LGC Lawson & Associates Geotechnical Consulting, Inc.

Preliminary Geotechnical Investigation of Proposed 85 Lot Residential Development (Tentative Tract No. 32535), Riverside County, California

Dated: June 15, 2005

Project No. 041138-01

Prepared For:

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June 15, 2005 Project No. 041138-01

Mr. Denny Brose
Temecula Creek Estates, LLC
18800 Von Karman Avenue, Suite 100
Irvine, CA 92612

Subject: ***Preliminary Geotechnical Investigation of Proposed 85 Lot Residential Development (Tentative Tract No. 32535) Riverside County, California***

In accordance with your request, Lawson & Associates Geotechnical Consulting, Inc. (LGC) has performed a subsurface geotechnical investigation of the proposed 85 lot residential development of Tentative Tract No. 32535, located generally north of the intersection of Clinton Keith Road and Palomar Street in Riverside County, California. The purpose of our investigation was to evaluate the existing onsite geotechnical conditions and review the readily available geotechnical and geologic reports and maps pertinent to the site. This report presents the results of our subsurface investigation and geotechnical analysis and provides a summary of our conclusions and preliminary recommendations relative to the proposed development of the site.

Also as part of this report we have reviewed the project Tentative Tract Map (HJK, 2004) and have included our comments, conclusions, and recommendations herein.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Sincerely,

LAWSON & ASSOCIATES GEOTECHNICAL CONSULTING, INC.

Kevin B. Colson, CEG 2210
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KBC/BTZ/sec

Distribution: (2) Addressee
(3) HJK Consultants
Attention: Mr. Jei Kim

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1.0 INTRODUCTION

1.1 Purpose and Scope of Services

This report presents the results of our preliminary geotechnical investigation for the development of the proposed 85 lot residential development (Tentative Tract No. 32535) Riverside County, California (see Site Location Map, Figure 1). The purpose of our investigation was to evaluate the pertinent geotechnical conditions at the site and to provide preliminary geotechnical recommendations relative to the proposed development of the site. The Tentative Tract Map No. 32535 (HJK, 2004) has been utilized as a base map for analysis and presentation of the data obtained in this study (see Sheet 1).

As part of this report, LGC has completed a geotechnical review of the Tentative Map for the subject site. This report includes a summary of our conclusions and recommendations with respect to the Tentative Tract Map No. 32535 (HJK, 2004).

Our scope of services included:

- Review of pertinent readily available geotechnical reports, geologic maps, and aerial photographs (Appendix A);
- Reconnaissance level geologic mapping of the site;
- Excavation, sampling, and logging of seventeen exploratory trenches. The excavations were sampled and logged under the supervision of an experienced geologist from our firm. The trenches were excavated to evaluate the general characteristics of the subsurface geologic conditions including estimated depth to ground water and to obtain representative soil samples. Logs of the trenches are presented in Appendix B and their approximate locations are depicted on the Geotechnical Map, Sheet 1;
- Laboratory testing of representative samples obtained during our subsurface investigation (Appendix C);
- Preparation of a geotechnical map depicting the interpreted geologic conditions on the site;
- Geotechnical analysis of the data reviewed/obtained;
- Review of the project Tentative Tract Map for conformance with the recommendations contained herein; and
- Preparation of this report presenting our findings, conclusions and recommendations with respect to the proposed site development.

1.2 Project Description and Background

The site is an irregularly-shaped property located generally north of the intersection of Clinton Keith Road and Palomar Street in the unincorporated territory of the County of Riverside, California. The site is currently occupied by several residential structures and associated auxiliary structures, dirt access roads and drives, buried utilities, horse corals, various fences, and landscaping. Site grading is anticipated to include remedial grading followed by excavation of cut and placement of fill soils to reach design grades for construction of the proposed residential structures, associated streets and utilities.

Topographically, the site generally consists of a central drainage, which is the convergence of two smaller drainages, which flow to the west. The remainder of the site consists of gently sloping hillsides which all drain to the central drainage. Planned finish grades on the site will be achieved with cuts and fills on the order of 15 feet or less from existing grades.

1.3 ***Grading Plan Review***

The tentative tract map, which was reviewed by LGC, is titled "Tentative Tract Map No. 32535". The plan was prepared at a scale of 1 inch = 100 feet by HJK Consultants, Inc. (2004).

1.4 ***Subsurface Investigation***

Our subsurface investigation consisted of the excavation of seventeen backhoe trenches ranging in depth from approximately 2.5 to 15 feet below the ground surface. During excavation the trenches were sampled and logged from the surface under the supervision of an experienced engineer/geologist from our firm to evaluate the general characteristics of the onsite soils. Soil descriptions are presented in the trench logs, which are included in Appendix B. The approximate locations of the trenches are shown on our Geotechnical Map, Sheet 1. Please note that some settlement of the backfill for the excavations may occur over time and they should be topped off if needed.

1.5 ***Laboratory Testing***

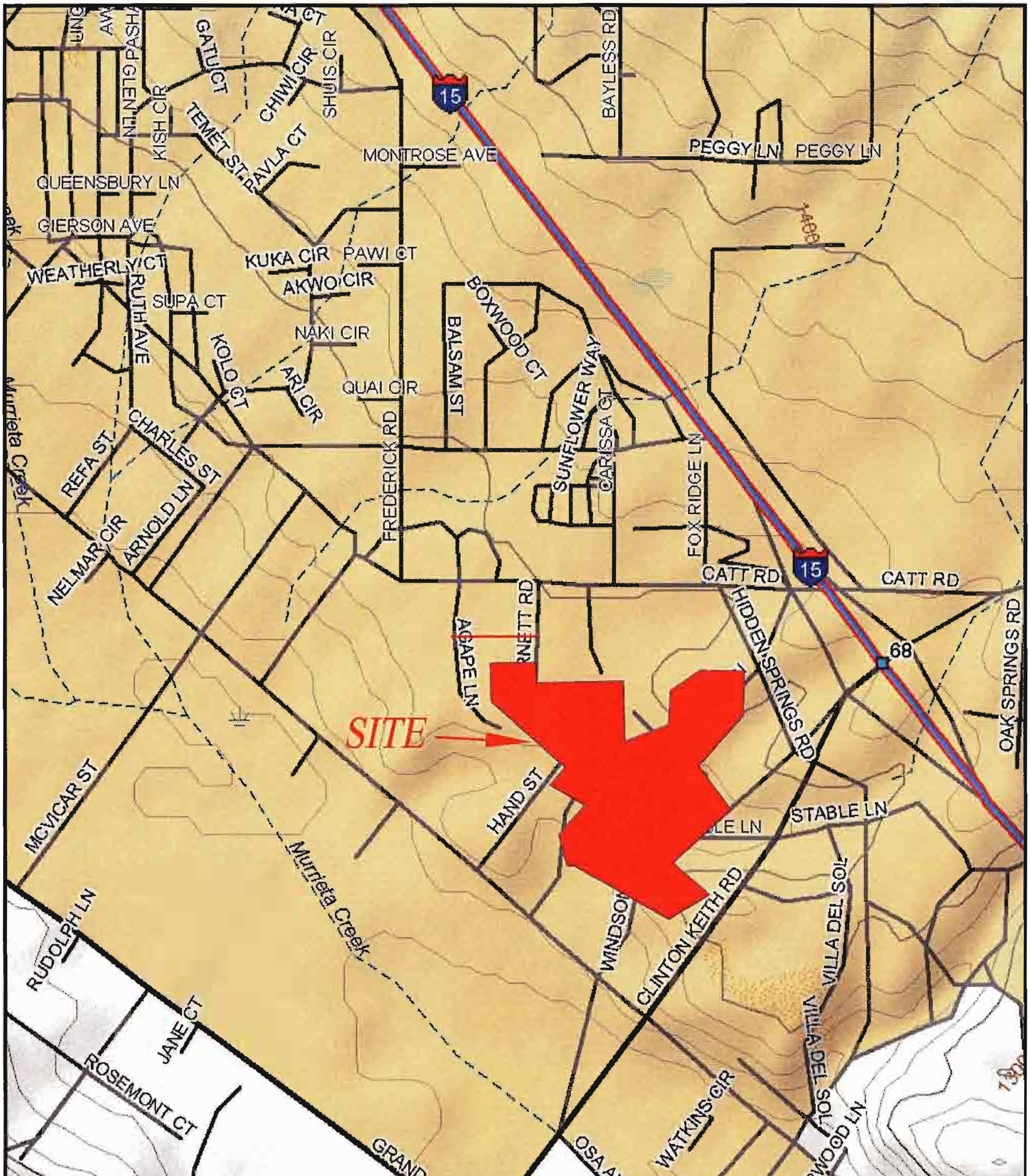
Representative bulk samples were retained for laboratory testing. Laboratory testing included maximum dry density and optimum moisture content, expansion potential, and corrosion potential.

Expansion potential testing of three representative samples on the site indicated expansion indices of 40, 58, and 140, "low", "medium", and "very high", respectively (1997 Uniform Building Code, U.B.C.).

Three laboratory compaction curves were performed on soil samples obtained from Trenches T-1, T-5, and T-15. The test results indicated maximum dry densities ranging from 120.0 pounds per cubic foot (pcf) to 125.0 pcf. The optimum moisture content ranged from 10.0 to 12.0 percent.

Corrosion test results are presented in Section 2.12.

A discussion of the tests performed and a summary of the results are presented in Appendix C.



LGC

Figure 1
Site Location Map

Project Name	TT 32535
Project No.	041138-01
Eng. / Geol.	BTZ / KBC
Scale	N/A
Date	June 2005

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional Geology

Regionally, the site is located within the Perris structural block of the Peninsular Ranges Geomorphic Province of California. The Peninsular Ranges are characterized by steep, elongated valleys that trend west to northwest. The northwest-trending topography is controlled by the Elsinore fault zone, which extends from the San Gabriel River Valley southeasterly to the United States/Mexico border. The Santa Ana Mountains lie along the western side of the Elsinore fault zone, while the Perris Block is located along the eastern side of the fault zone. The mountainous regions are underlain by Pre-Cretaceous, metasedimentary and metavolcanic rocks and Cretaceous plutonic rocks of the Southern California Batholith. Tertiary and Quaternary rocks are generally comprised of non-marine sediments consisting of sandstone, mudstones, conglomerates, and occasional volcanic units.

2.2 Site-Specific Geology

Based on our subsurface investigation, the primary bedrock unit encountered within the subject area is Pauba Formational material. Surficial units consisting of undocumented artificial fill, topsoil/colluvium, and alluvium overlie the bedrock material. A brief description of these geologic units is presented below (from youngest to oldest).

2.2.1 Artificial Fill - Undocumented (Map Symbol - Afu)

Areas of undocumented artificial fill material were observed at various locations on the site, usually associated with dirt roads, building pads, earthen dams, leveling of undulatory areas, etc. Based on the results of our subsurface investigation, it is apparent that little to no remedial grading was performed prior to placement of fill material on the site and that the fill was not placed with engineering observation and testing. In general, the fill materials encountered on the site were found to be loose to medium dense and damp to moist. The fill materials encountered on the site are considered potentially compressible and should be removed to competent material prior to additional fill placement. Existing undocumented fill is estimated to be on the order of approximately 5 feet thick in some portions of the onsite drainages, however deeper areas may be encountered during site grading. Only the larger areas of undocumented artificial fill were mapped on the site due to their relatively thin nature and variable lateral extent (Sheet 1). Therefore, additional pockets of undocumented fill material, other than those depicted on the map, should be anticipated.

2.2.2 Topsoil/Colluvium (Not Mapped)

The topsoil/colluvium observed during our field study mantles the mid- to lower-portions of the slopes across the majority of the site. The topsoil/colluvium, as observed, consists predominantly of brown to dark brown, damp to moist, loose to medium dense, clayey sand to sandy clay. These soils are typically massive, porous and contain scattered roots and organics. The potentially compressible topsoil is estimated to be approximately 1 to 2 feet in thickness; however, localized areas of thicker accumulations of topsoil may be encountered during grading. Topsoil/colluvial soils on the lower hillsides of the onsite drainages can be expected to be somewhat deeper in extent and locally variable in composition. Topsoil/colluvium was not mapped on the site due to its relatively thin nature and variable lateral extent, however, thicker deposits of colluvium have been incorporated into the material mapped as Quaternary Alluvium discussed below.

2.2.3 ***Quaternary Alluvium (Map Symbol - Qal)***

Alluvial soils were encountered in the drainages on the site during our field study. Some of the suspected deeper accumulations were not investigated due to the presence of standing water on the surface within some of the alluvial channels. The alluvium, as observed, consists predominantly of brown, damp to moist, loose to medium dense, clayey sand to sandy clay. These soils are typically massive, porous and contain organics and scattered roots. The potentially compressible alluvium is estimated up to be approximately 5 to 10 feet in thickness; however, localized areas of thicker accumulations may be encountered during grading. Please note, in areas where undocumented fill soils have been placed above alluvial soils, deeper removals than those cited above should be anticipated. The approximate lateral extent of these materials has been depicted on our Geotechnical Map (Sheet 1).

2.2.4 ***Quaternary Pauba Formation (Map Symbol - Qp)***

The Pauba Formation underlies the majority of the site. As encountered, this material consists of moderately indurated silty sand and clayey sand with minor amounts of cobble-sized material. Typically this material has good bearing properties and a low potential for expansion.

2.3 ***Geologic Structure***

The material observed on the site was generally massive with only, rare approximately horizontal bedding observed. Locally, cross bedding was encountered dipping approximately 25 degrees to the northwest.

No faults have been mapped on the site nor were any encountered during our field study.

2.4 ***Landslides***

No landslides have been identified on the site.

2.5 Ground Water

Surface water was observed within portions of the drainages on the site. Ground water seepage was observed feeding the drainages from the sides of the drainages. Ground water was encountered during our investigation in excavations within the alluvial soils. The ground water encountered appears to be perched within the alluvial soils within the drainages, and is likely a recent accumulation from this winters rains. Based on a discussion with one of the homeowners on the adjacent site to the west, ground-water wells consistently report a static ground-water table at depths of approximately 100 feet below existing ground surface. In general, ground water is not expected to be a major problem on the site. If ground-water seepage is encountered, mitigation recommendations can be provided to reduce the impact of ground water seepage or saturated conditions.

2.6 Faulting

California is located on the boundary between the Pacific and North American Lithospheric Plates. The average motion along this boundary is on the order of 50-mm/yr in a right-lateral sense. The majority of the motion is expressed at the surface along the northwest trending San Andreas Fault Zone with lesser amounts of motion accommodated by sub parallel faults located predominantly west of the San Andreas including the Elsinore, Newport-Inglewood, Rose Canyon, and Coronado Bank Faults. Within Southern California, a large bend in the San Andreas Fault north of the San Gabriel Mountains has resulted in a transfer of a portion of the right-lateral motion between the plates into left-lateral displacement and vertical uplift. Compression south and west of the bend has resulted in folding, left-lateral, reverse, thrust faulting, and regional uplift creating the east-west trending Transverse Ranges and several east-west trending faults. Further south within the Los Angeles Basin, "blind thrust" faults are believed to have developed below the surface also as a result of this compression, which have resulted in earthquakes such as the 1994 Northridge event along faults with little to no surface expression.

Prompted by damaging earthquakes in Northern and Southern California, State legislation and policies concerning the classification and land-use criteria associated with faults have been developed. Their purpose was to prevent the construction of urban developments across the trace of active faults. The result is the Alquist-Priolo Earthquake Fault Zoning Act, which was most recently revised in 1997 (Hart, 1997). According to the State Geologist, an active fault is defined as one, which has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). A potentially active fault is defined as any fault, which has had surface displacement during Quaternary time (last 1,600,000 years), but not within the Holocene. Earthquake Fault Zones have been delineated along the traces of active faults within California. Where developments for human occupation are proposed within these zones, the state requires detailed fault investigations be performed so that engineering geologists can mitigate the hazards associated with active faulting by identifying the location of active faults and allowing for a setback from the zone of previous ground rupture.

While the subject site is not located within an Alquist-Priolo Earthquake Fault Zone, it is located approximately 780 feet east of the active trace of Elsinore-Temecula Fault and approximately 180 feet from the eastern margin of the Earthquake Fault Zone that surrounds it. A potentially active strand of the Elsinore-Temecula Fault has also been mapped approximately 80 feet east of the site (Figure 2). We have performed a photolineament analysis of the site utilizing the referenced aerial photographs (Appendix A). The results of our analysis did not indicate the presence of features suggestive of faulting on the site.

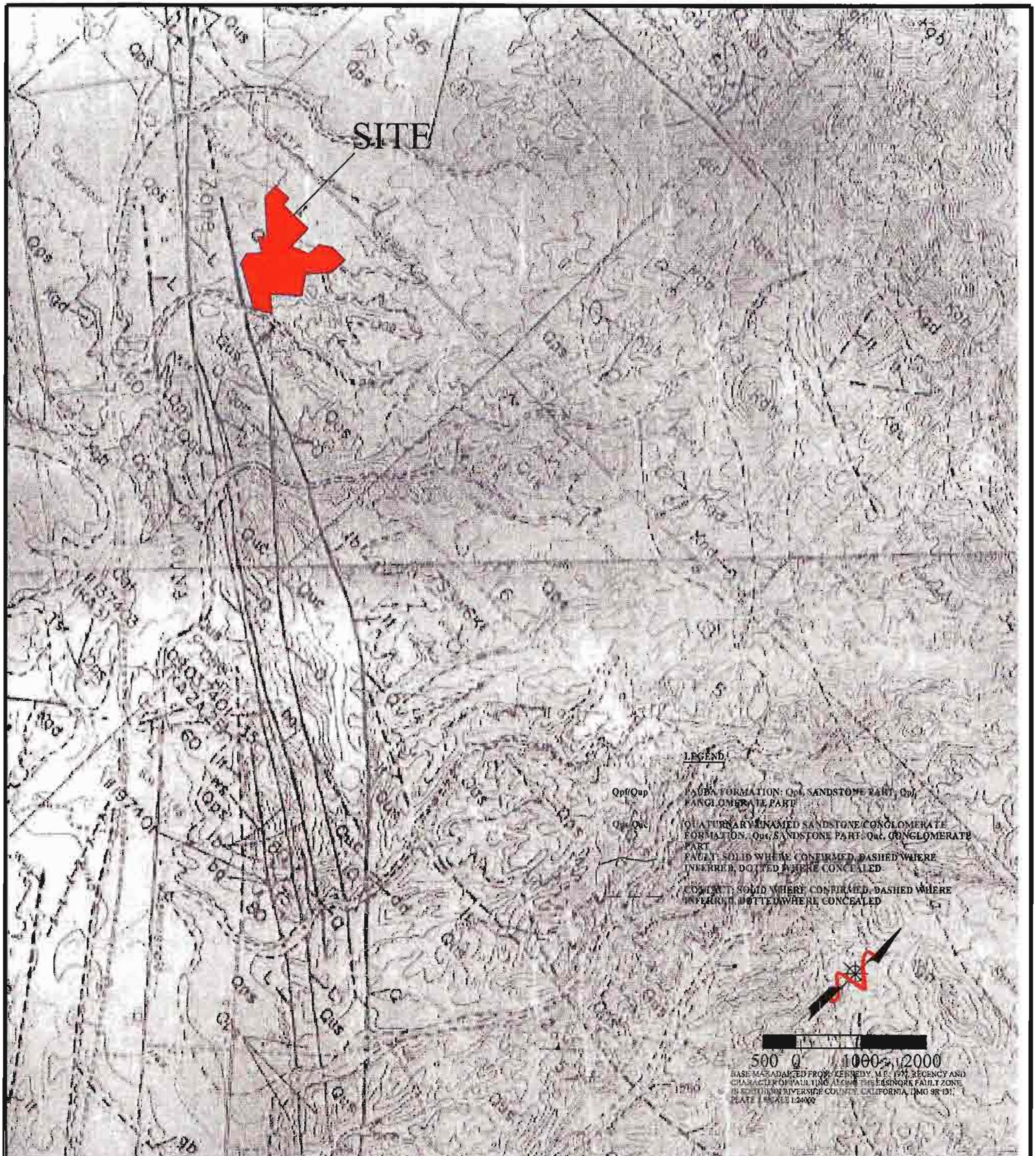
The possibility of damage due to ground rupture is considered low since active faults are not known to cross the site and there are no known active or potentially active mapped on the site. Fault traces are depicted on the map in close proximity to the eastern site boundary, but do not appear to cross the site. Short of leveling all structures on the site and excavating the entire site in search of faults, one can never be 100 percent sure of the absence of onsite faulting. Therefore, the potential presence of active or potentially active faults on the site cannot be absolutely precluded until the site subsurface conditions have been completely exposed and mapped by a geologist. With this said, the level of work performed for investigating the potential for active faulting on the site was within industry standards. Additional subsurface investigation can be performed (if desired) in the portions of the site closest to the known faults to provide further data with regard to the potential for onsite faulting. If active faulting is encountered on the site, building setbacks will be required from the trace of the active fault. If potentially active fault traces are identified on the site, recommendations are typically made on a case by case basis, often it is recommended that either buildings be set back from the trace of the fault, or a deed be attached to the property, which identifies the presence of the fault.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site include ground lurching and shallow ground rupture, soil liquefaction, dynamic settlement, seiches and tsunamis. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependant on the distance between the site and causative fault and the onsite geology. The major active faults that could produce these secondary effects include the Glen Ivy and Temecula branches of the Elsinore Fault. A discussion of these secondary effects is provided in the following sections.

2.6.1 ***Lurching and Shallow Ground Rupture***

Soil lurching refers to the rolling motion on the ground surface by the passage of seismic surface waves. Effects of this nature are not likely to be significant where the thickness of soft sediments does not vary appreciably under structures.

Ground rupture due to active faulting is not likely to occur on site due to the absence of known active fault traces. Minor cracking of near-surface soils due to shaking from distant seismic events is not considered a significant hazard, although it is a possibility at any site, and is often associated with ridgelines.



LGC	Figure 2 Regional Geologic Map	Project Name	T.T. No. 32535
		Project No.	041138-01
		Eng. / Geol.	BTZ/KBC
		Scale	1" : 2000'
		Date	June 2005

2.6.2 *Liquefaction and Dynamic Settlement*

Liquefaction and liquefaction-induced dynamic settlement of soils can be caused by strong vibratory motion due to earthquakes. Liquefaction is typified by a build-up of pore-water pressure in the affected soil layer to a point where a total loss of shear strength occurs, causing the soil to behave as a liquid. Liquefaction primarily occurs in loose, saturated, granular soils while cohesive soils such as silty clays and clays are generally not considered susceptible to soil liquefaction. The effect of liquefaction may be manifested at the ground surface by rapid settlement and/or sand boils.

Site soils are primarily medium dense to very dense silty sands and sands with mixtures of fine-grained clays and silts. Due to the relatively dense nature of the formational materials (bedrock) encountered during our investigation and the lack of shallow ground water, the potential for liquefaction is considered low.

2.6.3 *Lateral Spreading*

Lateral spreading is a type of liquefaction induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading most commonly occurs on gentle slopes (up to about 5 percent) and may cause large horizontal displacements. Such movement typically damages pipelines, utilities, bridges, and structures. A procedure outlined by Youd, et al. requiring the design earthquake magnitude and corresponding fault distance is typically used to estimate lateral displacements.

Based on the low potential for liquefaction, the potential for lateral spreading is also considered low.

2.6.4 *Tsunamis and Seiches*

Based on the distance of the site from the sea and other large bodies of water, the possibility of seiches and/or tsunamis affecting the site is considered to be very low.

2.7 *Seismicity*

The principal seismic hazard, which could impact the site, is strong ground shaking resulting from an earthquake occurring along any of the several active and potentially active faults in Northern California. We have performed a site-specific probabilistic ground motion analysis using FRISKSP (Blake, 2000) computer program. The probabilistic analysis was performed using attenuation equations published by Boore et al., 1997; Sadigh et al., 1997; and

Campbell and Bozorgnia, 1997. The probabilistic analysis indicates that the average peak horizontal ground acceleration (PHGA) corresponding to 10 percent probability of exceedance in 50 and 100 years are 0.75g and 0.91g, respectively. These values were obtained by averaging the results of the above-referenced attenuation equations. Refer to Appendix D.

As discussed above, the site is not located in a seismic hazard zone or within an area covered by Alquist-Priolo Earthquake Fault Zoning Maps. The nearest active faults to the site are the Glen Ivy and Temecula branches of the Elsinore Fault. From a probabilistic standpoint, the design basis earthquake (defined as a 10 percent probability of exceedance in 50 years) could produce a peak horizontal ground acceleration (PGA) of 0.75g at the site.

2.8 Slopes

2.8.1 General

Based on our review, site development will include graded slopes of 2:1 (horizontal to vertical) inclinations or flatter. The largest slope on the site will be on the order of 15-feet-tall. Recommendations for the construction of design slopes are contained in Section 4.2.

2.8.2 Design Cut Slopes

In general, we anticipate that the proposed 2:1 (horizontal to vertical) cut slopes, excavated within Pauba Formational material and free of adverse geologic conditions, will be grossly stable.

2.8.3 Design Fill Slopes

Design fill slopes will be constructed utilizing fill material generated from the cut portions of the site. In general, we anticipate that the proposed 2:1 (horizontal to vertical) fill slopes, utilizing fill soils derived from the onsite materials, will be grossly stable.

2.9 Rippability

Based on the excavation characteristics encountered during our subsurface investigation, rippability is not anticipated to be an issue during site grading and construction. It is anticipated that the onsite soils may be excavated with conventional heavy-duty construction equipment.

2.10 Oversized Material

Based on our site investigation, oversize material (greater than 8-inches in maximum dimension) is not anticipated. However, if encountered, recommendations are provided for appropriate handling of oversized materials in Appendix E.

2.11 Expansive Soil Characteristics

Generally, the onsite soils should be expected to have a low to very high potential for expansion. Expansion potential testing of three representative samples on the site indicated expansion indices of 40, 58, and 140, "low", "medium", and "very high", respectively (1997 U.B.C.).

2.12 Corrosion Potential

Corrosion suites (pH, resistivity, soluble sulfate, and chloride content) were performed on two samples obtained during our subsurface investigation of the site to estimate the corrosion potential of onsite soils. The samples tested were obtained from Trenches T-1 and T-15. The resistivity tests resulted in a minimum resistivity of 605 and 800 ohm-centimeters for the T-1 and T-15 samples, respectively, a pH of 7.5 and 8.2 for the T-1 and T-15 samples, respectively, and chloride contents of 242 and 87 ppm for the T-1 and T-15 samples, respectively. The result of the soluble sulfate content tests for both samples was less than 0.02 percent ("Negligible" per 1997 U.B.C/2001 C.B.C. Table 19-A-4). Caltrans defines a corrosive area where any of the following conditions exist: the soil contains more than 500 ppm of chlorides, more than 2,000 ppm (0.2 percent) of sulfates, or a pH of 5.5 or less.

3.0 CONCLUSIONS

Based on the results of our subsurface investigation and geotechnical review of the tentative tract map, it is our opinion that the proposed development is feasible from a geotechnical standpoint, provided the recommendations contained in the following sections are incorporated during site grading and construction. A summary of our geotechnical conclusions is as follows:

- Based on our site visit and review of pertinent geologic maps and reports, the site is underlain by a thin veneer of surficial materials, which are in-turn underlain by Pauba Formation material.
- From a geotechnical perspective, the existing onsite soils appear to be suitable material for use as fill.
- Active or potentially active faults are not known to exist on the site. However, the Elsinore-Temecula Fault is located only 0.2 km southwest of the site. A potentially active strand of the Elsinore-Temecula Fault has been mapped approximately 80 feet west of the site.
- The proposed development will likely be subjected to strong seismic ground shaking during its design life. The peak horizontal ground acceleration at the site due to the design basis earthquake (defined at 10 percent probability of exceedance in 50 years) is estimated to be 0.75g.
- Based on laboratory test results, the onsite soils are anticipated to have a low to very high potential for expansion. However, this must be confirmed at the completion of grading.
- Based on laboratory test results, the onsite soils have a negligible potential for soluble sulfate attack on normal concrete. However, this must be confirmed at the completion of grading.
- Where adverse geotechnical conditions are not encountered, onsite design cut slopes are anticipated to be grossly stable as designed, but may be subject to surficial erosion.
- Design fill slopes are anticipated to be both grossly and surficially stable as designed.

4.0 RECOMMENDATIONS

The following recommendations are to be considered preliminary, and should be confirmed upon completion of grading and earthwork operations. In addition, they should be considered minimal from a geotechnical viewpoint, as there may be more restrictive requirements from the architect, structural engineer, building codes, governing agencies, or the owner.

It should be noted that the following geotechnical recommendations are intended to provide the owner with sufficient information to develop the site in general accordance with the 1997 U.B.C. and 2001 C.B.C. requirements. With regard to the potential occurrence of potentially catastrophic geotechnical hazards such as fault rupture, earthquake-induced landslides, liquefaction, etc. the following geotechnical recommendations should provide adequate protection for the proposed development to the extent required to reduce seismic risk to an "acceptable level". The "acceptable level" of risk is defined by the California Code of Regulations as "that level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project" [Section 3721(a)]. Therefore, repair and remedial work of the proposed structures may be required after a significant seismic event. With regards to the potential for less significant geologic hazards to the proposed development, the recommendations contained herein are intended as a reasonable mitigation against the potential damaging effects of these phenomena such as expansive soils, fill settlement, ground-water seepage, etc. It should be understood, however, that our recommendations are intended to maintain the structural integrity of the proposed development and structures given the site geotechnical conditions, but cannot preclude the potential for some cosmetic distress or nuisance issues to develop as a result of the site geotechnical conditions.

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of rough and precise grading operations followed by retaining wall construction, utility construction, foundation construction, and asphalt paving of the streets and drives. We recommend that earthwork onsite be performed in accordance with the following recommendations, the County of Riverside Grading Requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix E. In case of conflict, the following recommendations shall supersede all previous recommendations and those included as part of Appendix E. The following recommendations should be considered preliminary and may be revised based on the actual as-graded conditions of the site once grading is completed. If necessary, revisions will be provided in our as-graded report for the site following the completion of grading.

4.1.1 Site Preparation

Prior to grading of areas to receive structural fill or engineered structures, the areas should be cleared of surface obstructions and potentially compressible material (such as undocumented fill, topsoil, colluvium, alluvium, and vegetation). Vegetation and debris should be removed and properly disposed of offsite. Holes resulting from the removal of buried obstructions, which extend below proposed removal bottoms should be replaced with suitable compacted fill material.

4.1.2 *Removal and Recompaction*

We anticipate removals on the site will generally range from approximately 1.5 to 10 feet, typically less than approximately 3 to 4 feet below the majority of the site. Removals up to approximately 10 feet should be anticipated within the onsite drainages. Localized, deeper removals should be anticipated where deemed necessary by the geotechnical consultant based on observations during grading.

Removal bottoms should have a minimum relative compaction of 85 percent. Removal bottoms should be observed and accepted by the geotechnical consultant prior to fill placement. From a geotechnical perspective, material that is removed may be placed as fill provided the material is relatively free of organic material and/or deleterious debris, is moisture-conditioned or dried (as needed) to obtain above-optimum moisture content, and then recompacted prior to additional fill placement or construction. Areas to receive fill and/or other surface improvements should be scarified, moisture conditioned, and recompacted to at least 90 percent relative compaction (based on American Society for Testing and Materials [ASTM] Test Method D1557).

4.1.3 *Overexcavation of Cut/Fill Transitions*

To reduce the potential for differential settlement, the County of Riverside requires the cut portion of cut/fill transitions be overexcavated by at least one half the maximum fill thickness not to exceed 15 vertical feet and extending at least 5 horizontal feet outside of the proposed building footprints. In addition, we recommend, the cut portion of cut/fill transitions be undercut a minimum of 3 vertical feet. The bottom of the overexcavation should be graded to flow towards deeper fill areas. The overexcavated material should then be replaced by compacted fill material to design grade. Additionally, to soften the affect of differential fill settlement, we recommend that all steep slopes remaining after remedial grading be laid back to 3:1 inclinations below buildings.

4.1.4 *Fill Settlement/Dynamic Settlement*

Due to the self-weight consolidation of the fill and underlying soils, some amount of settlement will occur during the project design life. Based on the results of our site study and the recommended remedial grading, we estimate the post-construction settlement of the site due to self-weight of the material will be negligible. Due to primarily dense nature of the onsite soils, seismic settlement due to a major seismic event would likely be less than 1-inch.

4.1.5 Temporary Stability of Removal Excavations

Due to the recommended depth of remedial grading, temporary slopes will exist around the perimeter of the site. We do not expect these slopes to be grossly unstable, however, all excavations should be made in accordance with Cal OSHA requirements.

4.1.6 Fill Placement and Compaction

From a geotechnical perspective, the onsite soils are generally suitable for use as compacted fill, provided they are screened of organic materials and construction debris. Areas prepared to receive structural fill and/or other surface improvements should be scarified, brought to at least optimum-moisture content, and recompacted to at least 90 percent relative compaction (based on ASTM Test Method D1557). The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, granular fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant. Over-sized material (material larger than 8 inches in maximum dimension) should be placed in accordance with the recommendations provided in Appendix E.

From a geotechnical viewpoint, import soils (if necessary for potential retaining wall backfill) should consist of clean, granular soils of very low-to-low expansion potential (expansion index 30 or less based on U.B.C. 18-2). Source samples should be provided to the geotechnical consultant for laboratory testing a minimum of 48 hours prior to any planned importation.

4.1.7 Placement of Expansive Soils

If expansive soils are encountered during grading, we recommend they be placed in the deeper fill areas of the site. Expansive soils (expansion index 20 or greater based on U.B.C. 18-2) preferably should not be placed within 4 vertical feet of proposed structures or other improvements

Representative samples of the finish grade soils on the site must be collected at the completion of grading and laboratory tested to determine their relative expansion potentials for final recommendations.

4.1.8 Trench Backfill and Compaction

The onsite soils may generally be suitable as trench backfill provided the soils are screened of rocks and other material greater than 6 inches in diameter and organic matter. If trenches are shallow or the use of conventional equipment may result in damage to the utilities, a clean sand having a SE > 30 should be used to bed and shade the pipes. Sand backfill may be densified by tamping to ensure adequate compaction. Otherwise, trench backfill should be compacted in uniform lifts (generally not exceeding 12 inches in compacted thickness) by mechanical means to at least 90 percent relative compaction (per ASTM Test Method D1557). A representative from LGC should observe and test the backfill to verify compliance with the project specifications.

4.1.9 Shrinkage and Bulking

Allowance in the earthwork volumes budget should be made for an estimated 10 to 15 percent reduction in volume of the recompacted undocumented fill, topsoil/colluvium, and alluvium. Bulking on the order of 5 to 10 percent bulking should be anticipated for the Pauba Formational material. It should be stressed that these values are only estimates and that an actual shrinkage factor would be extremely difficult to predetermine. These estimates are based on our previous experience with similar site soils and conditions and are not based on laboratory test data. The effective shrinkage of onsite soils will depend primarily on the type of compaction equipment and method of compaction used onsite by the contractor. Shrinkage and bulking are also expected to vary with variations in survey accuracy during rough grading.

4.2 Slope Stability

4.2.1 Cut Slopes

Design cut slopes at the site are anticipated to be grossly and surficially stable as designed, provided the recommendations contained herein are implemented. During grading detailed geologic mapping should be performed to confirm the anticipated bedrock conditions. Cutting of the slope must be performed by the contractor to minimize potential fracturing of the near-surface material of the finished slope. Significant fracturing of the slope due to the method of excavation, may result in the necessity to perform additional surficial stabilization of loose material on the slope face, or the provision for debris catchment of the toe of slope. The exact determination of any additional surficial stabilization of the slope should be made at the completion of grading based on actual exposed conditions and the location of improvements close to the design cut slopes. Irrespective of the finish conditions, the cut slopes should be protected with properly designed vegetative covers. If trees are planned for slope construction, tree wells should be considered.

4.2.2 Fill Slopes

Design fill slopes at the site are anticipated to be both grossly surficially stable as designed, as long as they are constructed in accordance with the Standard Earthwork and Grading Specifications included in Appendix E. Fill slopes with a slope ratio of

2:1 (horizontal to vertical) and up to approximately 15 feet in height are proposed on the site.

4.3 Seismic Design Criteria

The soil parameters in accordance with the 1997 U.B.C. and the 2001 California Building Code (Section 1636) are as follows:

Soil Profile Type (Table 16-J) = S_D
Seismic Zone (Figure 16-2) = 4
Seismic Source Type (Table 16-U) = B
Slip Rate, SR, (Table 16-U) = 5 mm/yr (CDMG, 1996) based on the Elsinore Fault located approximately 0.2 kilometers to the west.
$N_a = 1.3$
$N_v = 1.6$

4. 4 Preliminary Foundation Recommendations

Limited laboratory test results for expansion potential ranged from "Low" to "Very High." It is our opinion that the majority of site soils have a low to medium expansion potential. Therefore, we are providing preliminary geotechnical foundation parameters for low and medium expansion potential. However, it should be emphasized that these parameters are preliminary based on limited testing, and must be verified on as-graded conditions. Laboratory testing at the completion of grading may require the following geotechnical design parameters to be updated based on the as-graded conditions.

4.4.1 Preliminary Post-Tensioned Foundation Design Parameters

The structural engineer may design a post-tensioned foundation system using the geotechnical parameters provided in the attached Tables 1A and 1B. In utilizing the geotechnical design parameters in Tables 1A and 1B, the foundation engineer should design the system to the tolerable deflection allowed by the structural engineer/architect, or governing codes, which ever is more stringent. Please note that the following geotechnical recommendations for foundation design are considered to be in general accordance with the industry standard for expansive soils conditions in Southern California. The use of a post-tensioned slab will not eliminate movement of the foundation due to soil settlement/movement, but rather reduce and effectively lessen distress to a cosmetic level.

The parameters presented in Tables 1A and 1B have been determined in general accordance with Chapter 18 of the C.B.C., 2001 edition. Please note that the post-tensioned design methodology reflected in C.B.C. Chapter 18 is in part based on the assumption that soil-moisture changes around and beneath the post-tensioned slabs are influenced only by climatological conditions. Soil-moisture change below slabs is the major factor in foundation damage relating to expansive soil. The C.B.C. design methodology has no consideration for presoaking, homeowner irrigation, or other nonclimate-related influences on the moisture content of subgrade soils. In recognition of these factors, we have modified the geotechnical parameters obtained from this methodology to account for reasonable irrigation practices and proper homeowner maintenance.

4.4.2 Foundation Subgrade Preparation and Maintenance

The moisture condition of the subgrade soils below and around the foundations should be maintained at optimum moisture content (ASTM D 1557) up to the time of concrete placement. We further recommend that the moisture content of the soil around the immediate perimeter of the slab be maintained at near optimum-moisture content (or above) to a minimum depth of 12 inches during construction and up to occupancy of the homes.

The geotechnical parameters provided in Tables 1A and 1B assume that if the areas adjacent to the foundation are planted and irrigated, these areas will be designed with proper drainage so ponding, which causes significant moisture changes below the foundation, does not occur. Our recommendations do not account for excessive irrigation and/or incorrect landscape design. Sunken planters placed adjacent to the foundation, should either be designed with an efficient drainage system or liners to prevent moisture infiltration below the foundation. Some lifting of the perimeter foundation beam should be expected even with properly constructed planters.

In addition to the factors mentioned above, future homeowners should be made aware of the potential negative influences of trees and/or other large vegetation. Roots that extend near the vicinity of foundations can cause distress to foundations. Future homeowners (and the owners landscape architect) should not plant trees/large shrubs closer to the foundations than a distance equal to half the mature height of the tree or 20 feet, whichever is more conservative unless specifically provided with root barriers to prevent root growth below the house foundation.

It is the homeowner's responsibility to perform periodic maintenance during hot and dry periods to insure that adequate watering has been provided to keep soil from separating or pulling back from the foundation. Future homeowners should be informed and educated regarding the importance of maintaining a constant level of soil-moisture. The owners should be made aware of the potential negative consequences of both excessive watering, as well as allowing potentially expansive soils to become too dry. Expansive soils can undergo shrinkage during drying, and swelling during the rainy winter season, or when irrigation is resumed. This can result in distress to building structures and hardscape improvements. The builder should provide these recommendations to future homeowners.

4.4.3 Vapor Retarder and Sand Below Slabs

Interior floor slabs with moisture sensitive floor coverings should be underlain by a

15-mil thick polyolefin (or equivalent) moisture/vapor barrier to help reduce the upward migration of moisture from the underlying subgrade soils. The moisture/vapor barrier product used should meet the performance standards of an ASTM E 1745 Class A material, and be properly installed in accordance with ACI publication 302. It is the responsibility of the contractor to ensure that the moisture/vapor barrier systems are placed in accordance with the project plans and specifications, and that the moisture/vapor retarder materials are free of tears and punctures prior to concrete placement. Additional moisture reduction and/or prevention measures may be needed, depending on the performance requirements of future interior floor coverings.

Recommendations are traditionally included with geotechnical foundation recommendations for sand layers placed below slabs and above/below vapor barriers and retarders for the purpose of protecting the barrier/retarder and to assist in concrete curing. Sand layer requirements are the purview of the foundation engineer/structural engineer, and should be provided in accordance with ACI Publication 302 "Guide for Concrete Floor and Slab Construction". We have provided recommendations in Tables 1A and 1B that we consider to be a minimum from a geotechnical perspective. These recommendations must be confirmed (and/or altered) by the foundation engineer, based upon the performance expectations of the foundation. Ultimately, the design of the moisture retarder system and recommendations for concrete placement and curing are the purview of the foundation engineer, in consideration of the project requirements provided by the architect and developer.

TABLE 1A

Preliminary Geotechnical Parameters for Post-Tensioned Foundation Slab Design

Parameter	Value
Expansion Index	Low[1]
Clay Mineral Type	Montmorillonite (assumed)
Thornthwaite Moisture Index	-20
Depth to Constant Soil Suction (depth to constant moisture content over time, but within CBC limits)	7 feet
Constant Soil Suction	PF 3.6
Moisture Velocity	0.7 inches/month
Center Lift Edge moisture variation distance, e_m Center lift, y_m	 5.5 feet 2.0 inches
Edge Lift Edge moisture variation distance, e_m Edge lift, y_m	 3.0 feet 0.75 inches
Modulus of Subgrade Reaction, k (assuming presoaking as indicated below)	200 pci
Minimum perimeter foundation embedment below finish grade (for a conventional PT foundation)	18 inches
Presoak	Optimum moisture content to a minimum depth of 12 inches
Under slab moisture retarder and sand layers	15 mil polyolefin or equivalent overlain by 1 inch of dry sand; Refer to Text[2]

1. Assumed for preliminary design purposes. Further evaluation is needed at the completion of grading.
2. Recommendations for sand below slabs are traditionally included with geotechnical foundation recommendations, although they are not the purview of the geotechnical consultant. The sand layer requirements are the purview of the foundation engineer/structural engineer, and should be provided in accordance with ACI Publication 302 "Guide for Concrete Floor and Slab Construction".

TABLE 1B

Preliminary Geotechnical Parameters for Post-Tensioned Foundation Slab Design

Parameter	Value
Expansion Index	Medium[1]
Clay Mineral Type	Montmorillonite (assumed)
Thornthwaite Moisture Index	-20
Depth to Constant Soil Suction (depth to constant moisture content over time, but within CBC limits)	7 feet
Constant Soil Suction	PF 3.6
Moisture Velocity	0.7 inches/month
Center Lift Edge moisture variation distance, e_m Center lift, y_m	 5.5 feet 2.5 inches
Edge Lift Edge moisture variation distance, e_m Edge lift, y_m	 3.5feet 1.0 inches
Modulus of Subgrade Reaction, k (assuming presoaking as indicated below)	150 pci
Minimum perimeter foundation embedment below finish grade (for a conventional PT foundation)	18 inches
Presoak	1.2 times optimum moisture content to a minimum depth of 18 inches
Under slab moisture retarder and sand layers	15 mil polyolefin or equivalent overlain by 1 inch of dry sand; Refer to Text[2]

1. Assumed for preliminary design purposes. Further evaluation is needed at the completion of grading.
2. Recommendations for sand below slabs are traditionally included with geotechnical foundation recommendations, although they are not the purview of the geotechnical consultant. The sand layer requirements are the purview of the foundation engineer/structural engineer, and should be provided in accordance with ACI Publication 302 "Guide for Concrete Floor and Slab Construction".

4.4.3 Foundation Setback from Top of Slope and Bottom of Slope

Foundation setbacks should meet the requirements of the County of Riverside and the U.B.C. Foundation setbacks should be reviewed during the precise grading plan review.

4.5 Soil Bearing

An allowable soil bearing pressure of 1,500 pounds per square foot (psf) may be used for the design of footings having a minimum width of 12 inches and minimum embedment of 18 inches below lowest adjacent ground surface. This value may be increased by 300 psf for each additional foot of embedment of 100 psf for each additional foot of foundation width to a maximum value of 2,500 psf. These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only.

In utilizing the above-mentioned allowable bearing capacity, static settlement due to structural loads is anticipated to be less than ½-inch over a horizontal span of 40 feet.

4.6 Lateral Earth Pressures and Retaining Wall Design Considerations

At this time, it is not know if site retaining walls are proposed. However, the following preliminary recommendations are provided for planning purposes. Onsite soils may be used for retaining wall backfill, provided they have an Expansion Index (EI) less than 30. Based on limited site laboratory testing, some site soils will not meet this specification. Therefore, import of select material for retaining wall backfill may be required.

The recommended lateral pressures for approved onsite materials (expansion index less than 30 per U.B.C. 18-I-B) for level or sloping backfill are presented in Table 2.

TABLE 2
Lateral Earth Pressures

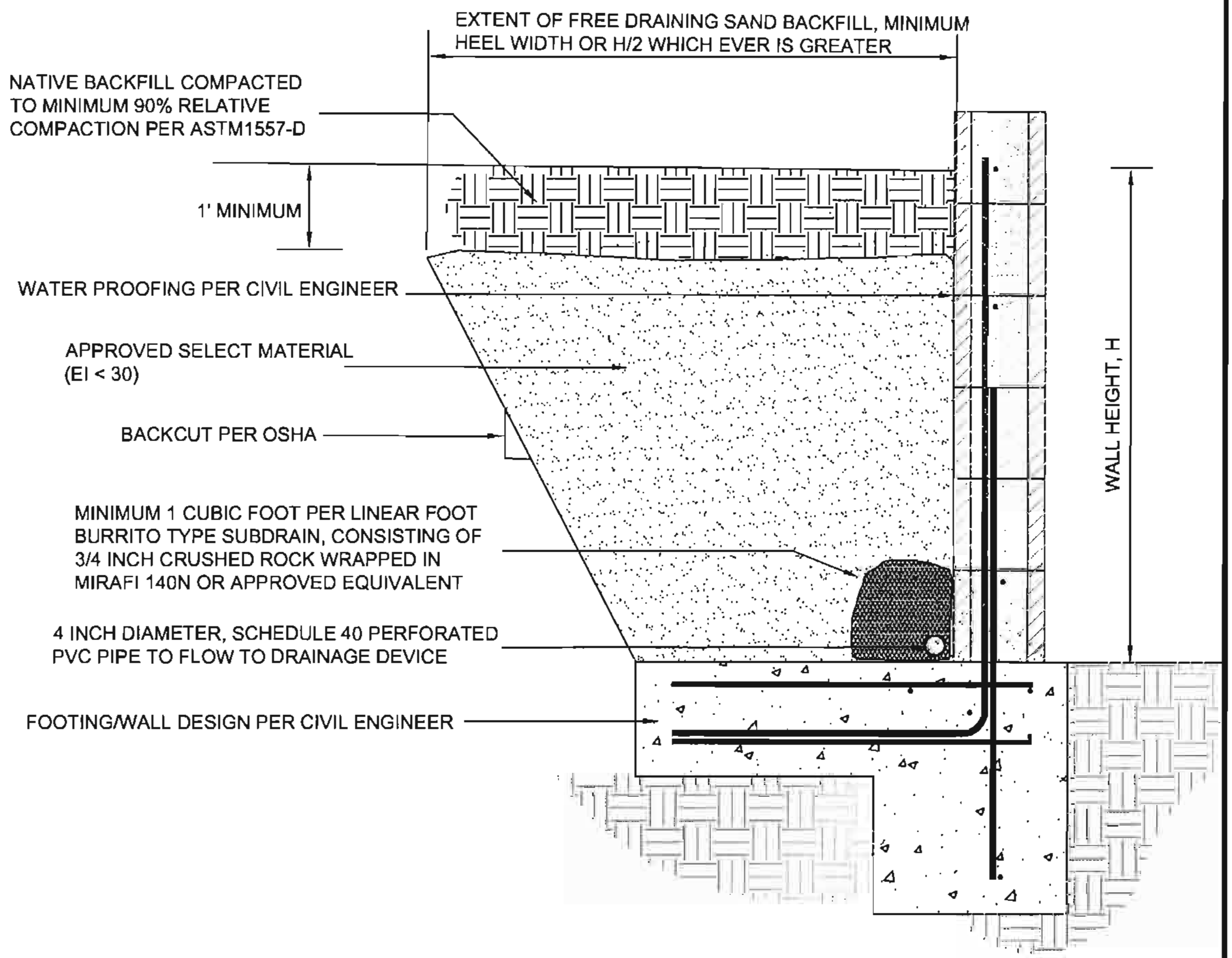
Conditions	Equivalent Fluid Unit Weight (pcf)	
	Level Backfill	2:1 Backfill Sloping Upwards
	Approved Material (EI<30)	Approved Material (EI<30)
Active	35	45
At-Rest	60	80
Passive	350	—

Embedded structural walls should be designed for lateral earth pressures exerted on them. The magnitude of these pressures depends on the amount of deformation that the wall can yield under load. If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at-rest" conditions and geotechnical design parameters should be requested from the geotechnical consultant. If a structure moves toward the soils, the resulting resistance developed by the soil is the "passive" resistance. The passive earth pressure values assumes sufficient slope setback (see previous section).

For design purposes, the recommended equivalent fluid pressure for each case for walls founded above the static ground water and backfilled with approved soils (expansion index less than 30) is provided in Table 2. The equivalent fluid pressure values assume free-draining conditions. If conditions other than those assumed above are anticipated, the geotechnical engineer should provide the equivalent fluid pressure values on an individual-case basis. The geotechnical and structural engineers should evaluate surcharge-loading effects from the adjacent structures. Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. The outlet pipe should be sloped to drain to a suitable outlet. Typical wall drainage design is illustrated on Figure 3. It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is generally a white crystalline powder (discoloration) that results when water, which contains soluble salts, migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential.

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. A coefficient of friction of 0.35 may be assumed with dead-load forces. A passive lateral earth pressure of 350 psf per foot of depth (or pcf) may be used for the sides of footings poured against properly compacted fill. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. The passive resistance value may be increased by one-third when considering loads of short duration such as wind or seismic loads.

Excavations should be made in accordance with Cal OSHA requirements.



Version 12/07/2001

LGC

Figure 3
Retaining Wall Detail
Approved Backfill Material

Project Name	Tract 32535, Riverside
Project No.	041138-01
Eng. / Geol.	BTZ/KBC
Scale	Not To Scale
Date	June 2005

4.7 *Preliminary Pavement Sections*

Based on an assumed R-value of 25, we recommend the following provisional minimum street sections for Traffic Indices of 4.5, 5, and 6. These recommendations should be confirmed with R-value testing of representative near-surface soils at the completion of grading and after underground utilities have been installed and backfilled. Final street sections should be confirmed by the project civil engineer based upon the design Traffic Index. In addition, additional sections can be provided based on other desired traffic indices.

Assumed Traffic Index	4.5	5	6
R -Value Subgrade	25	25	25
AC Thickness	4.0 inches	4.0 inches	4.5 inches
Base Thickness	4.0 inches	5.5 inches	7.0 inches

Aggregate base should conform to the requirements of the 2000 edition of the *Standard Specifications for Public Works Construction* ("Greenbook"). Aggregate base should be compacted to a minimum of 95 percent relative compaction over subgrade compacted to a minimum of 90 percent relative compaction per ASTM- D1557.

4.8 *Corrosivity to Concrete and Metal*

Although not corrosion engineers (LGC is not a corrosion consultant), several governing agencies in Southern California require the geotechnical consultant to determine the corrosion potential of soils to buried concrete and metal facilities. We therefore present the results of our testing with regard to corrosion for the use of the client and other consultants as they determine necessary. Recommendations for mitigation should be obtained from a corrosion engineer.

Based on preliminary testing performed at the site, concrete should be minimally designed in accordance with the negligible category of Table 19-A-4 of 1997 U.B.C./2001 C.B.C. This must be verified based on as-graded conditions.

4.9 *Nonstructural Concrete Flatwork*

Concrete flatwork (such as walkways, bicycle trails, etc.) has a high potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should minimally be designed in accordance with the minimum guidelines outlined in Table 3. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints, but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 3

Nonstructural Concrete Flatwork for Medium Expansion Potential

	Homeowner Sidewalks	**Private Drives**	**Patios/Entryways**	**City Sidewalk Curb and Gutters**
Minimum Thickness (in.)	4 (nominal)	5 (full)	5 (full)	City/Agency Standard
Presaturation	Wet down	Presoak to 12 inches	Presoak to 12 inches	City/Agency Standard
Reinforcement	—	No. 3 at 24 inches on-centers	No. 3 at 24 inches on-centers	City/Agency Standard
Thickened Edge (in.)	—	8 x 8	—	City/Agency Standard
Crack Control Joints	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	City/Agency Standard
Maximum Joint Spacing	5 feet	10 feet or quarter cut whichever is closer	6 feet	City/Agency Standard
Aggregate Base Thickness (in.)	—	—	2	City/Agency Standard

To reduce the potential for driveways to separate from the garage slab, the builder may elect to install dowels to tie these two elements together. Similarly, future homeowners should consider the use of dowels to connect flatwork to the foundation.

4.10 Control of Surface Water and Drainage Control

Positive drainage of surface water away from structures is very important. Water should not be allowed to pond adjacent to buildings or to flow freely down a graded slope. Positive drainage may be accomplished by providing drainage away from buildings at a gradient of at least 2 percent for earthen surfaces for a distance of at least 5 feet, and further maintained by a swale or drainage path at a gradient of at least 1 percent. Where necessary, drainage paths may be shortened by use of area drains and collector pipes. Eave gutters are recommended and should reduce water infiltration into the subgrade soils if the downspouts are properly connected to appropriate outlets.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Overwatering must be avoided.

4.11 ***Freestanding Walls***

To reduce the potential for unsightly cracks due to differential settlement or possibly expansive soils, we recommend the inclusion of construction joints at a maximum of 20-foot on center. The structural engineer, based upon the wall reinforcement, may alter this spacing. If the soil-moisture content below the wall foundation varies significantly, some wall movement should be expected; however, this movement is unlikely to cause more than cosmetic distress. Allowable soil bearing values are provided in Section 4.5.

4.12 ***Construction Observation and Testing***

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC.

Construction observation and testing should also be performed by the geotechnical consultant during future grading, excavations, backfill of utility trenches, preparation of pavement subgrade and placement of aggregate base, foundation or retaining wall construction or when any unusual soil conditions are encountered at the site.

Foundation plans, precise grading plans, and final project drawings should be reviewed by this office prior to construction to verify that our geotechnical recommendations have been incorporated.

5.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is based on data obtained from limited observations of the site, which have been extrapolated to characterize the site. While the scope of services performed is considered suitable to adequately characterize the site geotechnical conditions relative to the proposed development, no practical investigation can completely eliminate uncertainty regarding the anticipated geotechnical conditions in connection with a subject site. Variations may exist and conditions not observed or described in this report may be encountered during construction.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the other consultants and incorporated into the plans. The contractor should properly implement the recommendations during construction and notify the owner if they consider any of the recommendations presented herein to be unsafe, or unsuitable.

The findings of this report are valid as of the present date. However, changes in the conditions of a site can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. The findings, conclusions, and recommendations presented in this report can be relied upon only if LGC has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site. This report is intended exclusively for use by the client, any use of or reliance on this report by a third party shall be at such party's sole risk.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification.

Appendix A
References

APPENDIX A

References

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Aerial Photographs

Flight No.	Photo No.	Date	Scale
AXM-5F	158	5/6/49	1"-800'
AXM-5F	159	5/6/49	1"-800'

Appendix B
Trench Logs

Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-1

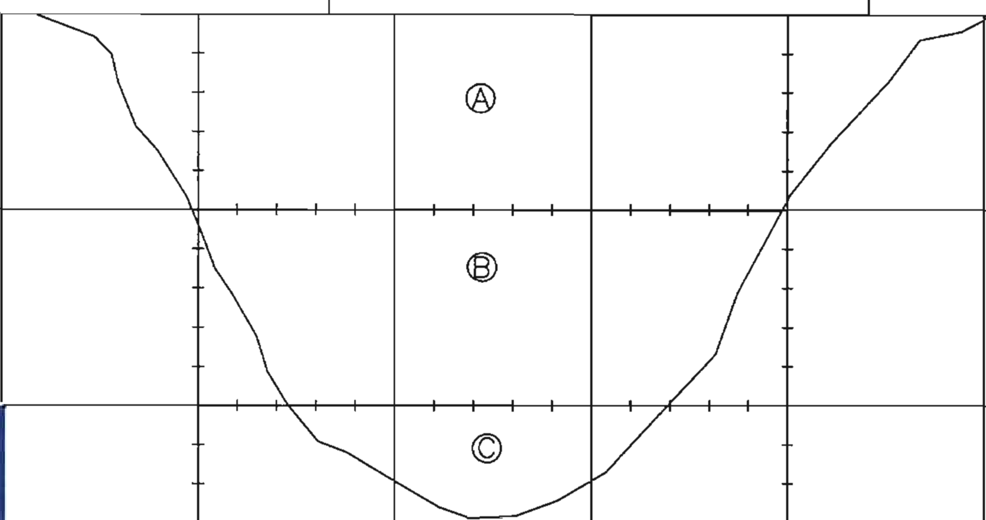
Project Number: 041138-01 | **Elevation:** 1285'

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Engineering Properties

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Pauba Formation:	Qp				
	A: @ 0-1' coarse Sand with Clay: red brown, dry, dense		SC			
	@ 1-4' coarse Sand with Clay: red brown, slightly moist to moist, dense			1 @ 2'-4'		
	@ 4'-5' Clayey to Clayey Sand: brown, moist, dense to medium dense					
	B: @ 5' Increasing Silt to Silty very fine Sand to fine Sandy Silt with Clay: yellow brown to yellow gray, moist, dense		SM			
	C: @ 10' Sand: yellow to light brown, moist, dense		SP			
	@ 13' Sand: yellow to light brown, moist to very moist, dense					

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** | **TREND:** EW



Total Depth: 13'
No Groundwater Encountered
Backfilled: 05/25/05

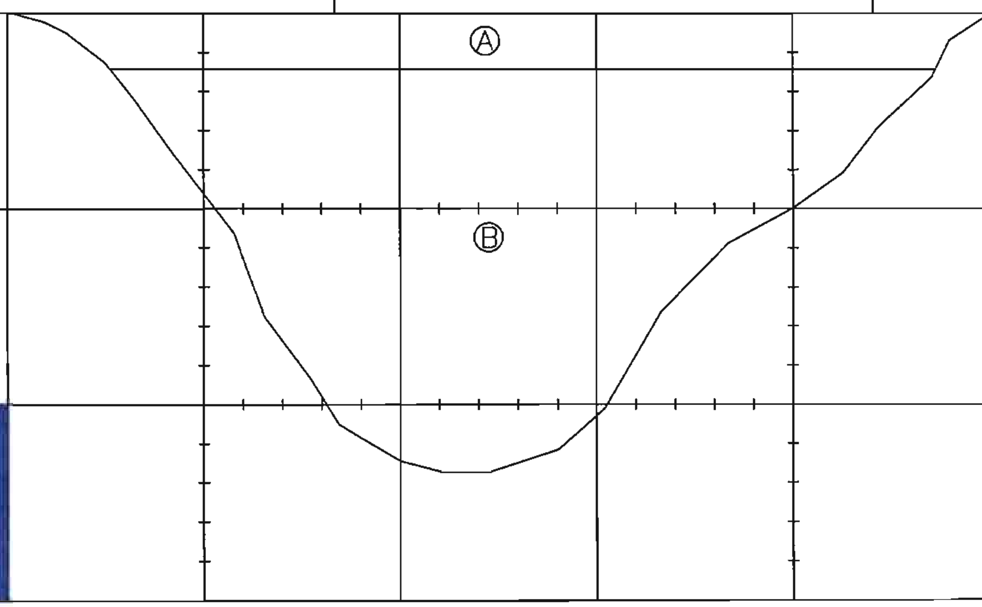
Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-2

Project Number: 041138-01 | **Elevation:** 1273' | **Engineering Properties**

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Geologic Attitudes	Date: 05/25/05 / Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Topsoil/Colluvium: A: @ 0-1.5' Sand with Clay and Silt: red brown, dry to slightly moist, dense to slightly hard		SM/SC			
@ 3' B: 40E 25W	Quaternary Pauba Formation: B: @ 1.5' Sand with lenses of Gravel: red brown to yellow brown, moist, dense @ 7' less Gravel than above @ 12' Sand with lenses of Gravel: red brown, moist, dense	Qp	SP	1		

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** | **TREND:** EW



Total Depth: 13'
No Groundwater Encountered
Backfilled: 05/25/04

Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-3

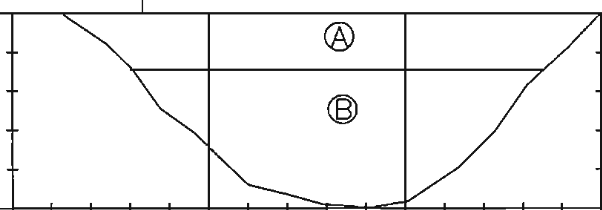
Project Number: 041138-01 | **Elevation:** 1272'

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Engineering Properties

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	<u>Topsoil/Colluvium</u> A: @ 0-1.5' Clay with Sand: Black, wet to very moist, soft; roots, organics		CL			
	<u>Quaternary Pauba Formation:</u> B: @ 1.5'- 5' Clayey Sand: brown, very moist, dense; Clay content decreases with depth, free water at contact with Clayey Sand	Qp	SC	1		

GRAPHICAL REPRESENTATION: | **SCALE:** 1” = 5’ | **SURFACE SLOPE:** | **TREND:** EW



Total Depth: 5'
Groundwater @ 1.5'
Backfilled: 05/25/05

LGC

Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-4

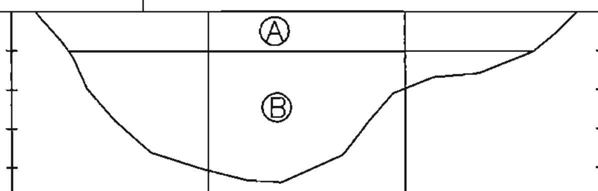
Project Number: 041138-01 | **Elevation:** 1263'

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Engineering Properties

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Alluvium:	Qal				
	A: @ 0-1' Sandy Clay: Black to dark brown, moist, soft; organics		CL			
	@ 1-3' Clayey Sand to Sandy Clay: Gray to dark Gray with yellow brown, very moist, soft; roots, seepage at 1.5'		CL/SC			
	Quaternary Pauba Formation:	Qp				
	B: @ 4' Increase Silt to Silty Sand to Sandy Clayey Silt		SM			
	@ 4.5' Sand with minor Clays: gray, wet, dense; flowing seepage		SC			

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** | **TREND:** NS

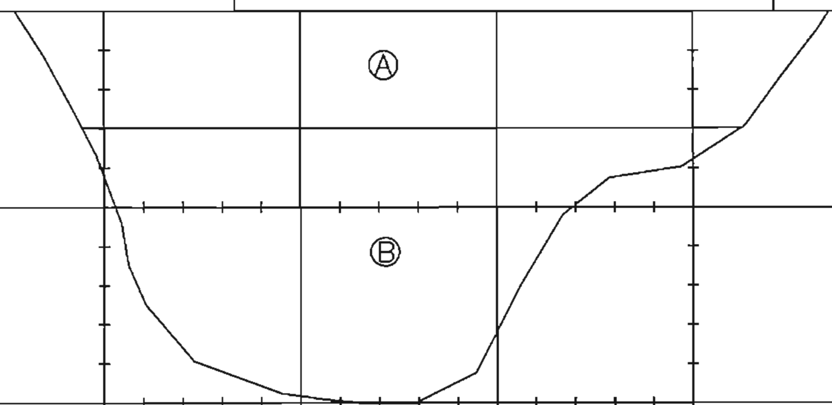


Total Depth: 5'
Groundwater @ 4.5'
Backfilled: 05/25/05

Project Name: T.T. 32535	Logged by: DAK	LOG OF TRENCH T-5
Project Number: 041138-01	Elevation: 1267'	Engineering Properties
Equipment: CASE 580L	Location/Grid: See Geotechnical Map	

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	<u>Topsoil/Colluvium:</u> A: @ 0-1' Fine Sand with Silt: light brown, medium dense, roots		SM			
	<u>Quaternary Pauba Formation:</u> B: @ 1'-3' Sand with Silt and Clay: red brown, medium dense	Qp	SM/SC	1		
	@ 3'-5' Clayey Sand: Gray, very moist, medium dense to soft		SC			
	@ 5' Clayey Sand: brown, moist, medium dense					
	@ 8' seepage					
	@ 10' Clay to Clayey Sand: getting denser/stiffer with depth, seepage		CL/SC			

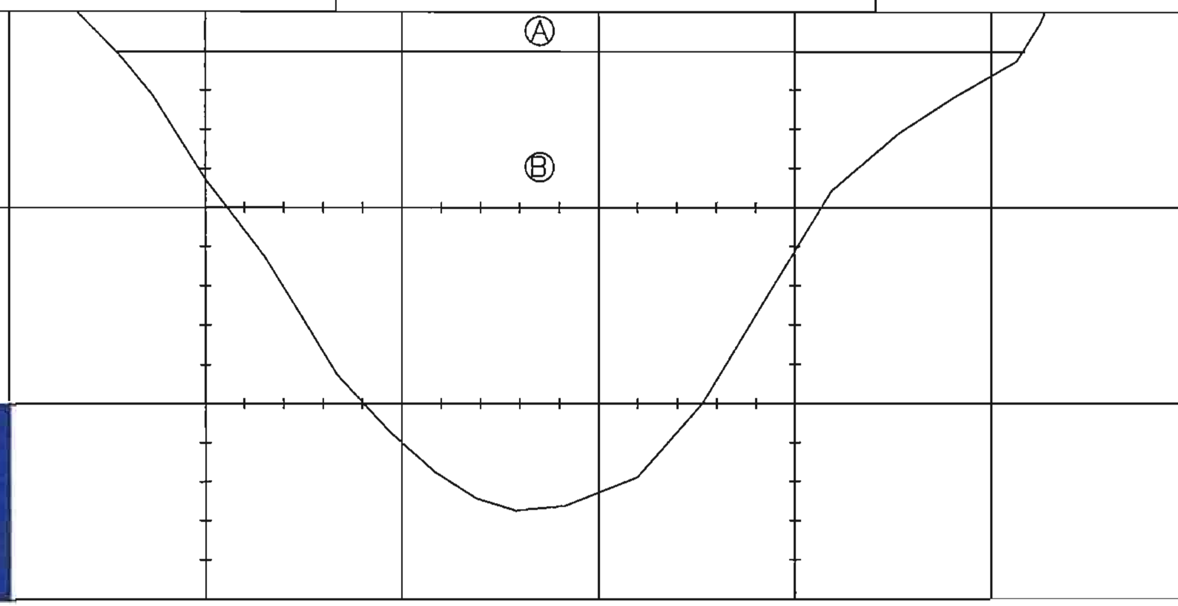
GRAPHICAL REPRESENTATION: **SCALE:** 1" = 5' **SURFACE SLOPE:** **TREND:** EW



Total Depth: 13'
Seepage @ 8'
Backfilled: 05/25/05

Project Name: T.T. 32535		Logged by: DAK		LOG OF TRENCH T-6			
Project Number: 041138-01		Elevation: 1250'		Engineering Properties			
Equipment: CASE 580L		Location/Grid: See Geotechnical Map					
Geologic Attitudes	Date: 05/25/05	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
@ 0-1' Laminations: 40E 25W		Quaternary Alluvium: A: @ 0-1' Sand to Silt: brown with red tinge, slightly moist to dry, medium dense; thin laminations	Qal	SM/ML			
		Quaternary Pauba Formation: B: @ 1'-3' Silty Sand: brown to dark brown, moist, medium dense; roots	Qp	SM			
		@ 3' Silty Sand: brown to dark brown with light yellow brown sand pods/lenses 4-6" thick, 6"-1' long, minor scattered gravel					
		@ 9' Sand: yellow brown, moist, dense		SP			
		@ 13' Silt with Sand: Gray, slightly moist, stiff, rootlets in fractures		ML	1		

GRAPHICAL REPRESENTATION: **SCALE:** 1" = 5' **SURFACE SLOPE:** **TREND:** EW



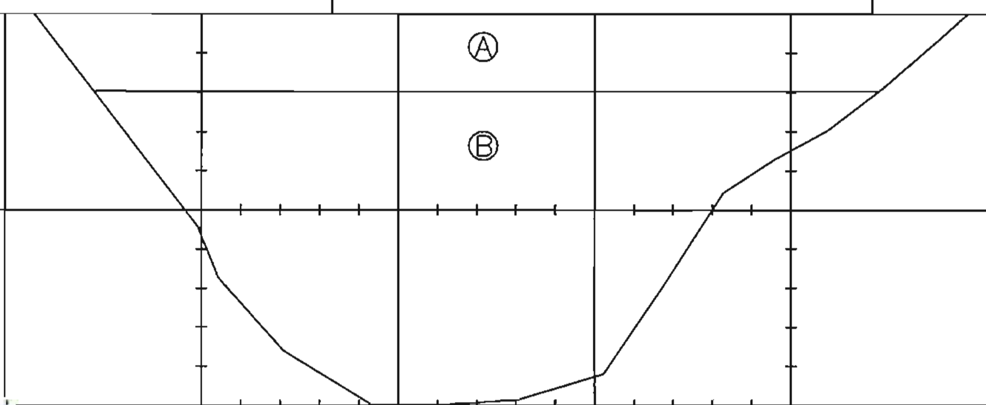
Total Depth: 13.5'
No Groundwater Encountered
Backfilled: 05/25/05

LGC

Project Name: T.T. 32535	**Logged by:** DAK	**LOG OF TRENCH** T-7
Project Number: 041138-01	**Elevation:** 1277'	**Engineering Properties**
Equipment: CASE 580L	**Location/Grid:** See Geotechnical Map	

Geologic Attitudes	Date: 05/25/05 / Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Pauba Formation:	Qp				
	A: @ 0-2' Coarse Sand and Silt with minor Gravel: red brown, dry, very dense to dense; weakly indurated		SW/SM			
	B: @ 2' Coarse Sand and Silt with an increase in clay: red brown, dry, very dense to dense; weakly indurated			1		
	@ 4' Sand with minor Clay and Silt: yellow brown, moist, dense		SC			
	@ 8' coarse Sand with minor Silt: light brown, slightly moist, dense		SM			
	@ 9'-10' coarse to medium Sand with minor Silt: brown, moist, very dense to slightly hard; indurated					

GRAPHICAL REPRESENTATION: **SCALE:** 1" = 5' **SURFACE SLOPE:** **TREND:** NS



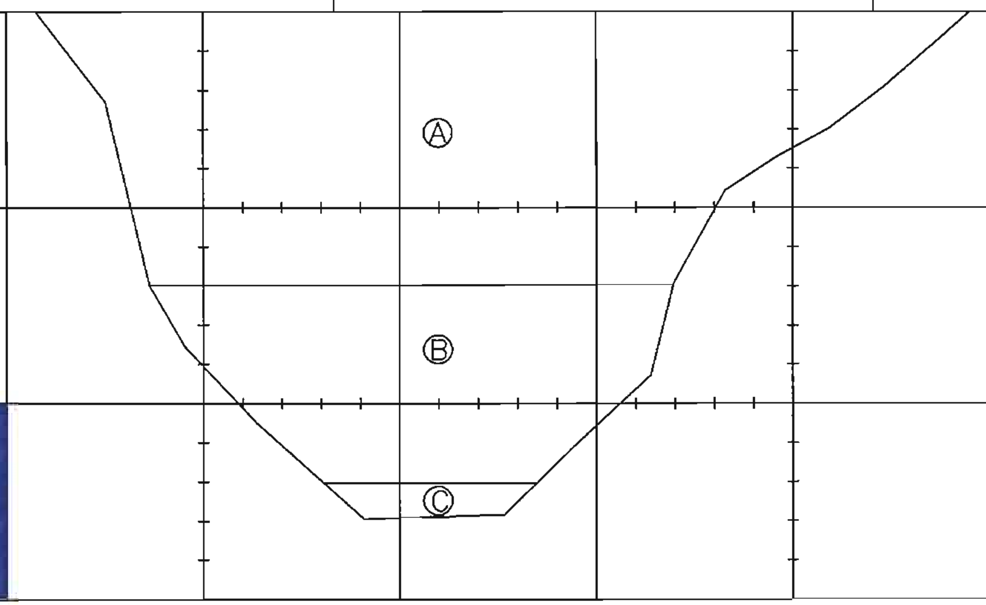
LGC

Total Depth: 10'
No Groundwater Encountered
Backfilled: 05/25/05

Project Name: T.T. 32535	Logged by: DAK	LOG OF TRENCH T-8
Project Number: 041138-01	Elevation: 1273'	Engineering Properties
Equipment: CASE 580L	Location/Grid: See Geotechnical Map	

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Alluvium:	Qal				
	A: @ 0-2' Sand with Silt and Clay: brown, slightly moist, very dense; minor gravel, roots		SM/SC			
	@ 2'-3' Sand with Silt and Clay: brown, slightly moist, very dense; roots decrease with depth					
	@ 3' Sand with Silt and Clay: Grayish brown, slightly moist, very dense; less gravel than above					
	Quaternary Pauba Formation:	Qp				
	B: @ 7' Coarse Sand with minor Silt: yellow light brown to reddish light brown, slightly moist, dense		SM			
	@ 8' Coarse Sand with rounded 9"-12" cobbles: red brown, moist, dense		SP			
	C: @ 12' Silt: Gray, slightly moist, stiff		ML			

GRAPHICAL REPRESENTATION:	SCALE: 1" = 5'	SURFACE SLOPE:	TREND: NS

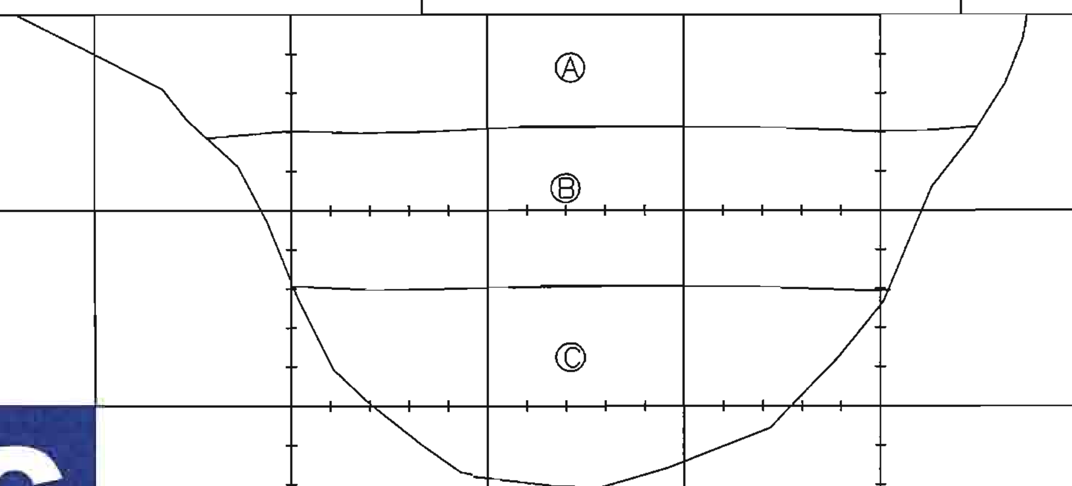


Total Depth: 13'
No Groundwater Encountered
Backfilled: 05/25/05

Project Name: T.T. 32535	Logged by: DAK	LOG OF TRENCH T-9
Project Number: 041138-01	Elevation: 1278'	Engineering Properties
Equipment: CASE 580L	Location/Grid: See Geotechnical Map	

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Pauba Formation:	Qp				
	A: @ 0-1' Silty Sand to Sandy Silt: reddish brown, dry to slightly moist, medium dense		SM			
	@ 1-3' Clayey Sand with lenses of Gravel: brown, slightly moist, dense		SC			
	B: @ 3' Clayey Sand with lenses of Sand and Gravel: brown, slightly moist, dense					
	@ 4' Clayey Sand: red brown, moist, dense					
	C: @ 7'-12' Sandy Clay: brown, moist, stiff		CL			

GRAPHICAL REPRESENTATION: **SCALE:** 1" = 5' **SURFACE SLOPE:** **TREND:** EW



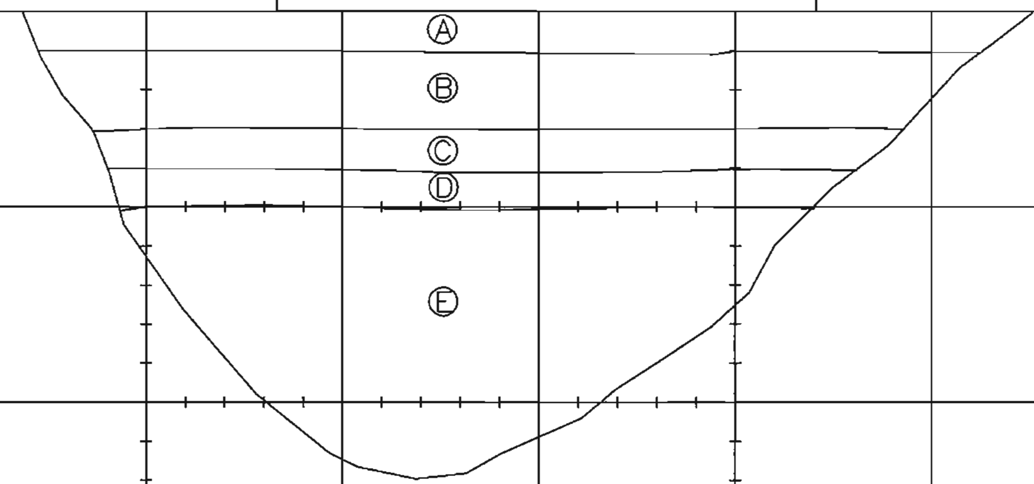
LGC

Total Depth: 12'
No Groundwater Encountered
Backfilled: 05/25/05

Project Name: T.T. 32535	**Logged by:** DAK	**LOG OF TRENCH** T-10
Project Number: 041138-01	**Elevation:** 1280'	**Engineering Properties**
Equipment: CASE 580L	**Location/Grid:** See Geotechnical Map	

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Pauba Formation:	Qp				
	A: @ 0-1' Silty Sand: brown, slightly moist to dry, medium dense		SM			
	B: @ 1'-3'Silty Sand: brown, slightly moist to dry, dense					
	C: @ 3'-4' Clayey Sand with Silt: red brown, slightly moist, dense		SC			
	D: @ 4' Fine Sand with Silt: brown, slightly moist, dense		SM			
	E: @ 5' Coarse Sand with Silt: brown, slightly moist, dense					
	@ 7' Sand with Silt: brown, slightly moist, dense					

GRAPHICAL REPRESENTATION: **SCALE:** 1" = 5' **SURFACE SLOPE:** **TREND:** EW



LGC

Total Depth: 12'
No Groundwater Encountered
Backfilled: 05/25/05

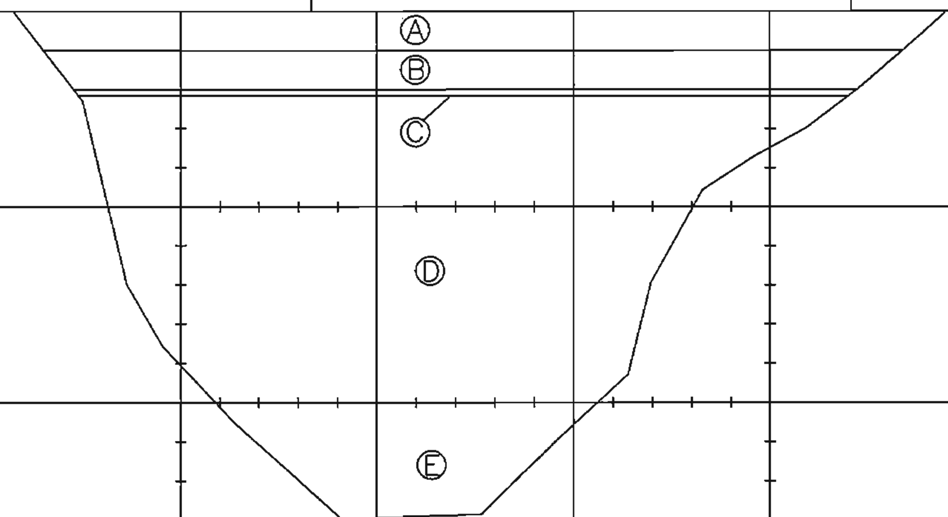
Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-11

Project Number: 041138-01 | **Elevation:** 1275' | **Engineering Properties**

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Alluvium:	Qal				
	A: @ 0-1' Clayey Fine Sand: brown, moist, slightly loose		SC			
	B: @ 1'-2' Clayey Fine Sand with cobbles: brown, moist, medium dense					
	C: @ 3' Loamy paleosoil: brown, slightly moist, loose					
	Quaternary Pauba Formation:	Qp				
	D: @ 3.5' Clayey Sand: brown, slightly moist, dense		SC			
	@ 6' Clayey Sand: brown, moist, dense			1		
	F: @ 10' coarse Sand: light brown, moist, dense		SP			

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** | **TREND:** NS



LGC

Total Depth: 13'
No Groundwater Encountered
Backfilled: 05/25/05

Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-12

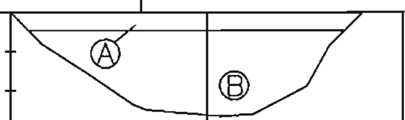
Project Number: 041138-01 | **Elevation:** 1291'

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Engineering Properties

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Topsoil/Colluvium: A: @ 0-0.5' Very Fine Sandy Silt: light brown/White, dry, loose		ML			
@ 0.5'-2.5' joints: 70E 36S	Quaternary Pauba Formation: B: @ 0.5'-2.5' Sandstone: white, hard; roots in joints	Qp	SC			

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** | **TREND:** NS



Total Depth: 2.5'
No Groundwater Encountered
Backfilled: 05/25/05

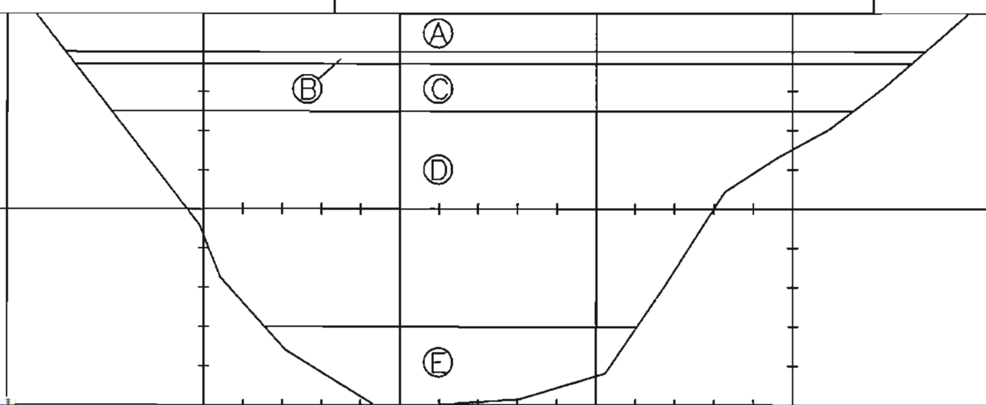
Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-13

Project Number: 041138-01 | **Elevation:** 1250' | **Engineering Properties**

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Topsoil/Colluvium:					
	A: @ 0-1' Sand with Silt: brown, moist, loose		SM			
	B: @ 1'-1.25' Sandy Clay: brown, moist, stiff		CL			
	Quaternary Pauba Formation:	Qp				
	C: @ 1.25'-2.5' Sand with minor Silt: light brown, moist, medium dense		SM			
	D: @ 2.5'-4' Clayey Sand: brown, moist, medium stiff		SC			
	@ 4' Clayey Sand: brown, moist, stiff					
	E: @ 8'-10' Coarse Sand: Gray, slightly moist, very dense; indurated		SP			

GRAPHICAL REPRESENTATION: **SCALE:** 1" = 5' **SURFACE SLOPE:** **TREND:** NS



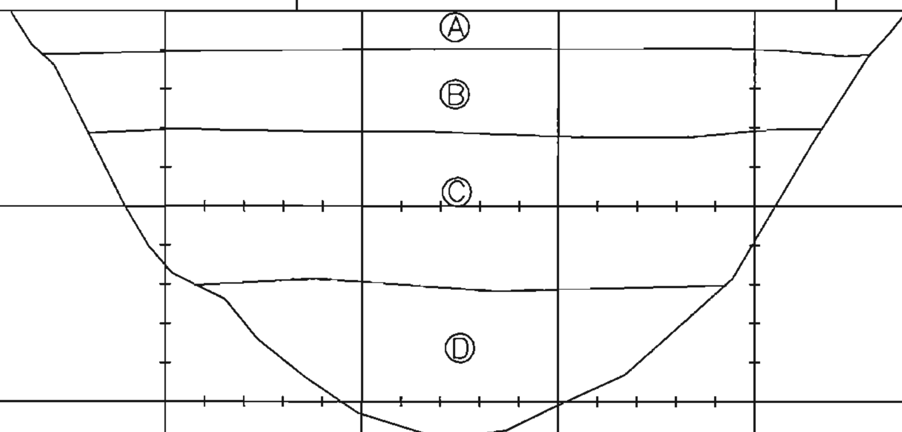
Total Depth: 10'
No Groundwater Encountered
Backfilled: 05/25/05

LGC

Project Name: T.T. 32535	Logged by: DAK	LOG OF TRENCH T-14
Project Number: 041138-01	Elevation: 1262'	Engineering Properties
Equipment: CASE 580L	Location/Grid: See Geotechnical Map	

Geologic Attitudes	Date: 05/5/04 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Topsoil/Colluvium:					
	A: @ 0-1' Sand with Silt: brown to red brown, moist, loose		SM			
	Quaternary Pauba Formation:	Qp				
	B: @ 1'-2' Sandy Clay: brown, moist, stiff		CL			
	@ 2'-3' Clayey Sand: brown, moist, medium stiff		SC			
	C: @ 3' Clayey Sand: brown, moist, stiff					
	D: @ 7'-10' coarse Sand: Gray, slightly moist, very dense; indurated		SP			

GRAPHICAL REPRESENTATION:	SCALE: 1" = 5'	SURFACE SLOPE:	TREND: NS



LGC

Total Depth: 11'
No Groundwater Encountered
Backfilled: 05/25/05

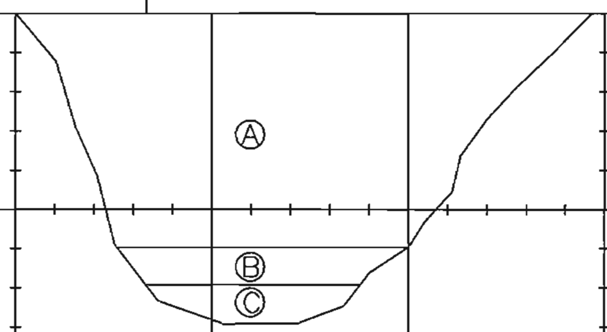
Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-15

Project Number: 041138-01 | **Elevation:** 1245'

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Geologic Attitudes	Date: 05/5/04 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Topsoil/Colluvium: A: @ 0-6' Clayey Sand: brown, slightly moist, very dense; slightly indurated, roots		SC	1		
	Quaternary Pauba Formation: B: @ 6' Clay with minor Sand: brown and White, slightly moist, very stiff; indurated, calcium carbonate nodules throughout		CL	2		
	C: @ 7' Sandstone: white, dry, hard		SP			

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** | **TREND:** NS



Total Depth: 8'
No Groundwater Encountered
Backfilled: 05/25/05

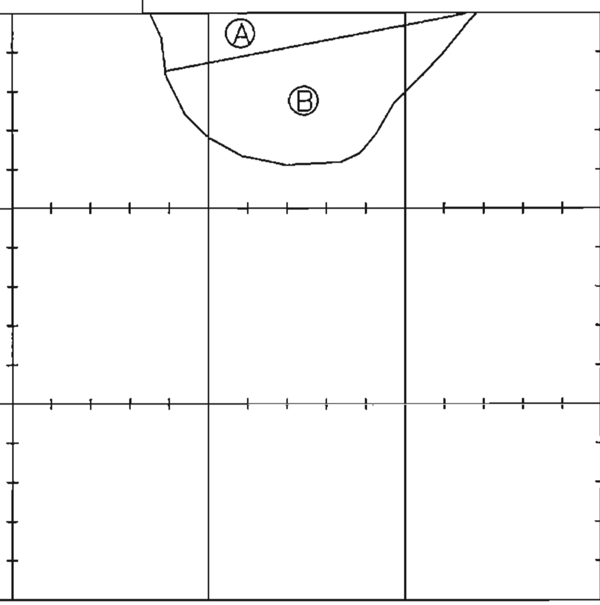
Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-16

Project Number: 041138-01 | **Elevation:** 1263' | **Engineering Properties**

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Artificial Fill - Undocumented A: @ 0-1.5' Clay, Silty Sand, and Sand: brown, Gray, red brown, dry to slighlty moist, med dense/medium stiff	Afu	CL/SM			
	Quaternary Pauba Formation: B: @ 1.5'-4' Sand: Gray, slightly moist, very dense; semi-well indurated	Qp	SP			

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** | **TREND:** EW



Total Depth: 4'
No Groundwater Encountered
Backfilled: 05/25/05

LGC

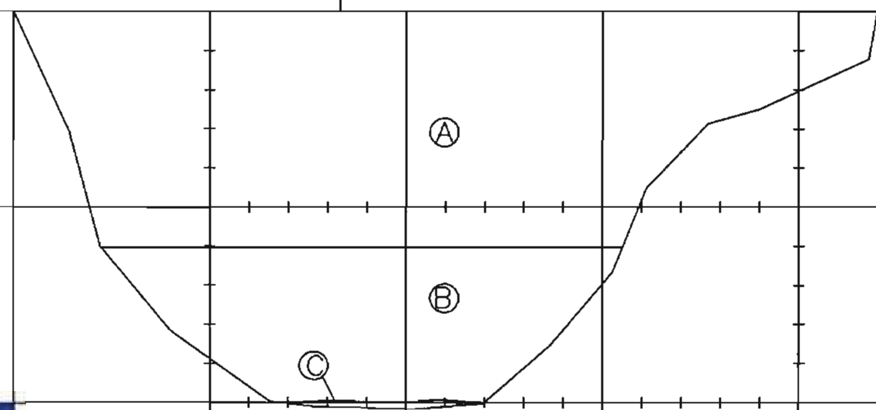
Project Name: T.T. 32535 | **Logged by:** DAK | **LOG OF TRENCH** T-17

Project Number: 041138-01 | **Elevation:** 1257' | **Engineering Properties**

Equipment: CASE 580L | **Location/Grid:** See Geotechnical Map

Geologic Attitudes	Date: 05/25/05 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
	Quaternary Pauba Formation: A @ 0-1' Clayey Sand: brown, Dry, medium dense	Qp	SC			
	@ 1'-2' Clayey Sand: brown and White, slightly moist, dense					
	@ 2' Sand with Clay: yellow brown, slightly moist, dense					
	B: @ 6' Sand: Very light Gray, moist, dense		SP			
	C: @ 10' Sandstone: Gray, slightly moist, hard; white mineral infill in fractures					

GRAPHICAL REPRESENTATION: | **SCALE:** 1" = 5' | **SURFACE SLOPE:** 10°S | **TREND:** EW



Total Depth: 10'
No Groundwater Encountered
Backfilled: 05/25/05

Appendix C
Laboratory Test Results

APPENDIX C

Laboratory Testing Procedures and Test Results

The laboratory test program was formulated towards providing quantitative data relating to the relevant engineering properties of the anticipated site soil conditions. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Expansion Index: The expansion potential of selected samples were evaluated by the Expansion Index Test, CBC Standard No. 18-2 and/or ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation. The prepared 1-inch-thick by 4-inch-diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results are presented in this appendix.

Maximum Dry Density and Optimum Moisture (Laboratory Compaction): The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results of these tests are presented in the table below:

Sample Location	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
T-1	Brown Slightly Silty Clayey Sand	121.0	12.0
T-5	Gray Slightly Clayey Silty Sand	120.0	12.0
T-15	Brown Clayey Silty Sand	125.0	10.0

Soluble Sulfates: The soluble sulfate contents of selected samples were determined by standard geochemical methods (CTM 417). The soluble sulfate content is used to determine the appropriate cement type and maximum water-cement ratios. The test results are presented in this appendix.

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The results are presented in this appendix.

Chloride Content: Chloride content was tested in accordance with California Test Method (CTM) 422. The results are presented in this appendix.

Location	Sample No.	Depth (ft)	Molding Moisture Content (%)	Initial Dry Density (pcf)	Final Moisture Content (%)	Expansion Index	Expansion Classification[1]
T-1	B-1	2-4	10.5	106.0	22.6	58	Medium
T-3	B-1	1	12.7	101.8	21.3	41	Low
T-15	B-2	6.5	16.3	90.1	32.5	140	Very High

[1] 1997 U.B.C. / 2001 C.B.C. Table 18-I-B

LGC

EXPANSION INDEX
(ASTM D 4829)

Project Number: 041138-01
Date: Jun-05

Tentative Tract 32535 / Riverside Co.

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: Wildonar #9

Project No. : 041138-01

Boring No.: T-1

Sample No. : B-1

Soil Identification: SC

Tested By : GB Date: 06/01/05

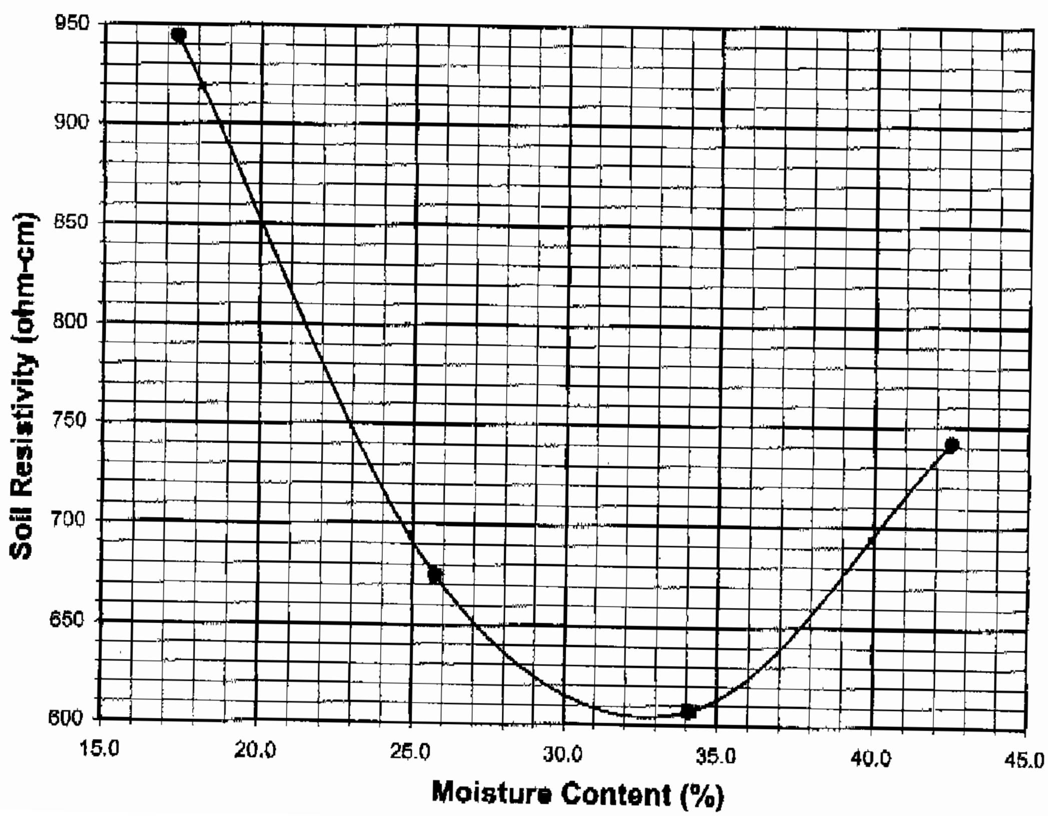
Data Input By: LF Date: 06/07/05

Depth (ft.) : 2-4

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	17.34	140	944
2	200	25.72	100	675
3	300	34.10	90	607
4	400	42.48	110	742
5				

Moisture Content (%) (MCi)	8.96
Wet Wt. of Soil + Cont. (g)	237.13
Dry Wt. of Soil + Cont. (g)	223.14
Wt. of Container (g)	66.95
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
605	**33.0**	**136**	**242**	**7.52**	**21.6**



Leighton

SOIL RESISTIVITY TEST
DOT CA TEST 532 / 643

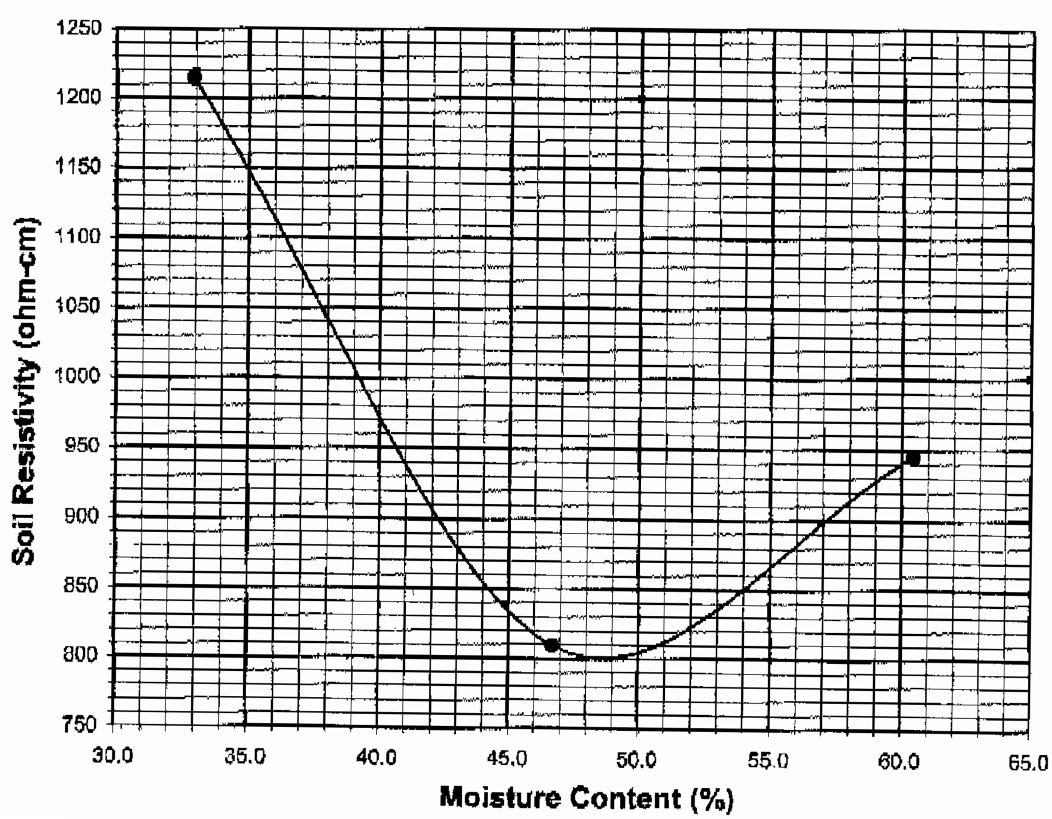
Project Name: Wildonar #9
Project No. : 041138-01
Boring No.: T-15
Sample No. : B-2
Soil Identification: SC

Tested By : GB Date: 06/01/05
Data Input By: LF Date: 06/07/05
Depth (ft.) : 6.5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	150	32.92	180	1214
2	300	46.67	120	810
3	450	60.42	140	944
4				
5				

Moisture Content (%) (MCi)	19.17
Wet Wt. of Soil + Cont. (g)	221.12
Dry Wt. of Soil + Cont. (g)	196.87
Wt. of Container (g)	70.35
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
800	**48.5**	**102**	**87**	**8.22**	**21.7**



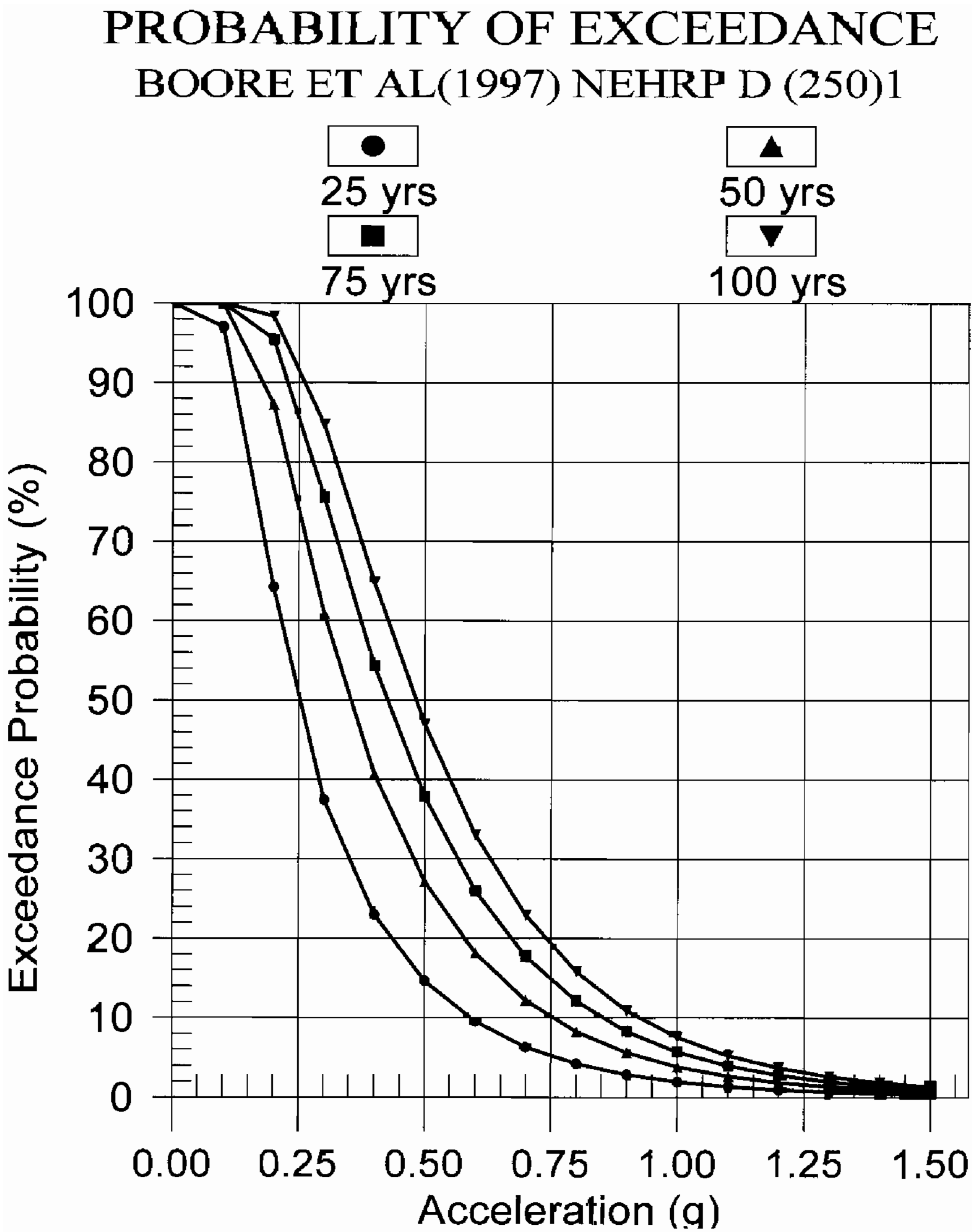
Appendix D
Seismic Analyses

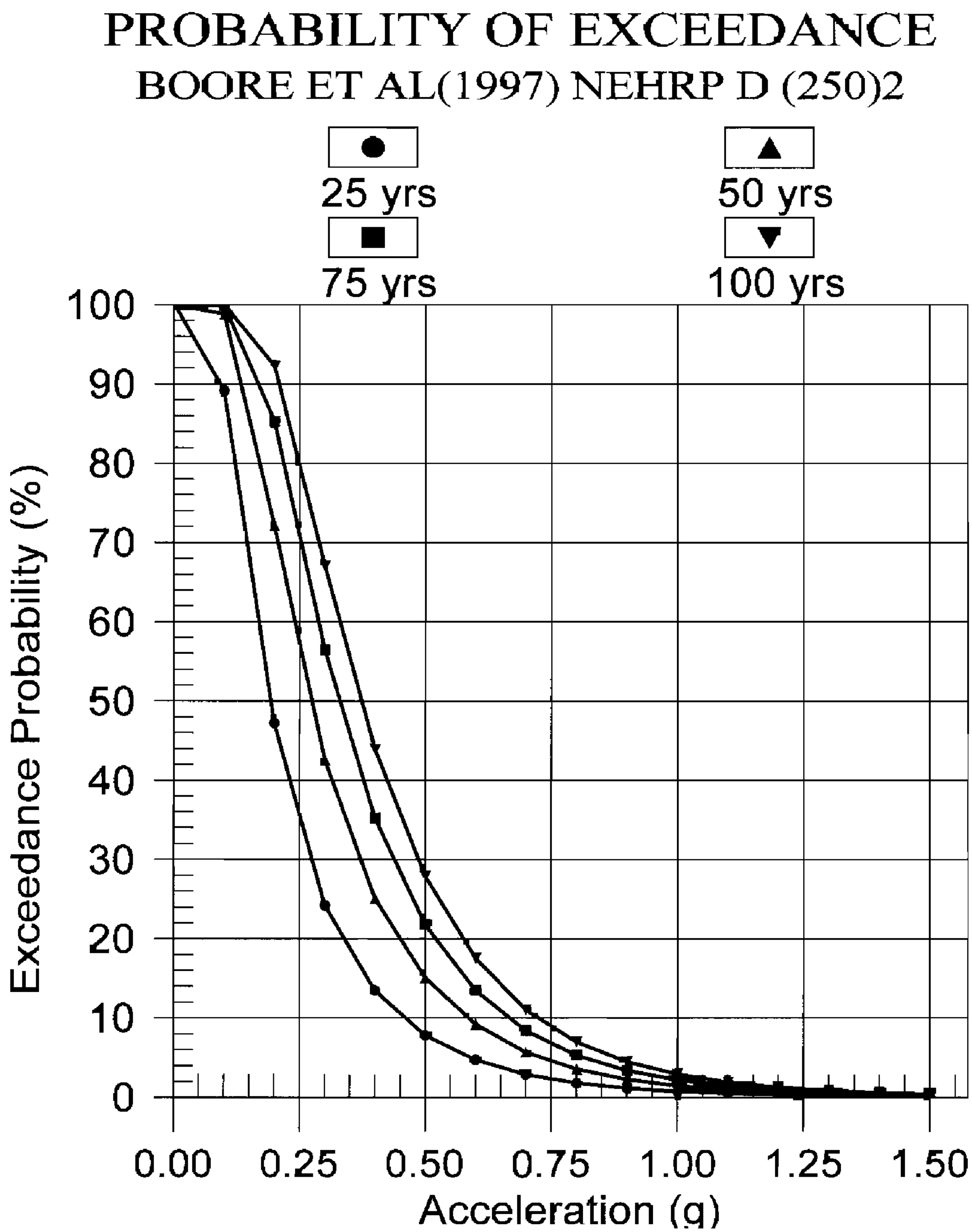
Site coordinates of latitude 33.5928 degrees north and longitude 117.2532 degrees west, which are representative of the site, were utilized for the following FRISKSP analysis.

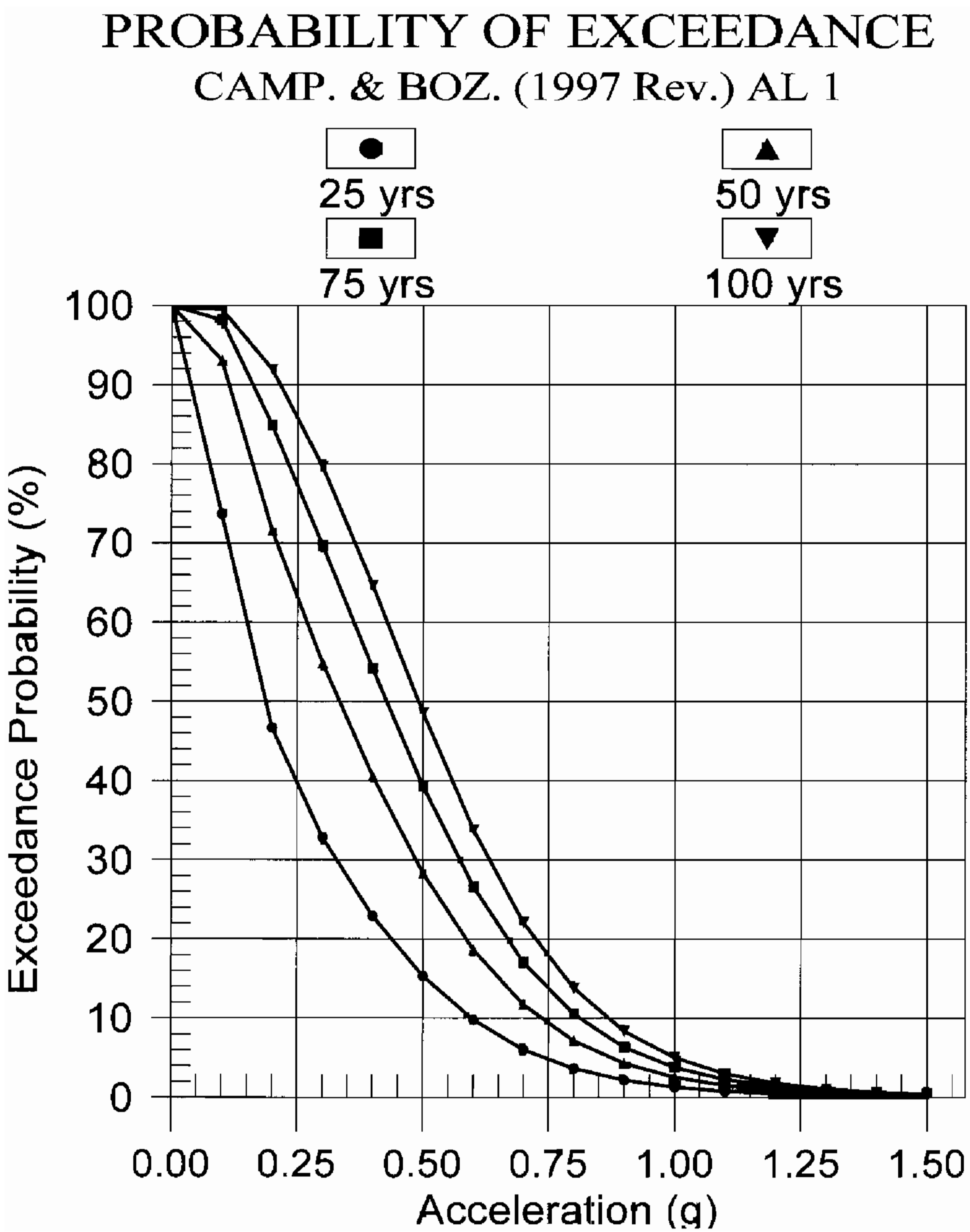
Attenuation	PGA_{DBE}	PGA_{DBE} (MWF Mag 7.5)	PGA_{UBE}
Boore et al. (1997) NEHRP D	0.75g	0.58g	0.92g
Campbell & Bozorgnia (1997rev) AL	0.73g	0.56g	0.86g
Sadigh et al. (1997) Deep Soil	0.78g	0.60g	0.95g
AVERAGE	**0.75g**	**0.58g**	**0.91g**

Notes:

- The 10% probability of exceedance during a 50-year exposure period (475-year return) corresponds to the UBC/CBC Design Basis Earthquake peak ground acceleration (PGA_{DBE}).
- The 10% probability of exceedance during a 100-year exposure period (949-year return) corresponds to the UBC/CBC Upper Bound Earthquake peak ground acceleration (PGA_{UBE}).


PROBABILITY OF EXCEEDANCE
BOORE ET AL(1997) NEHRP D (250)1
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)


PROBABILITY OF EXCEEDANCE
BOORE ET AL(1997) NEHRP D (250)2
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)


PROBABILITY OF EXCEEDANCE
CAMP. & BOZ. (1997 Rev.) AL 1
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

Appendix E
General Earthwork and Grading Specifications for Rough Grading

LAWSON & ASSOCIATES GEOTECHNICAL CONSULTING, INC.

General Earthwork and Grading Specifications For Rough Grading

1.0 *General*

1.1 ***Intent:*** These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 ***The Geotechnical Consultant of Record:*** Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 ***The Earthwork Contractor:*** The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "equipment" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. . The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 ***Preparation of Areas to be Filled***

2.1 ***Clearing and Grubbing:*** Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 10 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 ***Processing:*** Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 ***Overexcavation:*** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 ***Benching:*** Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 ***Evaluation/Acceptance of Fill Areas:*** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 ***General:*** Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 ***Oversize:*** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant (see Oversize Rock Disposal Figure). Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill.

3.3 ***Import:*** If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 ***Fill Placement and Compaction***

4.1 ***Fill Layers:*** Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 ***Fill Moisture Conditioning:*** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 ***Compaction of Fill:*** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 ***Compaction of Fill Slopes:*** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 ***Compaction Testing:*** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

A representative of the Geotechnical Consultant should be onsite continuously to observe rock fill placement. Evaluation of rock fills should be based on observation of the placement operations, nuclear gauge testing in areas of sufficient fines, and observation of frequent test pits.

4.6 ***Frequency of Compaction Testing:*** Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 ***Compaction Test Locations:*** The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 ***Subdrain Installation***

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 ***Excavation***

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 ***Trench Backfills***

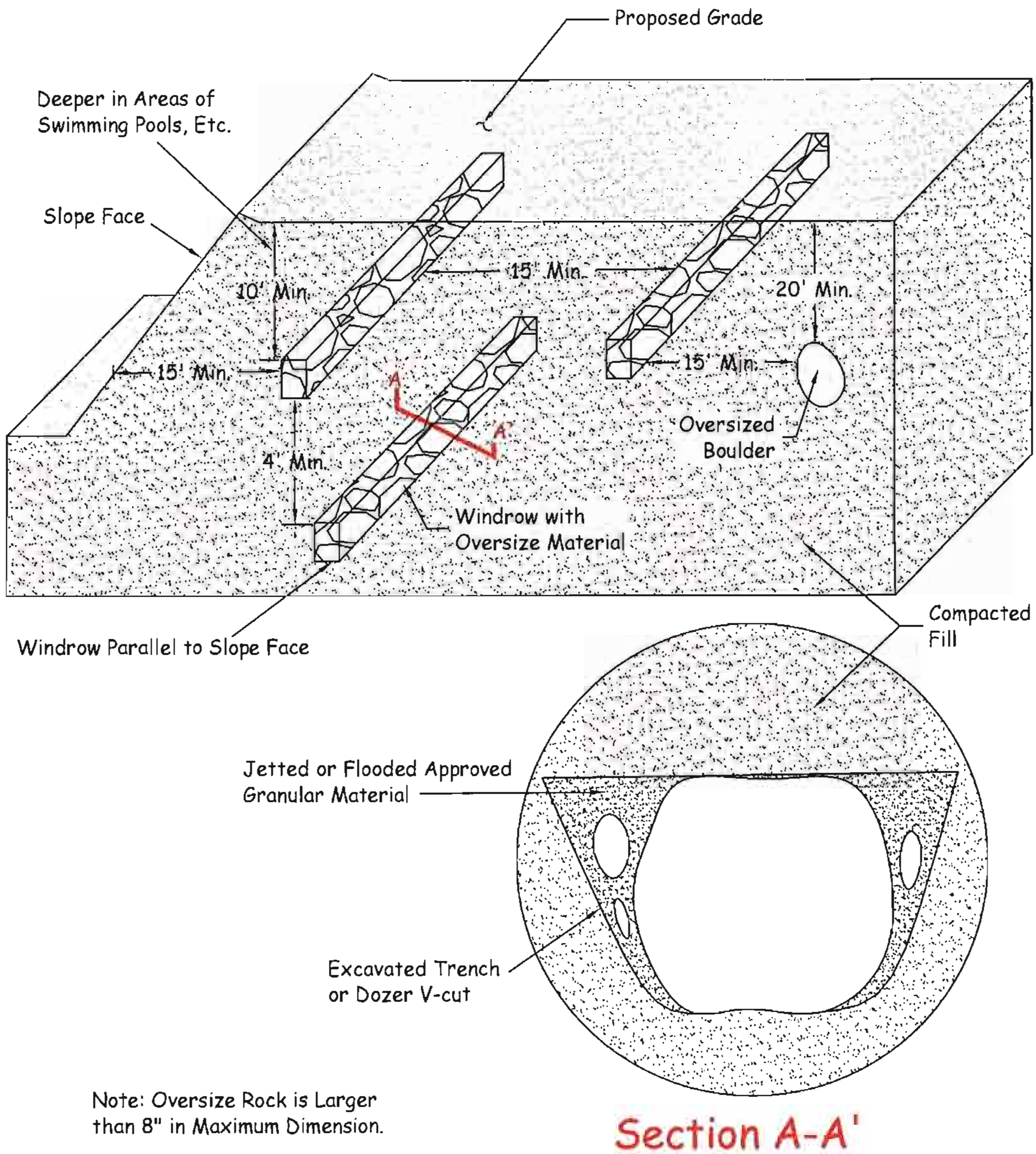
7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.



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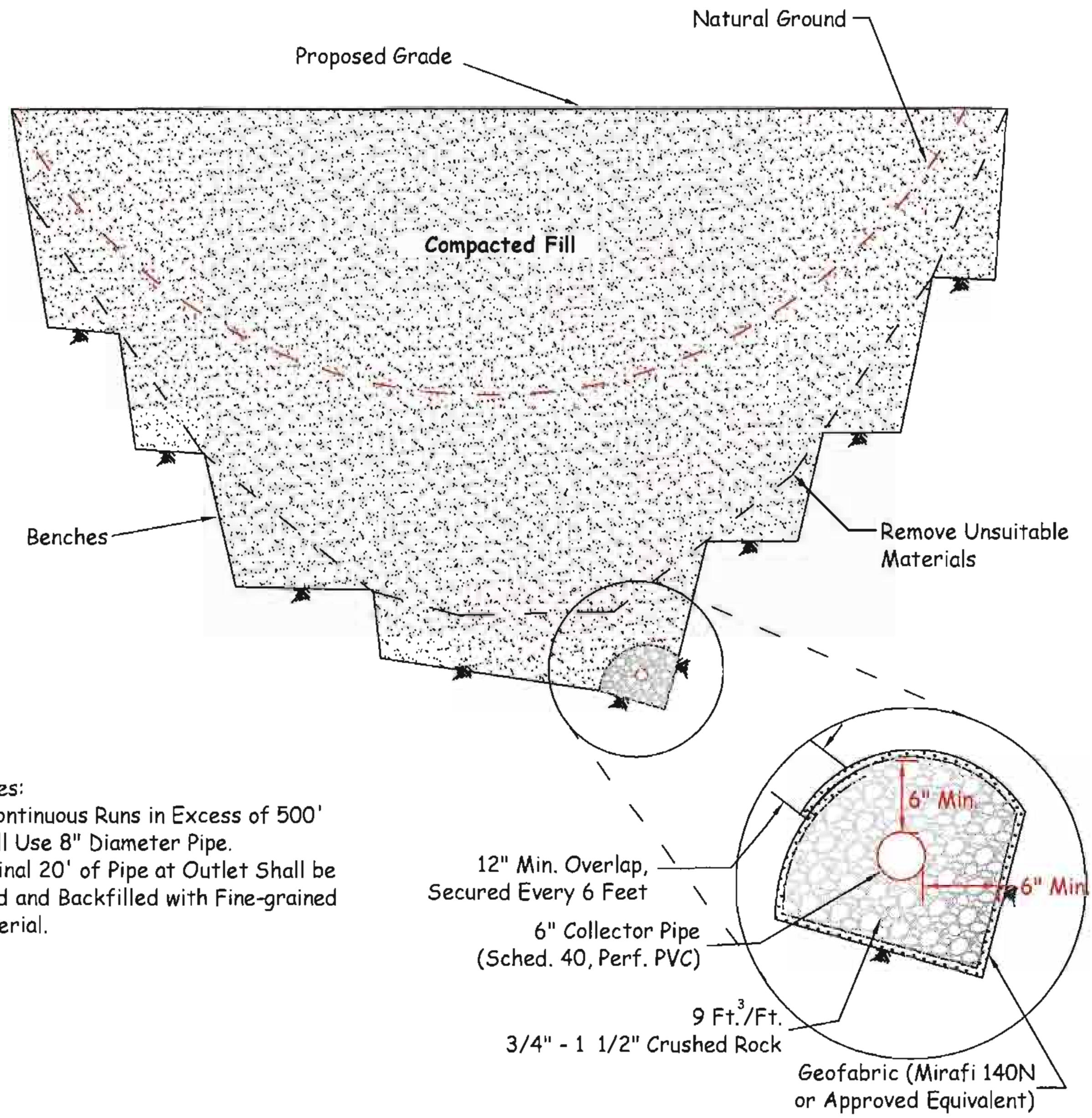
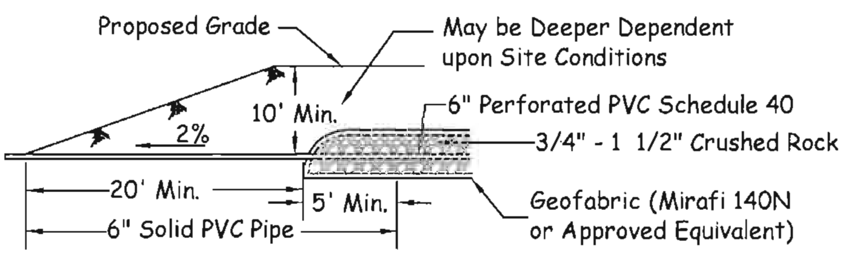
OVERSIZE ROCK DISPOSAL DETAIL

11/26/02



Notes:
1) Continuous Runs in Excess of 500' Shall Use 8" Diameter Pipe.
2) Final 20' of Pipe at Outlet Shall be Solid and Backfilled with Fine-grained Material.

Proposed Outlet Detail



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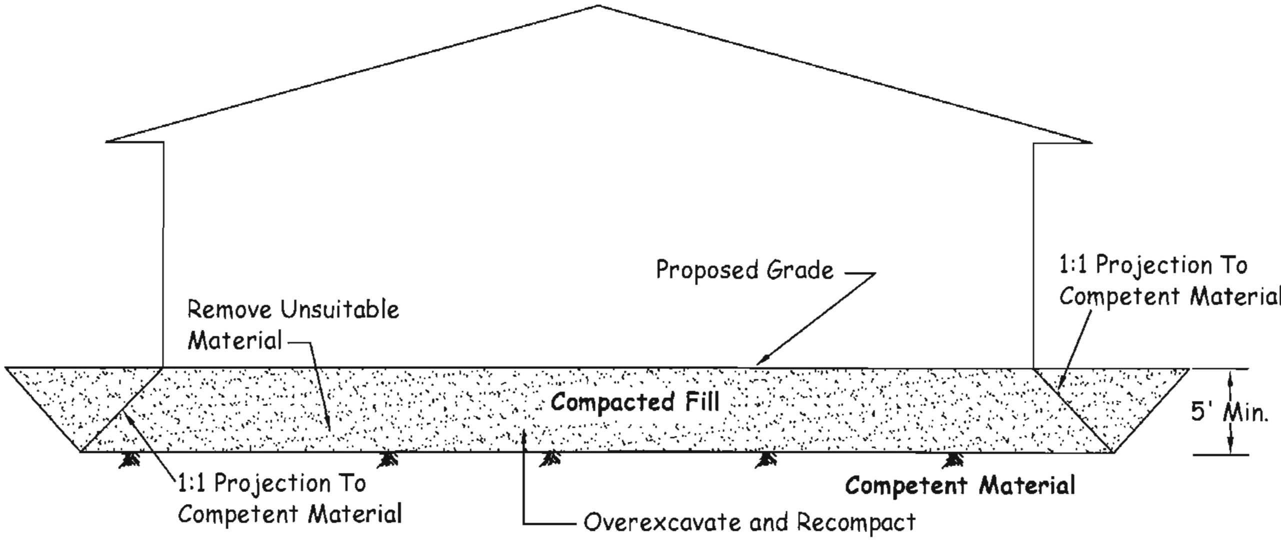
CANYON SUBDRAINS

11/26/02

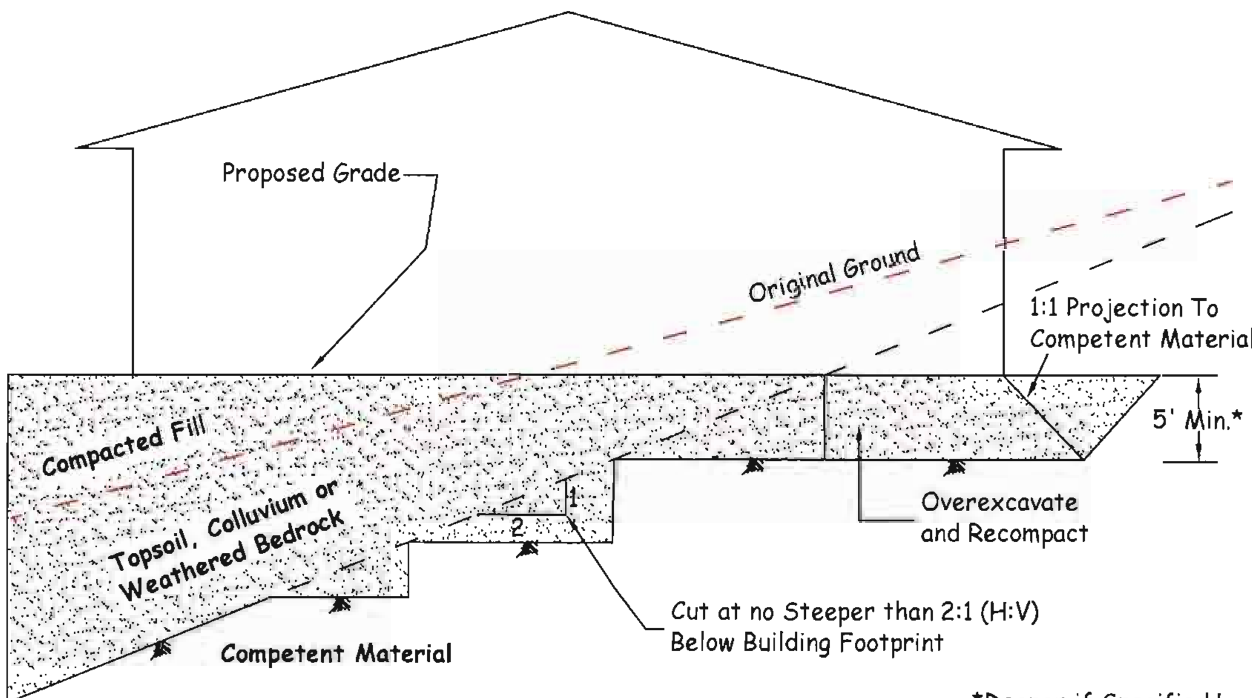
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

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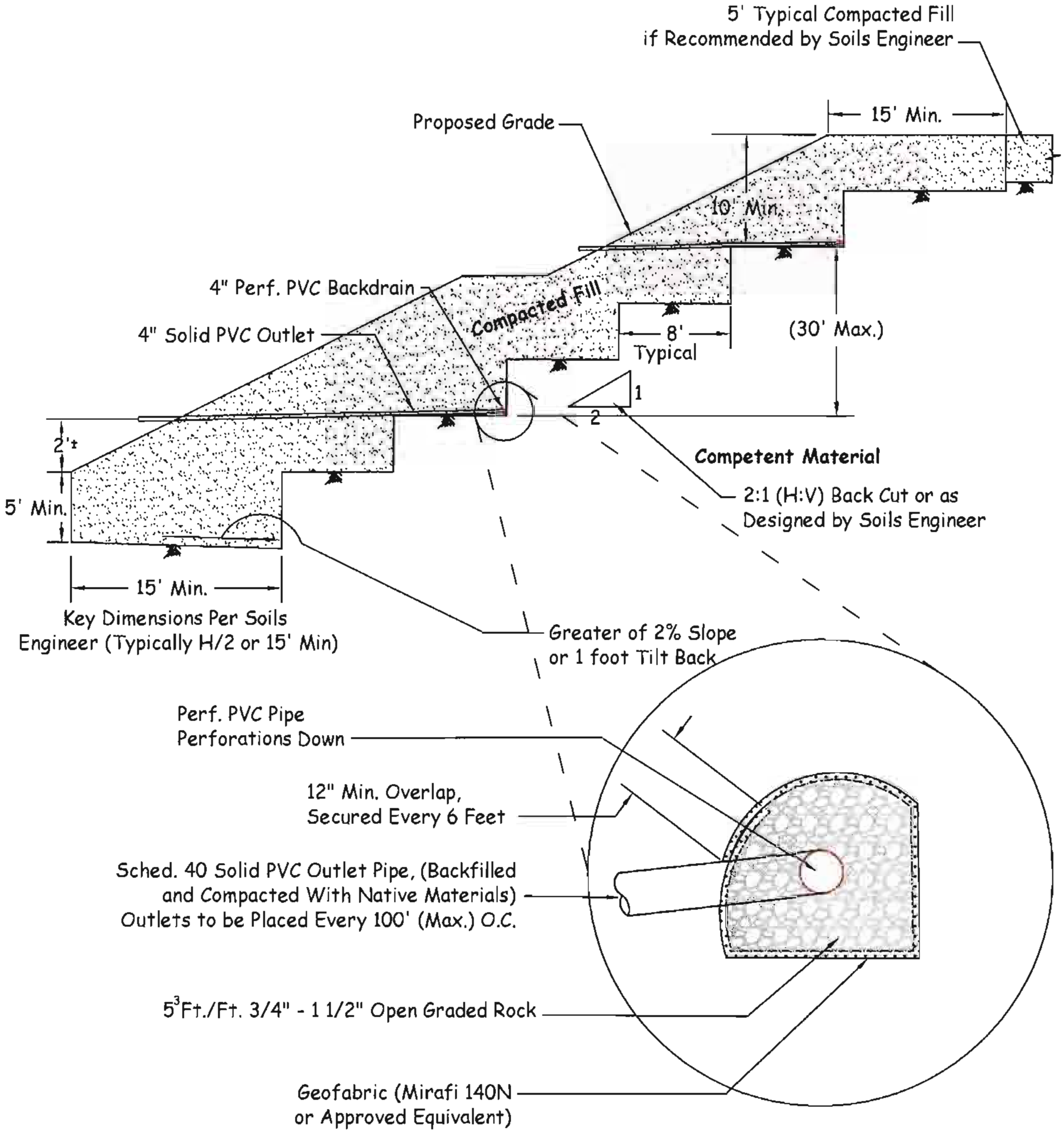
CUT AND TRANSITION LOT OVEREXCAVATION DETAIL

11/26/02



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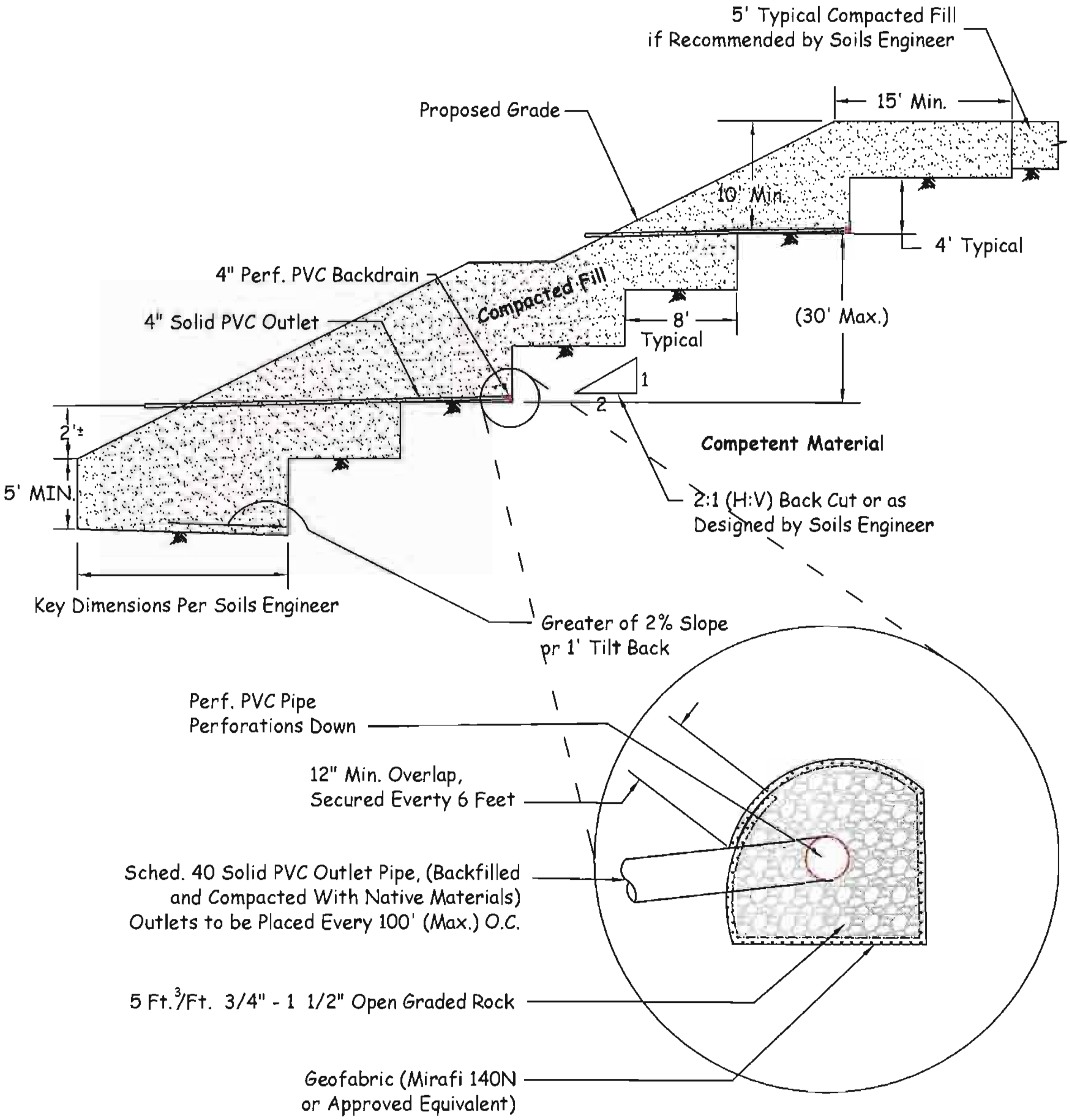
TYPICAL STABILIZATION FILL DETAIL

11/26/02



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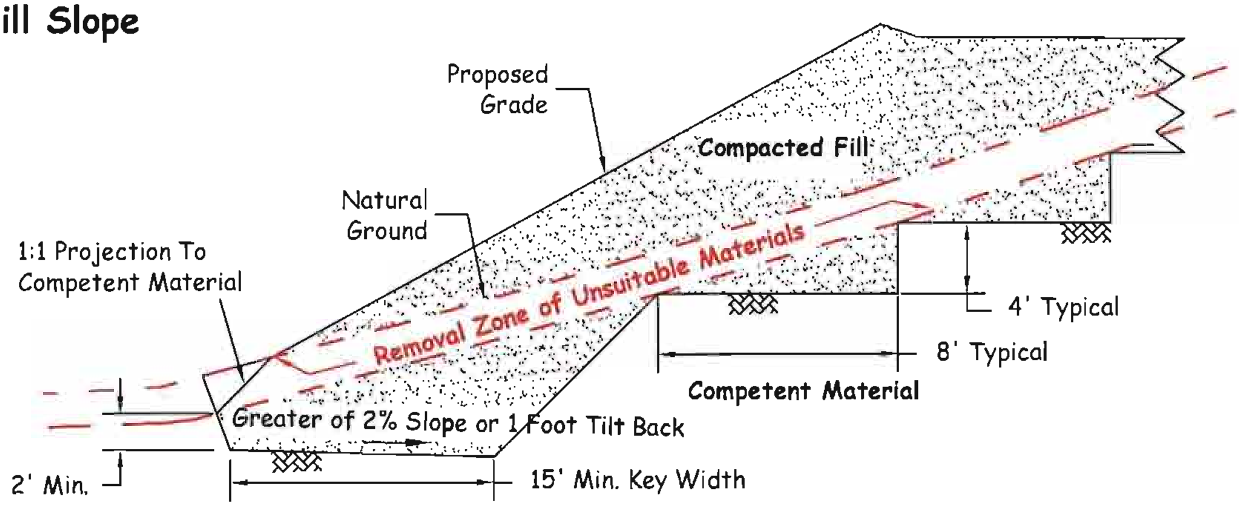
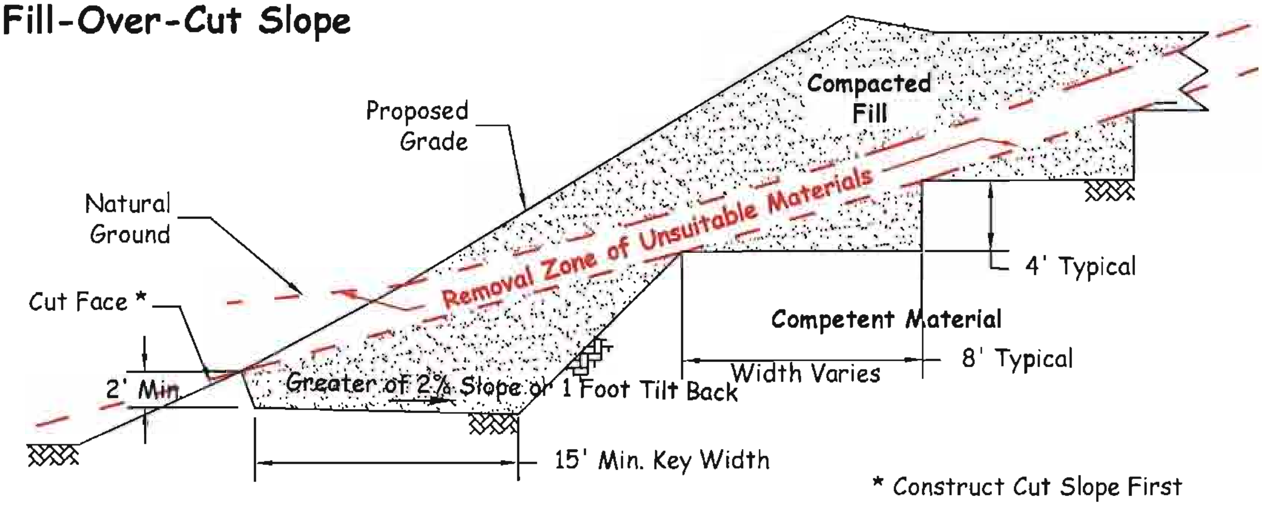
TYPICAL BUTTRESS DETAIL

11/26/02

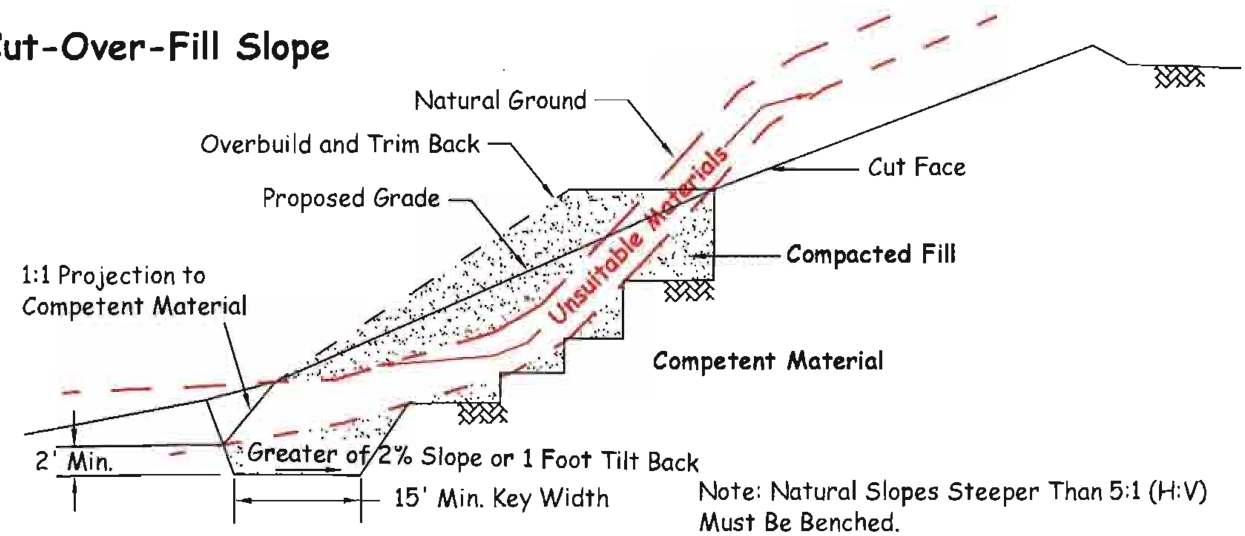
Fill Slope



Fill-Over-Cut Slope



Cut-Over-Fill Slope



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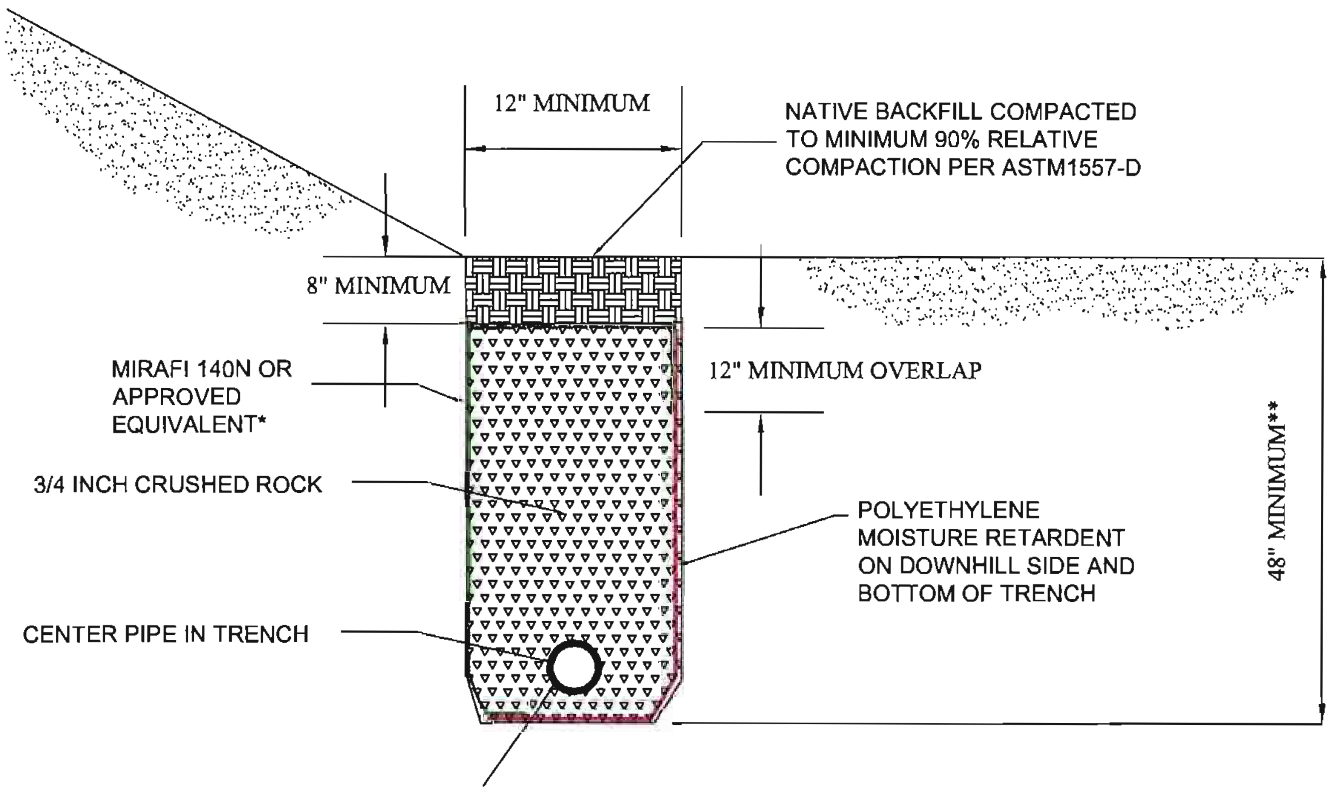
KEYING AND BENCHING

11/26/02



CONTINUOUS 4 INCH DIAMETER SCHEDULE 40 PERFORATED PVC PIPE FOR LENGTH OF TRENCH, WITH PERFORATIONS ORIENTED DOWN, NON-PERFORATED PVC PIPE BETWEEN END OF FRENCH DRAIN AND SUITABLE OUTLET. MIN 1% FALL THROUGHOUT. CONCRETE CUTOFF WALL TO BE CONSTRUCTED AT TRANSITIONS TO NON-PERFORATED PIPE. CLEANOUTS ARE RECOMMENDED AT EACH PROPERTY LINE.

SPECIFICATION FOR CLATRANS CLASS 2 PERMIABLE MATERIAL

U.S. STANDARD SIEVE SIZE	% PASSING
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SAND EQUIVALENT > 75

* IF CLASS 2 PERMEABLE MATERIAL (SEE GRADATION TO LEFT) IS USED IN PLACE OF 3/4" - 1-1/2" CRUSHED ROCK, FILTER MAY BE DELETED. CLASS 2 PERMEABLE MATERIAL SHOULD BE COMPACTED TO 90 PERCENT RELATIVE COMPACTION BASED ON ASTM D1557

** OR AS DEEP AS POSSIBLE WHILE STILL ALLOWING OUTLET TO STORM DRAIN SYSTEM

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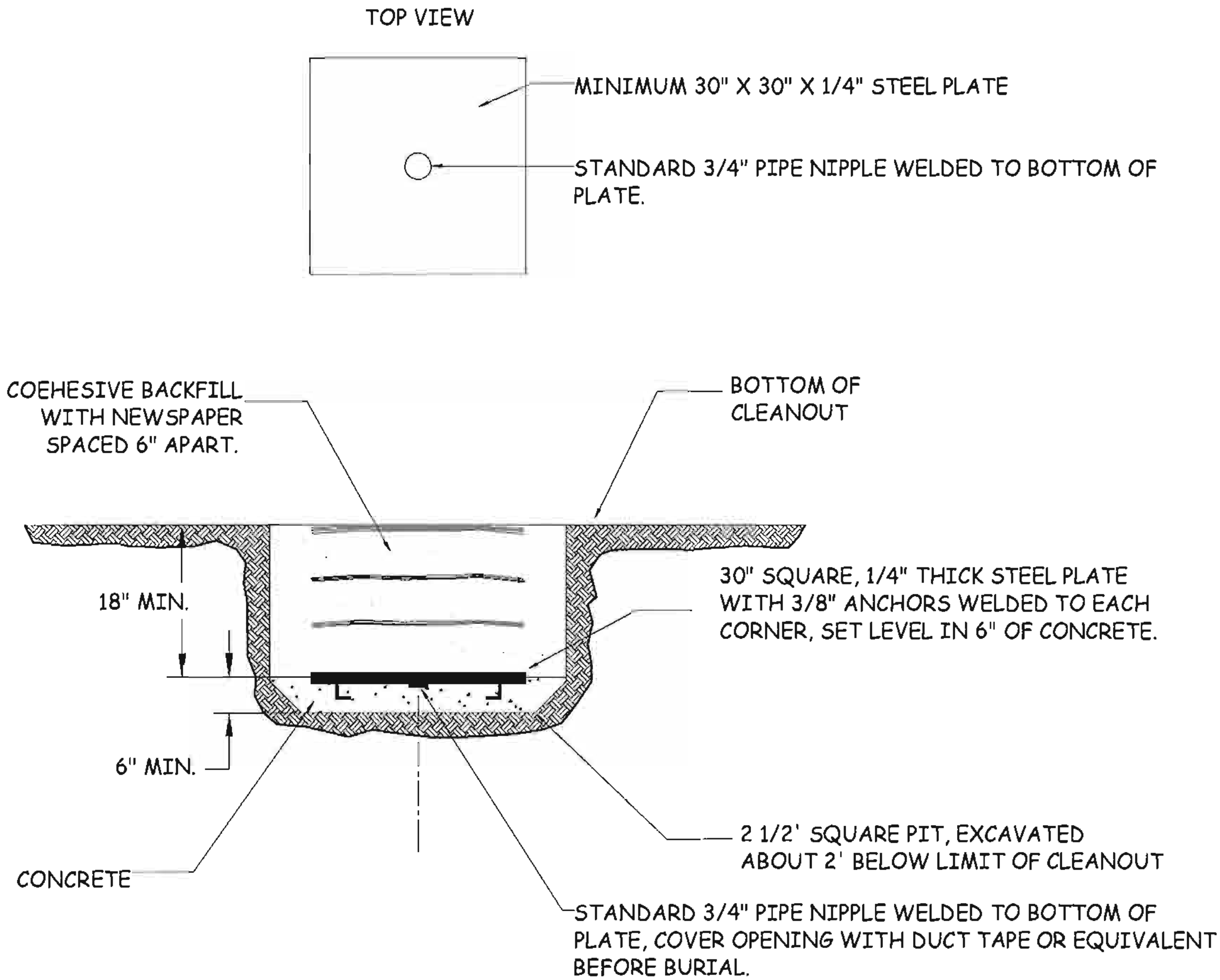
Typical Toe-Of-Slope Subdrain Detail



1. SURVEY FOR HORIZONTAL AND VERTICAL LOCATION TO NEAREST .01 INCH PRIOR TO BACKFILL USING KNOW LOCATIONS THAT WILL REMAIN INTACT DURING THE DURATION OF THE MONITORING PROGRAM. KNOW POINTS EXPLICITELY NOT ALLOWED ARE THOSE LOCATED ON FILL OR THAT WILL BE DESTROYED DURING GRADING.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE DURING GRADING, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. DRILL TO RECOVER AND ATTACH RISER PIPE.

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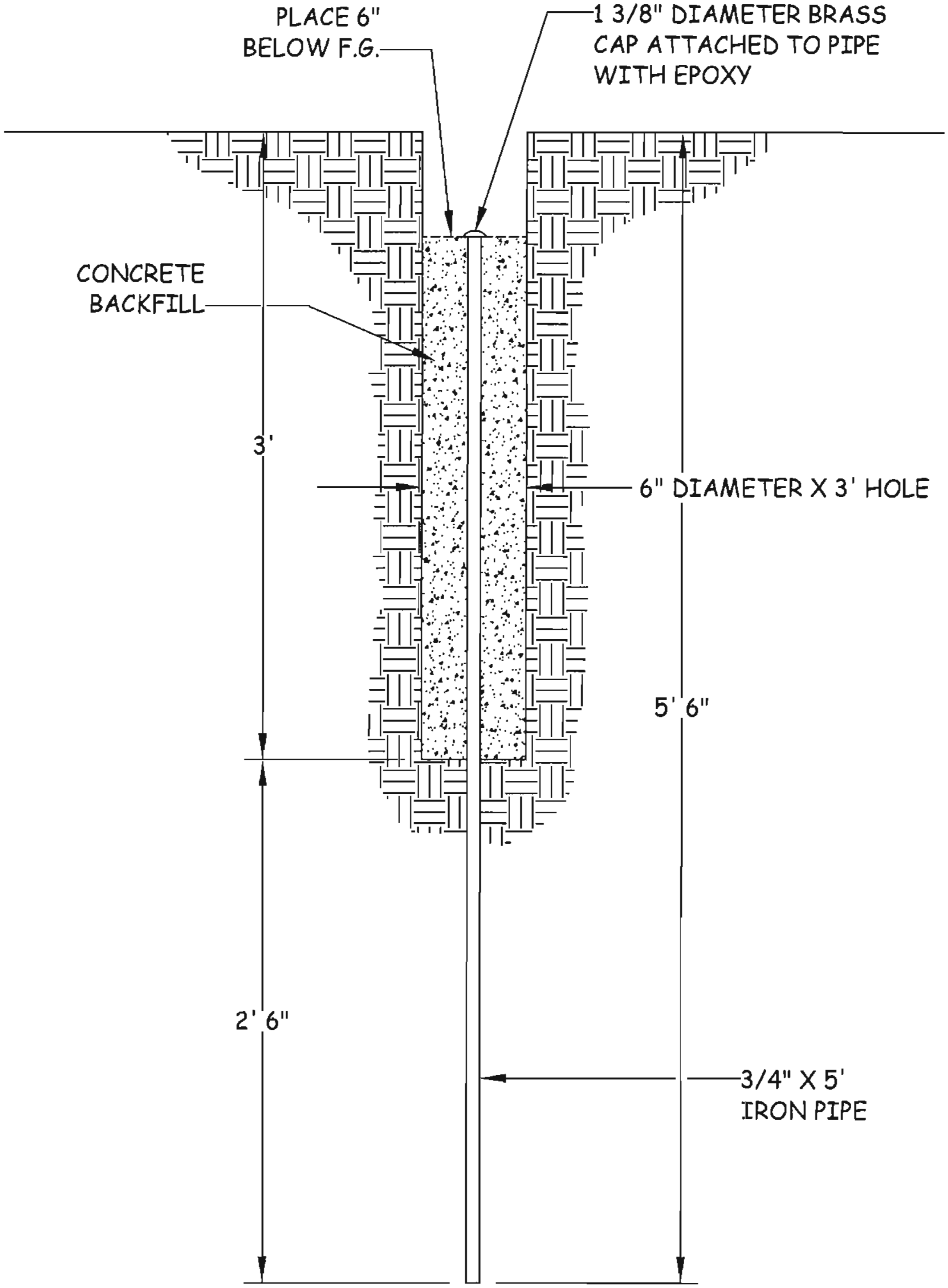
TYPICAL SETTLEMENT PLATE AND RISER



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TYPICAL SURFACE SETTLEMENT MONUMENT