LIMITED PRELIMINARY
GEOTECHNICAL INVESTIGATION
SERRANO HIGHLANDS
TENTATIVE TRACT 15594
CITY OF LAKE FOREST, CALIFORNIA

FOR

MADISON INVESTORS, L.P.
23201 MILL CREEK ROAD, SUITE 130
LAGUNA HILLS, CALIFORNIA 92653
W.O. 4414-A1-OC SEPTEMBER 30, 2004

GeoSoils, Inc.

GeoSoils, Inc.

Geotechnical ◦ Coastal ◦ Geologic ◦ Environmental

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September 30, 2004

W.O. 4414-A1-OC

Madison Investors, L.P.
23201 Mill Creek Road, Suite 130
Laguna Hills, California 92653

Attention: Mr. Gary Emsiek

Subject: Limited Preliminary Geotechnical Investigation, Serrano Highlands, Tentative Tract 15594, City of Lake Forest, California

Gentlemen:

In accordance with your request and authorization, this report presents the results of our Limited Preliminary Geotechnical Investigation of the subject site. The purpose of the study was to evaluate the onsite soils and geologic conditions and their effects on the proposed development from a geotechnical viewpoint.

EXECUTIVE SUMMARY

Based on our review of available data, limited field exploration, laboratory testing and geologic and engineering analyses, the proposed project appears suitable for its intended use from a geotechnical viewpoint, provided the recommendations presented in the text of this report are implemented during design and construction phases of the project.

- Removal of colluvial and alluvial deposits and weathered bedrock materials will be necessary prior to fill placement. For preliminary planning purposes, these depths are estimated to be 2± to 35± feet.
- Our review indicates no known active faults are crossing the project area, and the site is not within an (Alquist-Priolo) Earthquake Fault Zone.
- In general, and based upon data from our borings, groundwater is not expected to be a major factor in development of the site.
- The majority of the bedrock is expected to be readily excavatable to the planned depths.

- Deep alluvial removals may be required beneath fills planned at the site's main drainage channel.

- As an alternative to the total alluvial removal (within Lots 52, 53, 68, 69 and 76) in the vicinity of the existing easement, structures could be supported by a deep foundation system, embedded into the competent bedrock. Minor potential for damage should, however, be expected within rear yard improvements on these lots.

- In order to minimize the potential for fill settlement, fill materials should be compacted as follows:

Fill depth deeper than 30'	93% of relative compaction
Fill depth between 30' to surface	90% of relative compaction

- Settlement monitoring should be expected for fill areas deeper than 30 feet and a settlement monitoring plan will be recommended when the site final grading plan becomes available.

- No adverse geologic features that would preclude project feasibility were encountered during our field investigation.

- 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 greatly appreciated. If you should have any questions concerning this report or if we may be of further assistance, please do not hesitate to contact the undersigned.

Respectfully submitted,

GeoSoils, Inc.

Fred Aflakian

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LIMITED PRELIMINARY GEOTECHNICAL INVESTIGATION SERRANO HIGHLANDS, TENTATIVE TRACT 15594 CITY OF LAKE FOREST, CALIFORNIA

PURPOSE AND SCOPE OF STUDY

The purpose of this investigation was to obtain geotechnical data pertinent to the feasibility, planning, design and development of the site. This report provides preliminary recommendations for site preparation and grading, and preliminary design parameters. The scope of work completed for this geotechnical investigation has included the following activities:

1. Site reconnaissance and review of available soil and geologic data for the area.
2. Subsurface exploration consisting of the excavation, logging and sampling of six (6) exploratory borings.
3. Laboratory testing of samples collected during the field exploration for determination of classification, compaction characteristics, in-place density and moisture content, sulfate content, expansion index, and shear strength.
4. Engineering analyses of data collected with respect to the geotechnical planning and development of the site.
5. Preparation of this report.

This report includes a copy of the 40-scale Concept Grading Plan (Geological Map), which was prepared by Hunsaker and Associates, and is used as the base map for geotechnical data, and shows the approximate locations of exploratory borings (Plate 1), Geologic Cross-Section (Plates 2 & 3) References (Appendix A), Logs of Exploratory Borings (Appendix B), Laboratory Test Results (Appendix C), Seismic Analysis (Appendix D), and General Earthwork and Grading Guidelines (Appendix E).

SITE LOCATION AND DESCRIPTION

The site consists of two parcels of rectangular shaped land which are located at the northern end of Peachwood, in the City of Lake Forest, California (Figure 1). The smaller parcel is relatively flat, the larger parcel is a hilly site and topographically consists of a west-east trending ridge and associated tributaries. The slope ratios of the natural slopes range from 2:1 to 3:1 (h:v).

FIGURE 1

SITE LOCATION MAP

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PROPOSED DEVELOPMENT

Based on a review of the enclosed 40-scale Grading Plan (Plate 1), proposed development will consist of 83 one or two-story, single-family residences, and associated streets. Proposed grading will involve standard cut-fill grading procedures to create the proposed development. Maximum cut and fill slopes are planned at approximately 35 feet and 25 feet, respectively. Building loads are assumed to be typical for this relatively light construction.

SUBSURFACE EXPLORATION

Subsurface exploration was performed by GSI on August 30, 2004, and consisted of the excavation of six hollow stem borings to depths ranging from 10.8 to 41.5 feet below the surface. A GSI field geologist observed the excavation operations and collected bulk samples for visual examination and subsequent laboratory testing. Soils encountered in the borings were classified in general accordance with the Unified Soil Classification System (USCS), as described in Appendix B, Plate A. The Logs of the Exploratory Borings are presented in Appendix B and are based on visual examination of the samples, cuttings obtained during excavation operations, and results of laboratory tests.

The approximate locations of the exploratory excavations are shown on the Geological Map (Plate 1). The Logs of Borings are presented in Appendix B.

SITE GEOLOGY

Earth Materials

Colluvium (map symbol: Qc)

Colluvial material consisted of silty sand, brown to grayish brown, slightly moist, porous and subject to consolidation. This material was mapped where thicknesses are greater than 4 feet (see Plate 1).

Alluvium (map symbol: Qal)

Alluvial material consisted of silty sand, medium brown to grayish brown, slightly moist to moist and medium dense in consistency. These materials are subject to consolidation and not suitable for structural support.

Capistrano Formation, Oso Member (map symbol: Tso)

Sandstone of the Capistrano Formation, Oso Member, has been mapped throughout the site. This unit is characteristically light gray to white in color, and structurally massive. The sandstone is generally moderately hard and can locally be friable as well as cemented. The materials vary from silty fine sandstone to coarse grained sandstone.

FAULTING AND REGIONAL SEISMICITY

No known active or potentially active faults are shown crossing the site on published maps reviewed (Jennings, 1994). No evidence for active or potentially active faulting was encountered in any of our exploratory borings performed during this evaluation or in referenced reports reviewed for this study.

There are a number of faults in the southern California area which are considered active and will have an effect on the site in the form of moderate to strong ground shaking, should they be the source of an earthquake. These include, but are not limited to: the San Andreas fault, the Elsinore-Glen Ivy fault, the Chino-Central fault (approx.10.0 miles.), the Elsinore-Whittier fault, and the San Jose fault zone. The approximate location of these and other major faults relative to the site are presented in Appendix D. The possibility of ground acceleration or shaking at the site may be considered as approximately similar to the southern California region as a whole.

Historic Earthquakes

An historic earthquake analysis was performed for the project site using the computer program EQSEARCH (Blake, 2000b). To date, 168 earthquakes with Richter Magnitude 5.0 or greater have occurred within 100 kilometers of the site since the year 1800. Historically, the maximum site acceleration during this period has been calculated to be 0.246g, with a maximum Richter Magnitude of 7.6 (Appendix D).

Deterministic Evaluation

A deterministic seismic hazard analysis was performed for the project site using the computer program EQFAULT (Blake, 2000c). The closest fault to the site is the Chino-Central Ave. fault zone, which is approximately 10.0 miles away from the site. For this analysis we have selected the attenuation relationship of Boore, et al. (1997) for a site soil classification (average shear velocity = 250 m/sec). The largest maximum earthquake site acceleration anticipated at the site is 0.4716g assuming a maximum earthquake event of magnitude 6.7 (M_w) on the Chino-Central Ave. fault zone (Appendix D).

Probabilistic Evaluation

A probabilistic seismic hazard analysis was performed using the computer program FRISKSP (Blake, 2000c). The data presented in Appendix D was modified by one standard deviation of probability to accommodate the uncertainty (mean + 1). For this analysis we have selected the attenuation relationship of Boore, et al. (1997), for a site soil classification (average shear velocity = 250 m/sec), a fault search radius of 100 kilometers. This analysis indicates a ground acceleration of 0.4g for a 10% probability of occurrence in 50 years (Appendix D).

UBC Seismic Coefficients and Near Source Factors

In accordance with the 1997 UBC, the seismic parameters to be considered in the design are presented below:

Soil Profile (Table 16-J) = S_D
Seismic Zone (Figure 16-2) = 4
Seismic Zone Factor (Table 16-I) Z = 0.4
Seismic Source Type (Table 16-U) = B
Seismic Coefficient, C_a (Table 16-Q) = 0.44
Seismic Coefficient, C_v (Table 16-Q) = 0.64
Near Source Factor N_a (Table 16-S) = 1.0
Near Source Factor N_v (Table 16-T) = 1.0
Design Fault = Sierra Madre Fault
Source Distance = ±10 Miles

Seismic Hazards

The following list includes other seismic related hazards that have been considered during our evaluation of the site. The hazards listed are considered negligible and/or completely mitigated as a result of site location, soil characteristics and typical site development procedures:

- Surface Fault Rupture
- Ground Lurching or Shallow Ground Rupture

It is important to keep in perspective that in the event of a maximum probable or credible earthquake occurring on any of the nearby major faults, strong ground shaking would occur in the subject site's general area. Potential damage to any structure(s) would likely be greatest from the vibrations and impelling force caused by the inertia of a structure's mass than from those induced by the hazards considered above. This potential would be no greater than that for other existing structures and improvements in the immediate vicinity.

Our field observations and review of readily available geologic data indicate that active faults do not cross the site.

Experience has shown that wood frame structures designed in accordance with the Uniform Building Code tend to best resist earthquake effects. Earthquake effects may include lurching and/or localized ground cracking. This would be expected over other portions of southern California.

LANDSLIDES

No landslides were encountered during the course of our subsurface investigation. In addition, topographic landforms were not suggestive of landslides in the field.

GROUNDWATER

Groundwater was not encountered in GSI's exploratory borings for the current study and is not anticipated to adversely affect the site development. These observations reflect site conditions at the time of this investigation and do not preclude changes in local groundwater conditions in the future from natural causes or from damaged structures (pools, pipes, etc.), heavy irrigation or altered site drainage pattern(s).

LIQUEFACTION

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, consolidation and settlement of loose sediments, sand boils 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. Groundwater was not observed in GSI's borings and all susceptible alluvial materials to liquefaction will be removed and replaced with compacted fill materials.

RIPPABILITY

The underlying alluvium and bedrock materials on site are not anticipated to pose any excavation difficulties during grading. However, isolated hard lenses are common within the Capistrano Formation and Oso Member.

LABORATORY TESTING

General

Laboratory tests were performed on representative samples of the onsite earth materials encountered in order to evaluate their physical characteristics. The test procedures used and results obtained are presented below and in Appendix C. Additional testing will be required at the completion of site grading to determine the as-graded soil conditions as they relate to foundation design.

Moisture-Density Relations

The laboratory maximum dry density and optimum moisture content for the representative site soils were determined according to test method ASTM D-1557. Results of this testing are presented in Appendix C.

Expansion Potential

An expansion index test was performed on a representative sample of the site soil in general accordance with the 1997 Uniform Building Code Standard 18-2. The result is presented in the following table:

LOCATION	EXPANSION INDEX	EXPANSION POTENTIAL
B-1 @ 5'	5	Very Low

Sulfate Test

A test was conducted according to Caltrans Method 417 to determine soluble sulfate content of onsite soil. The test result is presented in the following table:

LOCATION	SOLUBLE SULFATE IN WATER (% By Weight)
B-1 @ 5'	0.001

Additional sulfate and expansion potential testings should be performed at the completion of site grading and prior to the start of construction.

Consolidation Testing

Consolidation tests were performed on selected undisturbed samples. Testing was performed in general accordance with ASTM Test Method D-2435-90. Test results are presented in Appendix C.

Shear Testing

Shear testings were performed on remolded and natural soil samples in a strain control-type direct shear machine. Remolded samples were remolded to 90 percent of relative compaction. Testing was performed in general accordance with ASTM Test Method D-3080-90. Results of this testing are presented in Appendix C.

Corrosivity

One corrosivity test was performed and collected from the site. The test was performed in accordance with the CalTrans Test Methods 422 and 532. Results of this testing are presented in Appendix C.

CONCLUSIONS

Based on the field exploration, laboratory testing and engineering and geological analysis, it is GSI's opinion that the site is suitable for the proposed development from geotechnical engineering and geologic viewpoints, provided that the recommendations presented herein are incorporated into the design and construction phases of site development.

The geologic and engineering analyses performed concerning site preparation, and the recommendations presented herein, have been completed using the information provided. In the event that any significant changes are made to proposed site development, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the recommendations of this report are verified or modified in writing by this office.

EARTHWORK CONSTRUCTION RECOMMENDATIONS

General

Grading should be accomplished under the observation and testing of the project soils engineer in accordance with the recommendations contained herein, the applicable grading ordinance of the City of Lake Forest where applicable, and GSI's "General Earthwork and Grading Guidelines" included herein as Appendix E.

Site Preparation and Grading

During earthwork construction, all removals and the general grading procedures should be observed and the fill selectively tested by a representative of GSI. Oversized material (>6" diameter) if encountered, should be separated and not placed in foundation areas with compacted fills. If unusual or unexcepted conditions are exposed in the field, they should be reviewed by this office, and, if warranted, modified and/or additional recommendations offered. All applicable requirements of the California Construction and General Industry Safety Order, the Occupational Safety and Health Act and the Construction Safety Act should be met.

Clearing and Grubbing

Prior to initiating the grading operation, all existing surficial vegetation, debris and other deleterious material should be removed from the site.

Removals

In areas to receive compacted fill, unsuitable surficial materials (including existing colluvium, alluvium and weathered bedrock) should be removed to competent materials as directed by the project geotechnical consultant or his/her field representatives (referred to herein as the geotechnical consultant). The depths of removal, as estimated from our study, generally vary from 2± to 35± feet. However, deeper removals in unexplored areas are possible.

Transition Lots

All geological transition lots should be capped with a minimum of 3 feet of compacted fill. In order to establish a uniform subgrade beneath any proposed foundations or materials of differing expansion potential, the cut portions of cut/fill transition lots/pads should be overexcavated a minimum of 3 feet and replaced with compacted fill. (This could be deepened based on proposed construction and/or exposed soil conditions.) Prior to replacing the overexcavated area with compacted fill, the exposed bedrock should be well scarified to a minimum depth of 6 inches, brought to at least optimum moisture content, and compacted to a minimum relative compaction of 90 percent of the laboratory standard. Since lot grades are not currently shown on site plans, overexcavation of transition lots will be determined when site plans become finalized, based on conditions exposed.

Stability of Temporary Excavations

The possibility of temporary excavations failing during grading may be minimized by keeping the time between cutting and filling operations to a minimum, limiting the maximum width of cut slope exposed at any one time, and cutting no steeper than a 1:1 gradient.

Fill Placement

Subsequent to completing the recommended removals and overexcavation, the excavated onsite soils that are free of vegetation and debris may be placed in relatively thin lifts (up to 8± inches loose), brought to at least optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard (ASTM D-1557).

Benching

Fills placed on slopes steeper than 5:1 (h:v) should be keyed and benched into competent material as the fill is placed. Keys and benches should be observed by the geotechnical engineer or engineering geologist. Typical benching details have been included in Appendix E.

Fill Slopes

All the fill slopes are designed at gradients no steeper than 2:1 (h:v). Fill slopes toeing on natural slopes require a minimum keyway of 15 feet or 1/2 of the slope height (whichever is greater). The keyway should be at least 2 feet into competent fill or bedrock materials. The importance of proper fill slope compaction cannot be overemphasized. In order to achieve proper compaction, one or more of the four following methods should be employed by the contractor following implementation of typical slope construction guidelines: 1) track walking the slope at grade, 2) gridroll the slope, 3) use a combination of a sheepsfoot roller and track walking, or 4) overfill the slopes 3 to 5 feet laterally and cut them back to grade to expose the compacted core. Random testing should be performed to verify compaction to the face of the slope.

Cut Slopes

The planned cut slopes are 2:1 (h:v) or flatter. The presence of any adverse geologic structures and need for cut slope stabilization should be further evaluated by the project engineering geologist during grading so that mitigative measures can be provided, if warranted.

Stabilization Fill Slopes

Some anticipated cut slopes within the subject project areas may locally require stabilization fills, although none are anticipated at this time. The backcuts for stabilization fills are recommended to be constructed at a minimum (i.e., no steeper than) inclination of 1:1 (h:v). Stability fills, if necessary, are to be at least 20 feet wide to the top of slopes and will require subdrains, including backdrains, etc., as indicated in Appendix D.

Subdrainage

Subdrains should be anticipated for canyon cleanouts and retaining wall backcuts. Preliminary locations and extent of subdrains should be determined based on a review of final construction plans. Actual locations and extent of subdrains should be determined during grading by the project geotechnical consultant. The general construction details of subdrain placement are shown in Appendix D.

Earthwork Balance

The volume change of excavated material upon compaction as engineered fill will vary with material type and location. It is anticipated that the bedrock materials will not subside due to the static and dynamic loading conditions imposed by earthwork equipment. The earthwork shrinkage/bulking factors for removed material may be approximated by using the following parameters:

Colluvium	10% to 15% shrinkage
Alluvium	5% to 10% shrinkage
Bedrock	5% to 10% bulking

The above factors are based on in-situ density testing performed during the field exploration phase of our evaluation, and our experience on similar, nearby projects.

Stability of Temporary Cut Slopes for Retaining Walls

The stability of temporary excavations depends on many factors, including the slope angle, the shearing strength of the existing fill material, and the height of the slope and the length of time the excavation remains unsupported and exposed to equipment vibrations and rainfall. All excavations should be observed by the engineering geologist during excavation.

The possibility of temporary excavations failing may be minimized by: 1) keeping the time between cutting and filling operations to a minimum; 2) limiting excavation length exposed at any one time; and, 3) cutting no steeper than a 1:1 (h:v) inclination.

The above information is intended to minimize the risk of temporary excavation failure, but does not guarantee one will not occur. Although not expected, any liability, risk or cost imposed by excavation failure is accepted as inherent in the construction of the proposed improvements between the contractor and the developer, and, as such, their parties are duly notified that, although unlikely, this may occur, and all safety precautions should be utilized.

FOUNDATION DESIGN RECOMMENDATIONS

General

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. The structural engineer 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 should consider all applicable codes and authoritative sources where needed. If analyses by the structural engineer 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 has any questions or requires further assistance, please do not hesitate to call or otherwise transmit his requests.

Based upon our observations and previous test data, the onsite soils are very low to low in expansion potential (per Table 18-I-B of the 1997 UBC). The following preliminary foundation construction recommendations are presented for planning purposes. Final foundation construction recommendations should be based on expansive soil tests performed after earthwork construction. If materials with an expansion index of 20 or higher are placed near finish grade elevations, then an effective plasticity index should be recommended for the upper 15 feet (per Section 1815.4.2 of the 1997 UBC). For preliminary purposes, an effective plasticity index of 60, and an unconfined compressive strength coefficient of 2 may be used.

Conventional Foundation Design

Conventional spread and continuous footings may be used provided they are founded entirely in properly compacted fill or bedrock.

An allowable bearing value of 1,500 psf may be used for design of footings which maintain a minimum width of 12 inches (15 inches for two-story buildings) for continuous footings and 24 inches for isolated footings and a minimum depth of at least 12 inches (18 inches for two-story building) into the properly compacted fill or bedrock. The bearing value may be increased by one-third for seismic or other temporary loads.

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

Passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 2,000 psf.

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

Building Setbacks From Slopes

Building setbacks from the tops and toes of slopes should minimally comply with the 1997 UBC. However, the required setback from the tops of the slopes could be reduced by deepening the building footings.

Settlement

The structures within the fill areas should be designed to withstand a total and differential settlement of 2.0 inches and 1.0 inch over a 40-foot horizontal span, respectively.

FOUNDATION CONSTRUCTION RECOMMENDATIONS

General

Based upon our observations and test data, the building pad areas are anticipated to have very low expansion potential. The following preliminary foundation construction recommendations are presented for planning purposes. Final foundation construction recommendations should be based on expansive soil tests performed after earthwork construction.

Very Low Expansive Soils (E.I. from 0-20)

1. Interior and exterior footings should be founded at a minimum depth of 12 inches below the lowest adjacent ground surface. Exterior footings for two-story construction should be founded at a minimum depth of 18 inches (12 inches of workshop building). All continuous footings should be reinforced with a minimum of 4 No. 4 reinforcing bars, two placed near the top and two placed near the bottom footing. Isolated and continuous footings should be minimally reinforced per structural requirements.

2. Concrete slabs in moisture-sensitive areas should be underlain with 2 inches of washed sand or crushed rock. In addition, a vapor barrier consisting of a minimum of six mil visqueen with all laps sealed should be provided. One inch of the sand should be placed over the membrane to aid in uniform curing of the concrete.

3. Concrete slabs should be a minimum of 4 inches (full) thick and be reinforced with No. 3 bars on 18-inch centers, both ways, or the equivalent. All slab reinforcement should be properly supported to ensure the desired placement near mid-height in the slab.

4. Moisture conditioning of subgrade is recommended for these soil conditions. The moisture condition of each slab area should be at least 110 percent of optimum and be verified by this office to a depth of 18 inches below slab grade prior to placement of concrete.

5. The reinforcing recommendations presented above reflect the design criteria from a soils engineering viewpoint. Architectural and structural engineering specifications, which exceed our recommendations, should prevail.

WALL DESIGN PARAMETERS

Conventional Retaining Walls

The design parameters provided below assume that either non-expansive soils (Class 2 permeable filter material or Class 3 aggregate base) or native materials (with an expansion index of up to 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 superseded 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 TO VERTICAL	EQUIVALENT FLUID WEIGHT P.C.F. (SELECT BACKFILL)	EQUIVALENT FLUID WEIGHT P.C.F. (NATIVE BACKFILL)
Level*	35	45
2 to 1	45	55

* 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, where H is the height of the wall.

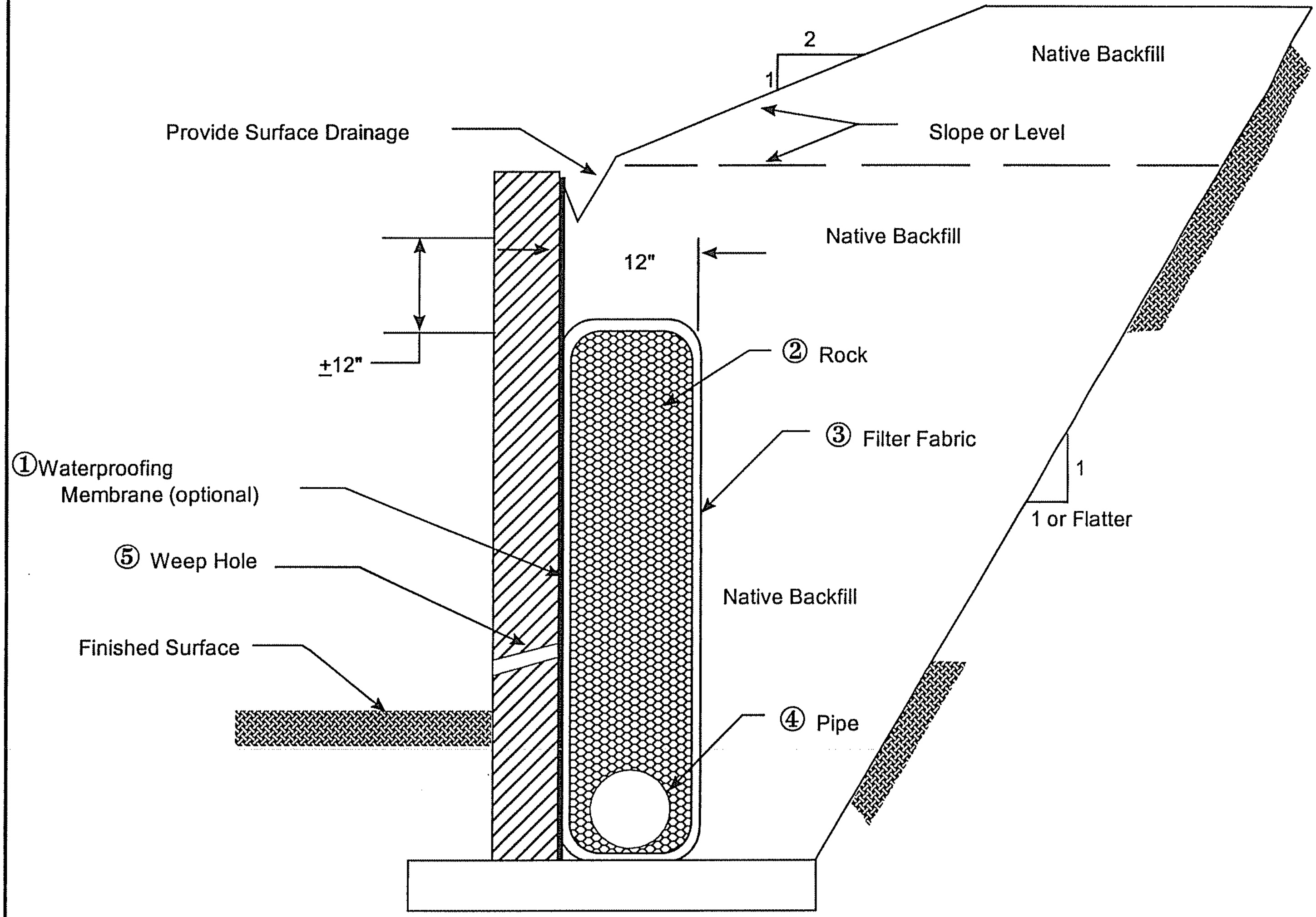
Retaining Wall Backfill and Drainage

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. Backdrains should consist of a 4-inch diameter perforated PVC or ABS pipe encased in either Class 2 permeable filter material or ½-inch to ¾-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 expansion index (E.I.) potential of greater than 90 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 in walls higher than 2 feet should not be considered. The surface of the backfill should be sealed by pavement or the top 18 inches compacted with 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.

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.

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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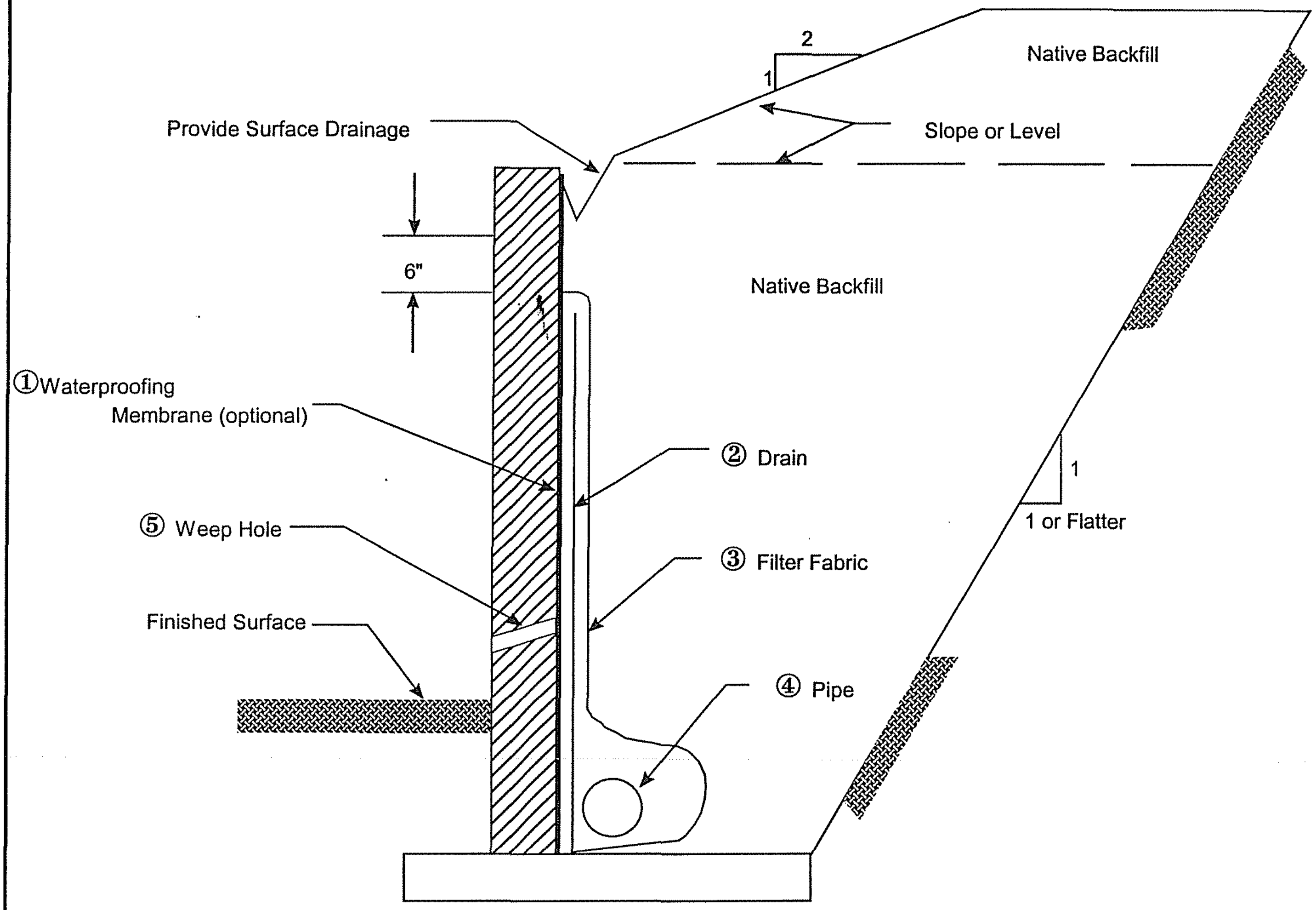
DETAILS

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.

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

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.)

GeoSoils, Inc.

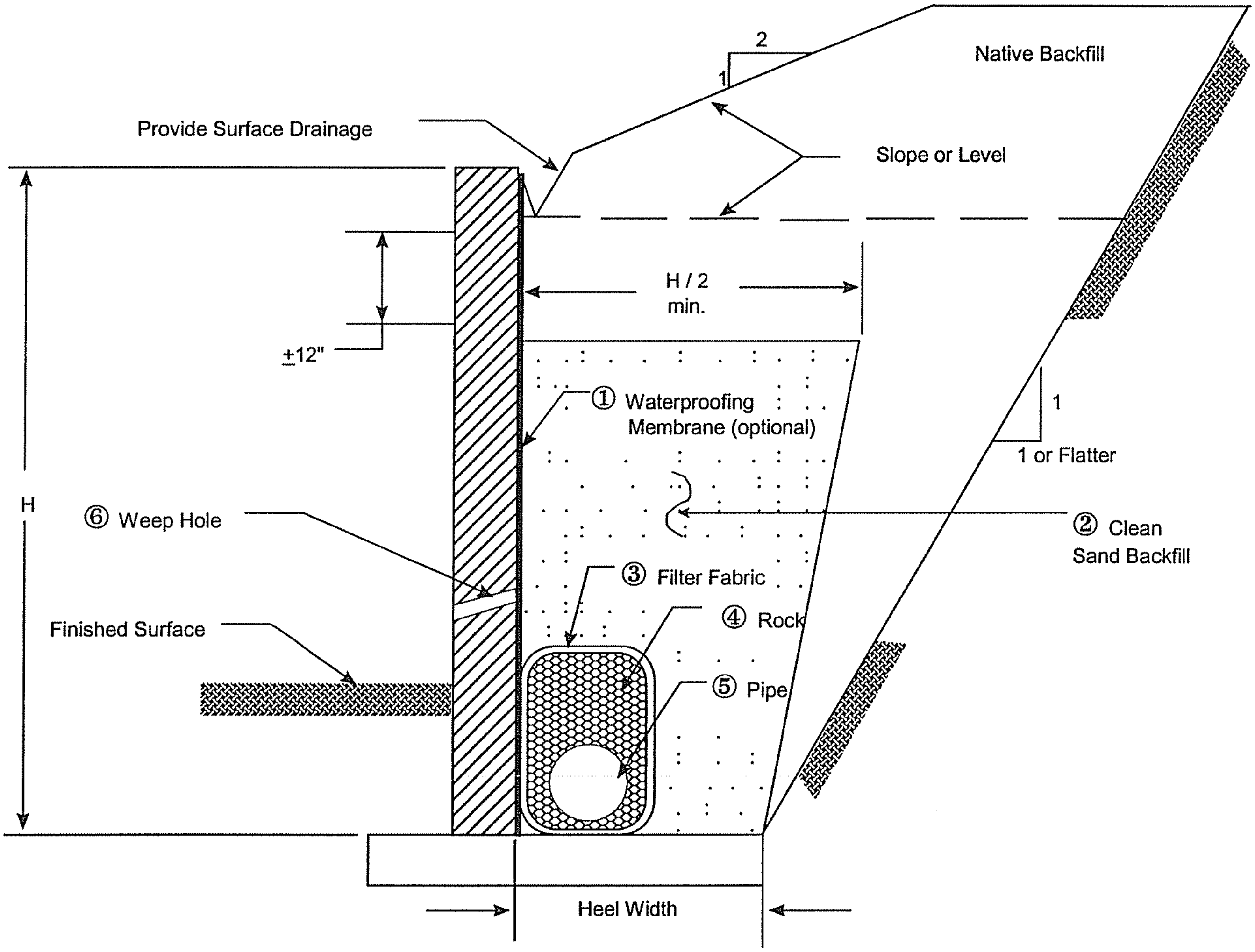
RETAINING WALL BACKFILL AND SUBDRAIN DETAIL GEOTEXTILE DRAIN

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.

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.)

GeoSoils, Inc.

RETAINING WALL AND SUBDRAIN DETAIL
CLEAN SAND BACKFILL

DETAIL 3

Geotechnical • Coastal • Geologic • Environmental

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 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 a combination of grade beam and caisson foundations. 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 110 percent of) the soils' optimum moisture content, to a depth of 18 inches below subgrade elevation. The moisture content of the subgrade should be verified within 48 hours prior to pouring concrete.

2. Concrete slabs should be cast over a relatively 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. The layer should 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. 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.

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.

PRELIMINARY PAVEMENT DESIGN

Based on an assumed "R"-Value of 40 and developed traffic indices using the county method of calculating traffic indices, and the design guide for California Cities and Counties, the pavement sections tabulated below are calculated:

Location	Assumed Traffic Index	Subgrade "R"-Value	AC (Inches)	AB (inches)
Paver Area	6.0	40	13	___
Access Roads	6.0	40	4.0	6.0

All pavement installation, including preparation and compaction of subgrade, compaction of base material, and placement and rolling of asphaltic concrete should be done in accordance with the City of Lake Forest's applicable specifications and under the observation and testing of the project geotechnical engineer and/or the City of Lake Forest. Minimum compaction requirements should be 90 percent for subgrade and 95 percent for aggregate base as per ASTM D-1557 (modified proctor). The final design shall be based on "R"-Values tested during grading.

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 (i.e., 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 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, 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 can adversely affect site improvements, and cause 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, downspouts, or other appropriate means may be utilized to control roof drainage. Downspouts, 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.

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 non-erosive devices that will carry the water away from the house. 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

Recommendations for exterior concrete flatwork design and construction can be provided upon request. 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. 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.

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 and 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 verify that the excavations are made into the recommended bearing material and to the minimum widths and depths recommended for construction. If loose or compressible materials are exposed within the footing excavation, a deeper footing or removal and recompaction of the subgrade materials would be recommended at that time. Footing trench spoil and any excess soils generated from utility trench excavations should be compacted to a minimum relative compaction of 90 percent, if not removed from the site.

Trenching

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

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 verify the desired results.

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

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

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 significant excavation (i.e., higher than 4 feet).

- 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.

- 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. 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 design criteria specified herein.

PLAN REVIEW

Final project plans 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 is expressed or implied. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, 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

Blake, Thomas F., 2000a, FRISKSP, Version 4.00, A computer program for the probabilistic estimation of peak accelerations and uniform hazard spectra using 3-D faults as earthquake sources.

_____, Updated 2000b, EQSEARCH, A computer program for the research of historic earthquakes in California from using DMG files.

_____, 2000c, Eqfault, Eqsearch, and Frisk89, Computer programs for the deterministic, historic, and probabilistic prediction of peak horizontal acceleration for digitized California faults.

_____, 2000d, UBCSEIS Version 1.03, A computer program to determine UBC seismic factors.

Boore, et. al, 1997, Equations for estimating horizontal response spectra and peak acceleration from Western North American Earthquakes: A Summary of Recent Work, Seismological Research Letters, Vol. 68, No. 1, pp. 128-153.

CDMG, 1974, Geology of the south half of the El Toro Quadrangle, special report 110.

CDMG, 2000, seismic hazard zone map, El Toro Quadrangle, dated June 30, 1:24,000 scale.

Jennings, C.W., 1994, fault activity map of California and adjacent areas, scale 1:750,000, CDMG Geologic Data Map No. 6.

APPENDIX B

LOGS OF EXPLORATORY BORINGS

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
		Gravels With Fines	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/ft²)
<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 moist; 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.

PLATE A

LOG OF BORING B-1

Sheet 1 of 1

Date Drilled: 8/30/04
Logged by: SRB
Equipment: HOLLOW-STEM AUGER
Driving Weight and Drop:
Surface Elevation(ft):
Depth to Water(ft):

☒ SPT
⧓ Modified California
▽ Water Level ADT
☐ Grab Sample
▦ Shelby Tube
▼ Static Water Table

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES Sample Type	SAMPLES Bulk	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (pcf)	USCS SYMB.
		COLLUVIUM (Qc): Silty fine SAND (SM), medium brown to medium brownish-gray, dry loose, trace amount of rootlets						
5		ilty fine to medium SAND (SM) with trace of fine gravel, medium to dark brown to dark grayish-brown, dry to slightly moist, loose to medium dense, fine gravel (<5%)	⧓		24	12.4	100.7	
10		**CAPISTRANO FORMATION, OSO MEMBER (Tco):** Silty fine SANDSTONE (SANDSTONE), brownish-yellow mottled with light gray to white near top grading to strictly light gray to white near base, slightly moist to moist, medium dense, density increases with depth grading from medium dense near top to very dense near base, massive	☒		64			
15			⧓		50/4"			
20		TOTAL DEPTH = 15.8 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED AND TAMPED						
25								
30								
35								
40								
45								

GSI
GEOSOILS, INC.
1446 East Chestnut Avenue
Santa Ana, California
Phone: 714-647-0277 Fax: 714-647-0745

Lake Forest
4414-A1-OC

Plate
B-1

LOG OF BORING B-2

Sheet 1 of 1

Date Drilled: 8/30/04
Logged by: SRB
Equipment: HOLLOW-STEM AUGER
Driving Weight and Drop:
Surface Elevation(ft):
Depth to Water(ft):

☒ SPT
⧓ Modified California
▽ Water Level ADT
☐ Grab Sample
■ Shelby Tube
▼ Static Water Table

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES Sample Type	SAMPLES Bulk	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (pcf)	USCS SYMB.
		COLLUVIUM (Qc): Silty fine SAND (SM), medium brown to medium brownish-gray, dry, loose, trace amount of rootlets						
		Silty fine to medium SAND (SM) with some coarse sand and fine gravel, medium to dark brown slightly moist, loose to medium dense, coarse sand/ fine gravel (<7%)						
5		**CAPISTRANO FORMATION, OSO MEMBER (Tco):** Silty fine to medium SANDSTONE (SANDSTONE) with trace of fine gravel, light brownish-yellow to cream color, slightly moist to moist, dense to very dense, massive, fine gravel (<2%)	☒		81			
10								
			⧓		50/3"			
		TOTAL DEPTH = 10.8 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED AND TAMPED						
15								

LAGNNN01 4414PGI.GPJ LAGNNN01.GDT 9/21/04

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Lake Forest
4414-A1-OC

Plate
B-2

LOG OF BORING B-3

Sheet 1 of 1

Date Drilled: 8/30/04
Logged by: SRB
Equipment: HOLLOW-STEM AUGER
Driving Weight and Drop:
Surface Elevation(ft):
Depth to Water(ft):

☒ SPT
⧓ Modified California
▽ Water Level ADT
✋ Grab Sample
■ Shelby Tube
▼ Static Water Table

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES Sample Type	SAMPLES Bulk	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (pcf)	USCS SYMB.
		COLLUVIUM (Qc): Silty fine SAND (SM), medium brown to medium brownish-gray, dry, loose, trace amount of rootlets						
		Silty fine to medium SAND (SM) with trace amount of fine gravel, medium to dark brown to dark grayish-brown, dry to slightly moist, loose to medium dense, fine gravel (<5%)						
5		**CAPISTRANO FORMATION, OSO MEMBER (Tco):** Silty fine to medium SANDSTONE (SANDSTONE) with some coarse sand and fine gravel, light brownish-yellow mottled with light gray to white, slightly moist, dense to very dense, fine gravel (<15%), massive, coarser grained than 1.0-3.0' interval grading to fine grained sandstone near base.	⧓		61	5.4	122.2	
10			☒		84			
		TOTAL DEPTH = 11.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED AND TAMPED						
15								

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Lake Forest
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Plate
B-3

LOG OF BORING B-4

Sheet 1 of 1

Date Drilled: 8/30/04
Logged by: SRB
Equipment: HOLLOW-STEM AUGER
Driving Weight and Drop:
Surface Elevation(ft):
Depth to Water(ft):

☒ SPT
⧓ Modified California
∇ Water Level ADT
▨ Grab Sample
■ Shelby Tube
▼ Static Water Table

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES Sample Type	SAMPLES Bulk	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (pcf)	USCS SYMB.
		ALLUVIUM (Qal): Silty fine SAND (SM) with trace of coarse sand/ fine gravel, medium brown to medium brownish-gray, dry, loose, coarse sand/ fine gravel (<5%)						
5			☒		26			
		Silty fine SAND (SM), medium brownish-gray, slightly moist, medium dense						
10			⧓		23	6.2	110.4	
15			☒		23			
20		@ 20.0' Silty fine SND (SM) with trace of coarse sand, dark brownish-gray, moist, medium dense, trace amount of coarse sand (<3%)	⧓		28	12.2	119.4	
25			☒		17			
30		@ 30.0' Silty fine to medium SAND (SM) with trace of coarse sand, dark grayish-brown, moist, dense, coarse sand (<2%)	⧓		33	11.7	96.3	
35		**CAPISTRANO FORMATION, OSO MEMBER (Tco):** Silty fine SANDSTONE (SANDSTONE), light tan to cream with small localized pockets of orangish-brown, moist, medium dense to dense becoming more dense with depth, massive	☒		23			
40			⧓		50/5"			
45		TOTAL DEPTH = 40.9 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED AND TAMPED						

LOG OF BORING B-5

Sheet **1** of **1**

Date Drilled: 8/30/04
Logged by: SRB
Equipment: HOLLOW-STEM AUGER
Driving Weight and Drop:
Surface Elevation(ft):
Depth to Water(ft):

☒ SPT
⧓ Modified California
▽ Water Level ADT
▨ Grab Sample
■ Shelby Tube
▼ Static Water Table

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES Sample Type	SAMPLES Bulk	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (pcf)	USCS SYMB.
		ALLUVIUM (Qal): Silty fine SAND (SM) with trace amount of coarse sand/ fine gravel, medium brown to medium brownish-gray, dry, loose, coarse sand/ fine gravel (<3%)						
5		Silty fine SAND (SM) with trace amount of coarse sand, medium to dark brownish-gray, slightly moist, medium dense, coarse sand (<5%)	⧓		34	4.1	115.2	
10			☒		9			
15		@ 15.0' Silty fine SAND (SM), medium brownish-gray, slightly moist, medium dense, no coarse sand apparent	⧓		23	4.5	108.8	
20			☒		19			
25		@ 25.0' Silty fine to medium SAND (SM) with trace amount of coarse sand, dark brownish-gray, moist, dense, coarse sand (<3%)	⧓		43	12.2	118.0	
30			☒		13			
35		**CAPISTRANO FORMATION, OSO MEMBER (Tco):** Silty fine SANDSTONE (SANDSTONE), light to medium gray mottled with medium tan, moist, dense to very dense, massive	⧓		50	10.5	113.2	
40		TOTAL DEPTH = 36.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED AND TAMPED						
45								

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Plate
B-5

LOG OF BORING B-6

Sheet1 of 1

Date Drilled: 8/30/04
Logged by: SRB
Equipment: HOLLOW-STEM AUGER
Driving Weight and Drop:
Surface Elevation(ft):
Depth to Water(ft):

☒ SPT
⧓ Modified California
▽ Water Level ADT
☐ Grab Sample
■ Shelby Tube
▼ Static Water Table

DEPTH (ft)	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES Sample Type	SAMPLES Bulk	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (pcf)	USCS SYMB.
	ALLUVIUM (Qal): Silty fine SAND (SM) with trace amount of coarse sand/ fine gravel, medium brown to medium brownish-gray, dry, loose, coarse sand/ fine gravel (<5%)						
5		☒		17			
10	Silty fine SAND (SM) with trace of medium to coarse sand, medium to dark brownish-gray, slightly moist, dense, small amount of pin-hole-size pore void space (<5%), medium to coarse sand (<3%)	⧓		48	5.7	115.0	
15		☒		16			
20	@ 20.0' pore voids are no longer present	⧓		63	6.5	120.4	
25		☒		18			
30	@ 30.0' - Silty fine to medium SAND (SM) with trace amount of coarse sand, dark brownish-gray with a few orangish-yellow mottled streaks, moist, medium dense, small amount of pin-hole-size pore void space (<7%), coarse sand (<5%)	⧓		19	21.7	102.6	
35	**CAPISTRANO FORMATION, OSO MEMBER (Tco):** Silty fine to medium SANDSTONE (SANDSTONE) with trace of fine gravel, light tan mottled with orangish-yellow, moist, dense to very dense, massive, fine gravel is well rounded (<2%)	☒		25			
40		⧓		50			
45	TOTAL DEPTH = 41.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED AND TAMPED						

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Lake Forest
4414-A1-OC

Plate
B-6

APPENDIX C

LABORATORY TESTING

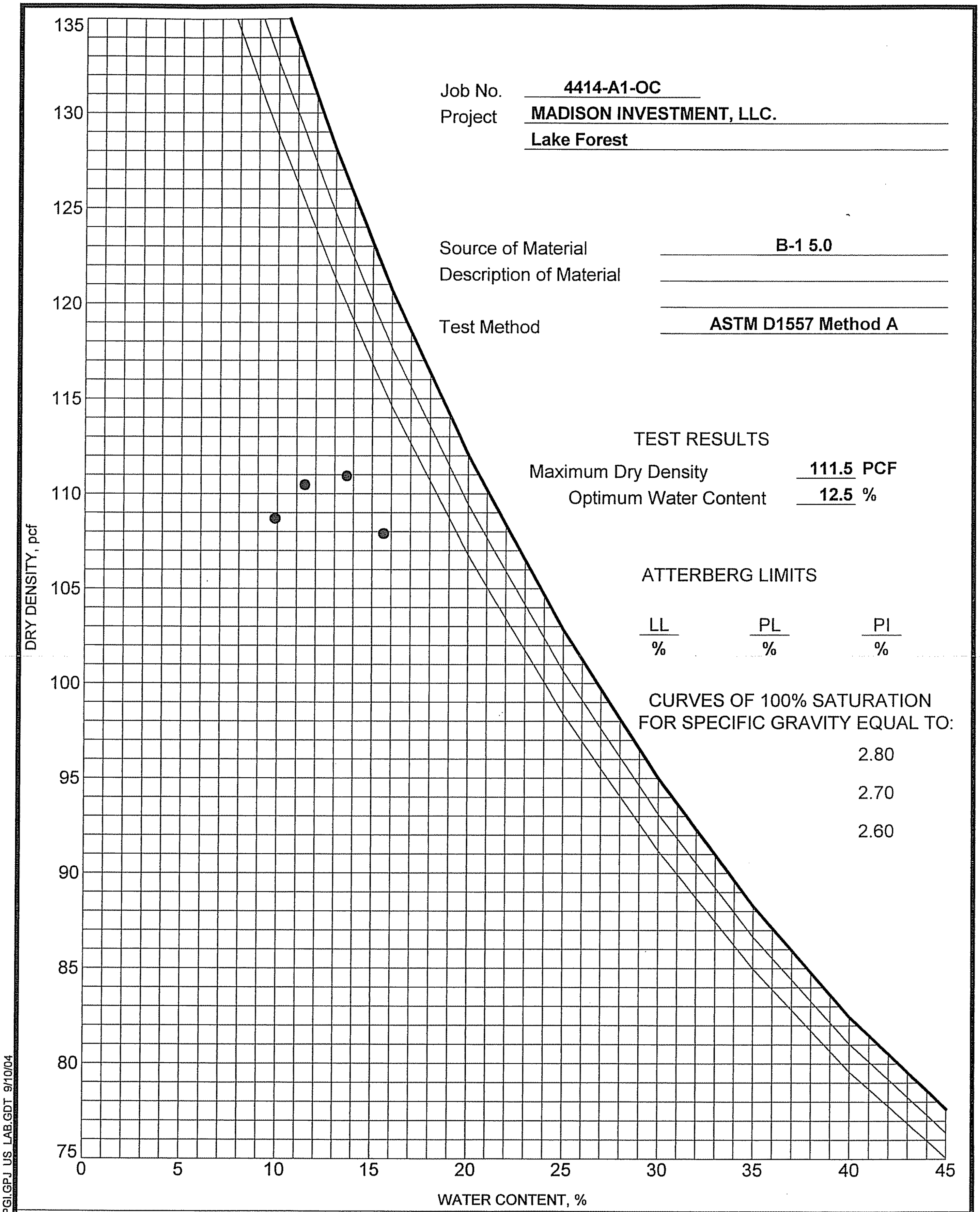
Job No. **4414-A1-OC**

Project **MADISON INVESTMENT, LLC.**
Lake Forest

Source of Material **B-1 5.0**

Description of Material

Test Method **ASTM D1557 Method A**



TEST RESULTS

Maximum Dry Density **111.5** PCF

Optimum Water Content **12.5** %

ATTERBERG LIMITS

LL	PL	PI
%	%	%

US_COMPACTION 4414PGI.GPJ US_LAB.GDT 9/10/04

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MOISTURE-DENSITY RELATIONSHIP

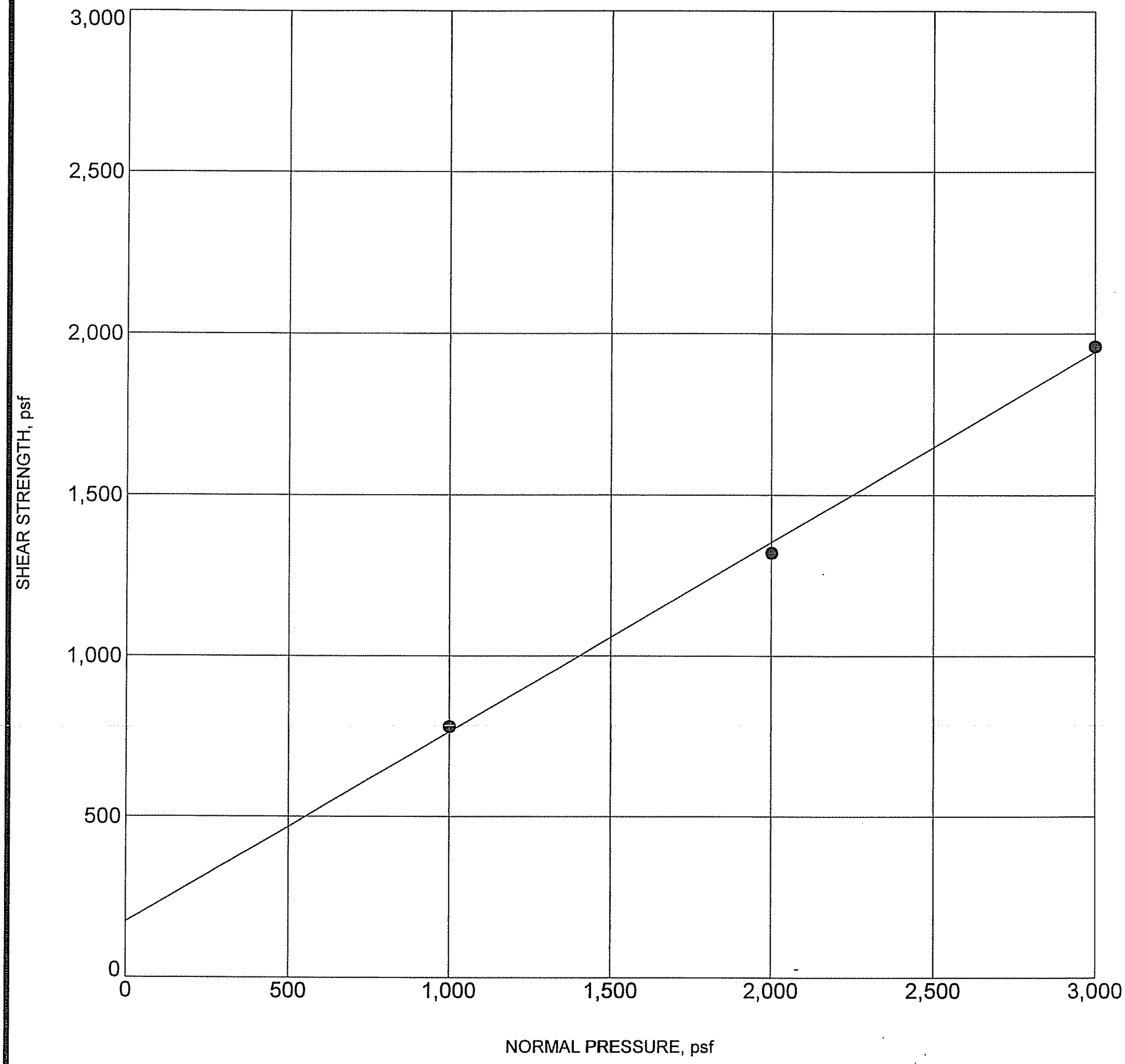
Project:

Location: Lake Forest

Number: 4414-A1-OC

PLATE

C-1



Specimen Identification			Classification	γ_d	MC%	c	ϕ
●	**B-1**	**5.0**	**REMOLDED**	**93**	**21**	**173**	**31**

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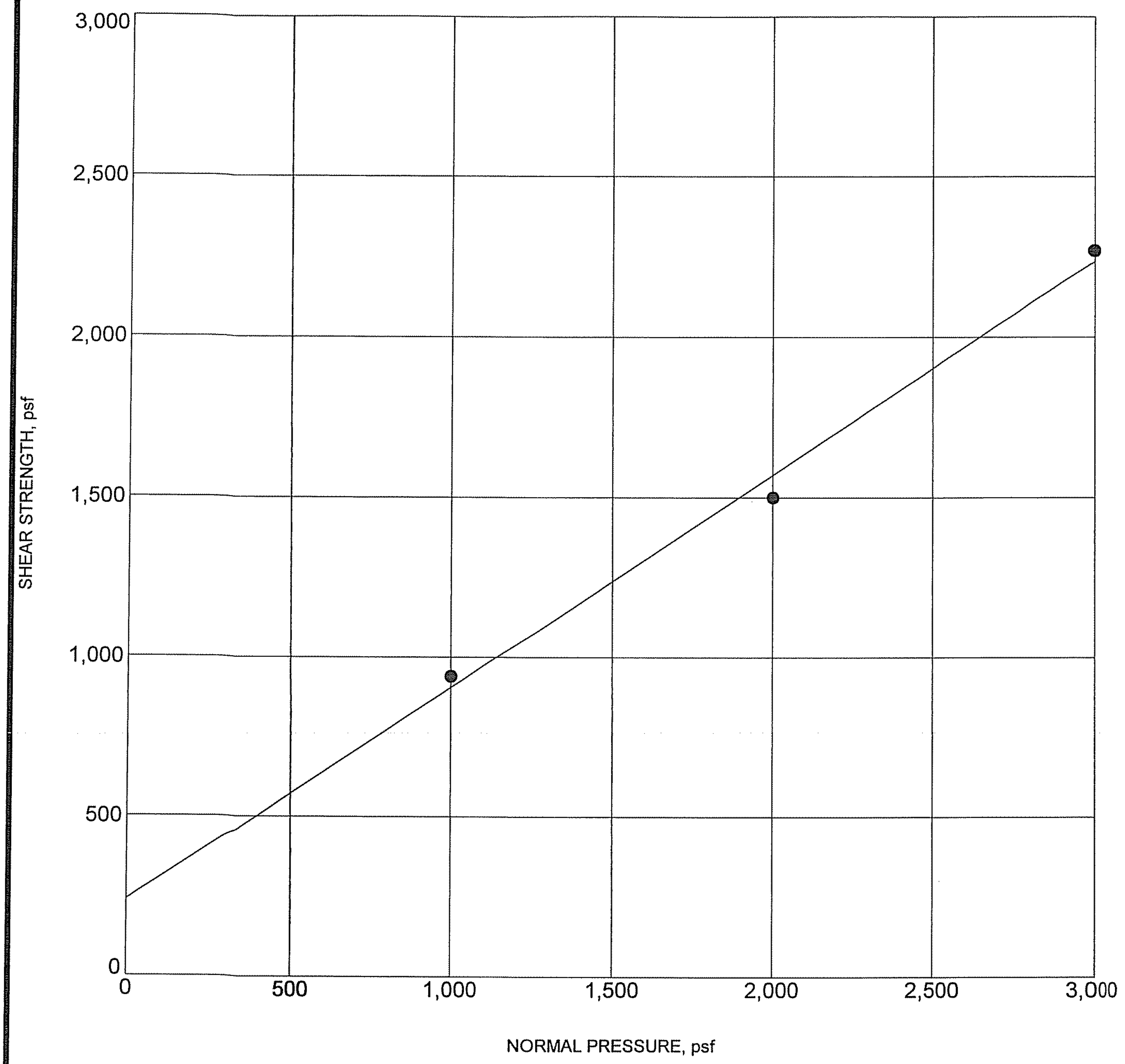
DIRECT SHEAR TEST

Project:
Location: Lake Forest
Number: 4414-A1-OC

PLATE
C-2



Specimen Identification			Classification	γ_d	MC%	c	ϕ
●	B-2	10.0		109	16	240	34

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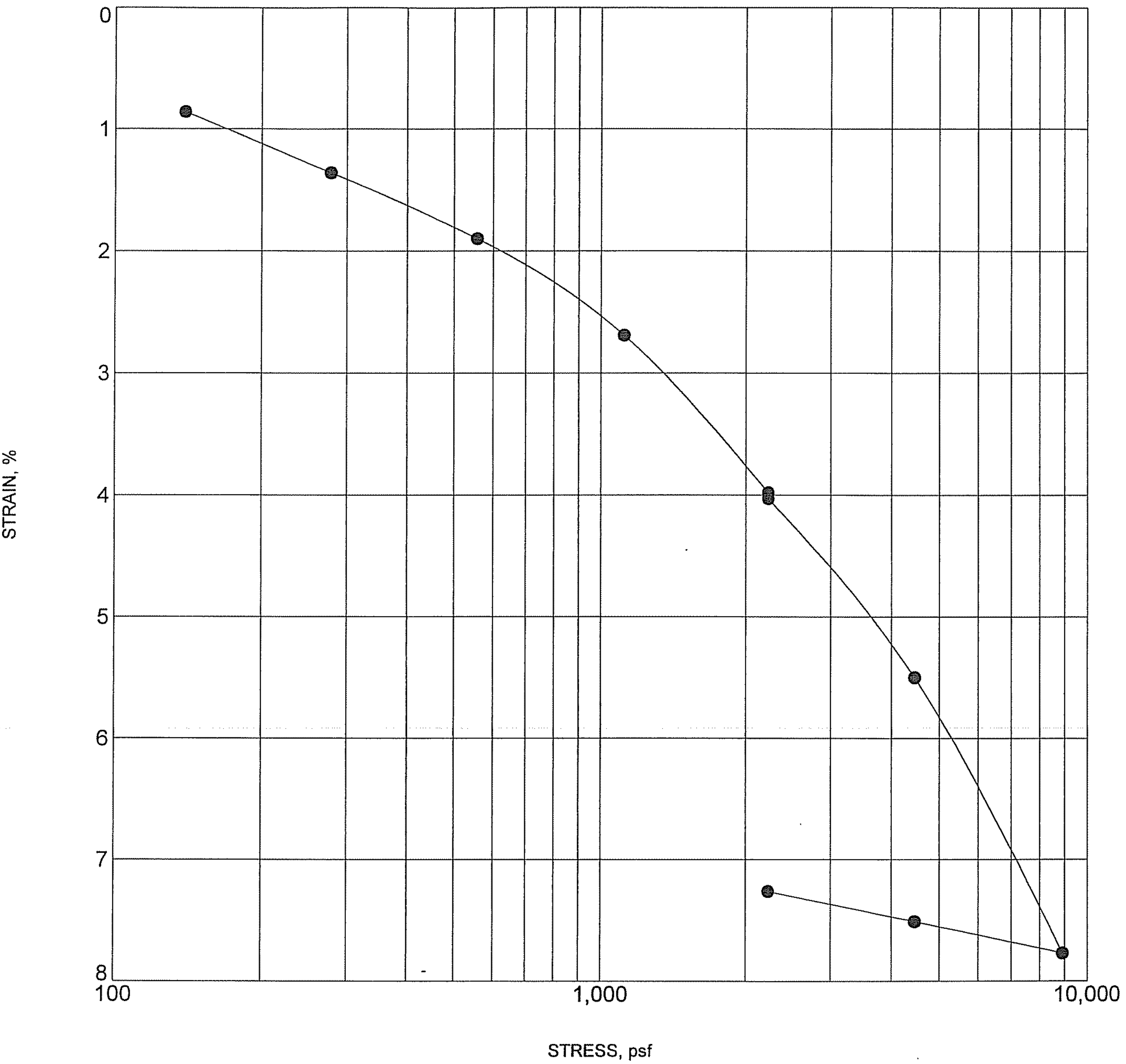
DIRECT SHEAR TEST

Project:
Location: Lake Forest
Number: 4414-A1-OC

PLATE
C-3



	Specimen Identification		Classification	γ_d	MC%
●	B-6	30.0		98	20

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CONSOLIDATION TEST

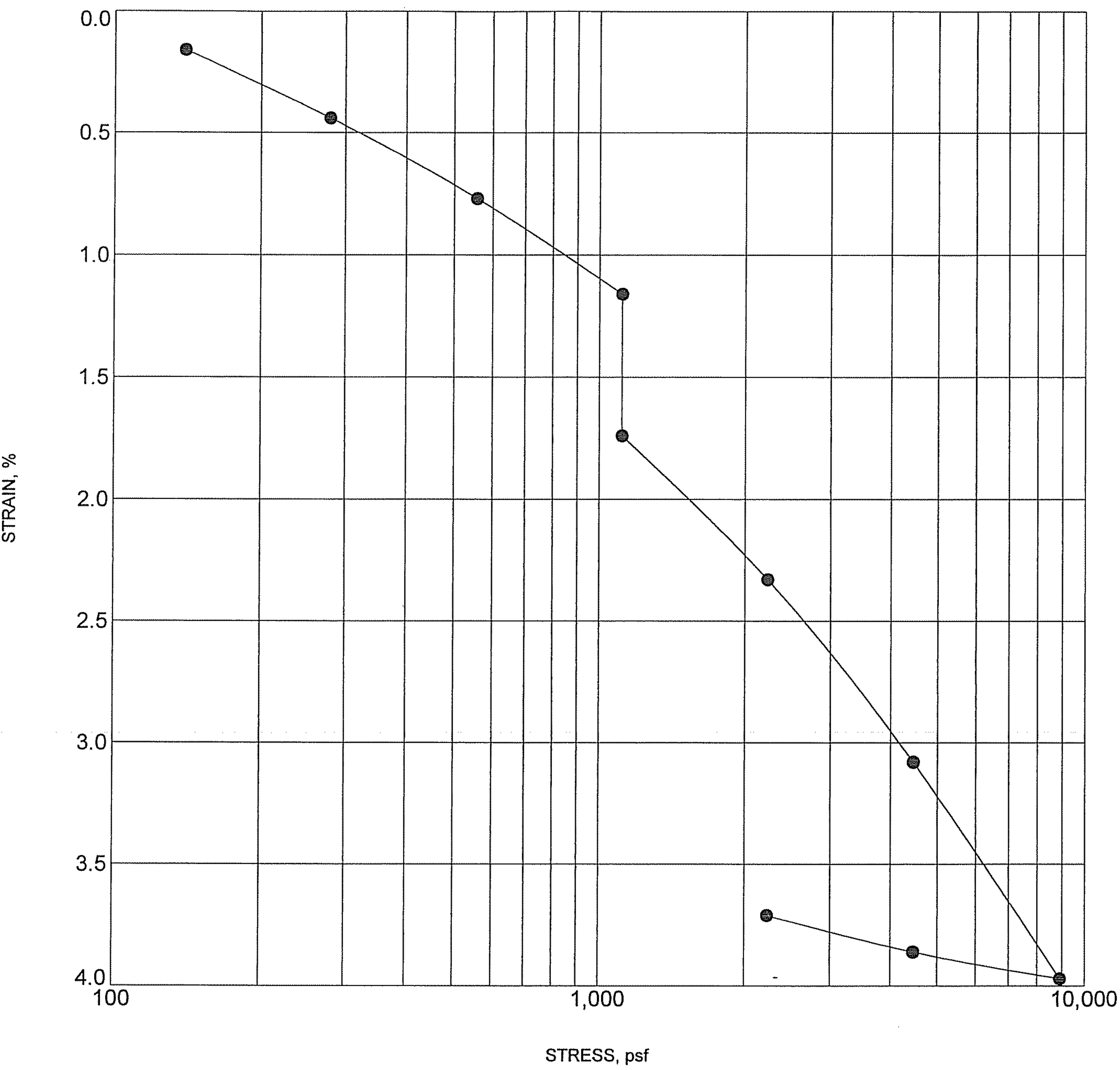
Project:

Location: Lake Forest

Number: 4414-A1-OC

PLATE

C-4



	Specimen Identification		Classification	γ_d	MC%
●	**B-6**	**20.0**		**119**	**12**

US_CONSOL_STRAIN 4414PGI.GPJ US_LAB.GDT 9/10/04

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CONSOLIDATION TEST

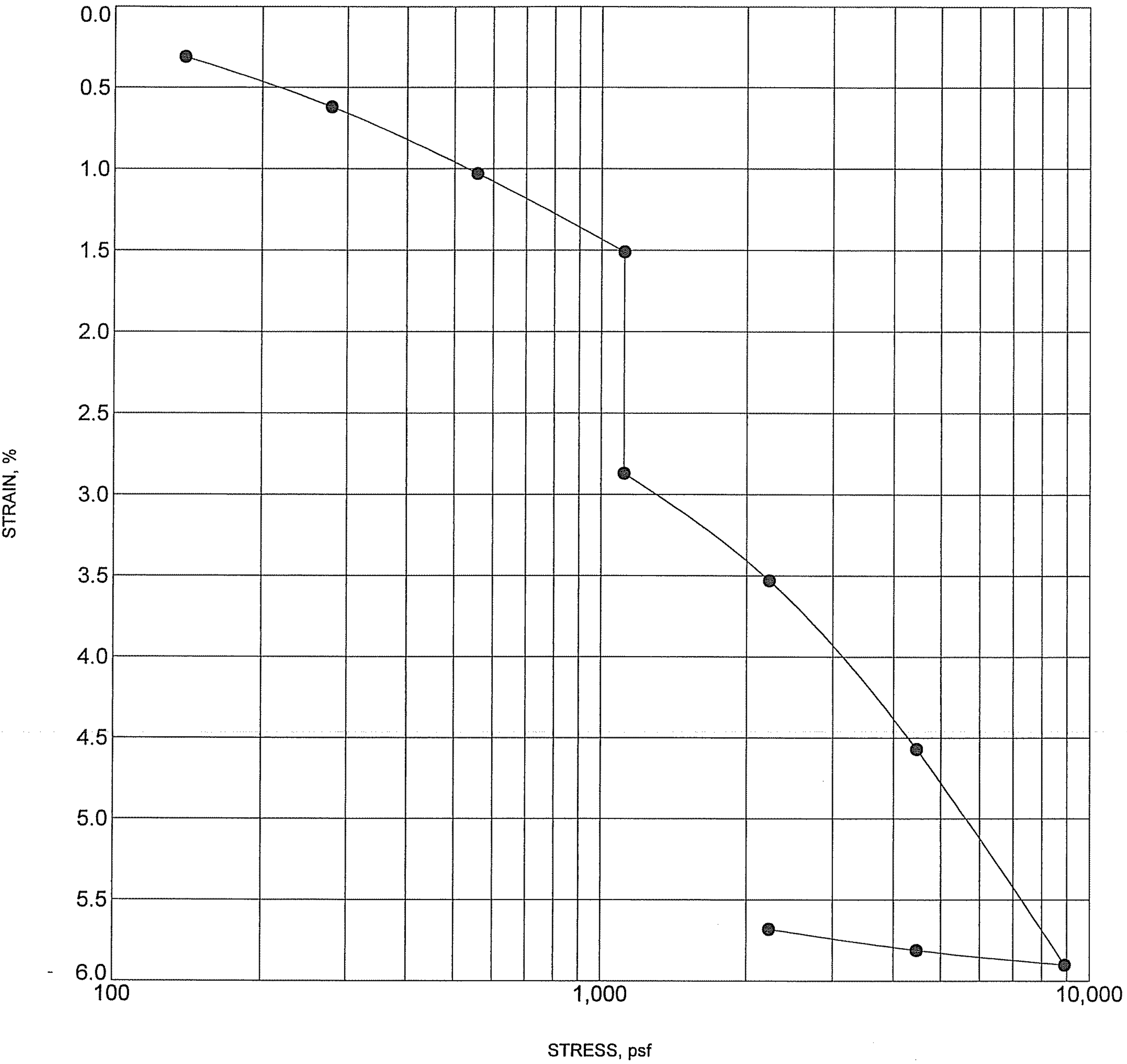
Project:

Location: Lake Forest

Number: 4414-A1-OC

PLATE

C-5



Specimen Identification			Classification	γ_d	MC%
●	**B-5**	**15.0**		**102**	**18**

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CONSOLIDATION TEST

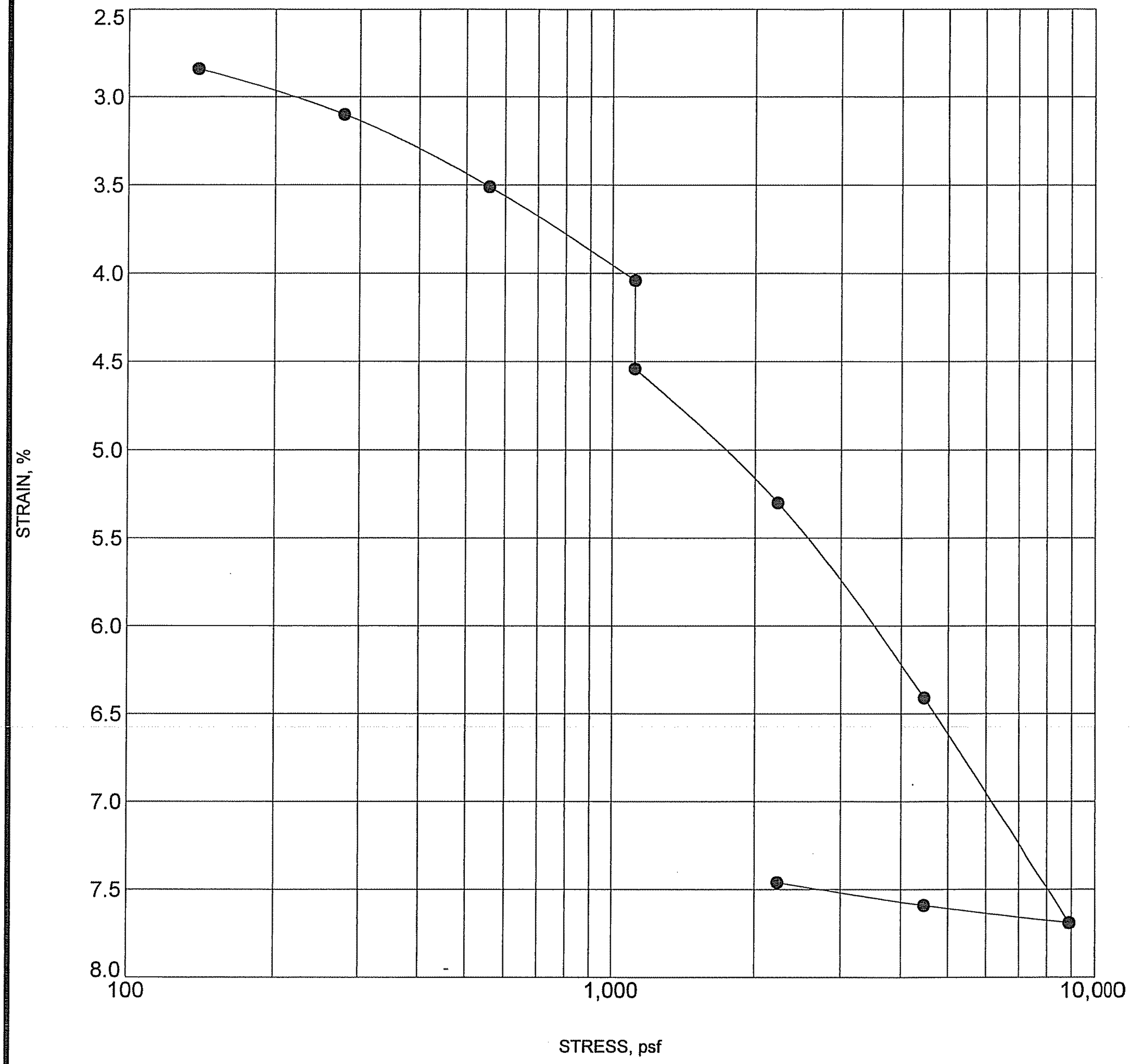
Project:

Location: Lake Forest

Number: 4414-A1-OC

PLATE

C-6



	Specimen Identification		Classification	γ_d	MC%
●	**B-4**	**20.0**		**114**	**13**

US CONSOL STRAIN 4414PGI.GPJ US LAB.GDT 9/10/04

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CONSOLIDATION TEST

Project:
Location: Lake Forest
Number: 4414-A1-OC

PLATE
C-7

Corrosivity

One corrosivity test was performed and collected from the site. The test was performed in accordance with the CalTrans Test Methods 422 and 532.

Location	Chloride (ppm)	Minimum Resistivity (ohm-cm)	Sulfate % by weight	Ph
B-1 @ 5'	53	7800	0.001	7.48

The correlation between electrical resistivity and corrosivity is as follows:

Below 1,000 ohm-cm = Severely Corrosive
1,000 to 2,000 ohm-cm = Corrosive
2,000 to 10,000 ohm-cm = Moderately corrosive
Over 10,000 ohm-cm = Mildly corrosive

APPENDIX D

SEISMIC ANALYSIS

```
                      **********************
                      *                    *
                      *    U B C S E I S   *
                      *                    *
                      *    Version  1.03   *
                      *                    *
                      **********************

                       COMPUTATION OF 1997
                      UNIFORM BUILDING CODE
                    SEISMIC DESIGN PARAMETERS

JOB NUMBER: 4414-A1                           DATE: 09-21-2004

JOB NAME: MADISON INVESTM

FAULT-DATA-FILE NAME: CDMGUBCR.DAT


SITE COORDINATES:
   SITE LATITUDE:  33.6621
   SITE LONGITUDE:  117.6857

UBC SEISMIC ZONE:  0.4

UBC SOIL PROFILE TYPE:  SD

NEAREST TYPE A FAULT:
   NAME:  ELSINORE-GLEN IVY
   DISTANCE:  19.0  km

NEAREST TYPE B FAULT:
   NAME:  CHINO-CENTRAL AVE. (Elsinore)
   DISTANCE:  17.2  km

NEAREST TYPE C FAULT:
   NAME:
   DISTANCE:  99999.0  km

SELECTED UBC SEISMIC COEFFICIENTS:
   Na:  1.0
   Nv:  1.0
   Ca:  0.44
   Cv:  0.64
   Ts:  0.582
   To:  0.116

   *******************************************************************
   * CAUTION:  The digitized data points used to model faults are     *
   *           limited in number and have been digitized from small-  *
   *           scale maps (e.g., 1:750,000 scale).  Consequently,     *
   *           the estimated fault-site-distances may be in error by  *
   *           several kilometers.  Therefore, it is important that   *
   *           the distances be carefully checked for accuracy and    *
   *           adjusted as needed, before they are used in design.    *
   *******************************************************************
```

```
                          --------------------------
                          SUMMARY OF FAULT PARAMETERS
                          --------------------------

Page  1
-------------------------------------------------------------------------------
                                 | APPROX.|SOURCE | MAX.  |  SLIP   |  FAULT
          ABBREVIATED            |DISTANCE| TYPE  | MAG.  |  RATE   |  TYPE
          FAULT  NAME            |  (km)  |(A,B,C)| (Mw)  | (mm/yr) |(SS,DS,BT)
=================================|========|=======|=======|=========|==========
CHINO-CENTRAL AVE. (Elsinore)    |  17.2  |   B   |  6.7  |  1.00   |   DS
ELSINORE-GLEN IVY                |  19.0  |   A   |  6.8  |  5.00   |   SS
NEWPORT-INGLEWOOD (Offshore)     |  19.8  |   B   |  6.9  |  1.50   |   SS
ELSINORE-WHITTIER                |  21.8  |   A   |  6.8  |  2.50   |   SS
NEWPORT-INGLEWOOD (L.A.Basin)    |  22.8  |   A   |  6.9  |  1.00   |   SS
ELSINORE-TEMECULA                |  31.3  |   B   |  6.8  |  5.00   |   SS
PALOS VERDES                     |  41.3  |   B   |  7.1  |  3.00   |   SS
SAN JOSE                         |  45.6  |   B   |  6.5  |  0.50   |   DS
CORONADO BANK                    |  49.1  |   B   |  7.4  |  3.00   |   SS
SIERRA MADRE (Central)           |  51.5  |   B   |  7.0  |  3.00   |   DS
CUCAMONGA                        |  51.7  |   B   |  7.0  |  5.00   |   DS
SAN JACINTO-SAN BERNARDINO       |  56.4  |   A   |  6.7  | 12.00   |   SS
SAN JACINTO-SAN JACINTO VALLEY   |  57.3  |   A   |  6.9  | 12.00   |   SS
RAYMOND                          |  63.4  |   B   |  6.5  |  0.50   |   DS
ROSE CANYON                      |  63.9  |   B   |  6.9  |  1.50   |   SS
CLAMSHELL-SAWPIT                 |  64.2  |   B   |  6.5  |  0.50   |   DS
VERDUGO                          |  67.8  |   B   |  6.7  |  0.50   |   DS
SAN ANDREAS - Southern           |  69.9  |   A   |  7.4  | 24.00   |   SS
ELSINORE-JULIAN                  |  69.9  |   A   |  7.1  |  5.00   |   SS
HOLLYWOOD                        |  71.6  |   B   |  6.5  |  1.00   |   DS
SAN JACINTO-ANZA                 |  71.7  |   A   |  7.2  | 12.00   |   SS
SAN ANDREAS - 1857 Rupture       |  73.5  |   A   |  7.8  | 34.00   |   SS
CLEGHORN                         |  74.6  |   B   |  6.5  |  3.00   |   SS
NORTH FRONTAL FAULT ZONE (West)  |  79.8  |   B   |  7.0  |  1.00   |   DS
SANTA MONICA                     |  81.5  |   B   |  6.6  |  1.00   |   DS
MALIBU COAST                     |  88.5  |   B   |  6.7  |  0.30   |   DS
SIERRA MADRE (San Fernando)      |  88.7  |   B   |  6.7  |  2.00   |   DS
SAN GABRIEL                      |  91.4  |   B   |  7.0  |  1.00   |   SS
PINTO MOUNTAIN                   |  99.4  |   B   |  7.0  |  2.50   |   SS
ANACAPA-DUME                     | 100.0  |   B   |  7.3  |  3.00   |   DS
NORTH FRONTAL FAULT ZONE (East)  | 104.1  |   B   |  6.7  |  0.50   |   DS
SANTA SUSANA                     | 105.0  |   B   |  6.6  |  5.00   |   DS
HELENDALE - S. LOCKHARDT         | 109.1  |   B   |  7.1  |  0.60   |   SS
SAN JACINTO-COYOTE CREEK         | 111.4  |   A   |  6.8  |  4.00   |   SS
HOLSER                           | 114.0  |   B   |  6.5  |  0.40   |   DS
EARTHQUAKE VALLEY                | 115.3  |   B   |  6.5  |  2.00   |   SS
OAK RIDGE (Onshore)              | 123.7  |   B   |  6.9  |  4.00   |   DS
LENWOOD-LOCKHART-OLD WOMAN SPRGS | 124.0  |   B   |  7.3  |  0.60   |   SS
SIMI-SANTA ROSA                  | 124.4  |   B   |  6.7  |  1.00   |   DS
BURNT MTN.                       | 125.2  |   B   |  6.5  |  0.60   |   SS
EUREKA PEAK                      | 129.5  |   B   |  6.5  |  0.60   |   SS
LANDERS                          | 130.0  |   B   |  7.3  |  0.60   |   SS
SAN CAYETANO                     | 131.7  |   B   |  6.8  |  6.00   |   DS
JOHNSON VALLEY (Northern)        | 133.3  |   B   |  6.7  |  0.60   |   SS
EMERSON So. - COPPER MTN.        | 143.7  |   B   |  6.9  |  0.60   |   SS
ELSINORE-COYOTE MOUNTAIN         | 145.0  |   B   |  6.8  |  4.00   |   SS
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                           ---------------------------
                           SUMMARY OF FAULT PARAMETERS
                           ---------------------------

Page  2
-------------------------------------------------------------------------------
                                 | APPROX. |SOURCE | MAX. |  SLIP   |  FAULT
      ABBREVIATED                |DISTANCE | TYPE  | MAG. |  RATE   |  TYPE
      FAULT  NAME                |  (km)   |(A,B,C)| (Mw) | (mm/yr) |(SS,DS,BT)
=================================|=========|=======|======|=========|==========
SAN JACINTO - BORREGO            |  147.3  |   B   | 6.6  |  4.00   |   SS
SANTA YNEZ (East)                |  151.2  |   B   | 7.0  |  2.00   |   SS
GRAVEL HILLS - HARPER LAKE       |  152.0  |   B   | 6.9  |  0.60   |   SS
CALICO - HIDALGO                 |  152.7  |   B   | 7.1  |  0.60   |   SS
VENTURA - PITAS POINT            |  154.6  |   B   | 6.8  |  1.00   |   DS
PISGAH-BULLION MTN.-MESQUITE LK  |  160.3  |   B   | 7.1  |  0.60   |   SS
BLACKWATER                       |  163.6  |   B   | 6.9  |  0.60   |   SS
M.RIDGE-ARROYO PARIDA-SANTA ANA  |  163.8  |   B   | 6.7  |  0.40   |   DS
GARLOCK (West)                   |  165.4  |   A   | 7.1  |  6.00   |   SS
RED MOUNTAIN                     |  168.9  |   B   | 6.8  |  2.00   |   DS
PLEITO THRUST                    |  171.1  |   B   | 6.8  |  2.00   |   DS
SANTA CRUZ ISLAND                |  173.2  |   B   | 6.8  |  1.00   |   DS
BIG PINE                         |  177.7  |   B   | 6.7  |  0.80   |   SS
SUPERSTITION MTN. (San Jacinto)  |  179.4  |   B   | 6.6  |  5.00   |   SS
GARLOCK (East)                   |  183.1  |   A   | 7.3  |  7.00   |   SS
ELMORE RANCH                     |  183.5  |   B   | 6.6  |  1.00   |   SS
SUPERSTITION HILLS (San Jacinto) |  185.6  |   B   | 6.6  |  4.00   |   SS
BRAWLEY SEISMIC ZONE             |  186.5  |   B   | 6.5  | 25.00   |   SS
WHITE WOLF                       |  191.1  |   B   | 7.2  |  2.00   |   DS
ELSINORE-LAGUNA SALADA           |  196.8  |   B   | 7.0  |  3.50   |   SS
SANTA YNEZ (West)                |  202.2  |   B   | 6.9  |  2.00   |   SS
So. SIERRA NEVADA                |  208.6  |   B   | 7.1  |  0.10   |   DS
SANTA ROSA ISLAND                |  209.4  |   B   | 6.9  |  1.00   |   DS
IMPERIAL                         |  212.7  |   A   | 7.0  | 20.00   |   SS
LITTLE LAKE                      |  216.6  |   B   | 6.7  |  0.70   |   SS
TANK CANYON                      |  223.7  |   B   | 6.5  |  1.00   |   DS
PANAMINT VALLEY                  |  228.6  |   B   | 7.2  |  2.50   |   SS
OWL LAKE                         |  228.8  |   B   | 6.5  |  2.00   |   SS
LOS ALAMOS-W. BASELINE           |  245.1  |   B   | 6.8  |  0.70   |   DS
DEATH VALLEY (South)             |  246.5  |   B   | 6.9  |  4.00   |   SS
LIONS HEAD                       |  262.5  |   B   | 6.6  |  0.02   |   DS
SAN JUAN                         |  267.6  |   B   | 7.0  |  1.00   |   SS
SAN LUIS RANGE (S. Margin)       |  270.6  |   B   | 7.0  |  0.20   |   DS
DEATH VALLEY (Graben)            |  278.3  |   B   | 6.9  |  4.00   |   DS
CASMALIA (Orcutt Frontal Fault)  |  279.9  |   B   | 6.5  |  0.25   |   DS
OWENS VALLEY                     |  282.5  |   B   | 7.6  |  1.50   |   SS
LOS OSOS                         |  300.0  |   B   | 6.8  |  0.50   |   DS
HOSGRI                           |  308.6  |   B   | 7.3  |  2.50   |   SS
HUNTER MTN. - SALINE VALLEY      |  313.8  |   B   | 7.0  |  2.50   |   SS
INDEPENDENCE                     |  318.0  |   B   | 6.9  |  0.20   |   DS
RINCONADA                        |  319.0  |   B   | 7.3  |  1.00   |   SS
DEATH VALLEY (Northern)          |  329.3  |   A   | 7.2  |  5.00   |   SS
SAN ANDREAS (Creeping)           |  372.1  |   B   | 5.0  | 34.00   |   SS
BIRCH CREEK                      |  373.4  |   B   | 6.5  |  0.70   |   DS
WHITE MOUNTAINS                  |  378.9  |   B   | 7.1  |  1.00   |   SS
DEEP SPRINGS                     |  398.3  |   B   | 6.6  |  0.80   |   DS
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                     SUMMARY OF FAULT PARAMETERS
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Page  3
-------------------------------------------------------------------------------
                                  | APPROX.|SOURCE | MAX. |   SLIP   |  FAULT
          ABBREVIATED             |DISTANCE| TYPE  | MAG. |   RATE   |   TYPE
          FAULT  NAME             |  (km)  |(A,B,C)| (Mw) | (mm/yr)  |(SS,DS,BT)
==================================|========|=======|======|==========|==========
DEATH VALLEY (N. of Cucamongo)    |  406.0 |   A   | 7.0  |   5.00   |    SS
ROUND VALLEY (E. of S.N.Mtns.)    |  407.5 |   B   | 6.8  |   1.00   |    DS
FISH SLOUGH                       |  416.4 |   B   | 6.6  |   0.20   |    DS
HILTON CREEK                      |  433.4 |   B   | 6.7  |   2.50   |    DS
ORTIGALITA                        |  455.4 |   B   | 6.9  |   1.00   |    SS
HARTLEY SPRINGS                   |  457.1 |   B   | 6.6  |   0.50   |    DS
CALAVERAS (So.of Calaveras Res)   |  461.6 |   B   | 6.2  |  15.00   |    SS
MONTEREY BAY - TULARCITOS         |  465.6 |   B   | 7.1  |   0.50   |    DS
PALO COLORADO - SUR               |  467.9 |   B   | 7.0  |   3.00   |    SS
QUIEN SABE                        |  474.6 |   B   | 6.5  |   1.00   |    SS
MONO LAKE                         |  492.9 |   B   | 6.6  |   2.50   |    DS
ZAYANTE-VERGELES                  |  493.4 |   B   | 6.8  |   0.10   |    SS
SARGENT                           |  498.5 |   B   | 6.8  |   3.00   |    SS
SAN ANDREAS (1906)                |  498.6 |   A   | 7.9  |  24.00   |    SS
ROBINSON CREEK                    |  524.0 |   B   | 6.5  |   0.50   |    DS
SAN GREGORIO                      |  540.8 |   A   | 7.3  |   5.00   |    SS
GREENVILLE                        |  547.4 |   B   | 6.9  |   2.00   |    SS
HAYWARD (SE Extension)            |  548.3 |   B   | 6.5  |   3.00   |    SS
MONTE VISTA - SHANNON             |  548.6 |   B   | 6.5  |   0.40   |    DS
ANTELOPE VALLEY                   |  564.0 |   B   | 6.7  |   0.80   |    DS
HAYWARD (Total Length)            |  567.8 |   A   | 7.1  |   9.00   |    SS
CALAVERAS (No.of Calaveras Res)   |  567.8 |   B   | 6.8  |   6.00   |    SS
GENOA                             |  588.9 |   B   | 6.9  |   1.00   |    DS
CONCORD - GREEN VALLEY            |  615.2 |   B   | 6.9  |   6.00   |    SS
RODGERS CREEK                     |  654.0 |   A   | 7.0  |   9.00   |    SS
WEST NAPA                         |  654.7 |   B   | 6.5  |   1.00   |    SS
POINT REYES                       |  673.5 |   B   | 6.8  |   0.30   |    DS
HUNTING CREEK - BERRYESSA         |  676.9 |   B   | 6.9  |   6.00   |    SS
MAACAMA (South)                   |  716.4 |   B   | 6.9  |   9.00   |    SS
COLLAYOMI                         |  733.1 |   B   | 6.5  |   0.60   |    SS
BARTLETT SPRINGS                  |  736.5 |   A   | 7.1  |   6.00   |    SS
MAACAMA (Central)                 |  758.0 |   A   | 7.1  |   9.00   |    SS
MAACAMA (North)                   |  817.2 |   A   | 7.1  |   9.00   |    SS
ROUND VALLEY (N. S.F.Bay)         |  823.2 |   B   | 6.8  |   6.00   |    SS
BATTLE CREEK                      |  847.0 |   B   | 6.5  |   0.50   |    DS
LAKE MOUNTAIN                     |  881.5 |   B   | 6.7  |   6.00   |    SS
GARBERVILLE-BRICELAND             |  898.7 |   B   | 6.9  |   9.00   |    SS
MENDOCINO FAULT ZONE              |  955.0 |   A   | 7.4  |  35.00   |    DS
LITTLE SALMON (Onshore)           |  961.4 |   A   | 7.0  |   5.00   |    DS
MAD RIVER                         |  964.1 |   B   | 7.1  |   0.70   |    DS
CASCADIA SUBDUCTION ZONE          |  968.7 |   A   | 8.3  |  35.00   |    DS
McKINLEYVILLE                     |  974.6 |   B   | 7.0  |   0.60   |    DS
TRINIDAD                          |  976.1 |   B   | 7.3  |   2.50   |    DS
FICKLE HILL                       |  976.5 |   B   | 6.9  |   0.60   |    DS
TABLE BLUFF                       |  982.0 |   B   | 7.0  |   0.60   |    DS
LITTLE SALMON (Offshore)          |  995.3 |   B   | 7.1  |   1.00   |    DS
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                         *     E Q F A U L T   *
                         *                     *
                         *     Version 3.00    *
                         *                     *
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                      DETERMINISTIC ESTIMATION OF
                 PEAK ACCELERATION FROM DIGITIZED FAULTS


JOB NUMBER: 4414-A1
                                                DATE: 09-21-2004

JOB NAME: MADISON

CALCULATION NAME: 4414

FAULT-DATA-FILE NAME: CDMGFLTE.DAT


SITE COORDINATES:
   SITE LATITUDE:  33.6621
   SITE LONGITUDE:  117.6857

SEARCH RADIUS:   100  mi

ATTENUATION RELATION:   3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): S       Number of Sigmas:  1.0
   DISTANCE MEASURE:  cd_2drp
   SCOND:   1
   Basement Depth:  5.00 km     Campbell SSR:        Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED:  CDMGFLTE.DAT


MINIMUM DEPTH VALUE (km):  0.0
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                    EQFAULT SUMMARY
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               DETERMINISTIC SITE PARAMETERS
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Page  1
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                               |              |ESTIMATED MAX. EARTHQUAKE EVENT
                               | APPROXIMATE  |-------------------------------
         ABBREVIATED           |   DISTANCE   | MAXIMUM   |   PEAK    |EST. SITE
         FAULT  NAME           |  mi    (km)  |EARTHQUAKE|   SITE    |INTENSITY
                               |              | MAG.(Mw)  | ACCEL. g  |MOD.MERC.
===============================|==============|===========|===========|=========
CHINO-CENTRAL AVE. (Elsinore)  |   9.4(  15.1)|   6.7     |   0.472   |    X
ELSINORE-GLEN IVY              |  11.8(  19.0)|   6.8     |   0.348   |   IX
NEWPORT-INGLEWOOD (Offshore)   |  12.3(  19.8)|   6.9     |   0.356   |   IX
WHITTIER                       |  13.5(  21.8)|   6.8     |   0.315   |   IX
NEWPORT-INGLEWOOD (L.A.Basin)  |  14.3(  23.0)|   6.9     |   0.319   |   IX
ELYSIAN PARK THRUST            |  18.5(  29.7)|   6.7     |   0.289   |   IX
COMPTON THRUST                 |  19.0(  30.6)|   6.8     |   0.298   |   IX
ELSINORE-TEMECULA              |  19.4(  31.3)|   6.8     |   0.241   |   IX
PALOS VERDES                   |  25.7(  41.4)|   7.1     |   0.228   |   IX
SAN JOSE                       |  28.3(  45.6)|   6.5     |   0.188   |  VIII
CORONADO BANK                  |  30.5(  49.1)|   7.4     |   0.234   |   IX
SIERRA MADRE                   |  32.0(  51.5)|   7.0     |   0.222   |   IX
CUCAMONGA                      |  32.1(  51.7)|   7.0     |   0.222   |   IX
SAN JACINTO-SAN BERNARDINO     |  35.0(  56.4)|   6.7     |   0.146   |  VIII
SAN JACINTO-SAN JACINTO VALLEY |  35.6(  57.3)|   6.9     |   0.160   |  VIII
RAYMOND                        |  39.4(  63.4)|   6.5     |   0.146   |  VIII
ROSE CANYON                    |  39.7(  63.9)|   6.9     |   0.147   |  VIII
CLAMSHELL-SAWPIT               |  39.9(  64.2)|   6.5     |   0.144   |  VIII
VERDUGO                        |  42.1(  67.8)|   6.7     |   0.154   |  VIII
SAN ANDREAS - Southern         |  43.4(  69.9)|   7.4     |   0.178   |  VIII
ELSINORE-JULIAN                |  43.4(  69.9)|   7.1     |   0.152   |  VIII
SAN ANDREAS - San Bernardino   |  43.4(  69.9)|   7.3     |   0.169   |  VIII
HOLLYWOOD                      |  44.5(  71.6)|   6.4     |   0.126   |  VIII
SAN JACINTO-ANZA               |  44.6(  71.7)|   7.2     |   0.157   |  VIII
SAN ANDREAS - Mojave           |  45.7(  73.5)|   7.1     |   0.147   |  VIII
SAN ANDREAS - 1857 Rupture     |  45.7(  73.5)|   7.8     |   0.212   |  VIII
CLEGHORN                       |  46.4(  74.6)|   6.5     |   0.106   |   VII
NORTH FRONTAL FAULT ZONE (West)|  49.5(  79.7)|   7.0     |   0.159   |  VIII
SANTA MONICA                   |  50.6(  81.5)|   6.6     |   0.126   |  VIII
MALIBU COAST                   |  55.0(  88.5)|   6.7     |   0.125   |   VII
SIERRA MADRE (San Fernando)    |  55.1(  88.7)|   6.7     |   0.125   |   VII
SAN GABRIEL                    |  56.8(  91.4)|   7.0     |   0.117   |   VII
NORTHRIDGE (E. Oak Ridge)      |  57.1(  91.9)|   6.9     |   0.135   |  VIII
PINTO MOUNTAIN                 |  61.8(  99.4)|   7.0     |   0.110   |   VII
ANACAPA-DUME                   |  62.1( 100.0)|   7.3     |   0.156   |  VIII
NORTH FRONTAL FAULT ZONE (East)|  63.6( 102.3)|   6.7     |   0.112   |   VII
SANTA SUSANA                   |  65.2( 105.0)|   6.6     |   0.104   |   VII
HELENDALE - S. LOCKHARDT       |  67.8( 109.1)|   7.1     |   0.108   |   VII
SAN JACINTO-COYOTE CREEK       |  69.2( 111.4)|   6.8     |   0.091   |   VII
HOLSER                         |  70.5( 113.5)|   6.5     |   0.093   |   VII
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                          DETERMINISTIC SITE PARAMETERS
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Page  2
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                                |              |ESTIMATED MAX. EARTHQUAKE EVENT
                                | APPROXIMATE  |-------------------------------
          ABBREVIATED           |   DISTANCE   | MAXIMUM   |   PEAK    |EST. SITE
          FAULT  NAME           |  mi    (km)  |EARTHQUAKE|   SITE    |INTENSITY
                                |              | MAG.(Mw)  | ACCEL. g  |MOD.MERC.
================================|==============|===========|===========|=========
EARTHQUAKE VALLEY               |  71.6( 115.3)|   6.5     |   0.075   |   VII
SAN ANDREAS - Coachella         |  72.2( 116.2)|   7.1     |   0.103   |   VII
OAK RIDGE (Onshore)             |  76.3( 122.8)|   6.9     |   0.108   |   VII
LENWOOD-LOCKHART-OLD WOMAN SPRGS|  77.0( 124.0)|   7.3     |   0.109   |   VII
SIMI-SANTA ROSA                 |  77.3( 124.4)|   6.7     |   0.096   |   VII
BURNT MTN.                      |  77.8( 125.2)|   6.4     |   0.067   |   VI
EUREKA PEAK                     |  80.5( 129.5)|   6.4     |   0.065   |   VI
LANDERS                         |  80.8( 130.0)|   7.3     |   0.105   |   VII
SAN CAYETANO                    |  81.8( 131.7)|   6.8     |   0.097   |   VII
JOHNSON VALLEY (Northern)       |  82.8( 133.3)|   6.7     |   0.075   |   VII
SAN ANDREAS - Carrizo           |  85.9( 138.3)|   7.2     |   0.095   |   VII
EMERSON So. - COPPER MTN.       |  89.3( 143.7)|   6.9     |   0.078   |   VII
ELSINORE-COYOTE MOUNTAIN        |  90.1( 145.0)|   6.8     |   0.074   |   VII
SAN JACINTO - BORREGO           |  91.5( 147.3)|   6.6     |   0.066   |   VI
OAK RIDGE(Blind Thrust Offshore)|  91.8( 147.7)|   6.9     |   0.093   |   VII
CHANNEL IS. THRUST (Eastern)    |  93.5( 150.4)|   7.4     |   0.120   |   VII
SANTA YNEZ (East)               |  93.6( 150.7)|   7.0     |   0.080   |   VII
GRAVEL HILLS - HARPER LAKE      |  94.4( 152.0)|   6.9     |   0.075   |   VII
CALICO - HIDALGO                |  94.9( 152.7)|   7.1     |   0.083   |   VII
VENTURA - PITAS POINT           |  96.1( 154.6)|   6.8     |   0.085   |   VII
PISGAH-BULLION MTN.-MESQUITE LK |  99.6 ( 160.3)|  7.1     |   0.080   |   VII
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-END OF SEARCH-   61 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE CHINO-CENTRAL AVE. (Elsinore) FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 9.4 MILES (15.1 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.4716 g
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                    *                       *
                    *     E Q S E A R C H   *
                    *                       *
                    *      Version 3.00     *
                    *                       *
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                         ESTIMATION OF
                    PEAK ACCELERATION FROM
                  CALIFORNIA EARTHQUAKE CATALOGS


JOB NUMBER: 4414-A1
                                               DATE: 09-21-2004

JOB NAME: MADISON

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT


MAGNITUDE RANGE:
   MINIMUM MAGNITUDE:  5.00
   MAXIMUM MAGNITUDE:  9.00

SITE COORDINATES:
   SITE LATITUDE:  33.6621
   SITE LONGITUDE:  117.6857

SEARCH DATES:
           START DATE:   1800
           END DATE:   2000

SEARCH RADIUS:
           100.0 mi
           160.9 km

ATTENUATION RELATION:   3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): S       Number of Sigmas:  1.0
   ASSUMED SOURCE TYPE:  DS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND:   0  Depth Source:  A
   Basement Depth:  5.00 km     Campbell SSR:        Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km):  0.0
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                         EARTHQUAKE SEARCH RESULTS
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Page  1
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    |       |        |          |  TIME  |     |     | SITE  |SITE|  APPROX.
FILE| LAT.  | LONG.  |   DATE   | (UTC)  |DEPTH|QUAKE| ACC.  | MM |  DISTANCE
CODE| NORTH | WEST   |          |H M Sec | (km)| MAG.|   g   |INT.|  mi   [km]
----+-------+--------+----------+--------+-----+-----+-------+----+------------
DMG |33.6990|117.5110|05/31/1938| 83455.4| 10.0| 5.50| 0.234 | IX | 10.4( 16.7)
MGI |33.8000|117.6000|04/22/1918|2115 0.0|  0.0| 5.00| 0.176 |VIII| 10.7( 17.2)
DMG |33.6170|117.9670|03/11/1933| 154 7.8|  0.0| 6.30| 0.255 | IX | 16.5( 26.5)
DMG |33.7000|117.4000|05/15/1910|1547 0.0|  0.0| 6.00| 0.216 |VIII| 16.6( 26.7)
DMG |33.7000|117.4000|04/11/1910| 757 0.0|  0.0| 5.00| 0.128 |VIII| 16.6( 26.7)
DMG |33.7000|117.4000|05/13/1910| 620 0.0|  0.0| 5.00| 0.128 |VIII| 16.6( 26.7)
DMG |33.5750|117.9830|03/11/1933| 518 4.0|  0.0| 5.20| 0.133 |VIII| 18.1( 29.2)
DMG |33.6170|118.0170|03/14/1933|19 150.0|  0.0| 5.10| 0.120 | VII| 19.3( 31.0)
DMG |33.6830|118.0500|03/11/1933| 658 3.0|  0.0| 5.50| 0.139 |VIII| 21.0( 33.8)
DMG |33.7000|118.0670|03/11/1933| 85457.0|  0.0| 5.10| 0.109 | VII| 22.1( 35.5)
DMG |33.7000|118.0670|03/11/1933| 51022.0|  0.0| 5.10| 0.109 | VII| 22.1( 35.5)
DMG |33.7500|118.0830|03/11/1933| 910 0.0|  0.0| 5.10| 0.103 | VII| 23.6( 38.0)
DMG |33.7500|118.0830|03/11/1933| 323 0.0|  0.0| 5.00| 0.098 | VII| 23.6( 38.0)
DMG |33.7500|118.0830|03/13/1933|131828.0|  0.0| 5.30| 0.115 | VII| 23.6( 38.0)
DMG |33.7500|118.0830|03/11/1933| 230 0.0|  0.0| 5.10| 0.103 | VII| 23.6( 38.0)
DMG |33.7500|118.0830|03/11/1933| 2 9 0.0|  0.0| 5.00| 0.098 | VII| 23.6( 38.0)
MGI |34.0000|117.5000|12/16/1858|10 0 0.0|  0.0| 7.00| 0.264 | IX | 25.6( 41.3)
DMG |33.7830|118.1330|10/02/1933| 91017.6|  0.0| 5.40| 0.109 | VII| 27.0( 43.5)
MGI |34.0000|118.0000|12/25/1903|1745 0.0|  0.0| 5.00| 0.083 | VII| 29.5( 47.4)
DMG |33.9000|117.2000|12/19/1880| 0 0 0.0|  0.0| 6.00| 0.130 |VIII| 32.3( 52.1)
GSP |34.1400|117.7000|02/28/1990|234336.6|  5.0| 5.20| 0.084 | VII| 33.0( 53.1)
DMG |33.7830|118.2500|11/14/1941| 84136.3|  0.0| 5.40| 0.093 | VII| 33.5( 53.8)
DMG |34.0000|117.2500|07/23/1923| 73026.0|  0.0| 6.25| 0.142 |VIII| 34.2( 55.0)
PAS |34.0610|118.0790|10/01/1987|144220.0|  9.5| 5.90| 0.115 | VII| 35.6( 57.3)
DMG |33.8500|118.2670|03/11/1933|1425 0.0|  0.0| 5.00| 0.071 | VI | 35.8( 57.6)
PAS |34.0730|118.0980|10/04/1987|105938.2|  8.2| 5.30| 0.081 | VII| 36.9( 59.4)
MGI |34.1000|117.3000|07/15/1905|2041 0.0|  0.0| 5.30| 0.080 | VII| 37.5( 60.3)
MGI |34.1000|118.1000|07/11/1855| 415 0.0|  0.0| 6.30| 0.134 |VIII| 38.4( 61.9)
DMG |34.2000|117.9000|08/28/1889| 215 0.0|  0.0| 5.50| 0.086 | VII| 39.1( 62.9)
DMG |33.7500|117.0000|06/06/1918|2232 0.0|  0.0| 5.00| 0.065 | VI | 39.8( 64.1)
DMG |33.7500|117.0000|04/21/1918|223225.0|  0.0| 6.80| 0.169 |VIII| 39.8( 64.1)
T-A |34.0000|118.2500|09/23/1827| 0 0 0.0|  0.0| 5.00| 0.065 | VI | 39.9( 64.2)
T-A |34.0000|118.2500|03/26/1860| 0 0 0.0|  0.0| 5.00| 0.065 | VI | 39.9( 64.2)
T-A |34.0000|118.2500|01/10/1856| 0 0 0.0|  0.0| 5.00| 0.065 | VI | 39.9( 64.2)
DMG |33.8000|117.0000|12/25/1899|1225 0.0|  0.0| 6.40| 0.135 |VIII| 40.5( 65.2)
DMG |34.2000|117.4000|07/22/1899| 046 0.0|  0.0| 5.50| 0.084 | VII| 40.6( 65.3)
MGI |34.0000|118.3000|09/03/1905| 540 0.0|  0.0| 5.30| 0.073 | VII| 42.3( 68.0)
DMG |34.2700|117.5400|09/12/1970|143053.0|  8.0| 5.40| 0.077 | VII| 42.8( 68.9)
MGI |34.0800|118.2600|07/16/1920|18 8 0.0|  0.0| 5.00| 0.061 | VI | 43.8( 70.4)
DMG |33.7100|116.9250|09/23/1963|144152.6| 16.5| 5.00| 0.061 | VI | 43.8( 70.5)
DMG |34.3000|117.6000|07/30/1894| 512 0.0|  0.0| 6.00| 0.102 | VII| 44.3( 71.3)
GSP |34.2620|118.0020|06/28/1991|144354.5| 11.0| 5.40| 0.073 | VII| 45.2( 72.7)
DMG |34.3000|117.5000|07/22/1899|2032 0.0|  0.0| 6.50| 0.131 |VIII| 45.3( 72.9)
PAS |32.9710|117.8700|07/13/1986|1347 8.2|  6.0| 5.30| 0.065 | VI | 48.9( 78.7)
DMG |34.3700|117.6500|12/08/1812|15 0 0.0|  0.0| 7.00| 0.160 |VIII| 48.9( 78.7)
DMG |34.2000|117.1000|09/20/1907| 154 0.0|  0.0| 6.00| 0.093 | VII| 50.0( 80.5)
DMG |33.0000|117.3000|11/22/1800|2130 0.0|  0.0| 6.50| 0.120 | VII| 50.8( 81.8)
DMG |33.9500|116.8500|09/28/1946| 719 9.0|  0.0| 5.00| 0.053 | VI | 51.9( 83.5)
MGI |34.0000|118.5000|11/19/1918|2018 0.0|  0.0| 5.00| 0.053 | VI | 52.2( 84.0)
DMG |34.0000|118.5000|08/04/1927|1224 0.0|  0.0| 5.00| 0.053 | VI | 52.2( 84.0)
DMG |34.1800|116.9200|01/16/1930| 02433.9|  0.0| 5.20| 0.055 | VI | 56.6( 91.1)
DMG |34.1800|116.9200|01/16/1930| 034 3.6|  0.0| 5.10| 0.053 | VI | 56.6( 91.1)
PAS |33.9190|118.6270|01/19/1989| 65328.8| 11.9| 5.00| 0.050 | VI | 56.8( 91.5)
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                    EARTHQUAKE SEARCH RESULTS
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Page  2
-------------------------------------------------------------------------------
    |       |        |          |  TIME  |     |     | SITE  |SITE|  APPROX.
FILE| LAT.  | LONG.  |   DATE   | (UTC)  |DEPTH|QUAKE| ACC.  | MM |  DISTANCE
CODE| NORTH | WEST   |          |H M Sec | (km)| MAG.|   g   |INT.|  mi   [km]
----+-------+--------+----------+--------+-----+-----+-------+----+------------
DMG |33.9500|118.6320|08/31/1930| 04036.0|  0.0| 5.20| 0.055 | VI | 57.8( 93.0)
DMG |34.2670|116.9670|08/29/1943| 34513.0|  0.0| 5.50| 0.063 | VI | 58.6( 94.4)
GSP |34.1630|116.8550|06/28/1992|144321.0|  6.0| 5.30| 0.057 | VI | 58.8( 94.7)
DMG |34.1000|116.8000|10/24/1935|1448 7.6|  0.0| 5.10| 0.051 | VI | 59.1( 95.1)
DMG |33.9760|116.7210|06/12/1944|104534.7| 10.0| 5.10| 0.051 | VI | 59.4( 95.6)
GSP |34.1950|116.8620|08/17/1992|204152.1| 11.0| 5.30| 0.056 | VI | 59.8( 96.3)
GSP |34.2310|118.4750|03/20/1994|212012.3| 13.0| 5.30| 0.056 | VI | 59.9( 96.4)
PAS |33.9440|118.6810|01/01/1979|231438.9| 11.3| 5.00| 0.048 | VI | 60.3( 97.1)
DMG |33.9940|116.7120|06/12/1944|111636.0| 10.0| 5.30| 0.056 | VI | 60.4( 97.1)
MGI |33.0000|117.0000|09/21/1856| 730 0.0|  0.0| 5.00| 0.047 | VI | 60.4( 97.3)
GSN |34.2030|116.8270|06/28/1992|150530.7|  5.0| 6.70| 0.114 | VII| 61.8( 99.4)
GSP |34.2130|118.5370|01/17/1994|123055.4| 18.0| 6.70| 0.114 | VII| 61.8( 99.5)
DMG |34.3080|118.4540|02/09/1971|144346.7|  6.2| 5.20| 0.051 | VI | 62.6(100.8)
GSP |34.2390|116.8370|07/09/1992|014357.6|  0.0| 5.30| 0.054 | VI | 62.8(101.1)
DMG |34.1000|116.7000|02/07/1889| 520 0.0|  0.0| 5.30| 0.053 | VI | 64.1(103.1)
GSP |34.3400|116.9000|11/27/1992|160057.5|  1.0| 5.30| 0.053 | VI | 64.9(104.5)
DMG |33.2000|116.7000|01/01/1920| 235 0.0|  0.0| 5.00| 0.045 | VI | 65.1(104.8)
DMG |34.4110|118.4010|02/09/1971|14 244.0|  8.0| 5.80| 0.068 | VI | 65.9(106.1)
DMG |34.4110|118.4010|02/09/1971|14 041.8|  8.4| 6.40| 0.093 | VII| 65.9(106.1)
DMG |34.4110|118.4010|02/09/1971|14 1 8.0|  8.0| 5.80| 0.068 | VI | 65.9(106.1)
DMG |34.4110|118.4010|02/09/1971|141028.0|  8.0| 5.30| 0.052 | VI | 65.9(106.1)
DMG |34.5190|118.1980|08/23/1952|10 9 7.1| 13.1| 5.00| 0.044 | VI | 66.0(106.2)
PAS |33.9980|116.6060|07/08/1986| 92044.5| 11.7| 5.60| 0.061 | VI | 66.1(106.4)
GSP |34.3690|116.8970|12/04/1992|020857.5|  3.0| 5.30| 0.052 | VI | 66.5(107.0)
GSB |34.3010|118.5650|01/17/1994|204602.4|  9.0| 5.20| 0.049 | VI | 66.9(107.7)
GSP |34.3050|118.5790|01/29/1994|112036.0|  1.0| 5.10| 0.046 | VI | 67.7(109.0)
PAS |33.5010|116.5130|02/25/1980|104738.5| 13.6| 5.50| 0.056 | VI | 68.4(110.0)
DMG |34.3000|118.6000|04/04/1893|1940 0.0|  0.0| 6.00| 0.073 | VII| 68.4(110.1)
MGI |32.8000|117.1000|05/25/1803| 0 0 0.0|  0.0| 5.00| 0.043 | VI | 68.5(110.2)
DMG |33.5000|116.5000|09/30/1916| 211 0.0|  0.0| 5.00| 0.043 | VI | 69.1(111.2)
DMG |32.8170|118.3500|12/26/1951| 04654.0|  0.0| 5.90| 0.068 | VI | 69.8(112.4)
MGI |33.2000|116.6000|10/12/1920|1748 0.0|  0.0| 5.30| 0.049 | VI | 70.2(113.0)
DMG |32.7000|117.2000|05/27/1862|20 0 0.0|  0.0| 5.90| 0.066 | VI | 72.1(116.0)
DMG |34.0170|116.5000|07/25/1947| 04631.0|  0.0| 5.00| 0.041 |  V | 72.3(116.3)
DMG |34.0170|116.5000|07/25/1947| 61949.0|  0.0| 5.20| 0.046 | VI | 72.3(116.3)
DMG |34.0170|116.5000|07/26/1947| 24941.0|  0.0| 5.10| 0.044 | VI | 72.3(116.3)
DMG |34.0170|116.5000|07/24/1947|221046.0|  0.0| 5.50| 0.054 | VI | 72.3(116.3)
GSP |34.3780|118.6180|01/19/1994|211144.9| 11.0| 5.10| 0.043 | VI | 72.7(117.0)
GSP |34.3260|118.6980|01/17/1994|233330.7|  9.0| 5.60| 0.056 | VI | 73.9(118.9)
GSP |34.3690|118.6720|04/26/1997|103730.7| 16.0| 5.10| 0.042 | VI | 74.6(120.1)
T-A |32.6700|117.1700|10/21/1862| 0 0 0.0|  0.0| 5.00| 0.040 |  V | 74.7(120.2)
T-A |32.6700|117.1700|12/00/1856| 0 0 0.0|  0.0| 5.00| 0.040 |  V | 74.7(120.2)
T-A |32.6700|117.1700|05/24/1865| 0 0 0.0|  0.0| 5.00| 0.040 |  V | 74.7(120.2)
GSP |34.3940|118.6690|06/26/1995|084028.9| 13.0| 5.00| 0.040 |  V | 75.6(121.7)
GSP |34.3770|118.6980|01/18/1994|004308.9| 11.0| 5.20| 0.044 | VI | 76.1(122.5)
GSB |34.3790|118.7110|01/19/1994|210928.6| 14.0| 5.50| 0.051 | VI | 76.8(123.5)
DMG |33.9330|116.3830|12/04/1948|234317.0|  0.0| 6.50| 0.087 | VII| 77.0(124.0)
DMG |32.8000|116.8000|10/23/1894|23 3 0.0|  0.0| 5.70| 0.056 | VI | 78.5(126.3)
MGI |34.0000|119.0000|12/14/1912| 0 0 0.0|  0.0| 5.70| 0.056 | VI | 78.9(127.0)
DMG |34.0000|119.0000|09/24/1827| 4 0 0.0|  0.0| 7.00| 0.111 | VII| 78.9(127.0)
GSP |34.1390|116.4310|06/28/1992|123640.6| 10.0| 5.10| 0.041 |  V | 79.1(127.3)
GSP |34.1080|116.4040|06/29/1992|141338.8|  9.0| 5.40| 0.047 | VI | 79.7(128.2)
DMG |33.3430|116.3460|04/28/1969|232042.9| 20.0| 5.80| 0.058 | VI | 80.2(129.1)
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                      EARTHQUAKE SEARCH RESULTS
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    |   .   |        |          |  TIME   |     |     | SITE  |SITE|  APPROX.
FILE| LAT.  | LONG.  |   DATE   |  (UTC)  |DEPTH|QUAKE| ACC.  | MM |  DISTANCE
CODE| NORTH | WEST   |          | H M Sec | (km)| MAG.|   g   |INT.|  mi  [km]
----+-------+--------+----------+---------+-----+-----+-------+----+------------
GSN |34.2010|116.4360|06/28/1992|115734.1|  1.0| 7.60| 0.149 |VIII| 80.7(129.8)
GSP |34.0640|116.3610|09/15/1992|084711.3|  9.0| 5.20| 0.042 | VI | 80.9(130.1)
GSP |34.3410|116.5290|06/28/1992|124053.5|  6.0| 5.20| 0.042 | VI | 81.1(130.5)
GSP |33.9610|116.3180|04/23/1992|045023.0| 12.0| 6.10| 0.067 | VI | 81.1(130.6)
DMG |33.4000|116.3000|02/09/1890|12 6 0.0|  0.0| 6.30| 0.074 | VII| 81.8(131.6)
PAS |33.6710|119.1110|09/04/1981|155050.3|  5.0| 5.30| 0.044 | VI | 81.9(131.8)
GSP |33.9020|116.2840|07/24/1992|181436.2|  9.0| 5.00| 0.037 |  V | 82.1(132.2)
DMG |34.0650|119.0350|02/21/1973|144557.3|  8.0| 5.90| 0.060 | VI | 82.2(132.3)
GSP |34.0290|116.3210|08/21/1993|014638.4|  9.0| 5.00| 0.037 |  V | 82.3(132.4)
DMG |34.0670|116.3330|05/18/1940| 72132.7|  0.0| 5.00| 0.037 |  V | 82.4(132.7)
DMG |34.0670|116.3330|05/18/1940| 55120.2|  0.0| 5.20| 0.041 |  V | 82.4(132.7)
GSP |33.8760|116.2670|06/29/1992|160142.8|  1.0| 5.20| 0.041 |  V | 82.8(133.2)
DMG |33.4080|116.2610|03/25/1937|1649 1.8| 10.0| 6.00| 0.062 | VI | 83.8(134.9)
GSP |34.3320|116.4620|07/01/1992|074029.9|  9.0| 5.40| 0.045 | VI | 83.9(135.1)
PAS |34.3270|116.4450|03/15/1979|21 716.5|  2.5| 5.20| 0.041 |  V | 84.6(136.1)
GSP |34.2680|116.4020|06/16/1994|162427.5|  3.0| 5.00| 0.037 |  V | 84.6(136.1)
DMG |34.0830|116.3000|05/18/1940| 5 358.5|  0.0| 5.40| 0.045 | VI | 84.6(136.1)
DMG |33.0000|116.4330|06/04/1940|1035 8.3|  0.0| 5.10| 0.038 |  V | 85.5(137.6)
PAS |34.5160|116.4950|06/01/1975| 13849.2|  4.5| 5.20| 0.039 |  V | 90.1(144.9)
DMG |33.2830|116.1830|03/23/1954| 41450.0|  0.0| 5.10| 0.037 |  V | 90.4(145.5)
DMG |33.2830|116.1830|03/19/1954|102117.0|  0.0| 5.50| 0.045 | VI | 90.4(145.5)
DMG |33.2830|116.1830|03/19/1954| 95429.0|  0.0| 6.20| 0.065 | VI | 90.4(145.5)
DMG |33.2830|116.1830|03/19/1954| 95556.0|  0.0| 5.00| 0.035 |  V | 90.4(145.5)
DMG |33.2910|119.1930|10/24/1969| 82912.1| 10.0| 5.10| 0.037 |  V | 90.5(145.6)
DMG |33.2000|116.2000|05/28/1892|1115 0.0|  0.0| 6.30| 0.068 | VI | 91.4(147.0)
DMG |32.5000|118.5500|02/24/1948| 81510.0|  0.0| 5.30| 0.039 |  V | 94.5(152.1)
DMG |33.2170|116.1330|08/15/1945|175624.0|  0.0| 5.70| 0.048 | VI | 94.6(152.2)
DMG |33.1900|116.1290|04/09/1968| 22859.1| 11.1| 6.40| 0.070 | VI | 95.4(153.6)
DMG |34.2500|116.1670|03/20/1945|2155 7.0|  0.0| 5.00| 0.033 |  V | 96.0(154.5)
T-A |32.2500|117.5000|01/13/1877|20 0 0.0|  0.0| 5.00| 0.033 |  V | 98.1(157.8)
GSP |34.4420|116.2480|10/16/1999|125721.0|  1.0| 5.70| 0.047 | VI | 98.3(158.2)
DMG |34.7120|116.5030|09/25/1965|174344.1| 10.6| 5.20| 0.036 |  V | 99.1(159.4)
DMG |34.0000|116.0000|09/05/1928|1442 0.0|  0.0| 5.00| 0.032 |  V | 99.5(160.0)
DMG |34.0000|116.0000|04/03/1926|20 8 0.0|  0.0| 5.50| 0.042 | VI | 99.5(160.0)

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-END OF SEARCH-   140 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH:   1800  TO  2000

LENGTH OF SEARCH TIME:   201  years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 10.4 MILES (16.7 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 7.6

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.264 g

COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
  a-value=  1.524
  b-value=  0.384
  beta-value=  0.883


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TABLE OF MAGNITUDES AND EXCEEDANCES:
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  Earthquake | Number of Times | Cumulative
   Magnitude |    Exceeded     | No. / Year
  -----------+-----------------+------------
     4.0     |       140       |   0.69652
     4.5     |       140       |   0.69652
     5.0     |       140       |   0.69652
     5.5     |        49       |   0.24378
     6.0     |        26       |   0.12935
     6.5     |        10       |   0.04975
     7.0     |         4       |   0.01990
     7.5     |         1       |   0.00498
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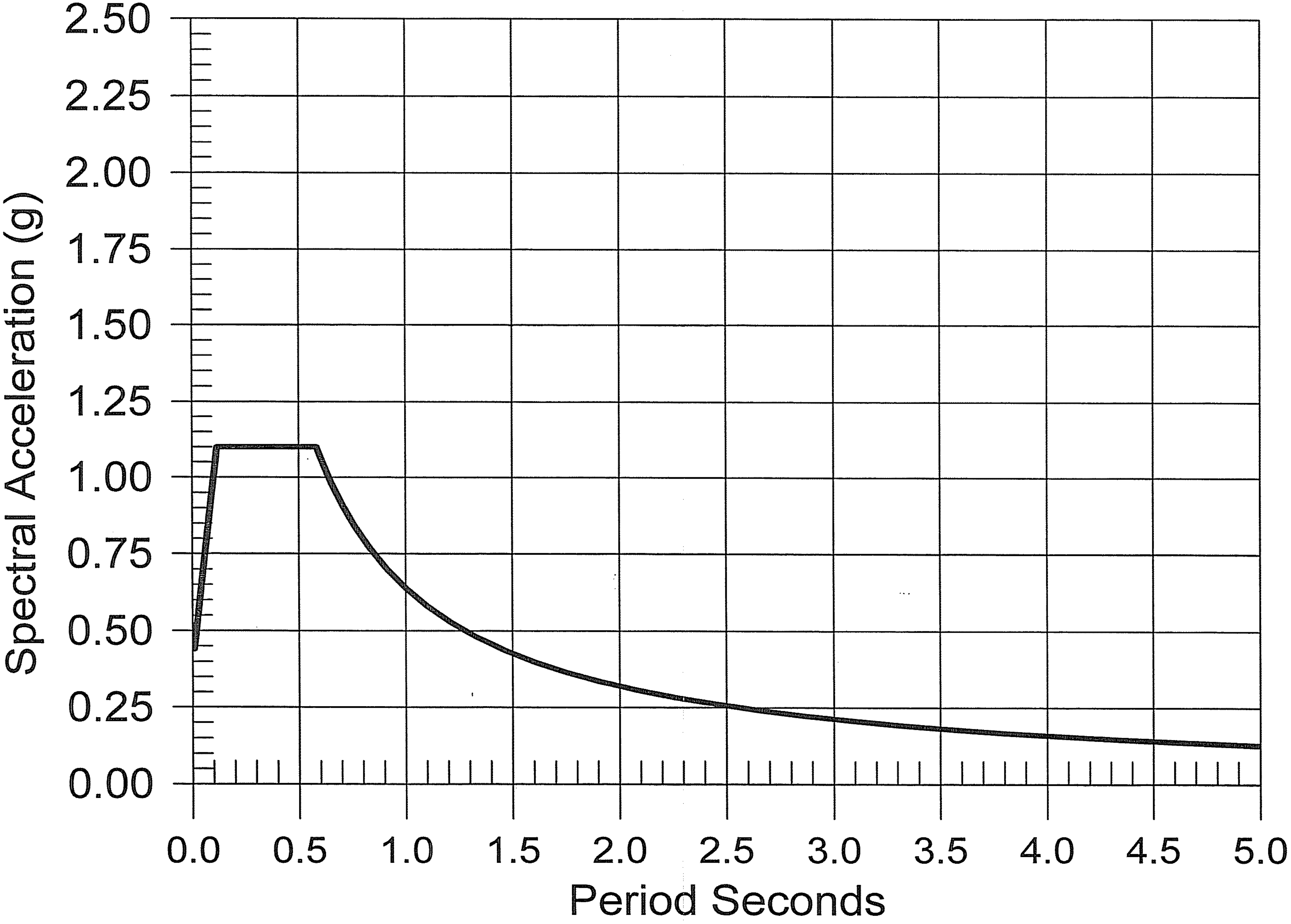
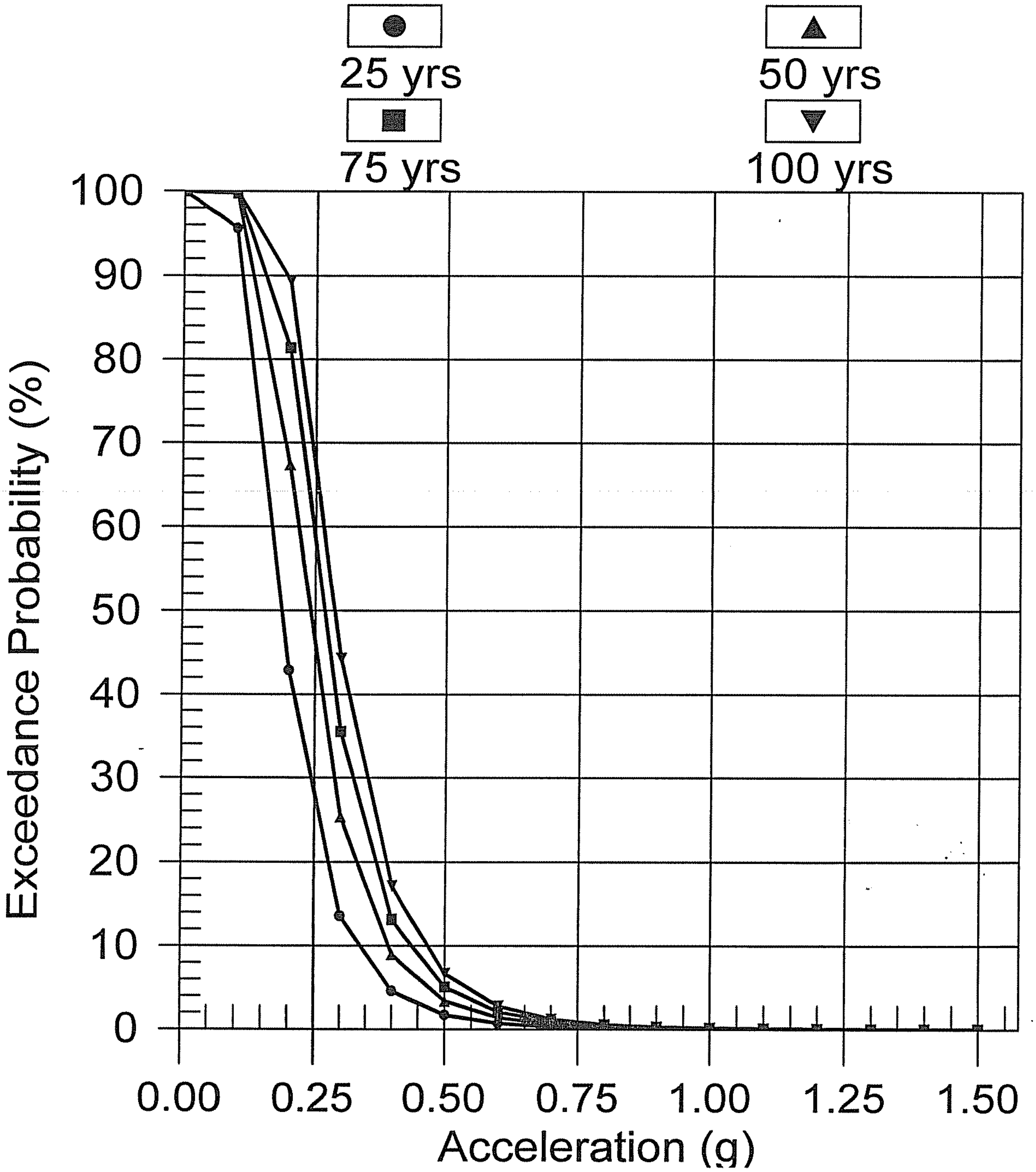
DESIGN RESPONSE SPECTRUM

Seismic Zone: 0.4 Soil Profile: SD



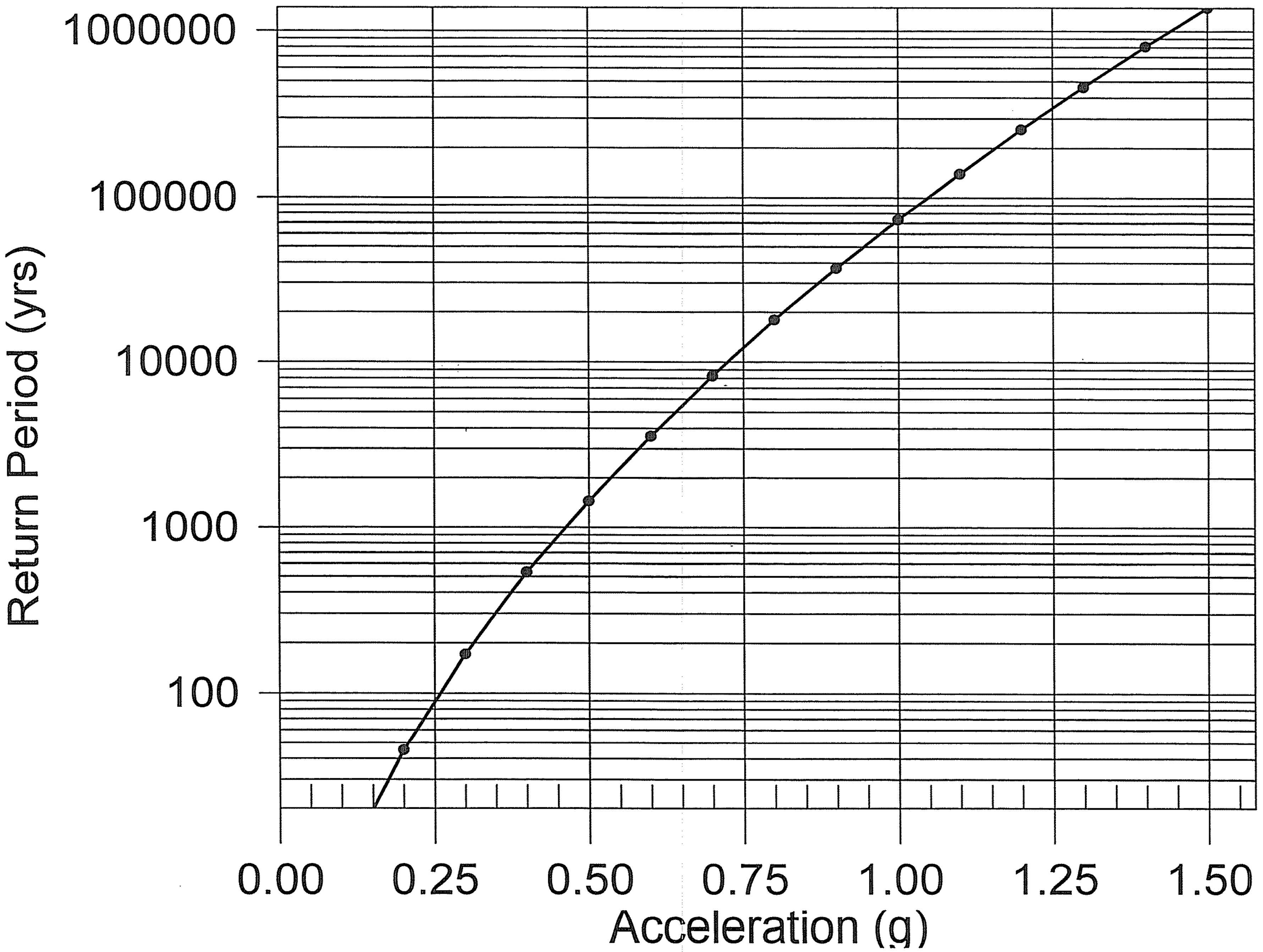
PROBABILITY OF EXCEEDANCE

BOORE ET AL(1997) NEHRP D (250)1



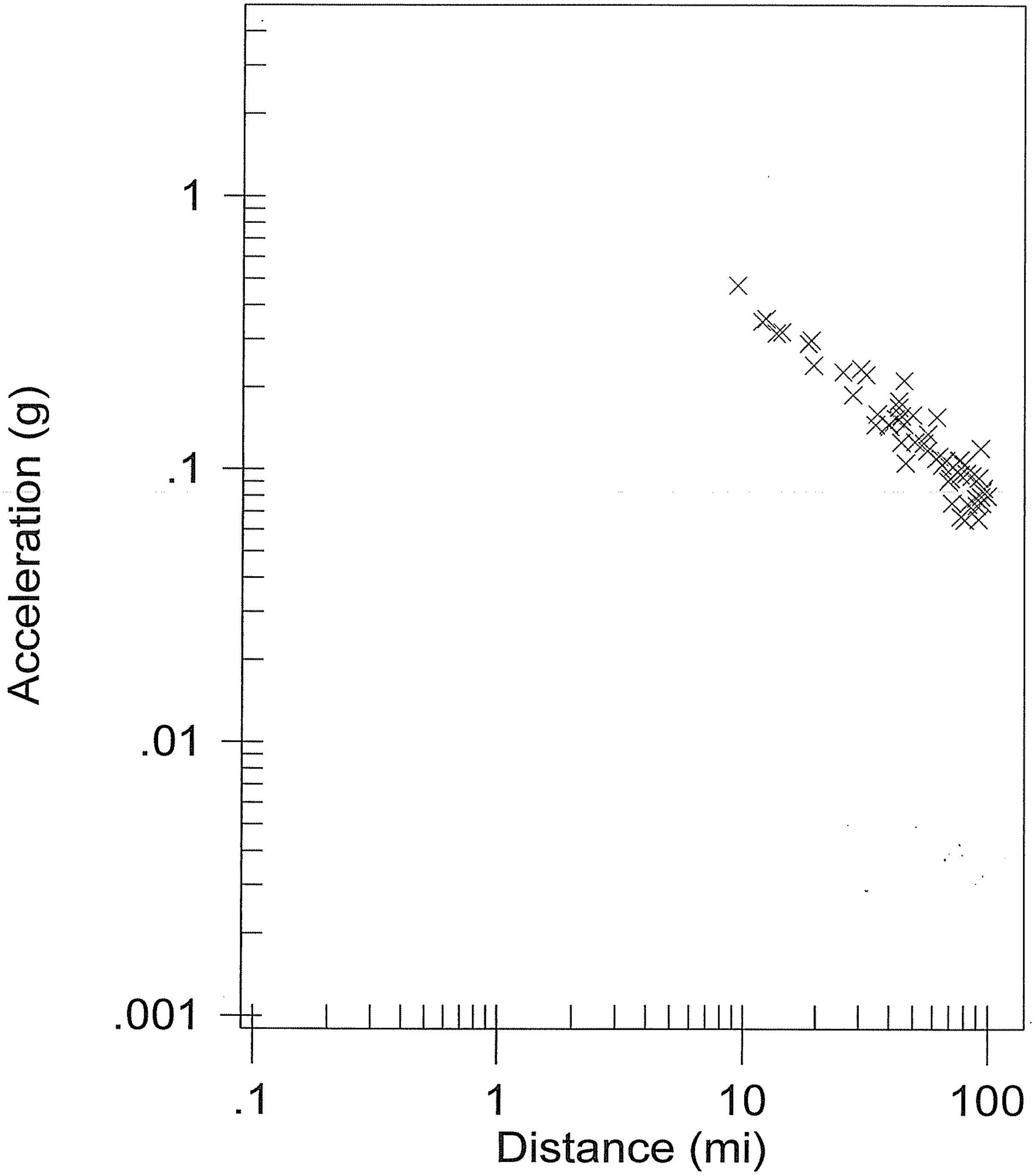
RETURN PERIOD vs. ACCELERATION

BOORE ET AL(1997) NEHRP D (250)1

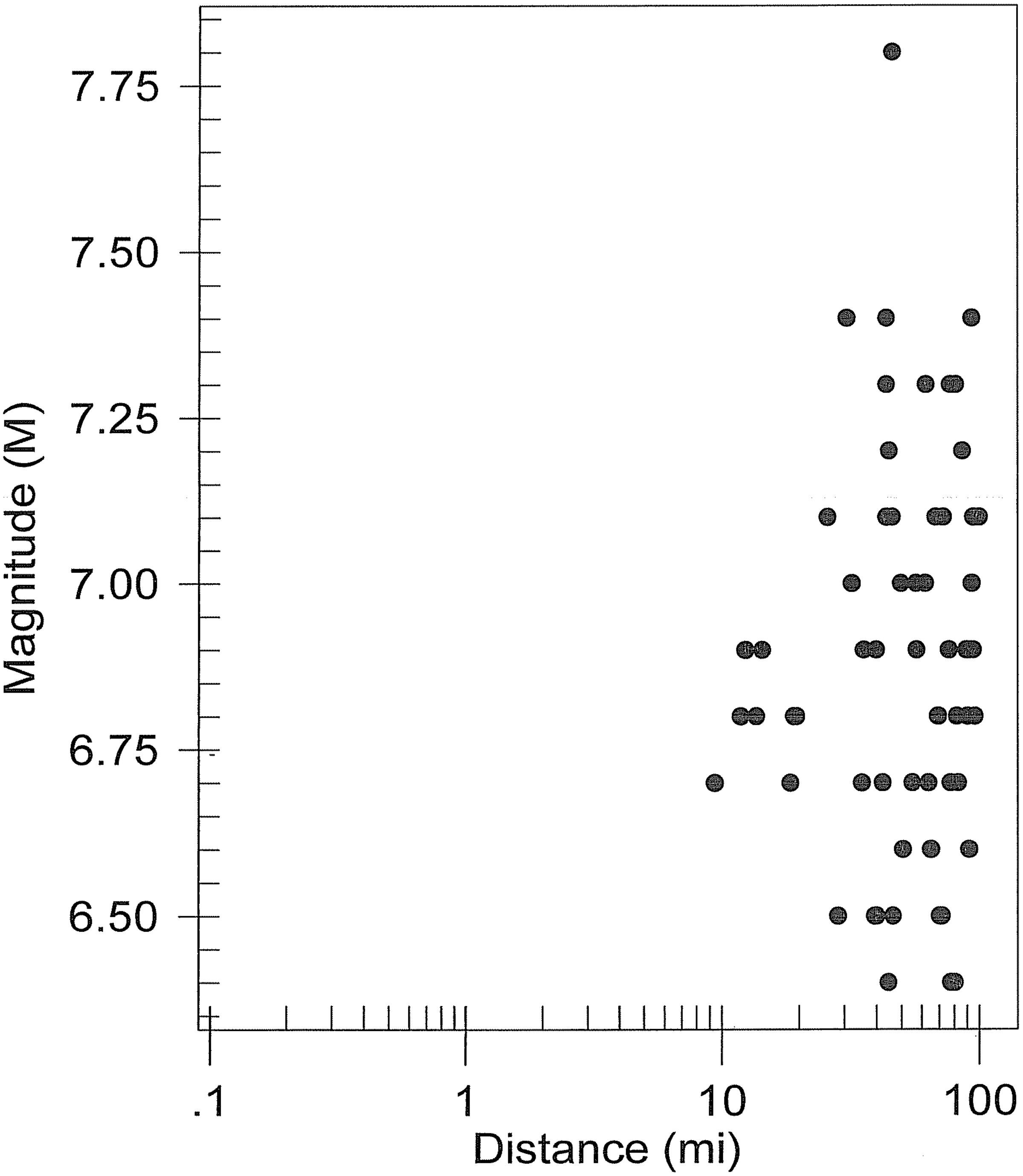


MAXIMUM EARTHQUAKES

MADISON

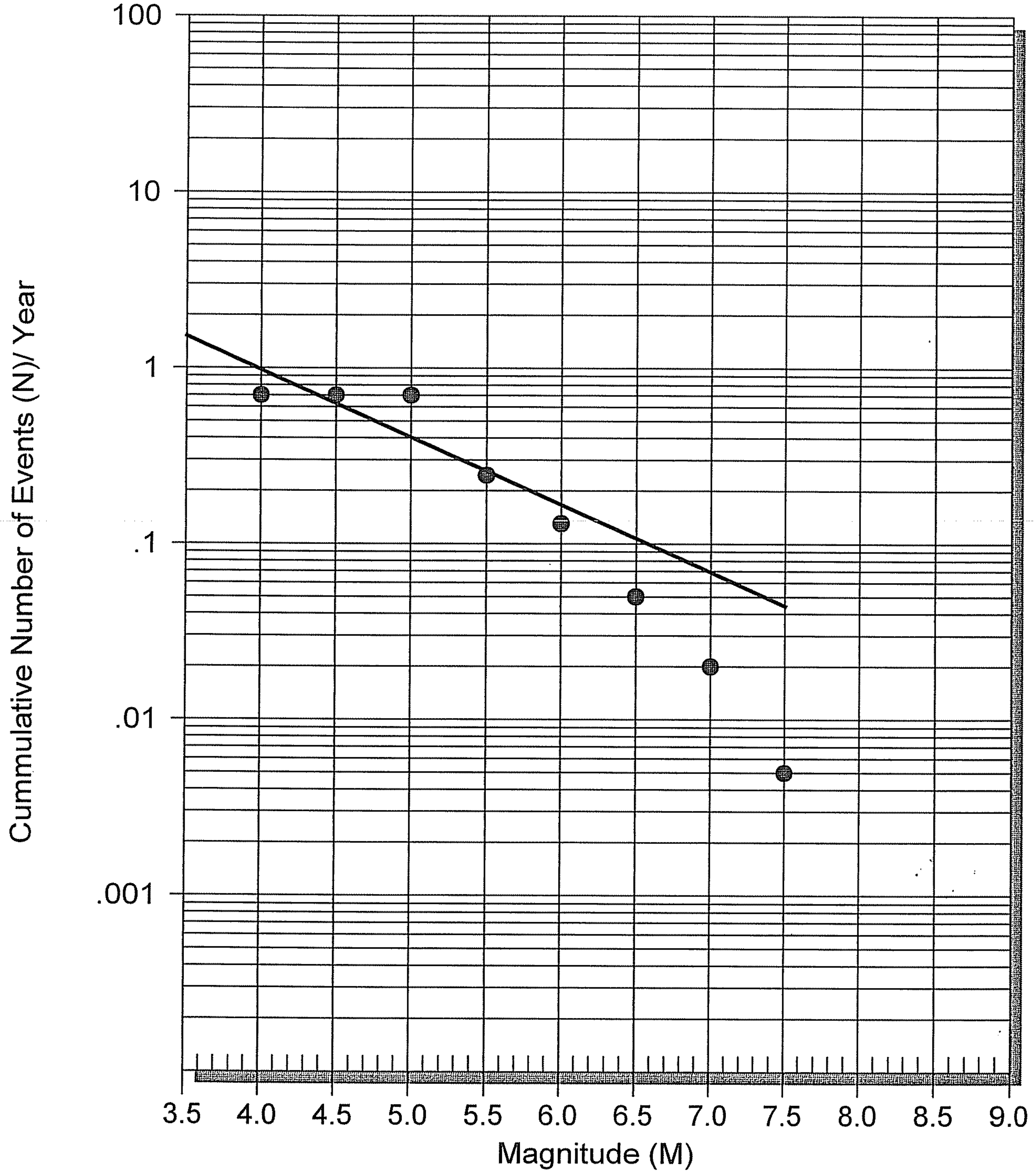


EARTHQUAKE MAGNITUDES & DISTANCES
MADISON



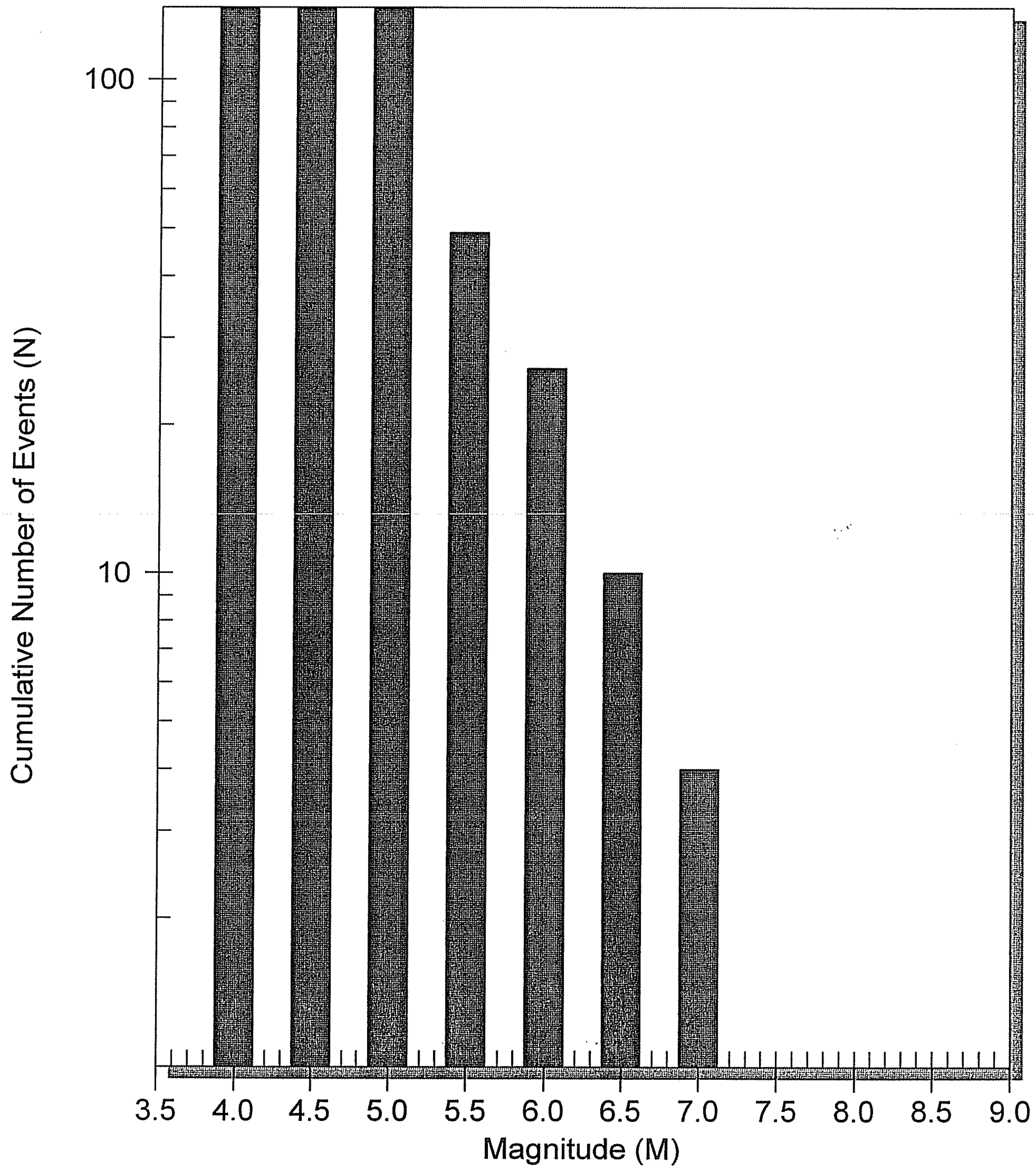
EARTHQUAKE RECURRENCE CURVE

MADISON



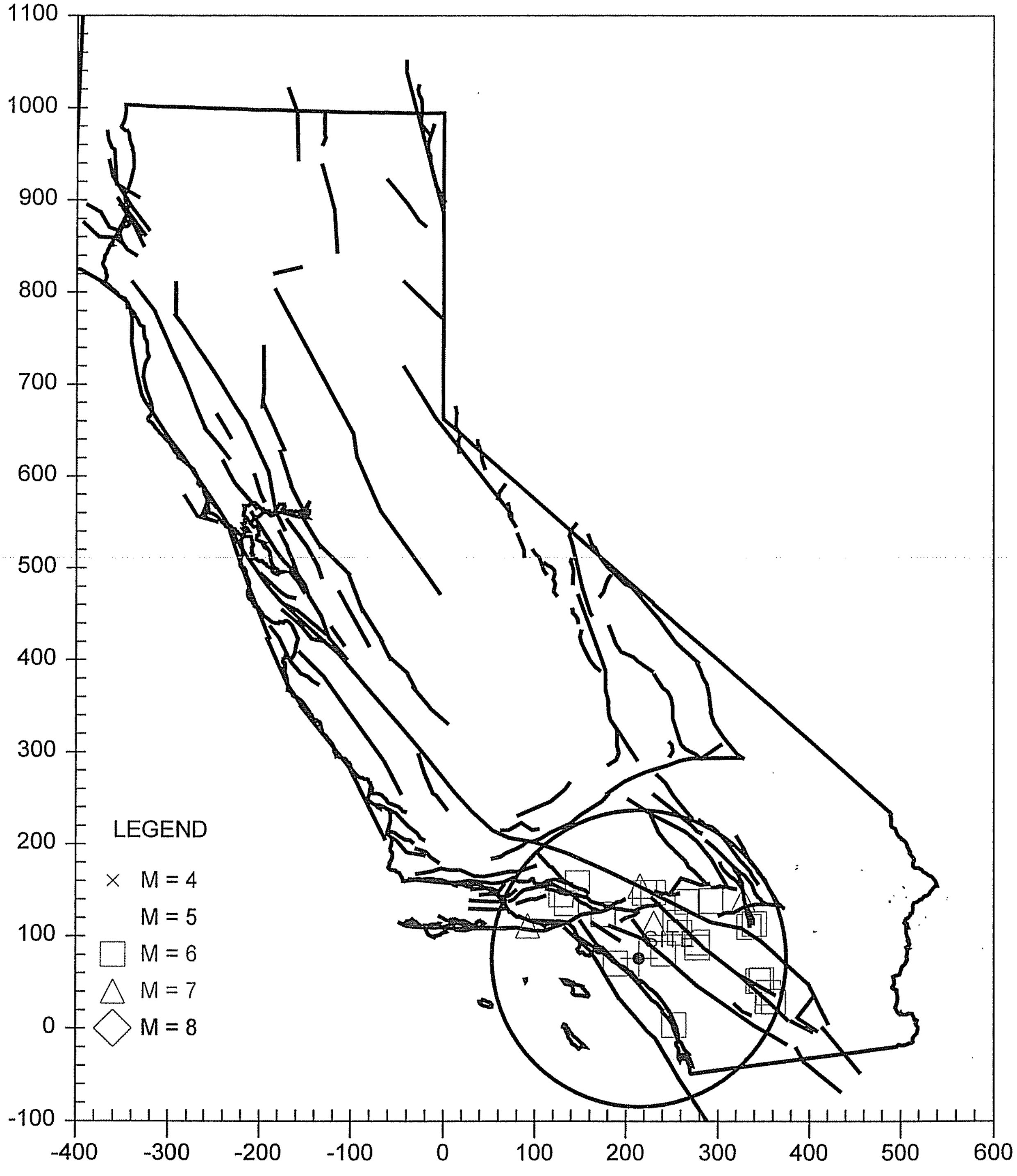
Number of Earthquakes (N) Above Magnitude (M)

MADISON



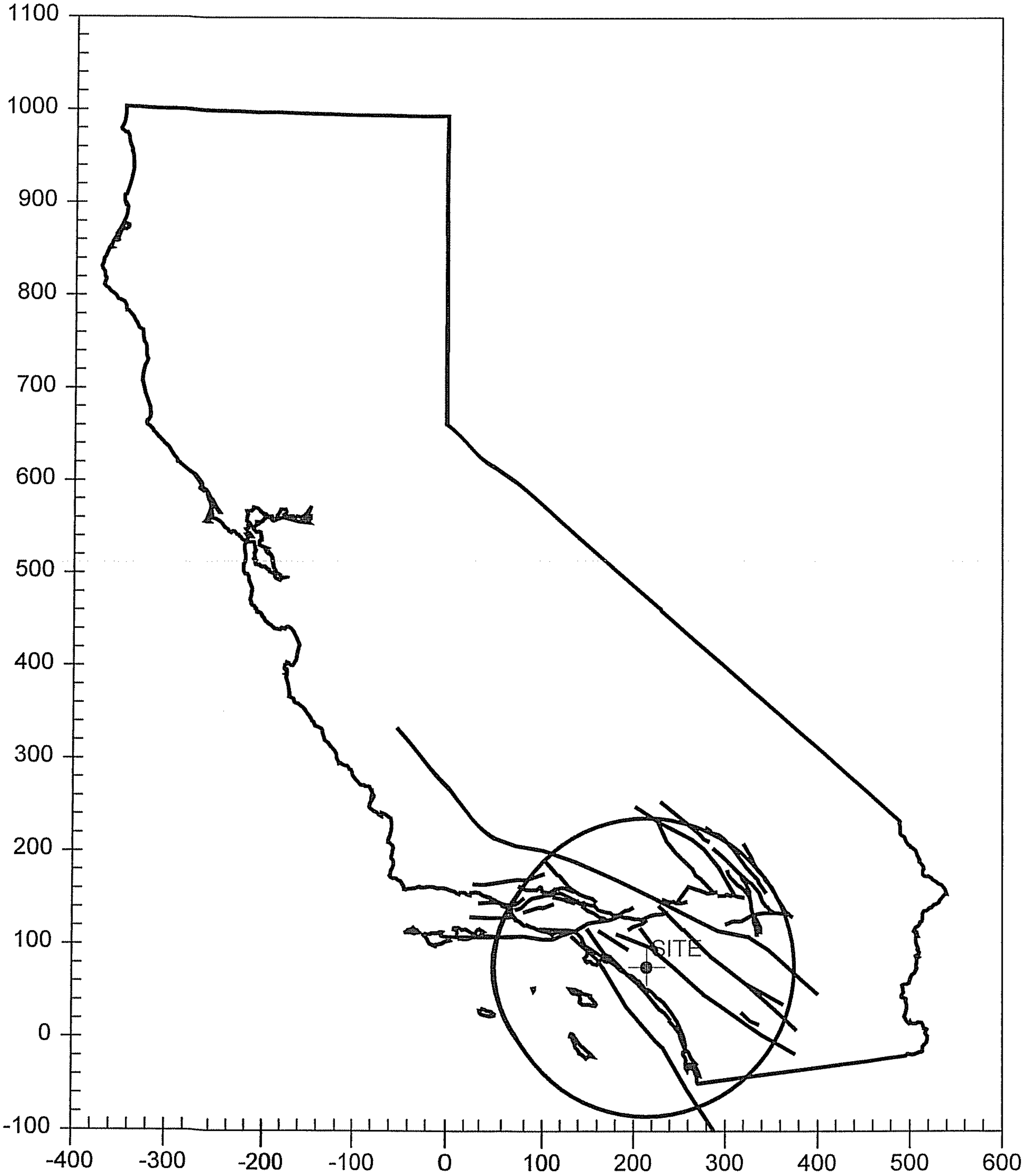
EARTHQUAKE EPICENTER MAP

MADISON



CALIFORNIA FAULT MAP

MADISON



APPENDIX E

GENERAL EARTHWORK AND GRADING GUIDELINES

GENERAL EARTHWORK AND GRADING GUIDELINES

GENERAL

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

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

EARTHWORK OBSERVATIONS AND TESTING

Geotechnical Consultant

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

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

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

Laboratory and Field Tests

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

Contractor's Responsibility

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

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

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

SITE PREPARATION

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

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, or other structures not located prior to grading are to be removed or treated in a manner recommended by the soil engineer. Soft, dry, spongy, highly fractured, or otherwise unsuitable ground extending to such a depth that surface processing cannot adequately improve the condition should be over-excavated 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 over-excavated as required in the geotechnical report or by the on-site soils engineer and/or engineering geologist. Scarification, disc harrowing, or other acceptable form of mixing should continue until the soils are broken down and free of large lumps or clods, until the working surface is reasonably uniform and free from ruts, hollow, hummocks, or other uneven features which would inhibit compaction as described previously.

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

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

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

COMPACTED FILLS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SUBDRAIN INSTALLATION

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

EXCAVATIONS

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

The engineering geologist should observe all cut slopes and should be notified by the contractor when cut slopes are started.

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

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

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

COMPLETION

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

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

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

JOB SAFETY

General

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

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

Safety Meetings:	GSI field personnel are directed to attend contractors regularly scheduled and documented safety meetings.
Safety Vests:	Safety vests are provided for and are to be worn by GSI personnel at all times when they are working in the field.
Safety Flags:	Two safety flags are provided to GSI field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

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

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

Test Pits Location, Orientation and Clearance

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

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

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

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

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location, well away from the equipment traffic pattern.

The contractor should inform our personnel of all changes to haul roads, cut and fill areas or other factors that may affect site access and site safety.

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

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

Trench and Vertical Excavation

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

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

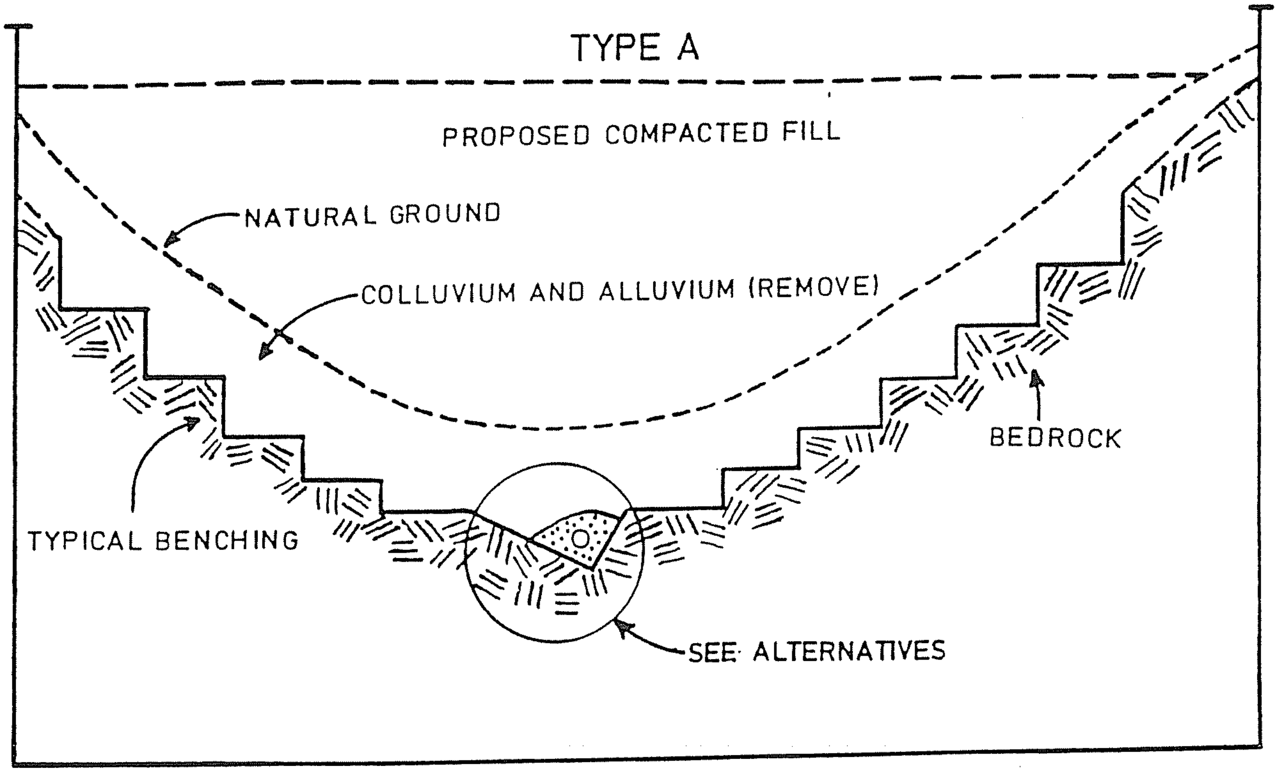
All trench excavations or vertical cuts in excess of 5 feet deep, which any person enters, should be shored or laid back.

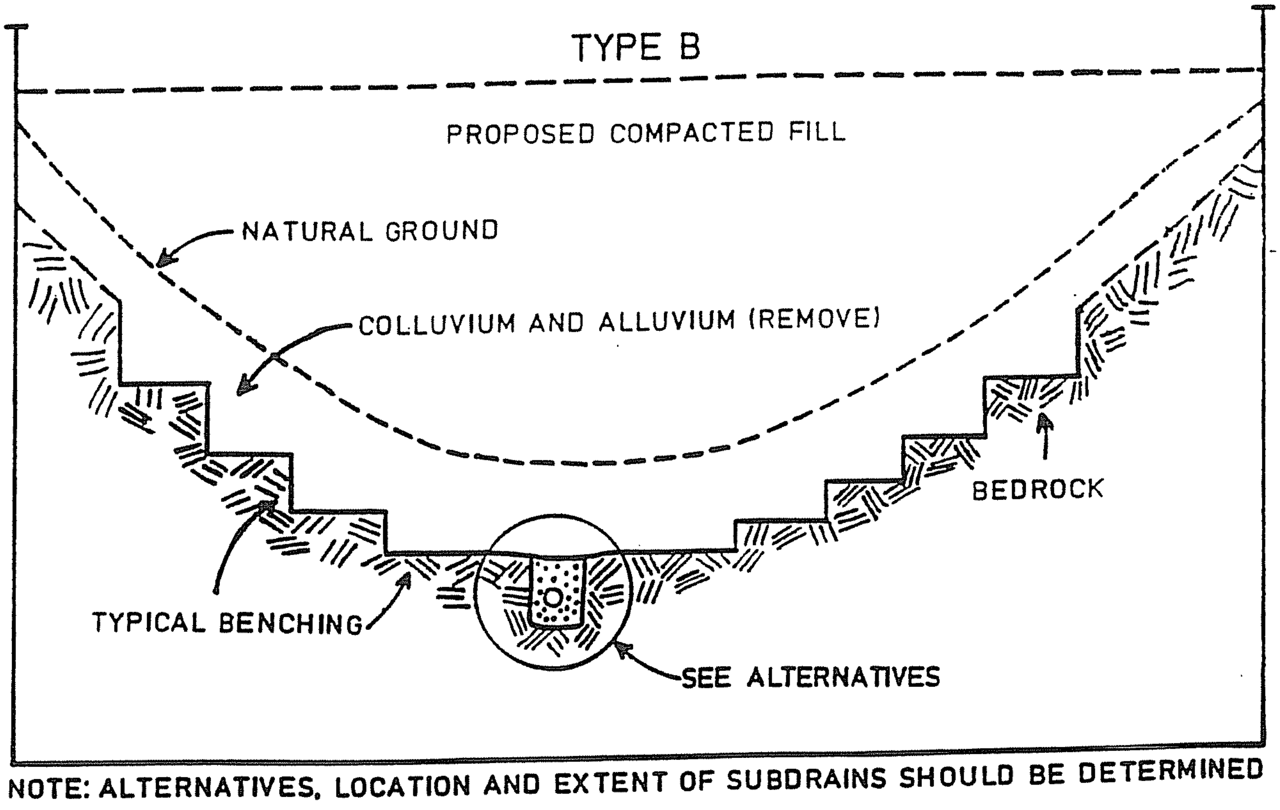
Trench access should be provided in accordance with CAL-OSHA and/or state and local standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

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

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

CANYON SUBDRAIN DETAIL



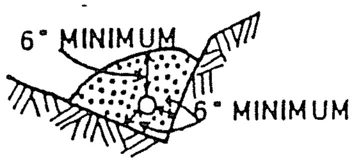


NOTE: ALTERNATIVES, LOCATION AND EXTENT OF SUBDRAINS SHOULD BE DETERMINED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST DURING GRADING.

PLATE EG—1

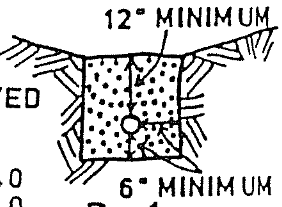
CANYON SUBDRAIN ALTERNATE DETAILS

ALTERNATE 1: PERFORATED PIPE AND FILTER MATERIAL



A—1

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

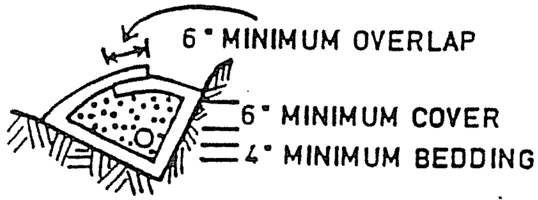


B—1

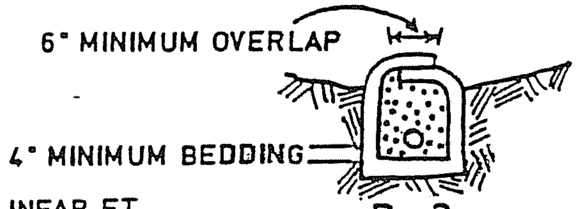
FILTER MATERIAL

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

ALTERNATE 2: PERFORATED PIPE, GRAVEL AND FILTER FABRIC



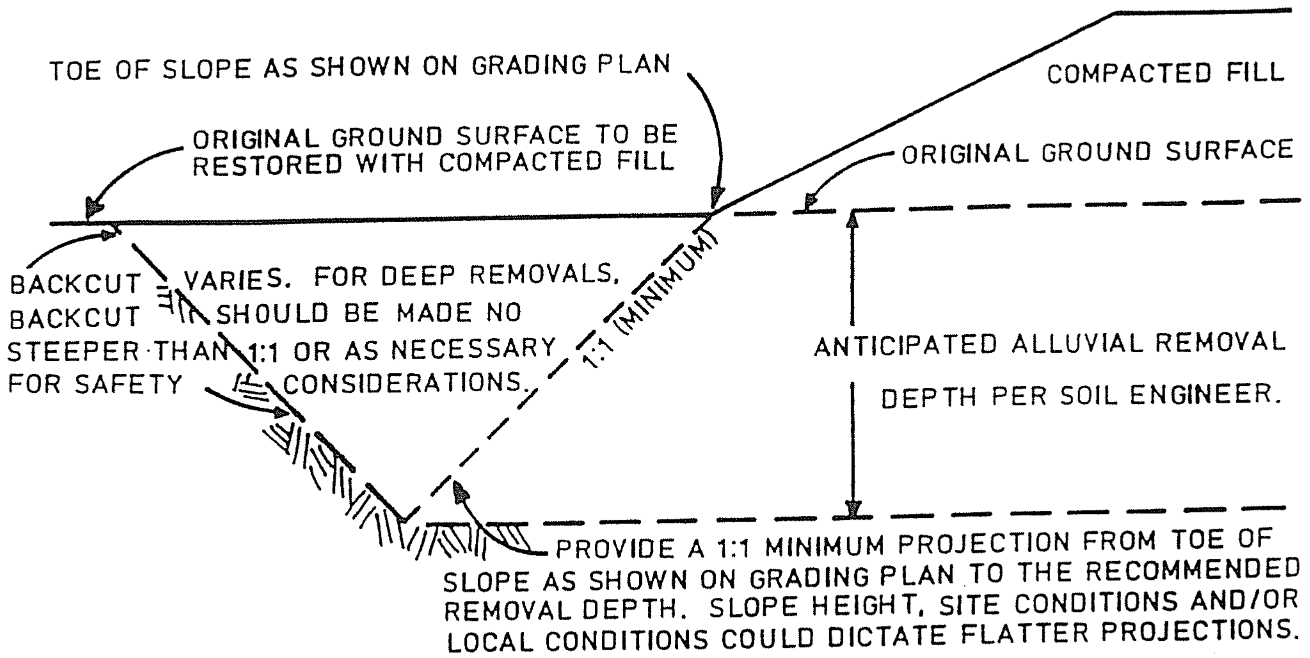
A—2



B—2

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

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON



REMOVAL ADJACENT TO EXISTING FILL

ADJOINING CANYON FILL

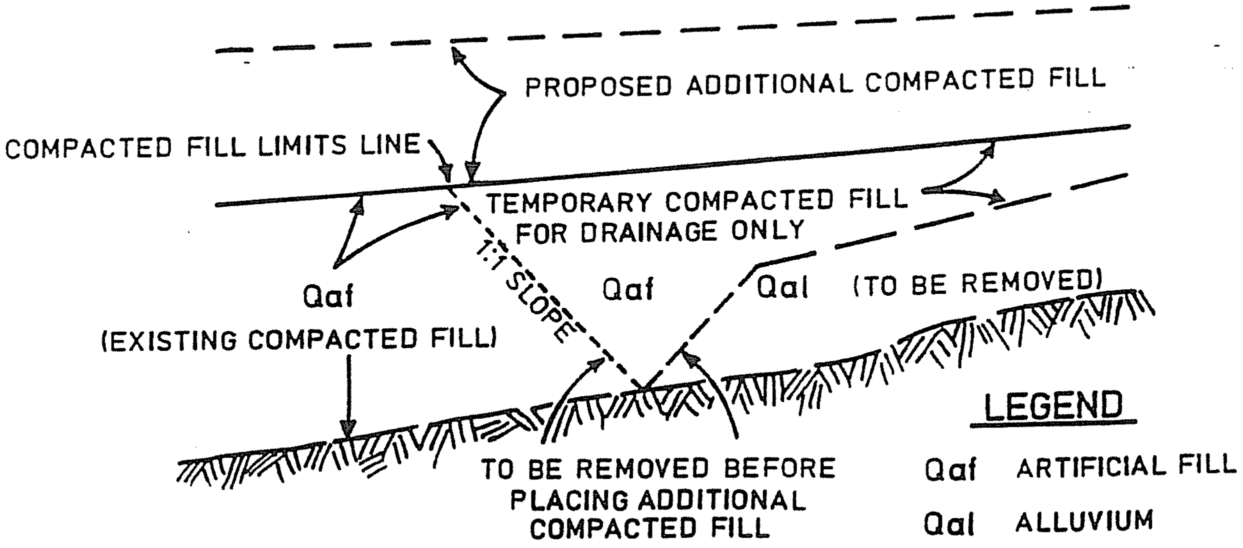


PLATE EG—3

TYPICAL STABILIZATION / BUTTRESS FILL DETAIL

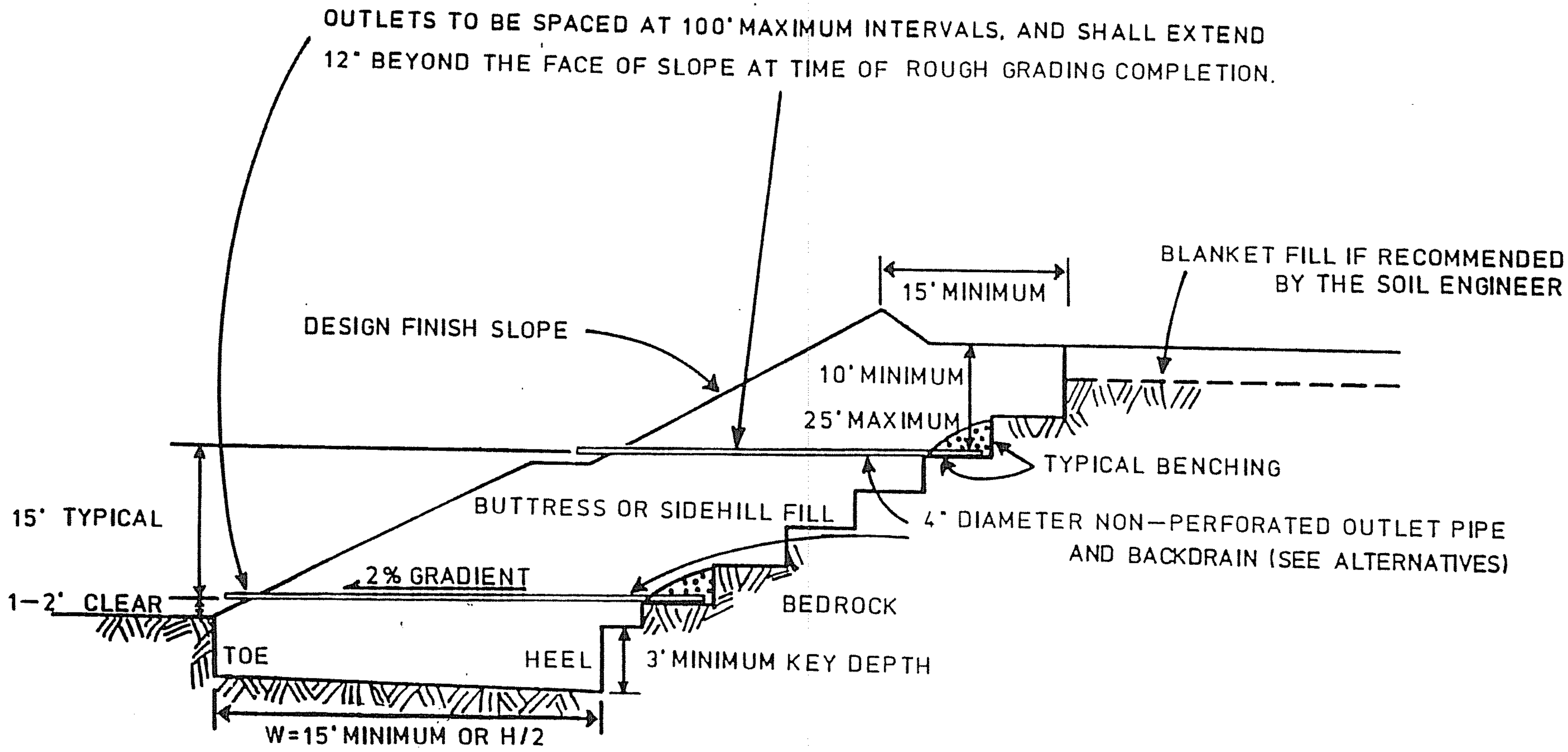
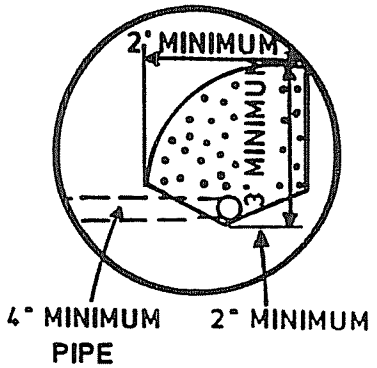
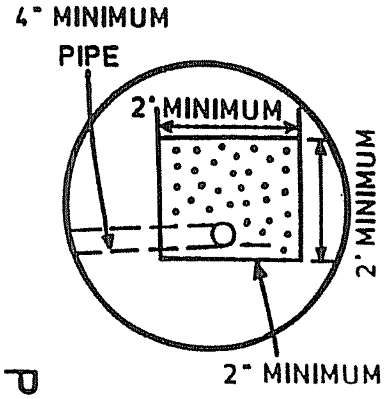


PLATE EG-4

TYPICAL STABILIZATION / BUTTRESS SUBDRAIN DETAIL





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

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

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

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

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

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

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

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

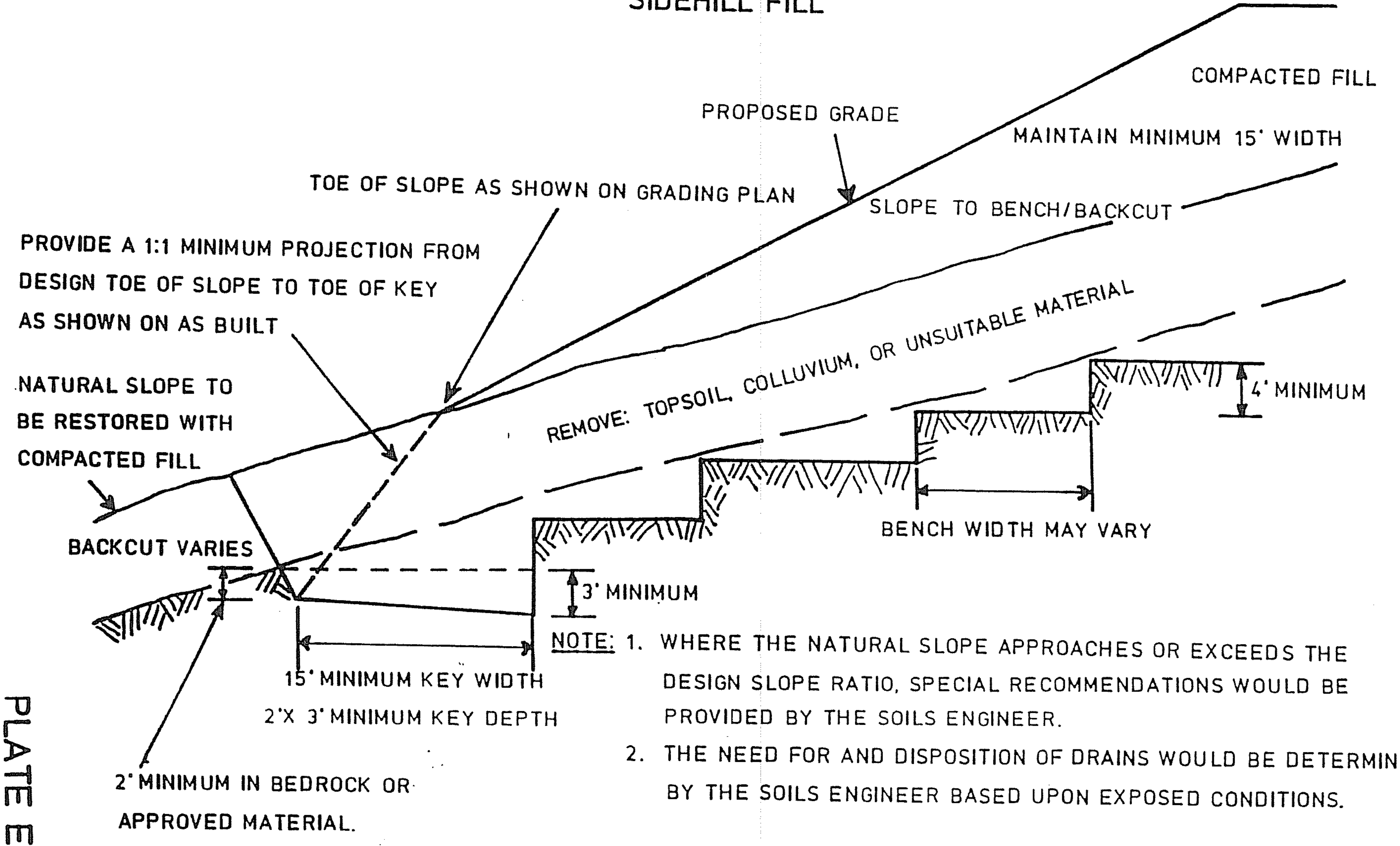
SIEVE SIZE	PERCENT PASSING
1 1/2 INCH	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT: MINIMUM OF 50

PLATE EG—5

FILL OVER NATURAL DETAIL

SIDEHILL FILL

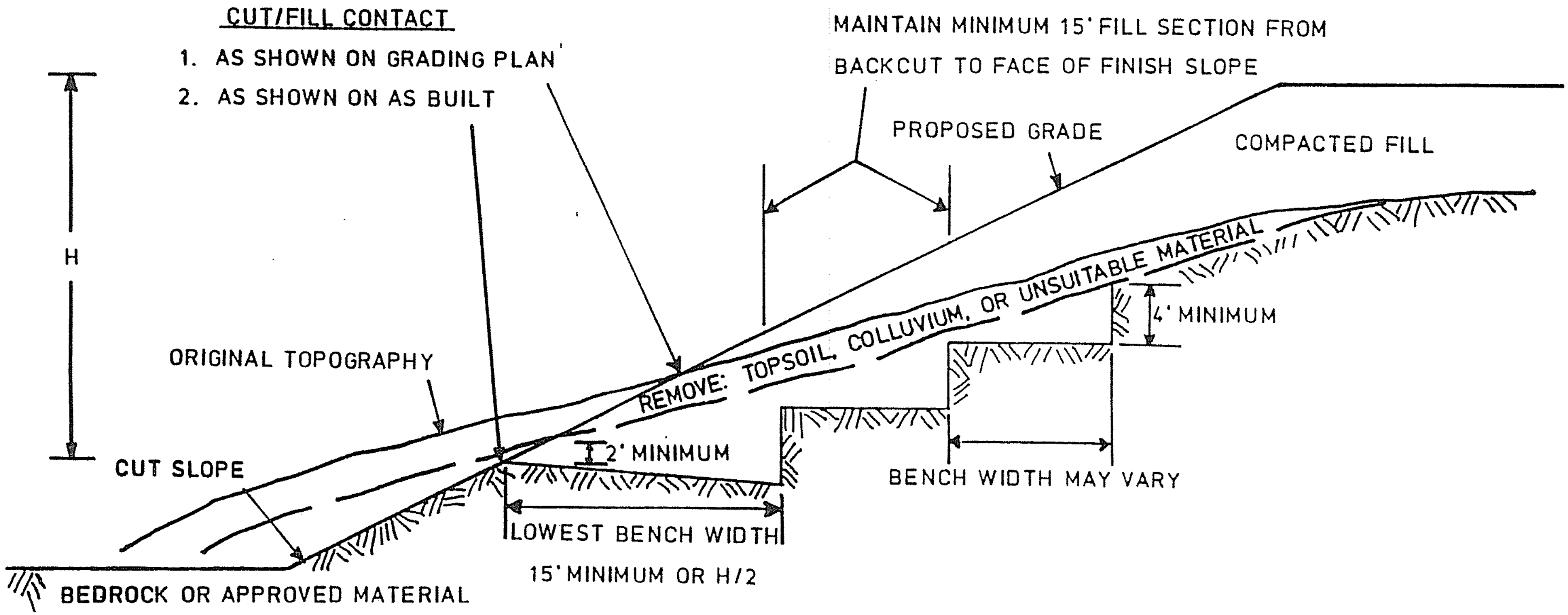


<u>NOTE:</u> 1. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WOULD BE PROVIDED BY THE SOILS ENGINEER.

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

PLATE EG—6

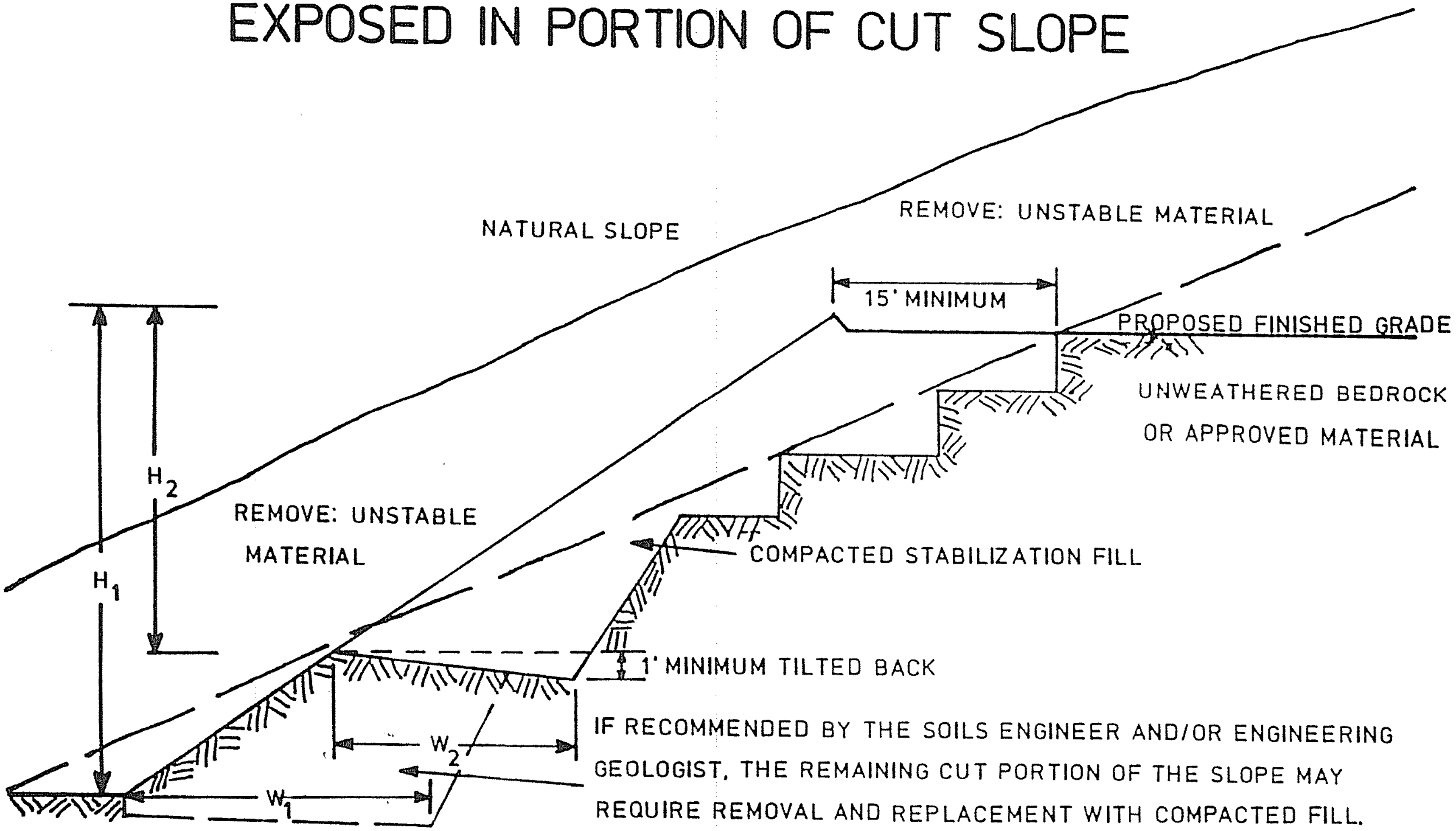
FILL OVER CUT DETAIL



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

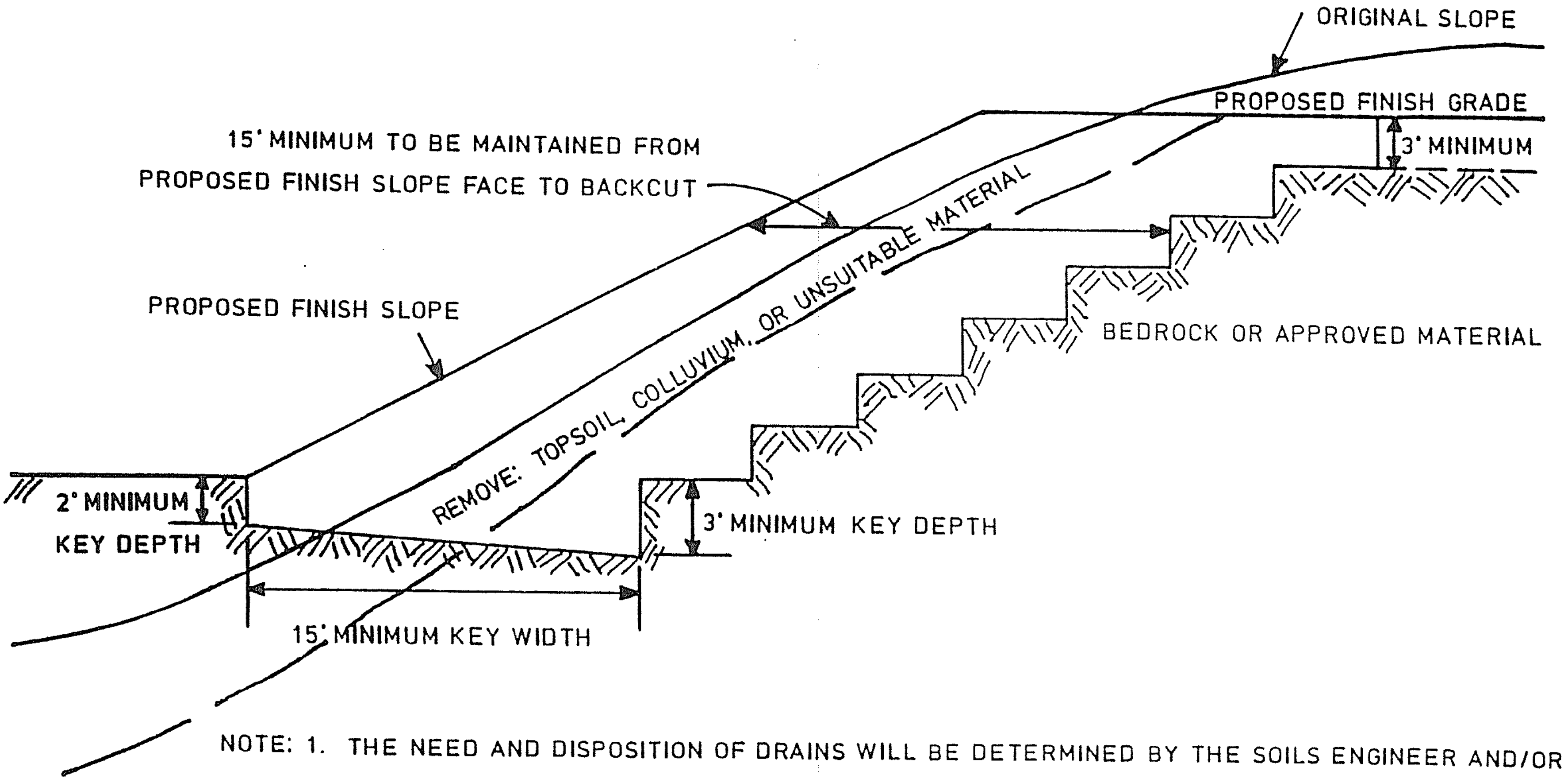
STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE



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

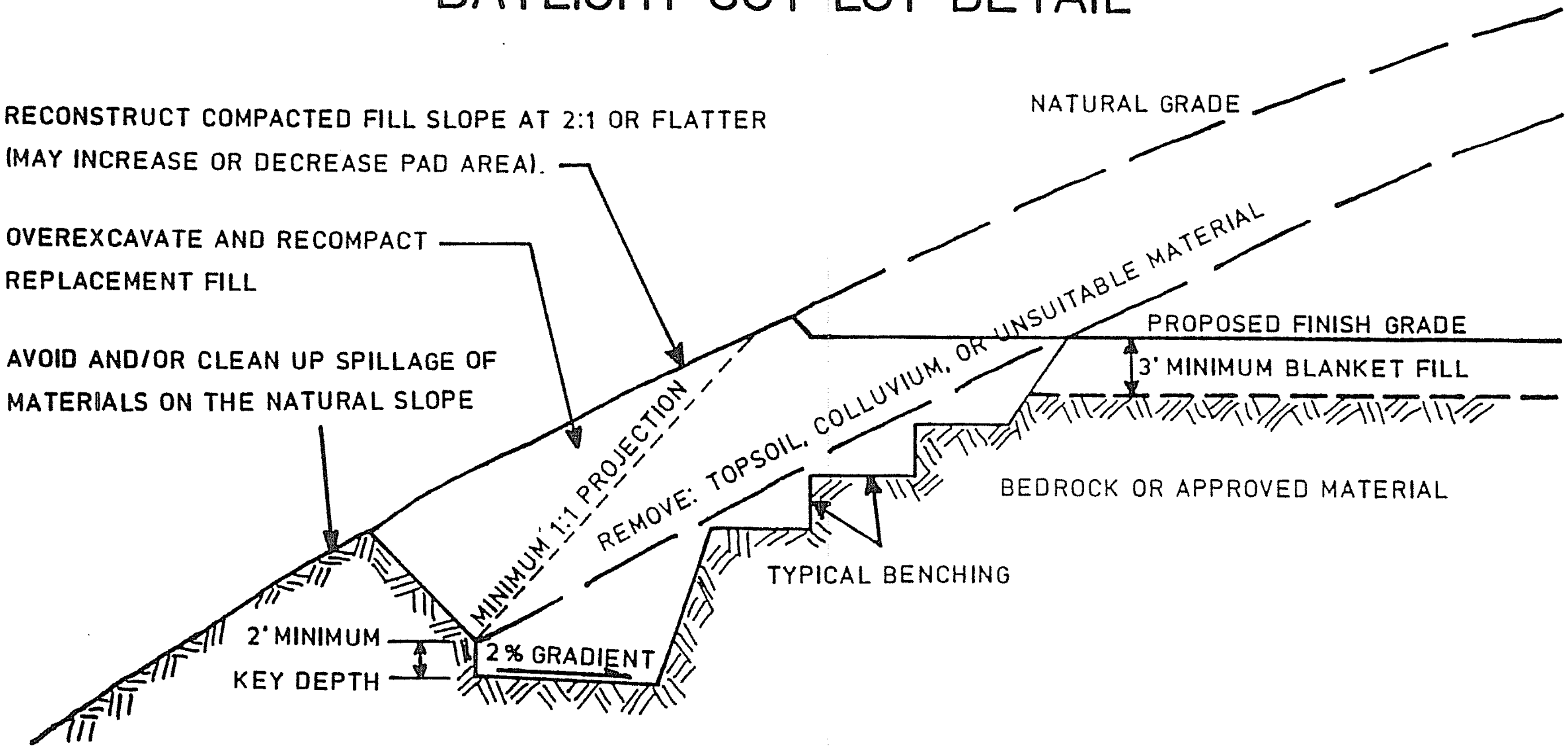


NOTE:

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



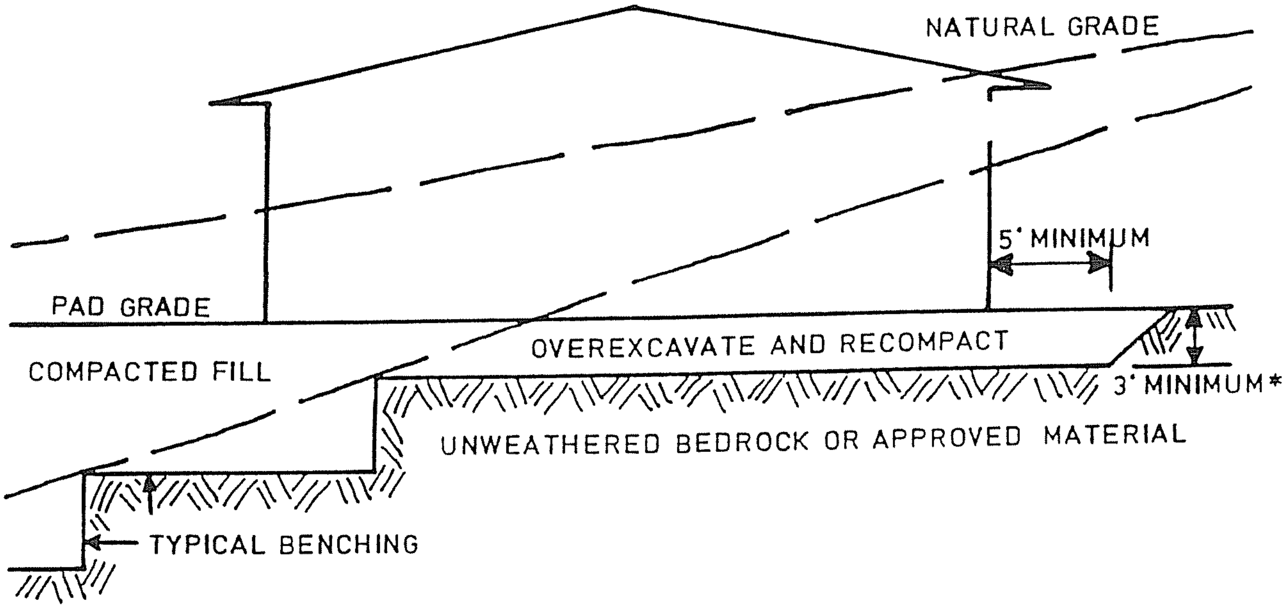
NOTE: 1. SUBDRAIN AND KEY WIDTH REQUIREMENTS WILL BE DETERMINED BASED ON EXPOSED SUBSURFACE CONDITIONS AND THICKNESS OF OVERBURDEN.

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

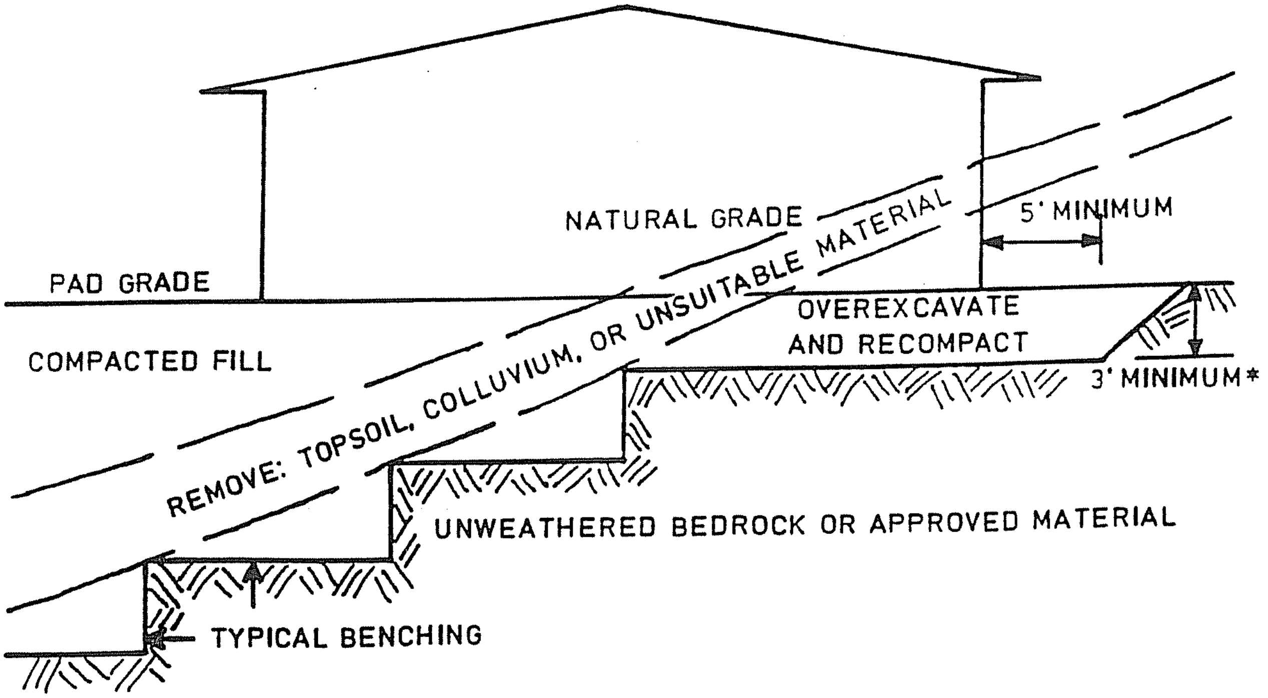
PLATE EG—10

TRANSITION LOT DETAIL

CUT LOT (MATERIAL TYPE TRANSITION)



CUT—FILL LOT (DAYLIGHT TRANSITION)

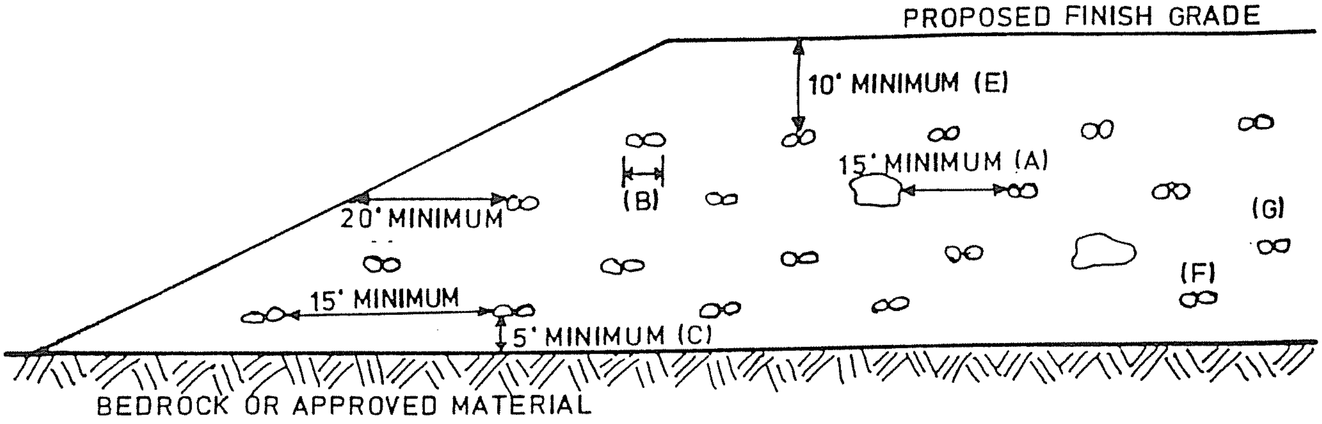


NOTE: * DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST IN STEEP CUT—FILL TRANSITION AREAS.

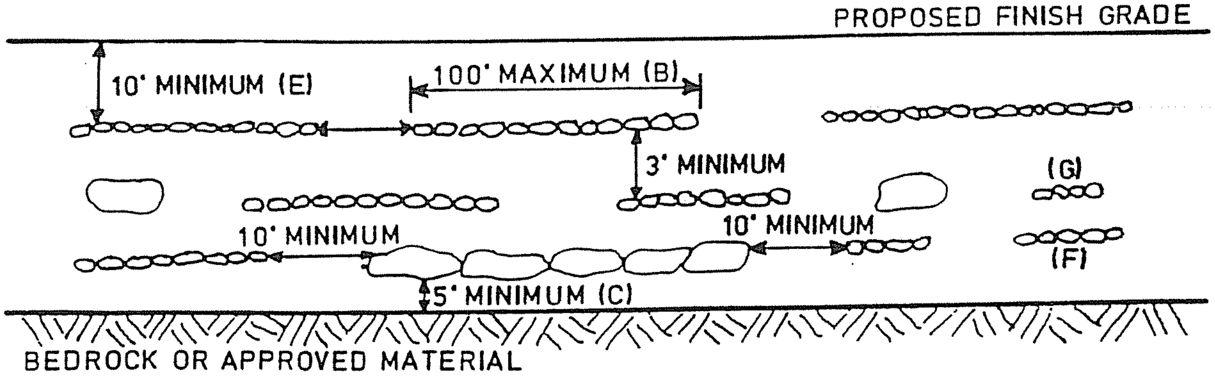
OVERSIZE ROCK DISPOSAL

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

VEIW 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 USED. LENGTH OF WINDROW SHALL BE NO GREATER THAN 100' MAXIMUM.

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

(D) ORIENTATION OF WINDROWS MAY VARY BUT SHALL 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.

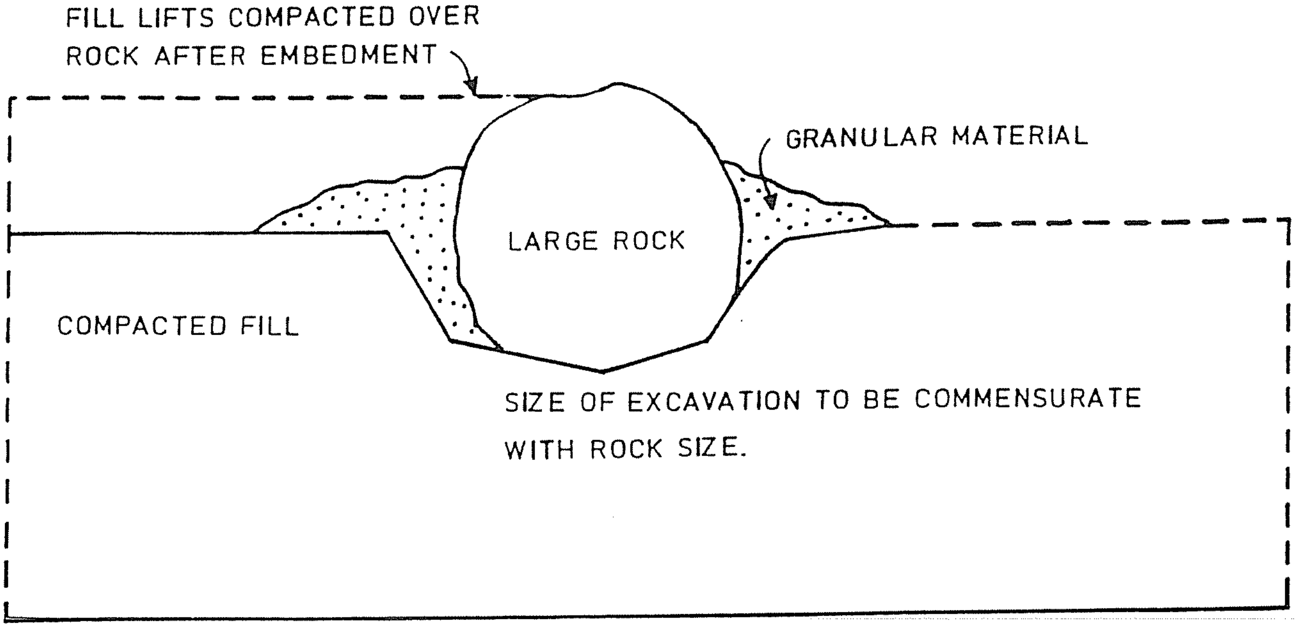
(F) VOIDS IN WINDROW SHALL BE FILLED BY FLOODING GRANULAR SOIL INTO PLACE. GRANULAR SOIL SHALL BE ANY SOIL WHICH HAS A UNIFIED SOIL CLASSIFICATION SYSTEM (UBC 29—1) DESIGNATION OF SM, SP, SW, GP, OR GW. ALL FILL OVER AND AROUND ROCK WINDROW SHALL BE COMPACTED TO 90% RELATIVE COMPACTION.

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

(H) OVERSIZED ROCK IS DEFINED AS LARGER THAN 12", AND LESS THAN 4 FEET IN SIZE.

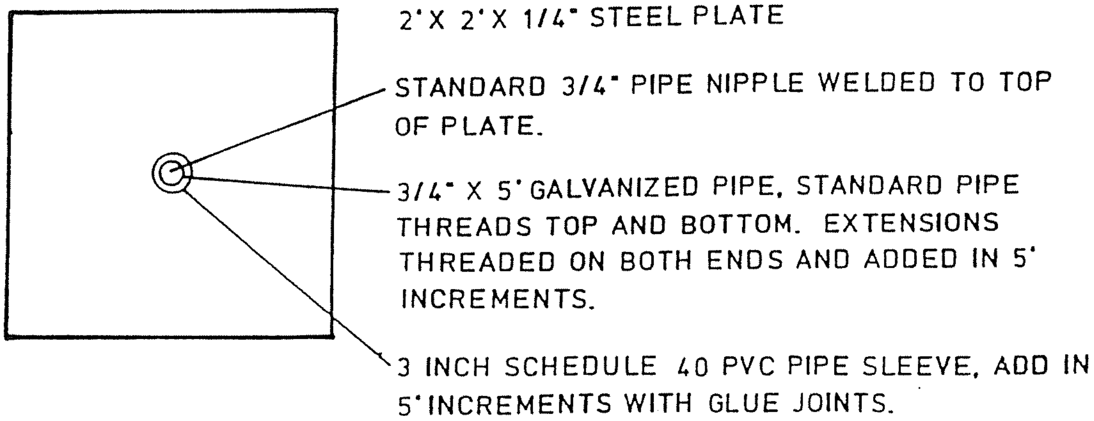
PLATE EG—12

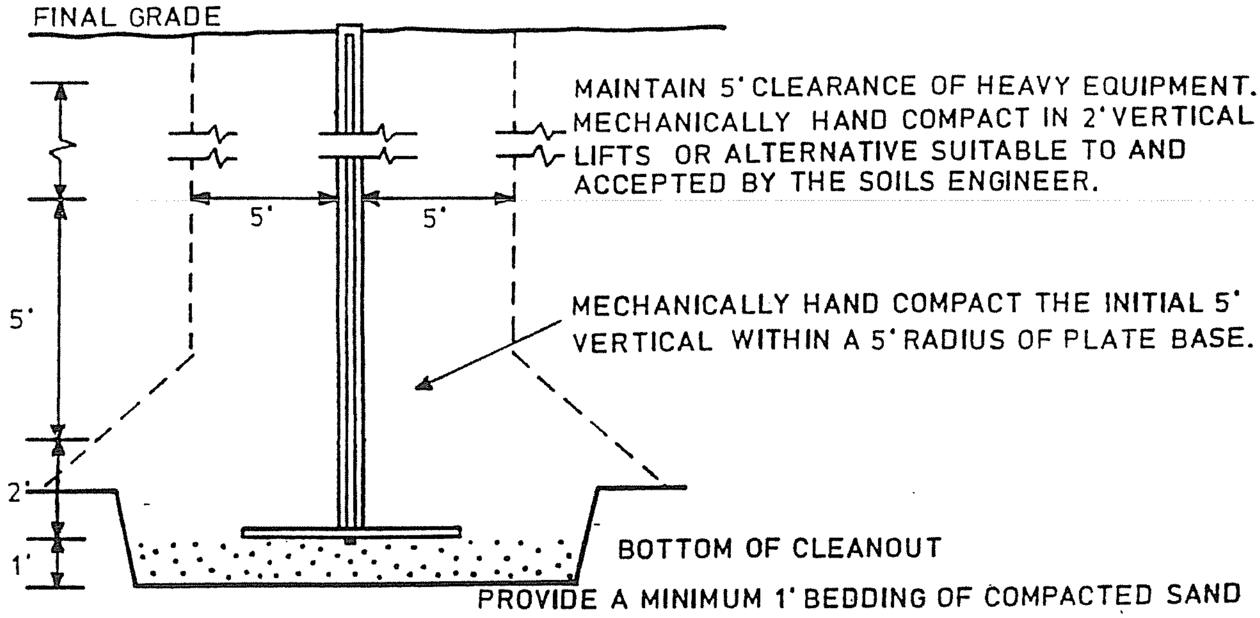
ROCK DISPOSAL PITS



NOTE:
1. LARGE ROCK IS DEFINED AS ROCK LARGER THAN 4 FEET IN MAXIMUM SIZE.
2. PIT IS EXCAVATED INTO COMPACTED FILL TO A DEPTH EQUAL TO 1/2 OF ROCK SIZE.
3. GRANULAR SOIL SHOULD BE PUSHED INTO PIT AND DENSIFIED BY FLOODING. USE A SHEEPSFOOT AROUND ROCK TO AID IN COMPACTION.
4. A MINIMUM OF 4 FEET OF REGULAR COMPACTED FILL SHOULD OVERLIE EACH PIT.
5. PITS SHOULD BE SEPARATED BY AT LEAST 15 FEET HORIZONTALLY.
6. PITS SHOULD NOT BE PLACED WITHIN 20 FEET OF ANY FILL SLOPE.
7. PITS SHOULD ONLY BE USED IN DEEP FILL AREAS.

SETTLEMENT PLATE AND RISER DETAIL





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

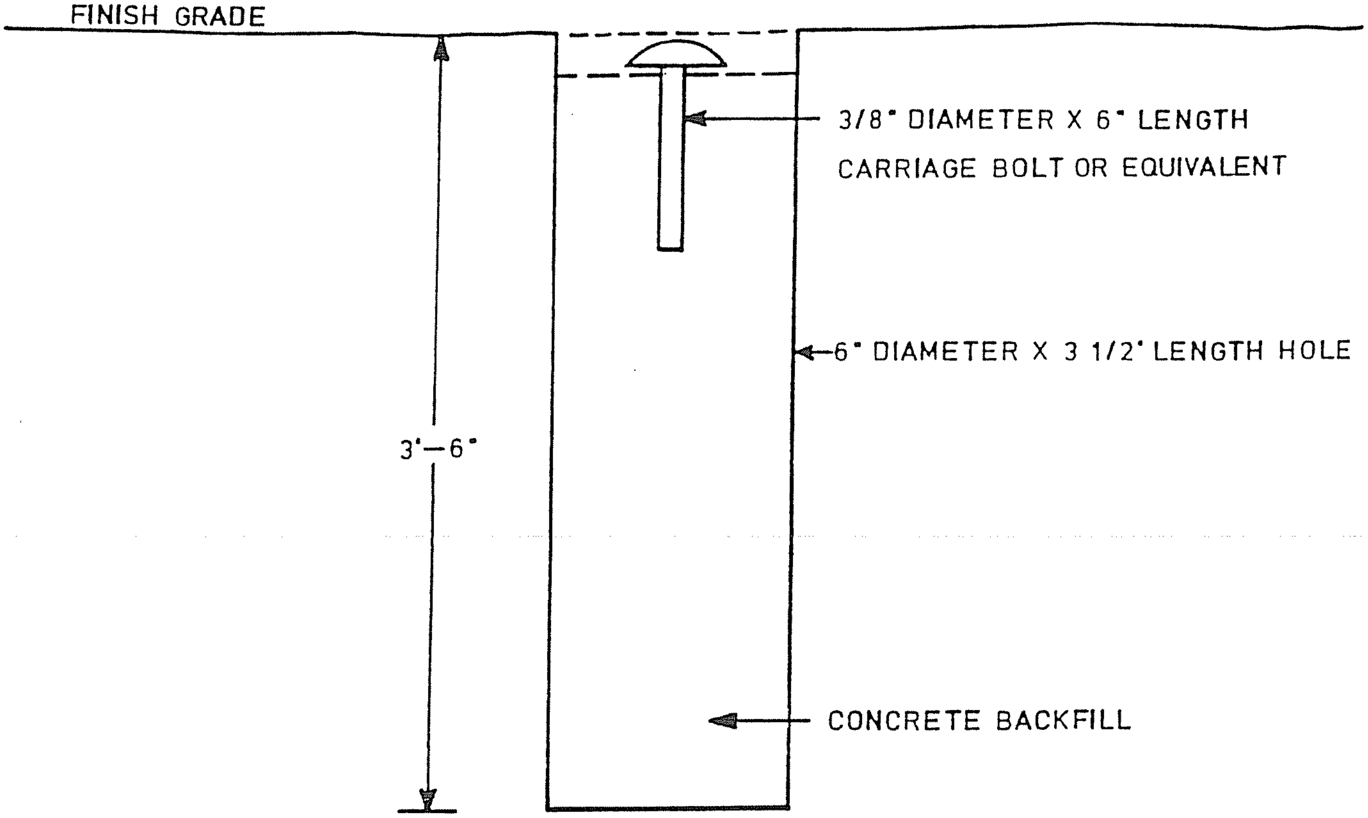
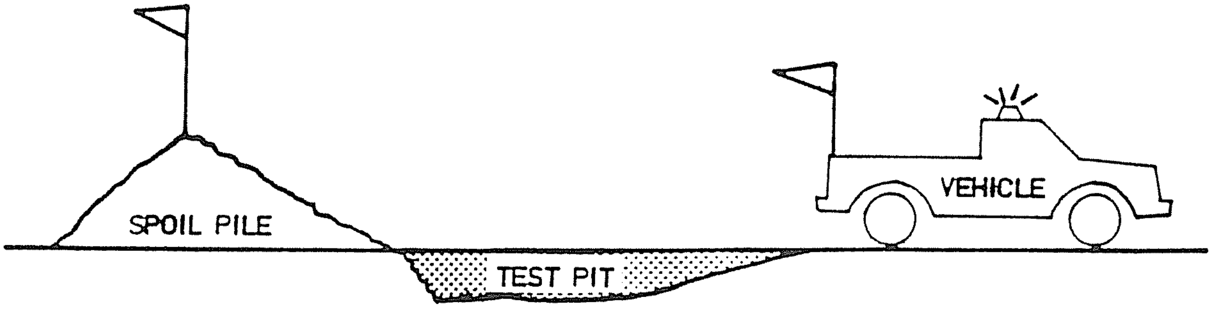


PLATE EG—15

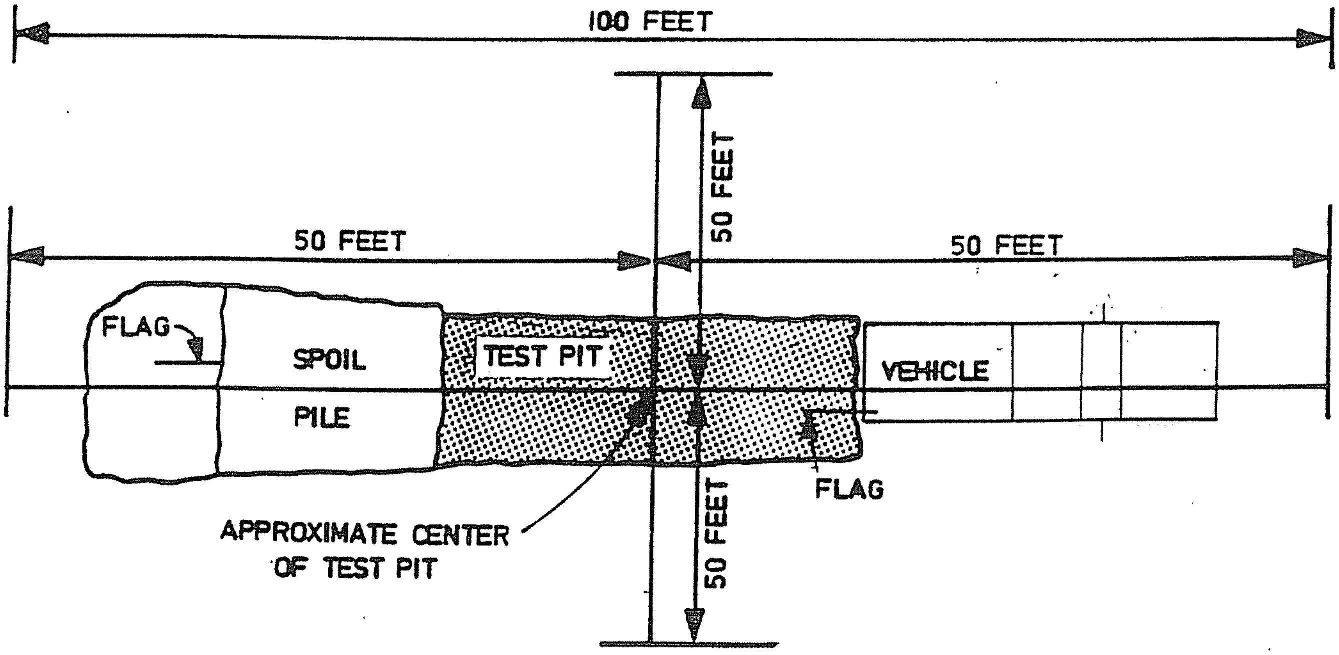
TEST PIT SAFETY DIAGRAM

SIDE VIEW



(NOT TO SCALE)

TOP VIEW



(NOT TO SCALE)

PLATE EG—16

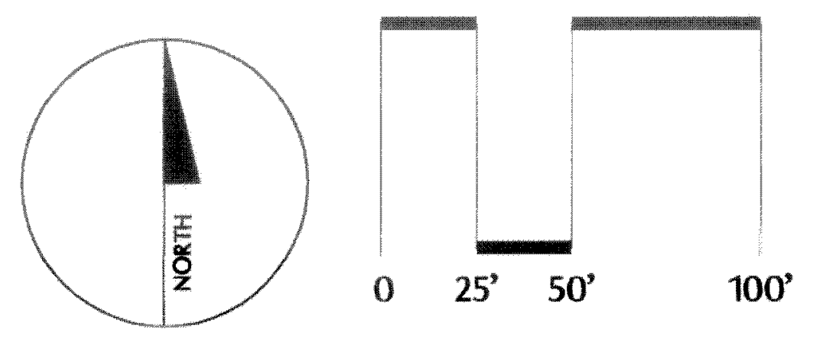
LOT AREA SUMMARY

LOT No.	LOT AREA (SQ.FT.)	LOT No.	LOT AREA (SQ.FT.)
1	4,502	49	4,568
2	4,602	50	4,808
3	6,499	51	5,329
4	4,177	52	4,512
5	4,641	53	3,865
6	4,392	54	4,881
7	5,598	55	6,381
8	4,945	56	5,076
9	5,162	57	4,689
10	6,802	58	4,282
11	7,868	59	4,261
12	4,898	60	4,304
13	4,052	61	4,384
14	4,117	62	4,727
15	4,154	63	4,743
16	4,316	64	5,692
17	4,102	65	8,429
18	5,704	66	5,240
19	4,120	67	4,650
20	4,275	68	4,936
21	4,199	69	5,343
22	4,049	70	6,274
23	7,965	71	6,280
24	7,052	72	6,456
25	4,228	73	5,471
26	4,200	74	4,052
27	4,219	75	5,180
28	4,525	76	6,923
29	4,101	77	4,784
30	5,271	78	4,352
31	4,065	79	4,476
32	3,977	80	4,201
33	4,065	81	4,135
34	3,981	82	4,187
35	5,922	83	4,550
36	4,490	84	4,949
37	4,087	85	5,734
38	4,053	A	16,858
39	4,155	B	19,090
40	4,134	C	55,318
41	4,375	D	1,980
42	4,459	E	27,678
43	4,447	F	19,634
44	4,838	G	23,656
45	5,428	H	22,853
46	4,623	I	7,385
47	4,370		
48	7,096		
		TOTAL	804,925
		AVERAGE	4,922

MAP DATE IDENTIFIER
DATE OF LATEST CHANGE TO THIS MAP
08/15/03 BY: LMM
DATE OF THIS PLOT
07/30/04

DESIGNED BY: D.H.
DRAFTED BY: L.A.S.
PROCESSED BY:

DATE	REVISION	BY



LEGEND

Qc Colluvium
Qal Alluvium
Tco Capistrano Formation, Oso Member
Geologic Contact, Approximately Location
B-6 Approximate Location of GSI's Exploratory Boring
A Geologic Cross-Section
Subdrain

SCALE 1" = 50'
DATE 08-05-03
W.O. 1914-7X
GROSS AREA 18.5 AC±
CONTOUR INTERVAL 10'
TOTAL LOTS 85 NUMBERED
9 LETTERED

NOTES

1. PROPOSED GENERAL DESIGNATION: 7–15 DU/ACRE
2. EXISTING LAND USE: VACANT.
3. PROPOSED LAND USE: SINGLE FAMILY RESIDENTIAL.
4. EXISTING ZONING: SERRANO HIGHLANDS PLANNED COMMUNITY, HIGH DENSITY AND OPEN SPACE.
5. ON SITE DRAINAGE WILL BE COLLECTED IN AN APPROVED ON–SITE DRAINAGE STRUCTURE AND CONVEYED OFF SITE TO EXISTING STORM DRAIN.
6. GRADED SLOPES SHALL BE 2:1, UNLESS OTHERWISE SHOWN.
7. ALL GRADING, SLOPE TERRACE DRAINS AND DOWN DRAINS SHALL CONFORM TO THE CITY OF LAKE FOREST GRADING MANUAL AND EXCAVATION CODE.
8. APPLICANT INTENDS TO PHASE THIS PROJECT WITH MULTIPLE FINAL MAPS.

SLOPE DESIGNATIONS

Ⓐ MAINTAINED BY PUBLIC AGENCY OR HOME OWNERS ASSOCIATION
Ⓑ MAINTAINED BY HOME OWNERS ASSOCIATION
Ⓒ MAINTAINED BY PRIVATE OWNERS

GeoSoils, Inc.
RIVERSIDE CO.
ORANGE CO.
SAN DIEGO CO.

GEOLOGICAL MAP

W.O. 4414-A1-OC DATE 9-30-04 SCALE 1"=40'

PLATE 1

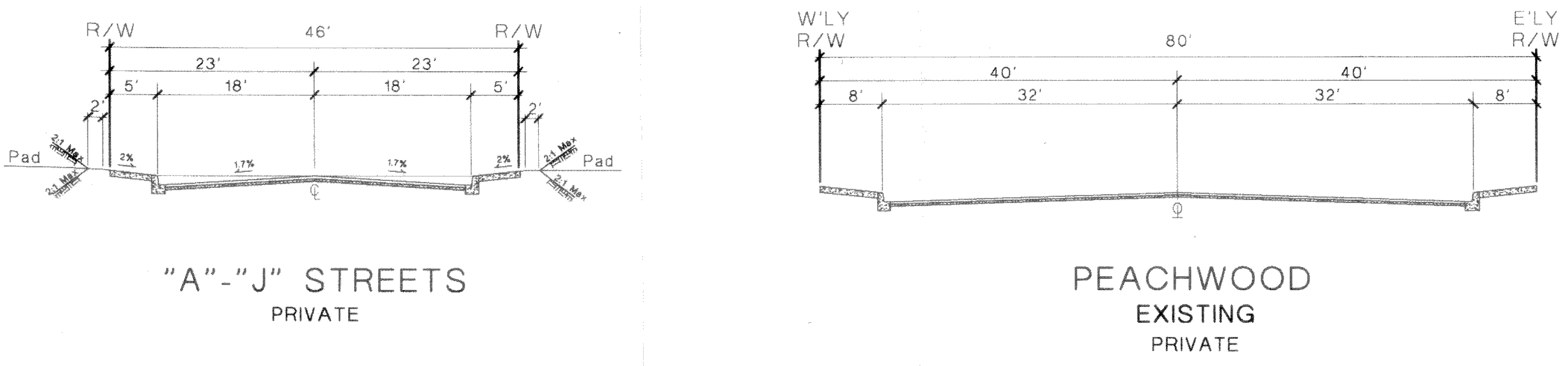
LEGAL DESCRIPTION

A SUBDIVISION OF LOTS 5 AND 6 OF TRACT NO. 10931, IN THE CITY OF LAKE FOREST, COUNTY OF ORANGE, STATE OF CALIFORNIA, AS PER MAP FILED IN BOOK 511, PAGES 1 THROUGH 5, INCLUSIVE, OF MISCELLANEOUS MAPS IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

LOT SUMMARY TABLE

1 – 85	SINGLE FAMILY RESIDENTIAL
A – I	LANDSCAPE LOTS

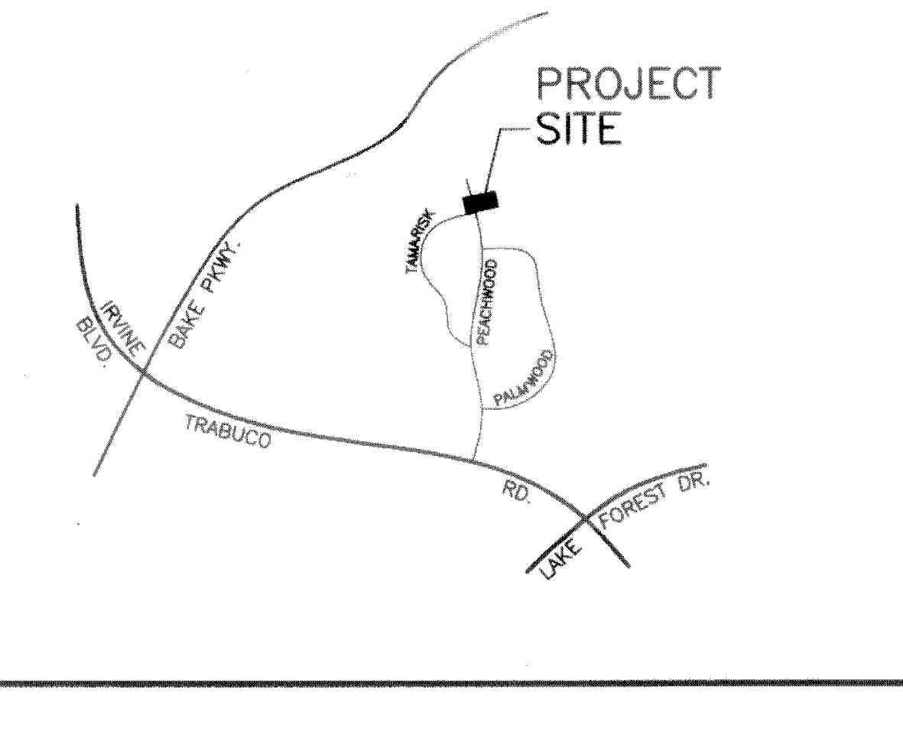
TYPICAL SECTIONS



"A"-"J" STREETS
PRIVATE

PEACHWOOD
EXISTING
PRIVATE

VICINITY MAP



PREPARED FOR:

PACIFIC HERITAGE
DEVELOPMENT
23201 MILL CREEK DRIVE
SUITE 130
LAGUNA HILLS, CA 92653
Tel (949) 472-6884
Fax (949) 462-9044

PREPARED BY:

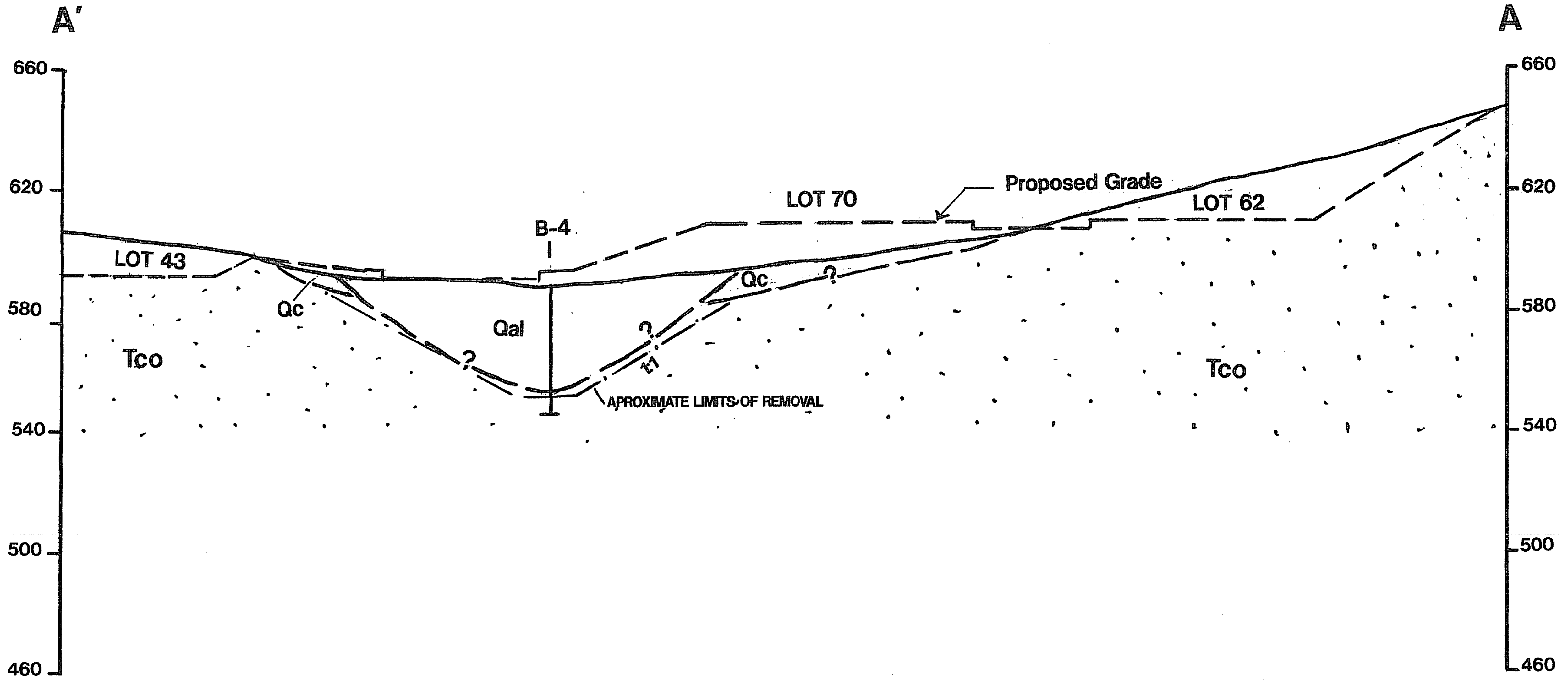
H&A
HUNSAKER & ASSOCIATES
IRVINE, INC.
PLANNING • ENGINEERING • SURVEYING
Three Hughes • Irvine, CA 92618
FX (714) 583-0756 • PH (714) 583-1010

CONCEPT PLAN

TENTATIVE TRACT NO. 15594

W.O. 245-9 TTM# 15594 BIN:316-G DOC: 49425

O:\:15594\SITE PLAN\SITE.DWG



GeoSoils, Inc.

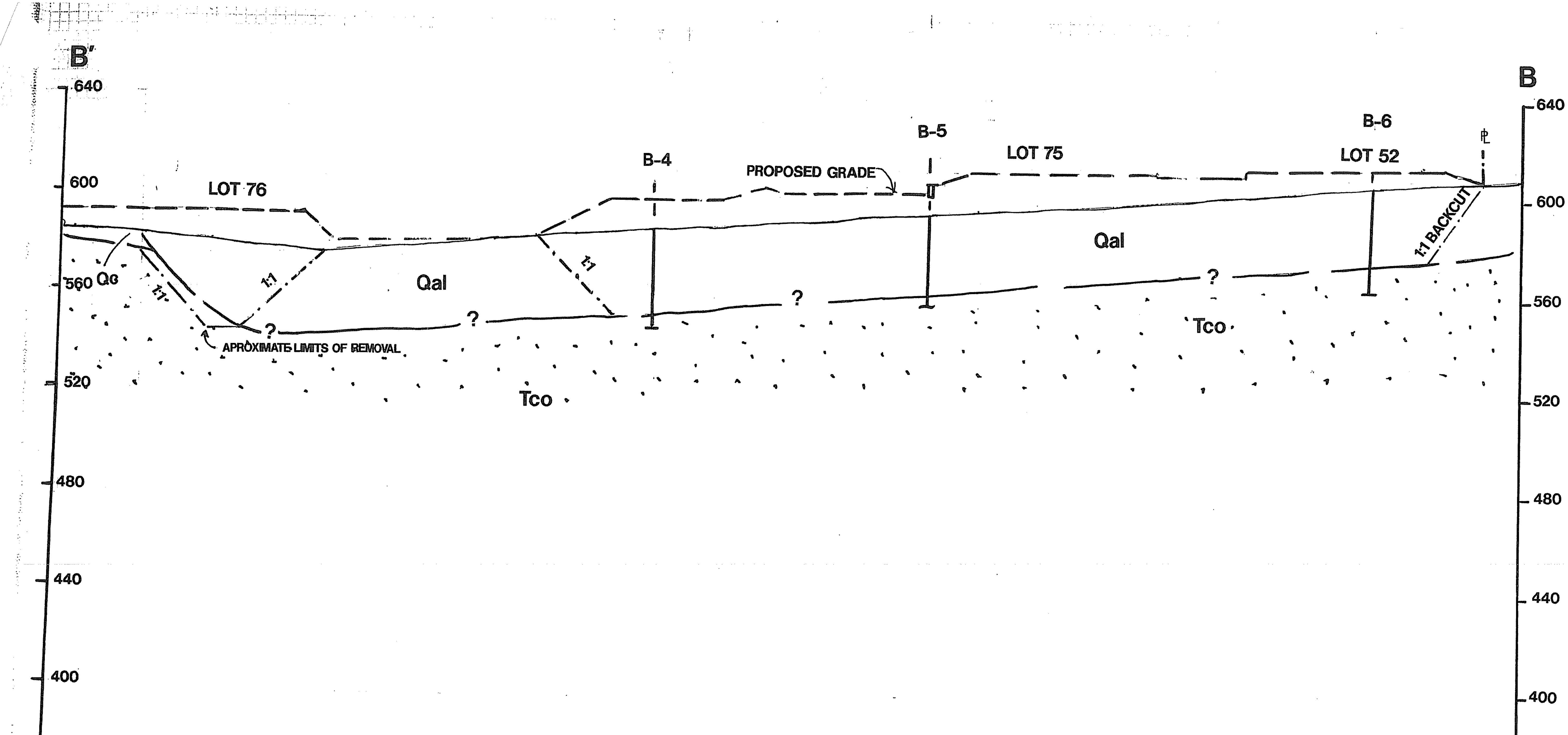
LOS ANGELES CO.
RIVERSIDE CO.
ORANGE CO.
SAN DIEGO CO.

Soil Mechanics · Geology
Foundation Engineering

W.O: 4414-A1-OC
DATE 9-30-04

PLATE 2

PLATE 3


B'
B
640
600
560
520
480
440
400
LOT 76
LOT 75
LOT 52
B-4
B-5
B-6
PROPOSED GRADE
℄
1:1 BACKCUT
QG
Qal
Qal
1:1
1:1
1:1
?
?
?
?
APROXIMATE LIMITS OF REMOVAL
Tco
Tco