0.39	5.00	0.00	0.11	0.11
22.50	0.41	0.39	5.00	0.00	0.11	0.11
22.55	0.41	0.39	5.00	0.00	0.11	0.11
22.60	0.41	0.39	5.00	0.00	0.11	0.11
22.65	0.41	0.39	5.00	0.00	0.11	0.11
22.70	0.41	0.39	5.00	0.00	0.11	0.11
22.75	0.41	0.39	5.00	0.00	0.11	0.11
22.80	0.41	0.39	5.00	0.00	0.11	0.11
22.85	0.41	0.39	5.00	0.00	0.11	0.11
22.90	0.41	0.39	5.00	0.00	0.11	0.11
22.95	0.41	0.39	5.00	0.00	0.11	0.11
23.00	0.41	0.39	5.00	0.00	0.11	0.11
23.05	0.41	0.39	5.00	0.00	0.11	0.11
23.10	0.41	0.39	5.00	0.00	0.11	0.11
23.15	0.41	0.39	5.00	0.00	0.11	0.11
23.20	0.41	0.39	5.00	0.00	0.11	0.11
23.25	0.41	0.39	5.00	0.00	0.11	0.11
23.30	0.41	0.39	5.00	0.00	0.11	0.11
23.35	0.41	0.39	5.00	0.00	0.11	0.11

23.40	0.41	0.39	5.00	0.00	0.11	0.11
23.45	0.41	0.39	5.00	0.00	0.11	0.11
23.50	0.41	0.39	5.00	0.00	0.11	0.11
23.55	0.41	0.39	5.00	0.00	0.10	0.10
23.60	0.41	0.39	5.00	0.00	0.10	0.10
23.65	0.41	0.39	5.00	0.00	0.10	0.10
23.70	0.41	0.39	5.00	0.00	0.10	0.10
23.75	0.41	0.39	5.00	0.00	0.10	0.10
23.80	0.41	0.39	5.00	0.00	0.10	0.10
23.85	0.41	0.39	5.00	0.00	0.10	0.10
23.90	0.41	0.39	5.00	0.00	0.10	0.10
23.95	0.41	0.39	5.00	0.00	0.10	0.10
24.00	0.41	0.39	5.00	0.00	0.10	0.10
24.05	0.41	0.39	5.00	0.00	0.10	0.10
24.10	0.41	0.39	5.00	0.00	0.10	0.10
24.15	0.41	0.39	5.00	0.00	0.10	0.10
24.20	0.41	0.39	5.00	0.00	0.10	0.10
24.25	0.41	0.39	5.00	0.00	0.10	0.10
24.30	0.41	0.39	5.00	0.00	0.10	0.10
24.35	0.41	0.39	5.00	0.00	0.10	0.10
24.40	0.41	0.39	5.00	0.00	0.10	0.10
24.45	0.41	0.39	5.00	0.00	0.10	0.10
24.50	0.41	0.39	5.00	0.00	0.10	0.10
24.55	0.41	0.39	5.00	0.00	0.10	0.10
24.60	0.41	0.39	5.00	0.00	0.10	0.10
24.65	0.41	0.39	5.00	0.00	0.10	0.10
24.70	0.41	0.39	5.00	0.00	0.10	0.10
24.75	0.41	0.39	5.00	0.00	0.10	0.10
24.80	0.41	0.39	5.00	0.00	0.10	0.10
24.85	0.41	0.39	5.00	0.00	0.10	0.10
24.90	0.41	0.39	5.00	0.00	0.10	0.10
24.95	0.41	0.39	5.00	0.00	0.10	0.10
25.00	0.41	0.39	5.00	0.00	0.10	0.10
25.05	0.41	0.39	5.00	0.00	0.10	0.10
25.10	0.41	0.39	5.00	0.00	0.10	0.10
25.15	0.41	0.39	5.00	0.00	0.10	0.10
25.20	0.41	0.39	5.00	0.00	0.10	0.10
25.25	0.41	0.39	5.00	0.00	0.10	0.10
25.30	0.41	0.39	5.00	0.00	0.10	0.10
25.35	0.41	0.39	5.00	0.00	0.10	0.10
25.40	0.41	0.39	5.00	0.00	0.10	0.10
25.45	0.41	0.39	5.00	0.00	0.10	0.10
25.50	0.41	0.39	5.00	0.00	0.09	0.09
25.55	0.41	0.39	5.00	0.00	0.09	0.09
25.60	0.41	0.39	5.00	0.00	0.09	0.09
25.65	0.41	0.39	5.00	0.00	0.09	0.09
25.70	0.41	0.39	5.00	0.00	0.09	0.09
25.75	0.41	0.39	5.00	0.00	0.09	0.09
25.80	0.41	0.39	5.00	0.00	0.09	0.09
25.85	0.41	0.39	5.00	0.00	0.09	0.09

25.90	0.41	0.39	5.00	0.00	0.09	0.09
25.95	0.41	0.39	5.00	0.00	0.09	0.09
26.00	0.41	0.39	5.00	0.00	0.09	0.09
26.05	0.41	0.39	5.00	0.00	0.09	0.09
26.10	0.41	0.39	5.00	0.00	0.09	0.09
26.15	0.41	0.39	5.00	0.00	0.09	0.09
26.20	0.41	0.39	5.00	0.00	0.09	0.09
26.25	0.41	0.39	5.00	0.00	0.09	0.09
26.30	0.41	0.39	5.00	0.00	0.09	0.09
26.35	0.41	0.39	5.00	0.00	0.09	0.09
26.40	0.41	0.39	5.00	0.00	0.09	0.09
26.45	0.40	0.39	5.00	0.00	0.09	0.09
26.50	0.40	0.39	5.00	0.00	0.09	0.09
26.55	0.40	0.39	5.00	0.00	0.09	0.09
26.60	0.40	0.39	5.00	0.00	0.09	0.09
26.65	0.40	0.39	5.00	0.00	0.09	0.09
26.70	0.40	0.39	5.00	0.00	0.09	0.09
26.75	0.40	0.39	5.00	0.00	0.09	0.09
26.80	0.40	0.39	5.00	0.00	0.09	0.09
26.85	0.40	0.39	5.00	0.00	0.09	0.09
26.90	0.40	0.39	5.00	0.00	0.09	0.09
26.95	0.40	0.39	5.00	0.00	0.09	0.09
27.00	0.40	0.39	5.00	0.00	0.09	0.09
27.05	0.40	0.39	5.00	0.00	0.09	0.09
27.10	0.40	0.39	5.00	0.00	0.09	0.09
27.15	0.40	0.39	5.00	0.00	0.09	0.09
27.20	0.40	0.39	5.00	0.00	0.09	0.09
27.25	0.40	0.39	5.00	0.00	0.08	0.08
27.30	0.40	0.39	5.00	0.00	0.08	0.08
27.35	0.40	0.39	5.00	0.00	0.08	0.08
27.40	0.40	0.39	5.00	0.00	0.08	0.08
27.45	0.40	0.39	5.00	0.00	0.08	0.08
27.50	0.40	0.39	5.00	0.00	0.08	0.08
27.55	0.40	0.39	5.00	0.00	0.08	0.08
27.60	0.40	0.39	5.00	0.00	0.08	0.08
27.65	0.40	0.39	5.00	0.00	0.08	0.08
27.70	0.40	0.39	5.00	0.00	0.08	0.08
27.75	0.40	0.39	5.00	0.00	0.08	0.08
27.80	0.40	0.39	5.00	0.00	0.08	0.08
27.85	0.40	0.39	5.00	0.00	0.08	0.08
27.90	0.40	0.39	5.00	0.00	0.08	0.08
27.95	0.40	0.39	5.00	0.00	0.08	0.08
28.00	0.40	0.39	5.00	0.00	0.08	0.08
28.05	0.40	0.39	5.00	0.00	0.08	0.08
28.10	0.40	0.39	5.00	0.00	0.08	0.08
28.15	0.40	0.39	5.00	0.00	0.08	0.08
28.20	0.40	0.39	5.00	0.00	0.08	0.08
28.25	0.40	0.39	5.00	0.00	0.08	0.08
28.30	0.40	0.39	5.00	0.00	0.08	0.08
28.35	0.40	0.39	5.00	0.00	0.08	0.08

28.40	0.40	0.39	5.00	0.00	0.08	0.08
28.45	0.40	0.39	5.00	0.00	0.08	0.08
28.50	0.40	0.39	5.00	0.00	0.08	0.08
28.55	0.40	0.39	5.00	0.00	0.08	0.08
28.60	0.40	0.39	5.00	0.00	0.08	0.08
28.65	0.40	0.39	5.00	0.00	0.08	0.08
28.70	0.40	0.39	5.00	0.00	0.07	0.07
28.75	0.40	0.39	5.00	0.00	0.07	0.07
28.80	0.40	0.39	5.00	0.00	0.07	0.07
28.85	0.40	0.39	5.00	0.00	0.07	0.07
28.90	0.40	0.39	5.00	0.00	0.07	0.07
28.95	0.40	0.39	5.00	0.00	0.07	0.07
29.00	0.40	0.39	5.00	0.00	0.07	0.07
29.05	0.40	0.39	5.00	0.00	0.07	0.07
29.10	0.40	0.39	5.00	0.00	0.07	0.07
29.15	0.40	0.39	5.00	0.00	0.07	0.07
29.20	0.40	0.39	5.00	0.00	0.07	0.07
29.25	0.40	0.39	5.00	0.00	0.07	0.07
29.30	0.40	0.39	5.00	0.00	0.07	0.07
29.35	0.40	0.39	5.00	0.00	0.07	0.07
29.40	0.40	0.39	5.00	0.00	0.07	0.07
29.45	0.40	0.39	5.00	0.00	0.07	0.07
29.50	0.40	0.39	5.00	0.00	0.07	0.07
29.55	0.40	0.39	5.00	0.00	0.07	0.07
29.60	0.40	0.39	5.00	0.00	0.07	0.07
29.65	0.40	0.39	5.00	0.00	0.07	0.07
29.70	0.40	0.39	5.00	0.00	0.07	0.07
29.75	0.40	0.39	5.00	0.00	0.07	0.07
29.80	0.40	0.39	5.00	0.00	0.07	0.07
29.85	0.40	0.39	5.00	0.00	0.07	0.07
29.90	0.40	0.39	5.00	0.00	0.06	0.06
29.95	0.40	0.39	5.00	0.00	0.06	0.06
30.00	0.40	0.39	5.00	0.00	0.06	0.06
30.05	0.40	0.39	5.00	0.00	0.06	0.06
30.10	0.40	0.39	5.00	0.00	0.06	0.06
30.15	0.40	0.39	5.00	0.00	0.06	0.06
30.20	0.40	0.38	5.00	0.00	0.06	0.06
30.25	0.40	0.38	5.00	0.00	0.06	0.06
30.30	0.40	0.38	5.00	0.00	0.06	0.06
30.35	0.40	0.38	5.00	0.00	0.06	0.06
30.40	0.40	0.38	5.00	0.00	0.06	0.06
30.45	0.40	0.38	5.00	0.00	0.06	0.06
30.50	0.40	0.38	5.00	0.00	0.06	0.06
30.55	0.40	0.38	5.00	0.00	0.06	0.06
30.60	0.40	0.38	5.00	0.00	0.06	0.06
30.65	0.39	0.38	5.00	0.00	0.06	0.06
30.70	0.39	0.38	5.00	0.00	0.06	0.06
30.75	0.39	0.38	5.00	0.00	0.06	0.06
30.80	0.39	0.38	5.00	0.00	0.06	0.06
30.85	0.39	0.38	5.00	0.00	0.06	0.06

30.90	0.39	0.38	5.00	0.00	0.06	0.06
30.95	0.39	0.38	5.00	0.00	0.06	0.06
31.00	0.39	0.38	5.00	0.00	0.05	0.05
31.05	0.39	0.38	5.00	0.00	0.05	0.05
31.10	0.39	0.38	5.00	0.00	0.05	0.05
31.15	0.39	0.38	5.00	0.00	0.05	0.05
31.20	0.39	0.38	5.00	0.00	0.05	0.05
31.25	0.39	0.38	5.00	0.00	0.05	0.05
31.30	0.39	0.38	5.00	0.00	0.05	0.05
31.35	0.39	0.38	5.00	0.00	0.05	0.05
31.40	0.39	0.38	5.00	0.00	0.05	0.05
31.45	0.39	0.38	5.00	0.00	0.05	0.05
31.50	0.39	0.38	5.00	0.00	0.05	0.05
31.55	0.39	0.38	5.00	0.00	0.05	0.05
31.60	0.39	0.38	5.00	0.00	0.05	0.05
31.65	0.39	0.38	5.00	0.00	0.05	0.05
31.70	0.39	0.38	5.00	0.00	0.05	0.05
31.75	0.39	0.38	5.00	0.00	0.05	0.05
31.80	0.39	0.38	5.00	0.00	0.05	0.05
31.85	0.39	0.38	5.00	0.00	0.05	0.05
31.90	0.39	0.38	5.00	0.00	0.05	0.05
31.95	0.39	0.38	5.00	0.00	0.05	0.05
32.00	0.39	0.38	5.00	0.00	0.05	0.05
32.05	0.39	0.38	5.00	0.00	0.05	0.05
32.10	0.39	0.38	5.00	0.00	0.05	0.05
32.15	0.39	0.38	5.00	0.00	0.05	0.05
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32.25	0.39	0.38	5.00	0.00	0.04	0.04
32.30	0.39	0.38	5.00	0.00	0.04	0.04
32.35	0.39	0.38	5.00	0.00	0.04	0.04
32.40	0.39	0.38	5.00	0.00	0.04	0.04
32.45	0.39	0.38	5.00	0.00	0.04	0.04
32.50	0.39	0.38	5.00	0.00	0.04	0.04
32.55	0.39	0.38	5.00	0.00	0.04	0.04
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32.65	0.39	0.38	5.00	0.00	0.04	0.04
32.70	0.39	0.38	5.00	0.00	0.04	0.04
32.75	0.39	0.38	5.00	0.00	0.04	0.04
32.80	0.39	0.38	5.00	0.00	0.04	0.04
32.85	0.39	0.38	5.00	0.00	0.04	0.04
32.90	0.39	0.38	5.00	0.00	0.04	0.04
32.95	0.39	0.38	5.00	0.00	0.04	0.04
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33.60	0.39	0.37	5.00	0.00	0.03	0.03
33.65	0.39	0.37	5.00	0.00	0.03	0.03
33.70	0.39	0.37	5.00	0.00	0.03	0.03
33.75	0.39	0.37	5.00	0.00	0.03	0.03
33.80	0.39	0.37	5.00	0.00	0.03	0.03
33.85	0.39	0.37	5.00	0.00	0.03	0.03
33.90	0.39	0.37	5.00	0.00	0.03	0.03
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34.75	0.39	0.37	5.00	0.00	0.03	0.03
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36.50	0.38	0.36	5.00	0.00	0.02	0.02
36.55	0.38	0.36	5.00	0.00	0.01	0.01
36.60	0.38	0.36	5.00	0.00	0.01	0.01
36.65	0.38	0.36	5.00	0.00	0.01	0.01
36.70	0.38	0.36	5.00	0.00	0.01	0.01
36.75	0.38	0.36	5.00	0.00	0.01	0.01
36.80	0.38	0.36	5.00	0.00	0.01	0.01
36.85	0.38	0.36	5.00	0.00	0.01	0.01
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37.85	0.38	0.36	5.00	0.00	0.01	0.01
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38.25	0.38	0.36	5.00	0.00	0.01	0.01
38.30	0.38	0.36	5.00	0.00	0.01	0.01
38.35	0.38	0.36	5.00	0.00	0.01	0.01

38.40	0.38	0.36	5.00	0.00	0.01	0.01
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38.55	0.38	0.36	5.00	0.00	0.00	0.00
38.60	0.38	0.36	5.00	0.00	0.00	0.00
38.65	0.38	0.36	5.00	0.00	0.00	0.00
38.70	0.38	0.36	5.00	0.00	0.00	0.00
38.75	0.38	0.36	5.00	0.00	0.00	0.00
38.80	0.38	0.36	5.00	0.00	0.00	0.00
38.85	0.38	0.36	5.00	0.00	0.00	0.00
38.90	0.38	0.36	5.00	0.00	0.00	0.00
38.95	0.38	0.36	5.00	0.00	0.00	0.00
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39.35	0.38	0.35	5.00	0.00	0.00	0.00
39.40	0.38	0.35	5.00	0.00	0.00	0.00
39.45	0.38	0.35	5.00	0.00	0.00	0.00
39.50	0.38	0.35	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

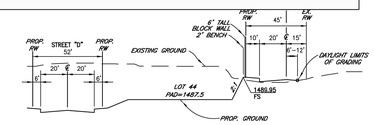
Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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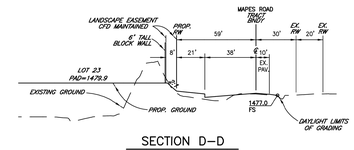
1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

GSI LEGEND

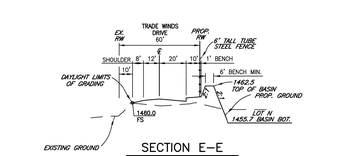
- **Afc** — ARTIFICIAL FILL – COMPACTED, PLACED IN 2007 UNDER THE GEOTECHNICAL OBSERVATION AND TESTING SERVICES OF GSI
- **Qof** — LATE TO MIDDLE PLEISTOCENE–AGE OLD ALLUVIAL FAN DEPOSITS, CIRCLED WHERE BURIED
- **Klmt** — CRETACEOUS–AGE GRANITIC BEDROCK (TONALITE), CIRCLED WHERE BURIED
- — APPROXIMATE LOCATION OF GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN, DOTTED WHERE CONCEALED
- B-3 — APPROXIMATE LOCATION OF EXPLORATORY BORING (GSI, 2005)
- TP-19 — APPROXIMATE LOCATION OF EXPLORATORY TEST PIT (GSI, 2005)
- SL-3 — APPROXIMATE LOCATION OF SEISMIC REFRACTION TRAVERSE (GSI, 2005)
- B B' — APPROXIMATE LOCATION OF ROCK DISPOSAL AREAS, WITH APPROXIMATE TOP OF ROCK ELEVATIONS, AND DEPTH (FEET)
- — GEOLOGIC CROSS SECTION LINE
- **N.A.P.** — NOT A PART OF THIS STUDY
- — AREA UNDER THE PURVIEW OF THIS REPORT
- — APPROXIMATE LIMITS OF GRADING
- 20 — APPROXIMATE THICKNESS OF EXISTING COMPACTED FILLS (FEET)



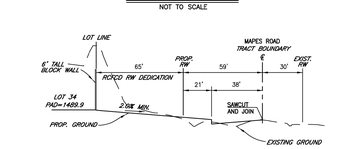
SECTION C–C
NOT TO SCALE



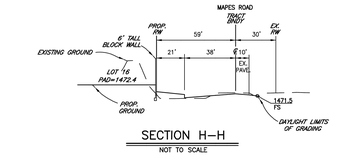
SECTION D–D
NOT TO SCALE



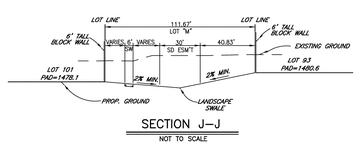
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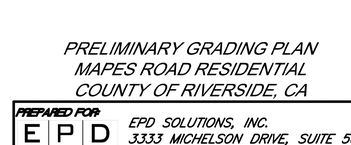
SECTION F–F
NOT TO SCALE



SECTION G–G
NOT TO SCALE



SECTION H–H
NOT TO SCALE



SECTION J–J
NOT TO SCALE

PRELIMINARY GRADING PLAN
MAPES ROAD RESIDENTIAL
COUNTY OF RIVERSIDE, CA

PREPARED FOR:
EPD SOLUTIONS, INC.
3333 MICHELSON DRIVE, SUITE 500
IRVINE, CA 92612

PREPARED BY:
KWC ENGINEERS
CIVIL ENGINEERS • PLANNERS • SURVEYORS
1181 CALIFORNIA AVENUE, SUITE 235 CORONA, CA. 92881-3376 951-734-2130

SHEET 2 OF 4 SHEET

GeoSoils, Inc.

GEOTECHNICAL MAP
Plate 1

W.O. 8978-A1-IE | DATE: 02/26 | SCALE: 1" = 50'

ALL LOCATIONS ARE APPROXIMATE

This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.

SCALE IN FEET

JN: 22-225-2 R:\22\225\2\PRELIM\GRADING PLAN\Preliminary Grading Plan\2257 PRELIM GRADING PLAN 02.dwg 02/26/26 3:56pm

GSI LEGEND

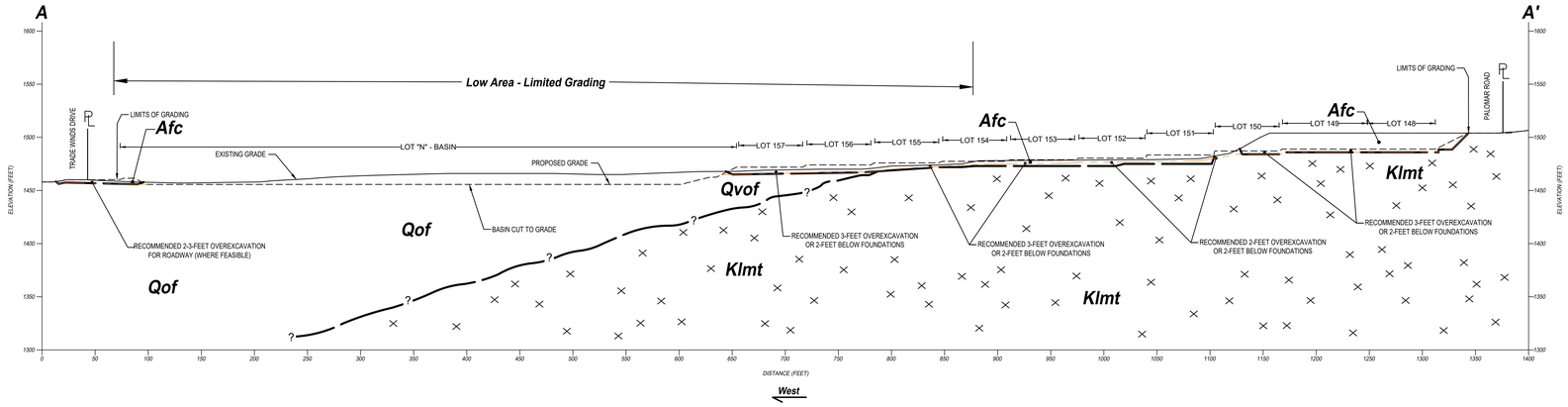
Afc – ARTIFICIAL FILL – COMPACTED, PLACED IN 2007 UNDER THE GEOTECHNICAL OBSERVATION AND TESTING SERVICES OF GSI

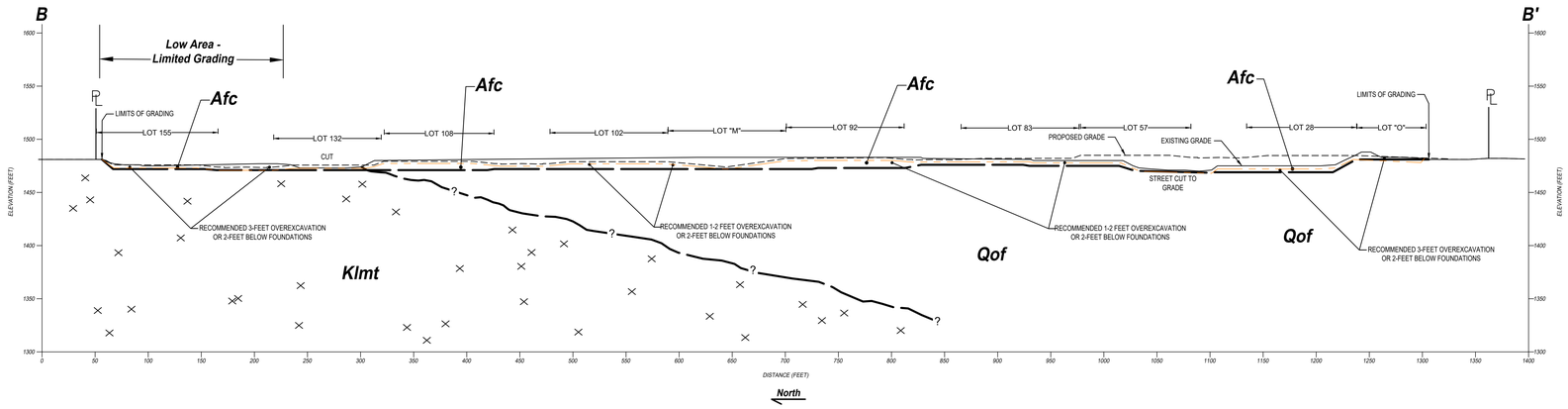
Qof – LATE TO MIDDLE PLEISTOCENE–AGE OLD ALLUVIAL FAN DEPOSITS

Klmt – CRETACEOUS–AGE GRANITIC BEDROCK (TONALITE)

—?— – APPROXIMATE LOCATION OF GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN

– APPROXIMATE LIMITS OF LIMITS AND DEPTH OF RECOMMENCED OVEREXCAVATION





DRAFT

ALL LOCATIONS ARE APPROXIMATE

This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.

GeoSoils,Inc.

GEOLOGIC CROSS-SECTIONS A-A' & B-B'

Plate 2

W.O. 8978-A1-IE	DATE: 02/26	SCALE: 1" = 50'