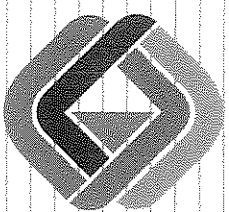
GEOTECHNICAL INVESTIGATION

RAMONA CROSSINGS
RAMONA EXPRESSWAY AND
PERRIS BOULEVARD
PERRIS, CALIFORNIA



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GEOTECHNICAL
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PREPARED FOR

PACIFIC DEVELOPMENT PARTNERS, LLC
SAN JUAN CAPISTRANO, CALIFORNIA

AUGUST 30, 2006
PROJECT NO. T2400-22-01

Project No. T2400-22-01
August 30, 2006

Pacific Development Partners, LLC
30200 Rancho Viejo Road, Suite B
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Attention: Mr. Lars Anderson

Subject: RAMONA CROSSINGS
RAMONA EXPRESSWAY AND PERRIS BOULEVARD
PERRIS, CALIFORNIA
GEOTECHNICAL INVESTIGATION

Gentlemen:

In accordance with your authorization, we have performed a geotechnical investigation for a proposed commercial development situated at the southwest corner of Ramona Expressway and Perris Boulevard, within the city of Perris, California. The accompanying report presents results of our study and includes conclusions and recommendations pertaining to the geologic and geotechnical aspects of developing the property as presently proposed. It is our opinion the site is suitable for the proposed commercial development, provided the recommendations of this report are followed.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INLAND EMPIRE, INC.

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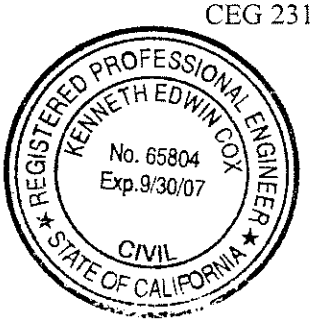

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1. PURPOSE AND SCOPE

This report presents the findings of a geotechnical investigation for a proposed residential development located south of Ramona Expressway between Perris Boulevard and Indian Street in Perris, California (see *Vicinity Map*, Figure 1). The purpose of the investigation was to assess site geologic conditions, to sample and observe the prevailing soil conditions and based on the conditions encountered provide recommendations regarding geotechnical aspects of developing the property.

Our field investigation was performed on August 4th and 7th, 2006 and consisted of a site reconnaissance, and excavating 18 exploratory hollow-stem auger borings. Samples obtained from the exploratory excavations were examined and logged. Details of the field investigation are presented in Appendix A. Approximate locations of the exploratory borings are depicted on the *Geologic Map*, Figure 2.

Laboratory testing was performed on soil samples obtained from the exploratory excavations to aid in evaluating in-situ moisture and density, maximum dry density and optimum moisture content, shear strength, collapse potential, consolidation characteristics, potential of hydrogen (pH), resistivity, and expansion characteristics for use in engineering analyses. Soluble sulfate and chloride testing was also performed. Details of the laboratory testing are presented in Appendix B.

2. SITE AND PROJECT DESCRIPTION

The site consists of approximately 17 acres of currently vacant land located on the south side of Ramona Expressway between Perris Boulevard and Indian Street in Perris, California. The site was previously used as a sod farm. An old foundation slab as well as other debris are present in the north west corner of the site. Existing utilities may be present along the project boundaries. Topographically, the site is relatively flat. Topographic maps available for the site indicate that, site elevation is likely between 1450 and 1460 feet above Mean Sea Level (MSL).

The site will be developed as a commercial development with approximately 11 buildings and associated parking. Grading plans were not available for our review at the time of this report, however, existing elevations are not likely to change by more than 5 feet.

Descriptions of the site and proposed development are based on our site reconnaissance, and observations during the field investigation. If project details differ significantly from those described, Geocon should be contacted for review and possible revision to this report.

3. SOIL AND GEOLOGIC CONDITIONS

Surficial soil encountered during our field investigation consists of very old alluvium which is discussed below.

3.1 Very Old Alluvium

Pleistocene-age alluvium underlies the entire site to depths in excess of 50 feet (Morton, 2003). The alluvium generally consists of moist, brown, loose to dense sand, with varying amounts of silt and clay. Discontinuous layers of silt and clay were also encountered. The upper portion of the alluvium is not considered suitable for the support of site improvements and/or structural fill and will require remedial grading.

4. GROUNDWATER

Groundwater was not encountered in our geotechnical borings extended to a maximum depth of 51 feet. Groundwater in the vicinity of the site has historically been in excess of 100 feet below ground surface (California of Department of Water Resources, 2003). It is our opinion that groundwater is not likely to be a factor during grading operations for the proposed development. However, depending on the weather conditions at the time of grading/construction, some localized perched water conditions could be encountered. If perched water is encountered, it is expected that it can be effectively managed with the use of sump pumps placed in the bottom of excavations.

5. GEOLOGIC HAZARDS

5.1 Geologic Setting

The subject site, like the rest of southern California, is located within a seismically active region near the margin between the North American and Pacific tectonic plates. The site is located within the Perris Valley which is bounded on the west by the Perris Erosion Surface, the east by several granitic hills and mountains, most notably of which are the Lakeview Mountains, the north by the Box Springs Mountains, and the south by a relatively undefined area of the Menifee Valley (Jenkins, 1965). The Perris Valley is a north-northwest trending alluvial basin which has been filled with sediment emanating from the surrounding bedrock highlands. Drainage within the valley is to the south and west.

Major faults within this area include the San Jacinto Valley and San Bernardino segments of the San Jacinto fault, and the Glen Ivy and Temecula segments of the Elsinore fault. The San Jacinto Valley segment of the San Jacinto fault is nearest to the site. Distances to local faults from the subject site are listed in Table 5.2 of this report.

5.2 Faulting and Seismicity

No active faults are known to exist at the site or in the immediate vicinity and none were encountered during our field investigation. The nearest known active fault is the San Jacinto Valley segment of the Elsinore Fault located approximately 8 miles to the northeast of the site.

The computer program *EQFAULT* (Blake, 1989, updated 2000) was used to calculate the distances of known faults from the site. References used within the program in selecting faults to be included were Jennings (1975), Anderson (1984), and Wesnousky (1986). In addition to fault location, *EQFAULT* estimated peak ground accelerations at the site for maximum magnitude earthquakes. Attenuation relationships presented by Sadigh, *et al.*, (1997) were used to estimate peak site accelerations. Presented on Table 5.2 are the faults determined by the analysis to be within 50 miles of the site.

TABLE 5.2
MAXIMUM EARTHQUAKE MAGNITUDE AND PEAK SITE ACCELERATIONS*

Fault Name	Approximate Distance From Site (miles)	Estimated Maximum Earthquake Magnitude (M_w)	Estimated Peak Site Acceleration (g)
San Jacinto – San Jacinto Valley	8	6.9	0.27
San Jacinto – San Bernardino	12	6.7	0.18
Elsinore – Glen Ivy	15	6.8	0.16
Elsinore – Temecula	16	6.8	0.15
San Jacinto – Anza	19	7.2	0.16
Chino – Central Avenue (Elsinore)	20	6.7	0.15
San Andreas – Southern	20	7.4	0.17
San Andreas – San Bernardino	20	7.3	0.16
Whittier	24	6.8	0.10
Cucamonga	26	7.0	0.13
North Frontal Fault Zone (West)	29	7.0	0.12
Cleghorn	30	65	0.06
San Jose	32	6.5	0.07
Pinto Mountain	33	7.0	0.08
Elsinore – Julian	35	7.1	0.08
Sierra Madre	35	7.0	0.09
North Frontal Fault Zone (East)	36	6.7	0.07
San Andreas – 1857 Rupture	37	7.8	0.12
San Andreas – Mojave	37	7.1	0.07
Elysian Park Thrust	37	6.7	0.07
Newport – Inglewood (offshore)	40	6.9	0.06

Fault Name	Approximate Distance From Site (miles)	Estimated Maximum Earthquake Magnitude (M_w)	Estimated Peak Site Acceleration (g)
Helendale – S. Lockhardt	42	7.1	0.06
Newport – Inglewood (L.A. Basin)	43	6.9	0.05
Compton Thrust	43	6.8	0.06
San Andreas – Coachella	44	7.1	0.06
Clamshell – Sawpit	45	6.5	0.05
Lenwood – Lockhart – Old Woman Springs	49	7.3	0.06
San Jacinto – Coyote Creek	49	6.8	0.04
Burnt Mountain	49	6.4	0.03
Raymond	50	6.5	0.04

*From *EQFAULT* Computer Program (Blake, 2000)

The site could be subjected to moderate to severe ground shaking in the event of an earthquake on any of the above-referenced faults or other faults within the southern California and northern Baja California region. With respect to this hazard, the site is considered comparable to others in the general vicinity. While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and the soil conditions underlying the site. We recommend that seismic design of the structures be performed in accordance with the California Building Code (CBC).

5.3 Probabilistic Seismic Hazard Analysis

The computer program *FRISKSP* (Blake, 1995, updated 2004) was used to perform a site-specific probabilistic seismic hazard analysis. The program is a modified version of *FRISK* (McGuire, 1978) that models faults as lines to evaluate site-specific probabilities of exceeding a given horizontal acceleration for each line source. The program operates under the assumption that the earthquake occurrence interval on each mapped Quaternary fault is proportional to the slip rate. The program accounts for fault rupture length as a function of earthquake magnitude. Site acceleration estimates are made using the earthquake magnitude and closest distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from all considered earthquake sources, the program calculates the total average annual expected number of occurrences for a site-acceleration greater than a specified value. Attenuation relationships proposed by Sadigh, *et al.* (1997), were utilized in the analysis. Using a weighting factor based on a 7.5 M_w event, the results of the analysis indicate that there is a 10 percent probability of exceeding a mean site acceleration of 0.34g within 50 years (475-year return period) and a 10 percent probability of exceeding a mean site acceleration of 0.40g within 100 years (949-year return period).

5.4 Liquefaction

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soil, in-situ stress conditions and depth to groundwater. Due to the depth of groundwater, the liquefaction potential at the site is considered very low.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 No soil or geologic conditions were encountered at the site that would preclude development of the property as presently proposed provided the recommendations of this report are followed.

6.1.2 The upper approximately 3 to 7 feet of the alluvium is considered unsuitable in its present condition for support of structural loads and will require remedial grading. Localized deeper removals should be expected.

6.1.3 Groundwater was not encountered during our investigation and is not anticipated to impact the project as presently proposed.

6.2 Soil and Excavation Characteristics

6.2.1 In our opinion, the alluvial soil can be excavated with conventional grading equipment.

6.2.2 Excavations should be performed in conformance with OSHA requirements. Excavations made adjacent to property lines or the existing improvements should not be left open during hours when construction is not being performed.

6.2.3 The near-surface on-site soil consists predominantly of sand with varying amounts of clay and silt and sandy clay which generally possess a *very low* expansion potential (EI<20) as defined by the Uniform Building Code (UBC) Table No. 18-I-B, and exhibit moderate shear strength characteristics. The on-site soil is considered suitable for use as fill, capping of building pads and construction of fill slopes provided it is free of organic or deleterious material. Where practical, soil with an expansion potential greater than *low* (if encountered) should be kept at least 3 feet below proposed finish grade elevations. Additional laboratory Expansion Index testing should be performed on soil exposed at finish grade subsequent to the completion of grading to assess at-grade expansion characteristics.

6.2.4 Results of laboratory testing indicate soil samples tested yielded water-soluble sulfate contents with a *negligible* sulfate exposure as defined by the 1997 Uniform Building Code (UBC) Table 19-A-4. Potential of hydrogen (pH) tests indicated values ranging from 6.5 to 7.4 and resistivity results ranging from 811 to 5408 ohm-cm. Chloride test results ranged from 21 to 340 parts per million (ppm). These results indicate the site soil is *corrosive* to *mildly corrosive* with respect to resistivity, *mildly corrosive* for pH, and *moderate* to *positive corrosivity* with respect to chlorides. These tests are general indications only and additional testing should be performed at finish grade (soil within 3 feet of rough pad grade elevations).

6.2.5 Geocon does not practice in the field of corrosion engineering. If improvements that could be susceptible to corrosion are planned, it is recommended that further evaluation by a corrosion engineer be performed. It is also recommended that these results and recommendations from the corrosion engineer be forwarded to the appropriate design team members (e.g. project architect, engineer) for incorporation into the plans and implementation during construction.

6.3 Seismic Design Criteria

The effect of seismic shaking may be reduced by adherence to the CBC. The CBC seismic design parameters for this site are presented on Table 6.3 below. The values listed in Table 6.3 are based on the Anza (Type A) and San Jacinto Valley (Type B) segments of the San Jacinto fault located approximately 19 and 8 miles from the site, respectively.

TABLE 6.3
SEISMIC DESIGN CRITERIA

Parameter	Value	UBC Reference
Seismic Zone Factor	0.40	Table 16-I
Soil Profile	S_D	Table 16-J
Seismic Coefficient, C_a	0.44	Table 16-Q
Seismic Coefficient, C_v	0.64	Table 16-R
Near-Source Factor, N_a	1.0	Table 16-S
Near-Source Factor, N_v	1.0	Table 16-T
Seismic Source	A&B	Table 16-U

6.4 Grading

6.4.1 Grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix C. Where the recommendations of this section conflict with those of Appendix C, the recommendations of this section take precedence.

6.4.2 Prior to grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

6.4.3 Site preparation should begin with off-site disposal of remaining remnants of previous construction including foundations, slabs and underground utilities. Existing deleterious material and vegetation should also be removed from the planned development areas of the

site. The depth of removal should be such that soil exposed in cut areas and soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.

6.4.4 At locations where buildings are planned, unsuitable alluvium not removed by planned grading should be removed to a depth of 3 to 7 feet below existing grade. As a minimum all building pads should be undercut at least 3 feet below existing or finished grade, whichever is deeper. These removals should extend at least 5 feet laterally beyond the building footprint were practical. For the purposes of grading, unsuitable native soil is defined as soil with a relative compaction less than 85 percent or soil with a collapse potential. Localized areas of deeper removals may be encountered during grading. The actual depth of removals should be evaluated in the field by a representative of Geocon.

6.4.5 Where parking or flatwork is planned, existing alluvium should be removed to a depth of at least 2 feet below existing or proposed grade, whichever is deeper.

6.4.6 During remedial grading temporary slopes greater than 5 feet high should be planned for an inclination no steeper than 1:1 (horizontal:vertical). Grading should be scheduled to backfill against these slopes as soon as practical. Removals along the edge of grading should include excavation of unsuitable soil that would adversely affect the performance of the planned fill, i.e., extend removals within a zone defined by a line projected down and out at a slope of 1:1 from the limit of grading to intersect with approved left-in-place soil.

6.4.7 After removal of unsuitable soil, the exposed ground surface should be scarified, moisture conditioned to slightly above optimum moisture content (ASTM D-1557-02), and compacted. Fill soil may then be placed and compacted in layers to the design finish grade elevations. Fill, including backfill and scarified ground surfaces, should be compacted to at least 90 percent of the laboratory maximum dry density and near optimum moisture content, as determined by ASTM Test Procedure D1557-02.

6.5 Bulking and Shrinkage Factors

6.5.1 Estimates of embankment bulking and shrinkage factors are based on comparing laboratory compaction tests with the density of soil in its natural state as encountered in exploratory excavations. It should be emphasized that variations in natural soil density, as well as in compacted fill density, render shrinkage value estimates very approximate. As an example, the contractor can compact the fill soil to any relative compaction of 90 percent or higher of the maximum laboratory density. Thus, the contractor has approximately a 10 percent range of control over the fill volume. Based on testing performed in during this

investigation and our experience with similar soil, it is our opinion that approximately 0 to 5 percent can be used as a basis for estimating how much the on-site alluvium may shrink when excavated from its natural state and placed as compacted fill.

6.6 Slopes

6.6.1 Cut slopes and fill slopes constructed with the on-site soil are anticipated to be stable with respect to deep seated and surficial instability to heights of up to 15 feet and at an inclination of 2:1 (horizontal:vertical).

6.6.2 Fill slopes should be overbuilt at least 3 feet horizontally and then cut to the design finish grade. As an alternative, fill slopes may be compacted by backrolling with a sheepsfoot compactor at vertical intervals not to exceed 4 feet and then track-walked with a D-8 bulldozer, or equivalent, such that the soil is uniformly compacted to at least 90 percent to the face of the finished slope.

6.6.3 In general, cohesionless soil should not be placed in the outer 15 feet of the face of fill slopes. Where cohesionless soil is exposed in cut slopes, this soil should be removed and replaced with suitable fill.

6.6.4 Slopes should be planted, drained and maintained to reduce erosion. Due to the very granular nature of the majority of the site soil, consideration should be given to landscaping the slopes relatively soon after completion to reduce the potential for surficial erosion.

6.7 Conventional Foundations

6.7.1 The project is suitable for the use of continuous strip footings, isolated spread footings, or appropriate combinations thereof. The following recommendations are for one- or two-story structures and assume that the grading operations will be performed as indicated in this report. The recommendations also assume the soil within the upper 4 feet of finish pad subgrade consists of *very low* to *low* expansive soil having an Expansion Index less than 50.

6.7.2 Continuous footings should be at least 12 inches wide and should extend at least 18 inches below lowest adjacent pad grade. Isolated spread footings should be at least 2 feet square and extend at least 18 inches below lowest adjacent grade.

6.7.3 Minimum continuous footing reinforcement should consist of at least four No. 4 steel reinforcing bars placed horizontally in the footings, two near the top and two near the bottom. The project structural engineer should provide recommendations for reinforcement of isolated spread footings.

6.7.4 The recommended dimensions and steel reinforcement presented above are based on soil characteristics only and are not intended to be in lieu of reinforcement necessary to satisfy structural loading. The project structural engineer should design the actual reinforcement for the foundations.

6.7.5 The recommended allowable bearing capacity for foundations designed as recommended above is 2,500 pounds per square foot. This value may be increased by 500 and 250 psf for each additional foot of depth and width, respectively up to a maximum bearing pressure of 4,000 psf. This value is for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.

6.7.6 Total static settlement due to footing loads conforming to the above recommended allowable soil bearing pressures is expected to be less than ¾ inch.

6.7.7 No special subgrade presaturation is deemed necessary prior to placement of concrete. However, the slab and foundation subgrade should be sprinkled as necessary to maintain a moist condition as would be expected in any concrete placement.

6.7.8 Interior concrete slabs-on-grade should be at least 4 inches thick. Minimum slab reinforcement should consist of No. 3 steel reinforcing bars placed 24 inches on center in both horizontal directions and positioned near the slab midpoint. The concrete slabs-on-grade should be underlain by at least 4 inches of clean sand (Sand Equivalent greater than 30) and, where moisture-sensitive floor coverings are planned, a 10-mil moisture barrier placed at the midpoint of the sand cushion should be provided.

6.7.9 Crack-control joints for exterior slabs should be spaced at intervals not greater than 12 feet and should be constructed using saw-cuts or other methods as soon as practical following concrete placement. Crack-control joints should extend a minimum depth of one-fourth the slab thickness. The project structural engineer should design the crack-control joint configuration.

6.7.10 Exterior slabs not subject to vehicular traffic should be at least 4 inches thick and reinforced with 6 x 6 - W2.9/W2.9 (6 x 6 - 6/6) welded wire mesh. The mesh should be

placed within the upper one-third of the slab. Proper mesh positioning is critical to future performance of the slab. It has been our experience that the mesh must be physically pulled up into the slab after concrete placement. The contractor should take extra measures to provide proper mesh placement. Prior to construction of slabs, the subgrade should be moisture conditioned to at least optimum moisture content and compacted to at least 90 percent relative compaction.

6.7.11 The slab-on-grade dimensions and minimum reinforcement recommendations presented above are based upon soil conditions only and are not intended to be used in lieu of those required for structural purposes.

6.7.12 The recommendations of this report are intended to reduce the potential for cracking of slabs due to differential settlement of fills of varying thickness. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such soil conditions may exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and the placement of crack-control joints at periodic intervals, particularly where re-entrant slab corners occur. Literature provided by the Portland Cement Association and American Concrete Institute present recommendations for proper concrete mix and construction and curing practices, and should be incorporated into project construction.

6.8 Retaining Walls and Lateral Loads

6.8.1 Retaining walls that are allowed to rotate more than 0.001H (where H equals the height of the retaining wall portion of the wall in feet) at the top of the wall and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2.0 to 1.0, an active soil pressure of 45 pcf is recommended. These soil pressures assume that the backfill within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion Index of less than 50. Where backfill soil does not conform to the above criteria, Geocon should be consulted for additional recommendations.

6.8.2 Where walls are restrained from movement at the top, an additional uniform pressure of 7H psf should be added to the above active soil pressure.

6.8.3 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (e.g. weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely impact the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (Expansion Index less than 50) backfill soil with no hydrostatic forces or imposed surcharge load. If conditions different than those described are anticipated, or if specific drainage details are desired, Geocon should be contacted for additional recommendations.

6.8.4 In general, wall foundations having a minimum depth and width of one foot may be designed for an allowable soil bearing pressure of 2,500 psf, provided the soil within 3 feet below the base of the wall has an Expansion Index of less than 50. The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Geocon should be consulted where such a condition is anticipated.

6.8.5 For resistance to lateral loads, an allowable passive earth pressure equivalent to a fluid density of 300 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soil. The allowable passive pressure assumes a horizontal surface extending at least 5 feet or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of soil not protected by floor slabs or pavement should not be included in the design for lateral resistance. An allowable friction coefficient of 0.4 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the allowable passive earth pressure when determining resistance to lateral loads.

6.8.6 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 8 feet. In the event that walls higher than 8 feet or other types of walls are planned, such as crib-type walls, Geocon Incorporated should be consulted for additional recommendations.

6.9 Slope Maintenance

6.9.1 Slopes that are steeper than 3:1 (horizontal to vertical) may, under conditions that are both difficult to prevent and predict, be susceptible to near surface (surficial) slope instability. The instability is typically limited to the outer three feet of a portion of the slope and usually does not directly impact the improvements on the pad areas above or below the slope. The occurrence of surficial instability is more prevalent on fill slopes and is generally preceded by a period of heavy rainfall, excessive irrigation, or the migration of

subsurface seepage. The disturbance and/or loosening of the surficial soil, as might result from root growth, soil expansion, or excavation for irrigation lines and slope planting, may also be a significant contributing factor to surficial instability. It is recommended that, to the maximum extent practical: (a) disturbed/loosened surficial soil be either removed or properly recompacted, (b) irrigation systems be periodically inspected and maintained to eliminate leaks and excessive irrigation, and (c) surface drains on and adjacent to slopes be periodically maintained to preclude ponding or erosion. Although the incorporation of the above recommendations should reduce the potential for surficial slope instability, it will not eliminate the possibility, and it may be necessary to rebuild or repair a portion of the project's slopes in the future.

6.10 Preliminary Flexible Pavement Design

6.10.1 The following pavement sections are preliminary. Final pavement design sections should be determined once subgrade elevations have been attained and R-Value testing on subgrade soil is performed. These preliminary pavement thicknesses were calculated using procedures outlined in the *California Highway Design Manual* (Caltrans) and are based on an assumed R-Value of 30. Summarized below are the preliminary pavement section recommended thicknesses.

TABLE 6.10
PRELIMINARY PAVEMENT DESIGN SECTIONS

Location	Estimated Traffic Index (TI)	Asphalt Concrete (inches)	Class 2 Base (inches)
Vehicle parking areas	4.5	3.0	5.0
Travel lanes	6.0	3.5	8.0

Greater thickness may be required by the local governing agency.

6.10.2 Asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction* (Green Book). Class 2 aggregate base should conform to Section 26-1.02A of the *Standard Specifications of the State of California Department of Transportation* (Caltrans).

6.10.3 Prior to placing base the subgrade should be scarified to a depth of at least 12 inches, moisture conditioned and compacted to a minimum of 95 percent relative compaction per ASTM D-1557-02. The base course should also be compacted to at least 95 percent relative compaction. Asphalt concrete should be compacted to a minimum of 95 percent of the Hveem density.

6.10.4 Loading aprons such as trash bin enclosures should utilize Portland Cement concrete. The pavement should consist of a minimum 7-inch concrete section reinforced with No. 3 bars at 24 inch spacing on centers, each way. The concrete should extend out from the trash bin such that both the front and rear wheels of the trash truck will be located on reinforced concrete pavement when loading and unloading.

6.10.5 The performance of pavements is highly dependent upon providing positive surface drainage away from the edge of pavements. Ponding of water on or adjacent to the pavement will likely result in saturation of the subgrade and subsequent pavement distress.

6.11 Drainage

6.11.1 Adequate drainage provisions are imperative. Under no circumstances should water be allowed to pond adjacent to footings. The building pads should be properly finish graded after the buildings and other improvements are in place so that drainage water is directed away from foundations, pavements, concrete slabs, and slope tops to controlled drainage devices.

6.12 Plan Review

6.12.1 Once grading and foundation plans are available, the geotechnical engineer should be provided the opportunity to review the plans prior to finalizing to check for substantial conformance with the recommendations of this report.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon.

2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. 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 should not be relied upon after a period of three years.

REFERENCES

Blake, T. F., 2000a, EQFAULT, Version 3.00b, *A Computer Program, for the Deterministic Prediction of Peak Horizontal Acceleration from Digitized California Faults.*

Blake, T. F., 2000b, FRISKSP for Windows, Version 4.00, *A Computer Program for the Probabilistic Estimation of Peak Acceleration and Uniform Hazard Spectra Using 3-D Faults as Earthquake Sources.*

Blake, T. F., 2000c, UBCSEIS, Version 1.03, *User's Manual for Evaluating the Seismic Parameters in accordance with the 1997 UBC.*

California Building Code, 2001, State of California, California Code of Regulations, Title 24, 1998, California Building Code: International Conference of Building Officials and California Building Standards Commission, 3 Volumes.

California Department of Water Resources, 2003, *Water Data Library*, 1999 - 2003, URL: http://well.water.ca.gov/

California Division of Mines and Geology, 1997, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, Special Publication 117.

County of Riverside, 2000, *Transportation and Land Management Agency, Technical Guidelines for Review of Geotechnical and Geologic Reports*, 2000 Edition.

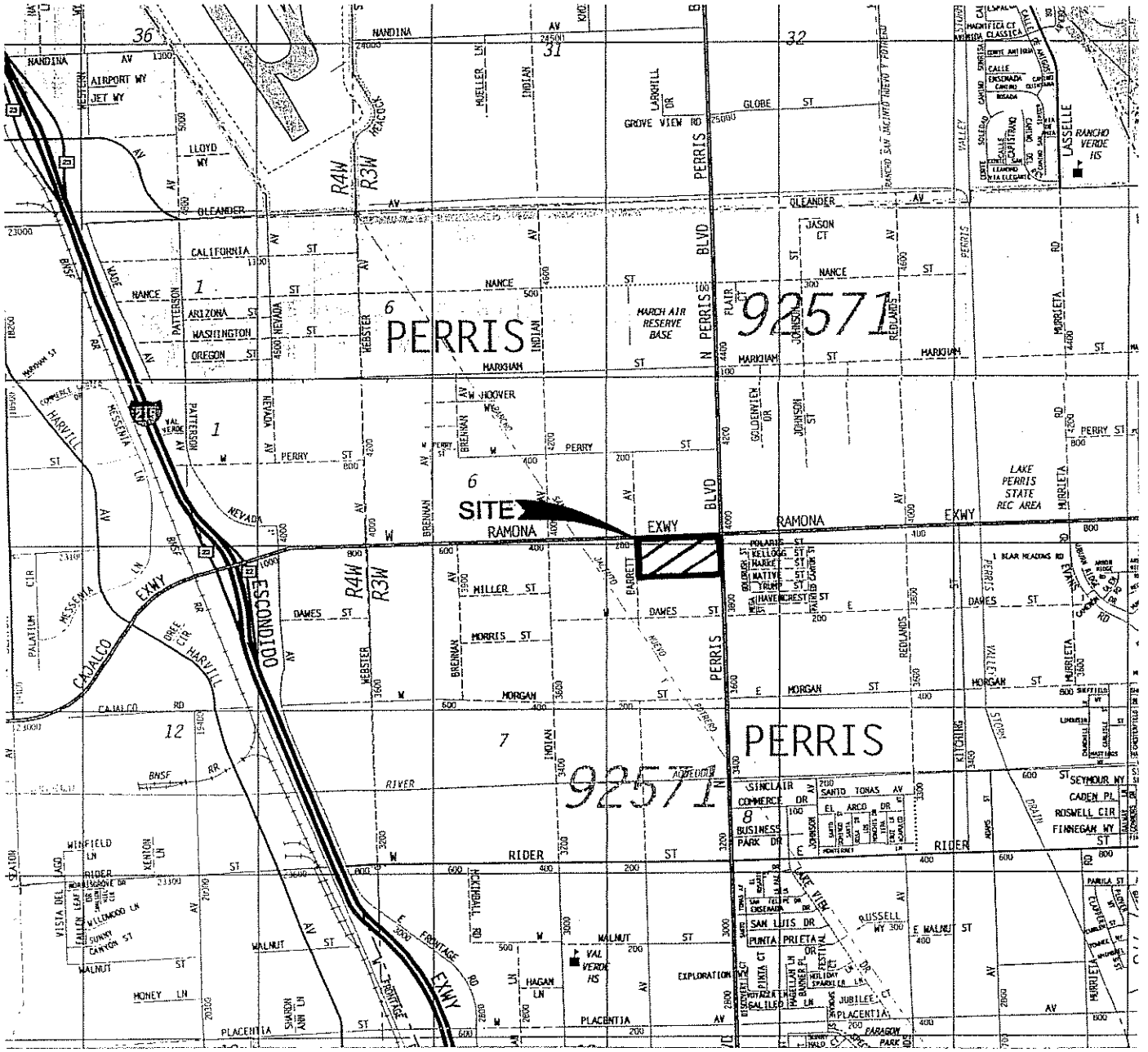
County of Riverside, 1978, *Seismic Safety/Safety Element Policy Report*, June 1978, by Envicom. Corporation, 1976, Technical report for County of Riverside Planning Department.

Jenkins, Olaf P., *Geologic Map of California, Santa Ana Sheet*, Compilation by Thomas H. Rogers, Scale 1:250,000.

Morton, D. M., 2003, *Preliminary Geologic Map of the Perris 7.5' Quadrangle, Riverside County, California*: U.S. Geological Survey, Open File Report 03-270.

Southern California Earthquake Center (SCEC), 1999, *Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California*, March 1999.

Uniform Building Code (UBC), 1997 Edition.



SOURCE: 2006 THOMAS BROTHERS MAP
RIVERSIDE COUNTY, CALIFORNIA

N

NO SCALE

GEOCON
INLAND EMPIRE
GEOTECHNICAL CONSULTANTS
41571 CORNING PLACE - MURRIETA, CALIFORNIA 92561 - 7065
PHONE 951 304-2300 - FAX 951 304-2392

KC / MG		DSK/GTYPD

VICINITY MAP

RAMONA CROSSING
PERRIS, CALIFORNIA

DATE 08 - 30 - 2006	PROJECT NO. T2400 - 22 - 01	FIG. 1

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The field investigation was performed on August 4 and 7, 2006, and consisted of a site reconnaissance and excavation of 18 small-diameter exploratory borings. Relatively undisturbed samples were obtained during drilling by driving a 3-inch O.D., split-tube sampler 12 inches into the undisturbed soil mass with blows from a 140-pound hammer falling a distance of 30 inches. The sampler was equipped with 1-inch by 2$^3/_8$-inch diameter brass rings to facilitate laboratory testing. Standard Penetration Tests (SPT) were also performed. Disturbed and relatively undisturbed samples were obtained from the borings for laboratory analysis.

Soil conditions encountered in the excavations were visually examined, classified and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual-Manual Procedure D2488). Logs of borings are presented on Figures A-1 through A-18. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The approximate locations of the exploratory borings are shown on the *Geologic Map*, Figure 2.

PROJECT NO. T2400-22-01

BORING B 1

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B1-1			CL	**ALLUVIUM** Stiff, moist, brown, Sandy CLAY			
2	B1-2					18	123.6	12.5
4				SM	Medium dense, moist, brown, Silty, fine to medium SAND			
6	B1-3					17		
8	B1-4					19	120.6	13.2
10	B1-5					17		
12								
14								
16	B1-6					22		
					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-1,
Log of Boring B 1, Page 1 of 1

T2400-22-01.GP

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◪ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 2

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**ALLUVIUM** Dense, moist, brown, Silty, fine to medium SAND; some mica			
2								
	B2-1					52		
4								
	B2-2				-Becomes loose and fine grained at 5'	13	107.3	12.9
6								
				SP	Medium dense, moist, brown, fine to coarse SAND; trace silt			
8	B2-3					41	121.6	6.7
10	B2-4					29		
12								
				SM	Medium dense, moist, brown, Silty, fine SAND			
14								
	B2-5					23		
16					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-2,
Log of Boring B 2, Page 1 of 1

T2400-22-01.GP

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 3

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SC	**ALLUVIUM** Medium dense, moist, brown, Clayey, fine to medium SAND			
2								
	B3-1					35		
4								
	B3-2			SM	Medium dense, moist, brown, Silty, fine to medium SAND	33	129.0	10.3
6								
	B3-3					22	119.5	10.6
8								
10	B3-4			SP	Medium dense, moist, brown, fine to medium SAND; trace silt	24		
12								
14				SM	Medium dense, moist, brown, Silty, fine SAND; trace clay			
	B3-5					19		
16					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-3,
Log of Boring B 3, Page 1 of 1

T2400-22-01.GP

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 4

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B4-1			SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND; trace clay			
2	B4-2					11		
4								
6	B4-3					27	120.7	12.5
8	B4-4				-Becomes fine grained at 7'	9		
10	B4-5				-Becomes fine to medium grained at 10'	21		
12								
14				ML	Stiff, moist, brown, Sandy SILT			
16	B4-6					12		
18								
20	B4-7			SM	Medium dense, moist, brown, Silty, fine to medium SAND	34		
22								
24								
26	B4-8					26		
28								

Figure A-4,
Log of Boring B 4, Page 1 of 2

T2400-22-01.GP

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 4

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B4-9					46		
32								
34								
	B4-10			ML	Very stiff, moist, brown SILT; trace sand	18		
36								
38								
				SM	Medium dense, moist, brown, Silty, fine to medium SAND			
40	B4-11					37		
				ML	Very stiff, moist, brown SILT; trace sand			
42								
44								
	B4-12					19		
46				SM	Medium dense, moist, brown, Silty, very fine SAND			
48								
50	B4-13					44		
					BORING TERMINATED AT 51 FEET No groundwater encountered			

Figure A-4,
Log of Boring B 4, Page 2 of 2

T2400-22-01.GP

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 5

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		SC	**ALLUVIUM** Medium dense, moist, brown, Clayey, fine to medium SAND			
2	B5-1			22	128.0	10.9
4						
6	B5-2			29	121.8	11.9
8	B5-3	SM	Medium dense, moist, brown, Silty, fine to medium SAND	32		
10	B5-4			20		
12						
14						
16	B5-5		-Becomes fine grained at 15'	18		
			BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-5,
Log of Boring B 5, Page 1 of 1

T2400-22-01.GP

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 6

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B6-1			SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND			
2	B6-2					18	124.2	9.9
4	B6-3					30	127.3	11.9
6					-Becomes fine grained at 7'			
8	B6-4					41	118.3	13.6
10	B6-5				-Becomes fine to medium grained at 10'	26		
12								
14								
16	B6-6				-Becomes fine grained at 15'	36		
					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-6,
Log of Boring B 6, Page 1 of 1

T2400-22-01.GP

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◪ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 7

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SC	**ALLUVIUM** Medium dense, moist, brown, Clayey, fine to medium SAND			
2								
	B7-1					24	123.2	12.5
4								
	B7-2			SM	Medium dense, moist, brown, Silty, fine to medium SAND	29	122.2	14.8
6								
	B7-3			SP	Medium dense, moist, brown, fine to medium SAND; trace silt	30		
8								
	B7-4				-Becomes clean, fine to medium sand at 10'	14		
10								
12								
14								
	B7-5			SC	Medium dense, moist, brown, Clayey, fine to medium SAND	33		
16					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-7,
Log of Boring B 7, Page 1 of 1

T2400-22-01.GF

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◹ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 8

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B8-1			SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to coarse SAND			
2	B8-2					14	123.4	9.5
4	B8-3					26	125.1	8.6
6	B8-4				-Becomes fine to medium grained at 7½'	32		
8	B8-5			SP	Medium dense, moist, brown, fine to medium SAND; trace silt	33		
10	B8-6			SM	Medium dense, moist, brown, Silty, fine to medium SAND	35		
12					BORING TERMINATED AT 16 FEET No groundwater encountered			
14								
16								

Figure A-8,
Log of Boring B 8, Page 1 of 1

T2400-22-01.GI

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ▩ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 9

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND			
2								
	B9-1					18	122.7	5.9
4								
	B9-2					18	124.2	11.1
6								
	B9-3					32	120.8	11.3
8								
	B9-4					23		
10								
12								
14								
	B9-5				-Becomes fine grained at 15'	34		
16					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-9,
Log of Boring B 9, Page 1 of 1

T2400-22-01.GF

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▩ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 10

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**ALLUVIUM** Loose, moist, brown, Silty, fine to medium SAND			
2	B10-1					13	120.9	6.6
4								
6	B10-2				-Becomes medium dense at 5'	26	130.0	10.0
8	B10-3					38	126.0	12.5
10	B10-4					22		
12								
14								
16	B10-5				-Becomes fine grained at 15'	39		
					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-10,
Log of Boring B 10, Page 1 of 1

T2400-22-01.GI

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 11

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B11-1			SC	**ALLUVIUM** Loose, moist, brown, Clayey, fine SAND			
2	B11-2					12	121.5	13.0
4								
6	B11-3			SM	Loose, moist, brown, Silty, fine to medium SAND	14	121.9	11.4
8	B11-4					13		
10	B11-5			SP	Medium dense, moist, brown, clean SAND	20		
12				ML	Stiff, moist, brown, Sandy SILT			
14								
16	B11-6			SM	Medium dense, moist, brown, Silty, fine to medium SAND	30		
					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-11,
Log of Boring B 11, Page 1 of 1

T2400-22-01.GI

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 12

ELEV. (MSL.) ~1455' DATE COMPLETED 08-04-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	ALLUVIUM Medium dense, moist, brown, Silty, fine to medium SAND			
2								
	B12-1					41	128.8	11.8
4								
	B12-2					31	123.8	13.4
6								
	B12-3					22		
8								
				SP	Medium dense, moist, brown, fine to coarse SAND; trace silt			
10	B12-4					18		
				SM	Medium dense, moist, brown, Silty, fine to medium SAND			
12								
14								
	B12-5				-Becomes fine grained at 15'	29		
16					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-12,
Log of Boring B 12, Page 1 of 1

T2400-22-01.GI

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 13

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B13-1			SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND			
2	B13-2					14	123.5	7.4
4	B13-3					2		
6				SC	Loose, moist, olive-brown, Clayey, fine to medium SAND			
8	B13-4			SM	Medium dense, moist, brown, Silty, fine to medium SAND	24	117.1	17.2
10	B13-5					10		
12								
14								
16	B13-6			ML	Very stiff, moist, brown SILT; trace sand	38		
18								
20	B13-7					21		
22								
24								
26	B13-8			SM	Very dense, moist, brown, Silty, fine to coarse SAND, some gravel	84/11"		
28								

Figure A-13,
Log of Boring B 13, Page 1 of 2

T2400-22-01.GP

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 13

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B13-9			ML	Stiff, moist, light brown SILT; trace sand and gravel	10		
32								
34								
36	B13-10				-Becomes brown	20		
38								
40	B13-11			CL	Stiff, moist, brown CLAY; trace sand	15		
42								
44								
46	B13-12			ML	Very stiff, moist, brown SILT; trace sand	34		
48								
50	B13-13			SM	Medium dense, moist, brown, Silty, fine to medium SAND	28		
					BORING TERMINATED AT 51½ FEET No groundwater encountered			

Figure A-13,
Log of Boring B 13, Page 2 of 2

T2400-22-01.G

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 14

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND			
2	B14-1					43		
4								
6	B14-2					39	128.0	7.4
8	B14-3					39		
10	B14-4					37		
12								
14								
16	B14-5			ML	Very stiff, moist, brown, SILT; trace sand BORING TERMINATED AT 16 FEET No groundwater encountered	27		

Figure A-14,
Log of Boring B 14, Page 1 of 1

T2400-22-01.GP

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 15

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B15-1			SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND; voids			
2	B15-2					37		
4								
6	B15-3					30	116.9	4.7
8	B15-4				-Becomes dense with no voids at 7'	47		
10	B15-5			ML	Very stiff, moist, brown SILT	38		
12								
14								
16	B15-6					18		
					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-15,
Log of Boring B 15, Page 1 of 1

T2400-22-01.G

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▩ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 16

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND			
2	B16-1					37		
4								
6	B16-2					31	128.7	6.8
8	B16-3					40	120.6	6.4
10	B16-4					26		
12								
14				ML	Stiff, moist, brown SILT; trace sand			
16	B16-5					15		
					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-16,
Log of Boring B 16, Page 1 of 1

T2400-22-01.GP

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 17

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND			
2								
	B17-1					28	129.5	10.2
4								
	B17-2					27	129.1	10.1
6								
	B17-3					35	123.6	9.1
8								
10	B17-4			SP	Medium dense, moist, brown, fine to coarse SAND; trace silt	22		
12								
14								
	B17-5			SM	Medium dense, moist, brown, Silty, fine to medium SAND	29		
16					BORING TERMINATED AT 16 FEET No groundwater encountered			

Figure A-17,
Log of Boring B 17, Page 1 of 1

T2400-22-01.G

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◥ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 18

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B18-1			SM	**ALLUVIUM** Medium dense, moist, brown, Silty, fine to medium SAND			
2	B18-2					22		
4	B18-3				-Becomes fine grained at 5'	39	124.6	12.4
6	B18-4				-Becomes loose at 7½'	8		
8	B18-5					11		
10								
12								
14	B18-6					7		
16								
18								
20	B18-7				-Becomes dense at 20'	45		
22								
24								
	B18-8			ML	Very stiff, moist, brown, Sandy SILT	21		
26								
28								

Figure A-18,
Log of Boring B 18, Page 1 of 2

T2400-22-01.GI

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2400-22-01

BORING B 18

ELEV. (MSL.) ~1455' DATE COMPLETED 08-07-2006

EQUIPMENT CME 75 BY: K. COX

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B18-9					21		
32								
34								
36	B18-10			SM	Medium dense, moist, brown, Silty, fine SAND	20		
38								
40	B18-11			ML	Very stiff, moist, brown, Sandy SILT	54		
42								
44								
46	B18-12					16		
48								
50	B18-13			SM	Dense, moist, brown, Silty, fine to medium SAND	65		
					BORING TERMINATED AT 51 FEET No groundwater encountered			

Figure A-18,
Log of Boring B 18, Page 2 of 2

T2400-22-01.G

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected undisturbed samples were tested to evaluate their in-place dry density and moisture content, shear strength, collapse potential, and consolidation characteristics. Disturbed bulk samples were tested to obtain maximum dry density and optimum moisture content, expansion characteristics, soluble sulfate content, potential of hydrogen, resistivity, and chloride content. Results of the laboratory tests are presented in tabular and graphic form herewith.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557-02

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
B1-1	SM - Dark brown, Silty, fine to coarse SAND	133.5	7.5
B11-1	SM - Dark brown, Silty, fine to coarse SAND	136.4	8.1
B18-1	SM - Gray brown, Silty, fine to medium SAND , with little clay	131.9	8.4

TABLE B-II
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D4829-03

Sample No.	Moisture Content		Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
B1-1*	8.7	18.1	116.6	18
B8-1*	7.5	14.7	121.7	3

* Expansion index was corrected in accordance with §10.2.3 of ASTM D4829.

TABLE B-III
SUMMARY OF DIRECT SHEAR TEST RESULTS

Sample No.	Dry Density (pcf)	Moisture Content (%)	Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
B11-1	122.8	8.0	180	31
B18-1	117.0	10.0	210	26

Samples remolded to 90 percent relative compaction at near or slightly above optimum moisture content.

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

Sample No.	Water-Soluble Sulfate	Sulfate Exposure*
B4-4	0.014%	Negligible
B15-1	0.002%	Negligible

* Per UBC Table 19-A-4.

TABLE B-V
SUMMARY OF SINGLE-POINT CONSOLIDATION (COLLAPSE) TESTS
ASTM D-2435-96

Sample Number	In-situ Dry Density (pcf)	Moisture Content Before Test	Axial Load with Water Added (psf)	Consolidation Before Water Added (%)	Percent Collapse
B1-4	120.6	13.2	2,000	1.7	0.1
B2-2	107.3	12.9	2,000	2.1	0.8
B3-3	119.5	10.6	2,000	1.9	0.4
B5-1	128.0	10.9	2,000	1.6	0.0
B6-2	124.2	9.9	2,000	1.5	0.3
B6-3	127.3	11.9	2,000	2.8	0.7
B7-2	122.2	14.8	2,000	1.8	0.3
B8-2	123.4	9.5	2,000	1.6	0.6
B9-2	124.2	11.1	2,000	1.6	0.2
B9-3	120.8	11.3	2,000	1.4	0.3
B10-2	130.0	10.0	2,000	1.9	0.2
B11-2	121.5	13.0	2,000	2.1	0.4
B11-3	121.9	11.4	2,000	1.5	0.2
B12-1	128.8	11.8	2,000	2.0	0.7
B13-4	117.1	17.2	2,000	1.7	0.2
B15-3	116.9	4.7	2,000	1.5	3.4
B16-2	128.7	6.8	2,000	1.5	1.6
B17-2	129.1	10.1	2,000	1.9	0.4

Negative sign indicates soil expansion

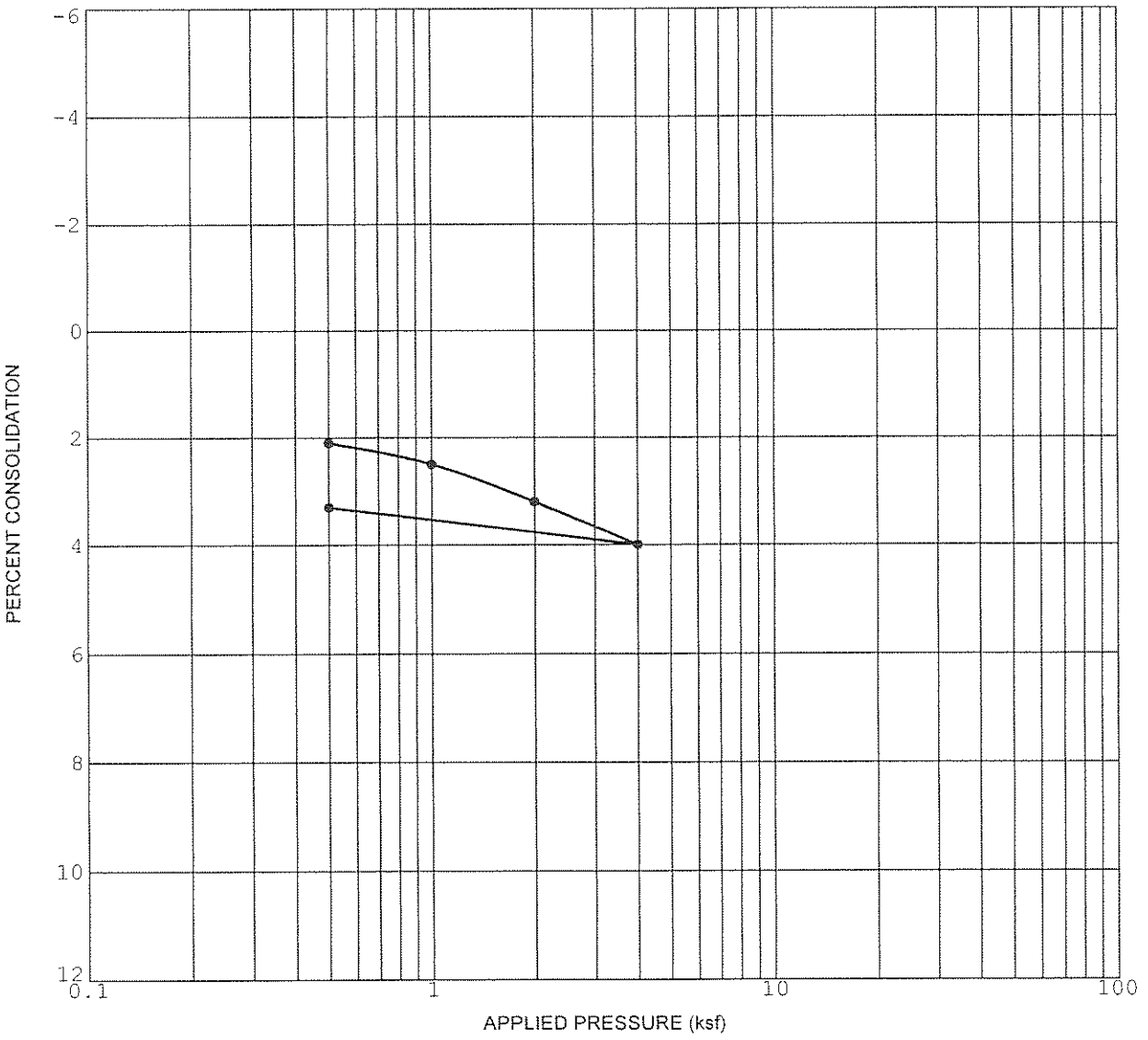
TABLE B-VI
SUMMARY OF PH, RESISTIVITY AND CHLORIDE TESTS

Sample No.	pH	Chloride (ppm)	Resistivity (Ohm-cm)
B4-1	7.4	340	811
B15-1	6.5	21	5408

Resistivity and pH tests were performed in accordance with Cal Trans Test 532.

PROJECT NO. T2400-22-01

SAMPLE NO. B4-3



Initial Dry Density (pcf)	120.7
Initial Water Content (%)	12.5

Initial Saturation (%)	88.7
Sample Saturated at (ksf)	2.0

CONSOLIDATION CURVE

RAMONA CROSSING

PARIS, CALIFORNIA

T2400-22-01.GPJ

Figure B-1

GEOCON

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

RAMONA CROSSINGS
RAMONA EXPRESSWAY AND PERRIS BOULEVARD
PERRIS, CALIFORNIA

PROJECT NO. T2400-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1. These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon Inland Empire, Inc. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2. Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. It will be necessary that the Consultant provide adequate testing and observation services so that he may determine that, in his opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep him apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3. It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, adverse weather, and so forth, result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that construction be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1. **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2. **Contractor** shall refer to the Contractor performing the site grading work.

2.3. **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4. **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5. **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6. **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7. **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1. Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1. **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than 3/4 inch in size.

3.1.2. **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3. **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than 3/4 inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2. Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3. Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4. The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized, provided it is acceptable to the governing agency, Owner and Consultant.

3.5. Representative samples of soil materials to be used for fill shall be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6. During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

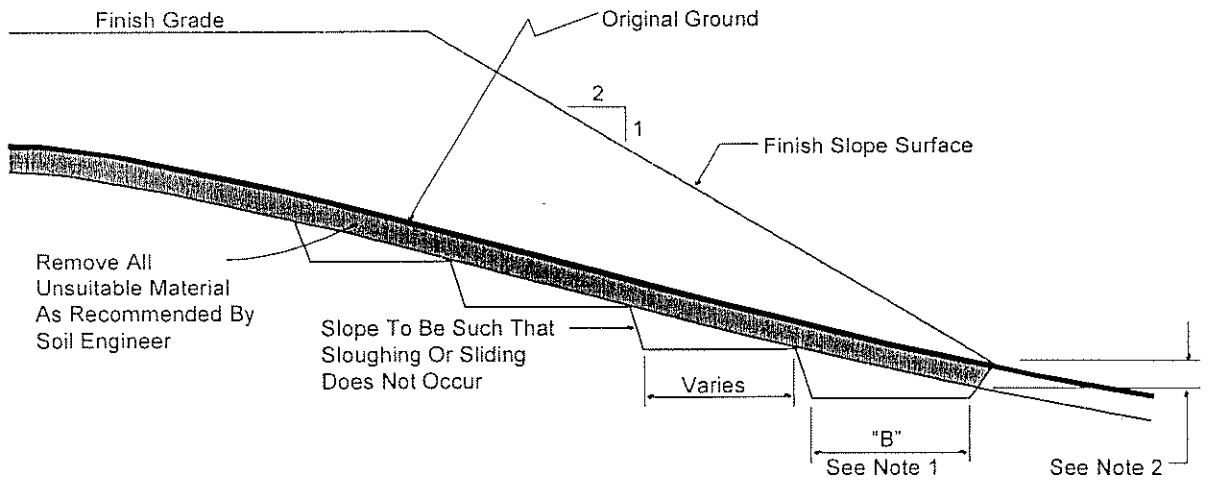
4.1. Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1-1/2 inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2. Any asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility. Concrete fragments which are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3. After clearing and grubbing of organic matter or other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction shall be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4. Where the slope ratio of the original ground is steeper than 6:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES:

(1) Key width "B" should be a minimum of 10 feet wide, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the bottom key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5. After areas to receive fill have been cleared, plowed or scarified, the surface should be disced or bladed by the Contractor until it is uniform and free from large clods. The area should then be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6.0 of these specifications.

5. COMPACTION EQUIPMENT

5.1. Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2. Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1. *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1. *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2. In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D1557-02.

6.1.3. When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4. When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5. After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D1557-02. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6. Soils having an Expansion Index of greater than 50 may be used in fills if placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7. Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8. As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2. *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1. Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2. Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3. For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4. For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5. Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6. All rock placement, fill placement and flooding of approved granular soil in the windrows must be continuously observed by the Consultant or his representative.

6.3. *Rock* fills, as defined in Section 3.1.3., shall be placed by the Contractor in accordance with the following recommendations:

6.3.1. The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent, maximum slope of 5 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2. *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the

required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made will be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3. Plate bearing tests, in accordance with ASTM D1196-93, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the number of passes of the compaction equipment to be performed. If performed, a minimum of three plate bearing tests shall be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4. A representative of the Consultant shall be present during *rock* fill operations to verify that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading. In general, at least one test should be performed for each approximately 5,000 to 10,000 cubic yards of *rock* fill placed.

6.3.5. Test pits shall be excavated by the Contractor so that the Consultant can state that, in his opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

6.3.6. To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

6.3.7. All *rock* fill placement shall be continuously observed during placement by representatives of the Consultant.

7. OBSERVATION AND TESTING

7.1. The Consultant shall be the Owners representative to observe and perform tests during clearing, grubbing, filling and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill shall be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test shall be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

7.2. The Consultant shall perform random field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion as to whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

7.3. During placement of *rock* fill, the Consultant shall verify that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant shall request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. If performed, plate bearing tests will be performed randomly on the surface of the most-recently placed lift. Plate bearing tests will be performed to provide a basis for expressing an opinion as to whether the *rock* fill is adequately seated. The maximum deflection in the *rock* fill determined in Section 6.3.3 shall be less than the maximum deflection of the properly compacted *soil* fill. When any of the above criteria indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

7.4. A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

7.5. The Consultant shall observe the placement of subdrains, to verify that the drainage devices have been placed and constructed in substantial conformance with project specifications.

7.6. Testing procedures shall conform to the following Standards as appropriate:

7.6.1. Soil and Soil-Rock Fills:

7.6.1.1. Field Density Test, ASTM D1556-00, *Density of Soil In-Place By the Sand-Cone Method.*

7.6.1.2. Field Density Test, Nuclear Method, ASTM D2922-96, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

7.6.1.3. Laboratory Compaction Test, ASTM D1557-02, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop.*

7.6.1.4. Expansion Index Test, ASTM D4829-95, *Expansion Index Test.*

7.6.2. Rock Fills

7.6.2.1. Field Plate Bearing Test, ASTM D1196-93 (Reapproved 1997) *Standard Method for Nonreparative Static Plate Load Tests of Soils and Flexible Pavement Components, For Use in Evaluation and Design of Airport and Highway Pavements.*

8. PROTECTION OF WORK

8.1. During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

8.2. After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

9. CERTIFICATIONS AND FINAL REPORTS

9.1. Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

9.2. The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.