Appendix I

Updated Geotechnical Investigation

UPDATED
GEOTECHNICAL INVESTIGATION

EAST OTAY MESA CENTER MIXED-USE
OTAY MESA AND HARVEST ROADS
SAN DIEGO COUNTY, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

SUNROAD ENTERPRISES
SAN DIEGO, CALIFORNIA

JULY 20, 2015
PROJECT 06263-42-03

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. 06263-42-03
July 20, 2015

Sunroad Enterprises
4445 Eastgate Mall, Suite 400
San Diego, California 92121

Attention: Mrs. Andrea Contreras Rosati, Vice President and Counsel

Subject: UPDATED GEOTECHNICAL INVESTIGATION
EAST OTAY MESA CENTER MIXED-USE
OTAY MESA AND HARVEST ROADS
SAN DIEGO COUNTY, CALIFORNIA

Dear Mrs. Contreas:

In accordance with your authorization of our proposal (LG-15194 dated June 12, 2015), we herein submit the results of our Updated Geotechnical Investigation for the subject site. The accompanying report presents the findings and conclusions from our study. Based on the results of our study, it is our opinion that the subject site can be developed as proposed, provided the recommendations of this report are followed.

This updated report presents recommendations that should be incorporated into the phases of design and construction. The new recommendations supersede those presented in our reports titled *Soils and Geologic Investigation for Rancon Otay Mesa, dated November 15, 1990* and *Soil and Geologic Investigation for Sunroad Centrum (Rancon Otay Mesa)*, dated February 26, 1999. Differences between the recommendations are attributable to changes in the standard of geotechnical practice that have occurred since the issuing our previous reports. The recommendations presented herein are based on proposed grades shown on the project Preliminary Grading Plan.

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

Very truly yours,

GEOCON INCORPORATED

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UPDATED GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of an Updated Geotechnical Investigation for East Otay Mesa Center Mixed-Use project located in the Otay Mesa area of San Diego County, California (see Vicinity Map, Figure 1). The purpose of our work was to review our reports titled *Soil and Geologic Investigation for Rancon Otay Mesa* dated November 15, 1990, and *Updated Geotechnical Investigation for Sunroad Centrum (Rancon Otay Mesa),* dated February 26, 1999, and, based upon our review, to provide updated geotechnical recommendations pertaining to development of the property as presently proposed.

The scope of our services included the following:

- Reviewing our previous geotechnical investigation reports;
- Reviewing readily available published and unpublished geologic geotechnical reports pertaining to the area as indicated in the *List of References*.
- Performing a reconnaissance of the site;
- Plotting the exploratory borings and trenches on the preliminary grading plan;
- Producing four, geologic, cross-sections based on the soil conditions encountered in the exploratory borings and trenches;
- Preparing a geologic map over the preliminary grading plan;
- Reviewing existing grading, foundation and retaining wall recommendations;
- Preparing an updated geotechnical investigation report with updated grading and foundation recommendations based on the proposed grades presented on the preliminary grading plan.

The Geologic Map (Figure 2) was prepared using the *Preliminary Grading Plan* prepared by Stevens Cresto Engineering, plot date May 10, 2015. Stereoscopic aerial photographs dated 1953 (USDA, AXN-3M-24 and AXN-3M-25) were also analyzed to aid geologic mapping and identification of potential geologic constraints.

Laboratory tests were performed on selected representative soil samples obtained from the exploratory borings and trenches to evaluate pertinent physical properties. Descriptions of the field and laboratory procedures and methods are presented in Appendices A and B, respectively.

The conclusions and recommendations presented herein are based on analysis of the data obtained from our reviews, analysis of the laboratory test results, and our experience with similar soil and geologic conditions.

2. SITE AND PROJECT DESCRIPTION

The subject property encompasses approximately 250 acres of undeveloped land east and west of Harvest Road and immediately north of Otay Mesa Road in San Diego County, California (see Vicinity Map Figure 1 and Geologic Map, Figure 2, map pocket).

The property is nearly flat-lying to steeply sloping with elevations ranging from approximately 620 feet Mean Sea Level (MSL) in the central portion of the site to approximately 527 feet MSL at the northwest corner.

Existing improvements consist of Harvest Road at the west end, a dirt road along the east property line, several dirt roads trending east-west in the central portion of the site over the existing knoll, an abandoned borrow pit in the north-central portion, and several buried and surface irrigation lines. A seepage pit was observed at the southeast end of the site. Natural drainage is mainly a network of shallow swales and ravines that discharge into Johnson Canyon to the northeast (area designated as open space easement) or into controlled facilities along Otay Mesa Road to the south. Vegetation primarily consists of grasses with brush on the steeper slopes. The central-north section of the site is covered with an extensive volume of dumped soils, trash, and debris.

We understand that project will consist of grading the property to receive 29, sheet-graded lots of the East Otay Mesa Mixed-Use development with four major arterial streets and four interior streets. Improvements along Harvest Road and the widening of Otay Mesa Road along the frontage of the property are also planned. The area north of the proposed Lone Star Road is designated open space easement.

Review of the project preliminary grading plan indicates that cuts and fills on the order of 35 and 30 feet, respectively, are proposed to achieve subgrade elevations on the proposed industrial sheet-graded lots. We expect that the lots will be fine-graded at a later date on an individual basis. In addition, extensive remedial grading in the form of removal and compaction of existing topsoils, alluvium/colluvium and the weathered soil of the Otay Formation should be anticipated.

The buildings will be for industrial and/or commercial mixed use and will likely consist of concrete tilt-up walls with concrete reinforced, steel, and/or wood-frame structures, supported on conventional continuous and/or spread footings.

3. SOIL AND GEOLOGIC CONDITIONS

During our field investigation we encountered undocumented fill soil, topsoil, alluvium/colluvium, Old Terrace Deposits, and the Otay Formation. These units are described below.

3.1 Undocumented Fill Soils (Qudf)

Undocumented fill soils were observed throughout the north-central portion of the site. The undocumented fill soils contain considerable amounts of vegetation and debris. These soils should be cleaned of vegetation and any deleterious debris prior to being used as structural fill. We expect that that majority of this soil will be removed as part of the normal grading operations to achieve proposed grades.

3.2 Topsoil (Unmapped)

Soft clayey topsoil overlies the majority of the site and have a somewhat uniform thickness of 2 to 3 feet. The topsoil generally consists of silty to sandy clays and clayey sands. The topsoil is potentially compressible and/or highly expansive and will require remedial grading measures in the form of removal and compaction as indicated in the grading section.

3.3 Alluvium/Colluvium (Qal/Qc)

Undifferentiated alluvial/colluvial soils are composed primarily of compressible silty and sandy clays. The thickness of these soils range from 3 to 7 feet with an average of 5 feet. The alluvial/colluvial soils are unsuitable for the support of settlement-sensitive structures or structural fill soils. Accordingly, remedial grading will be required.

3.4 Old Terrace Deposits (Qt)

Quaternary-age Old Terrace Deposits consist of very dense, weakly-cemented to cohesionless sand, cobble, and boulders that cap the broad knoll in the central portion of the property and the southwestern corner of the site. Metavolcanic rock clasts are abundant and indicate that the Old Terrace Deposits probably originated from the nearby Otay Mountains. The soils of these deposits possess satisfactory foundation engineering characteristics in both undisturbed and properly compacted states. The presence of very large boulders (some in excess of 3 feet in diameter), as encountered in Trenches T1 through T6, is not uncommon and, if encountered during grading, may require special handling and placement techniques in compacted fills. Oversize rocks should be placed in accordance with Section 6.3 at Appendix C.

3.5 Otay Formation (To)

The Oligocene-age Otay Formation consists of very dense, light gray-brown to light brown, silty to clayey sandstones and hard, sandy claystones and siltstones. The sandy and clayey units vary in thickness and are typically interbedded. The sandier portions of the Otay Formation are considered to have *low* to *medium* expansive potential, whereas the clayey portions are *medium* to *high* in expansive potential. One bentonite clay seam, with critically *high* expansive potential also was encountered in the exploratory boring LB-7. The claystone units of the Otay Formation typically exhibit low shear strength and accordingly, landslides or other types of slope instability can occur where these soils are present. A study of the previously-referenced aerial photographs and geologic observations made during the drilling and trenching operations did not reveal the presence of landslides; however, we recommend that the potential impact of the Otay Formation on slope stability be further evaluated after final grading plans become available for review. Based on the preliminary grading plan, we expect that highly expansive bentonitic clays may be exposed within 10 feet of subgrade elevation in Lot 17 as indicated in Geologic Cross-section B-B', Figure 3. Highly weathered Otay Formation that requires remedial grading may be encountered where exposed at the surface or beneath alluvium/colluvium. Weathering extends to 5 to 8 feet in some locations.

4. GEOLOGIC STRUCTURE

The general geologic structure is a gently, southwesterly dipping planar strata. Data obtained from Borings B-1, B-2, and B-3 suggest that the Otay Formation generally strikes N60°W and dips 3°SW.

We observed remolded clay seams and/or fractured claystone within bentonitic layers within the Otay Formation during our subsurface investigation. These features are interpreted as bedding parallel shears and may be related to stress relief along weak beds (Hart, M.W., 2000). Bedding parallel shears are postulated to be a significant factor in landsliding processes. However, based on our analysis, the likelihood of these features contributing to sliding within the property limits is low provided that mitigative measures are incorporated in slope design.

5. GROUNDWATER

A permanent groundwater table was not encountered during our field investigation and is not anticipated to significantly impact project development as presently proposed. It is not uncommon for groundwater or seepage conditions to develop where none previously existed. Surface water that is not properly drained will typically perch on the top of the impervious clay soil. Therefore, proper surface drainage of irrigation and rain runoff will be critical to future performance of the project. Seeps were observed in some of the borings and running water was encountered in the Johnson Canyon drainage bottom. The seeps encountered in the borings appear to be related to localized perched ground water conditions.

6. GEOLOGIC HAZARDS

6.1 Seismic Hazard Analysis

According to the computer program *EZ-FRISK (Version 7.65)* there are 6 known active faults located within a search radius of 50 miles from the property. We used the 2008 USGS fault database, which provides several models and combinations of fault data to evaluate fault information. The nearest active faults are the Newport-Inglewood and Rose Canyon Fault Zones, located approximately 12 miles west of the site and are the dominant source of seismic ground motion. Earthquakes that might occur on the Newport-Inglewood and Rose Canyon Fault Zones or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated maximum earthquake magnitude and peak ground acceleration for the Newport-Inglewood and Rose Canyon Fault Zones are 7.5 and 0.25g, respectively. Table 6.1.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for the most dominant faults in relationship to the site location. We calculated peak ground acceleration (PGA) using *Boore-Atkinson (2008) NGA USGS 2008*, *Campbell-Bozorgnia (2008) NGA USGS 2008*, and *Chiou-Youngs (2007) NGA USGS 2008* acceleration-attenuation relationships.

TABLE 6.1.1
DETERMINISTIC SEISMIC SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson, (2008) NGA USGS 2008 (g)	Campbell-Bozorgnia, (2008) NGA USGS 2008 (g)	Chiou-Youngs, (2007) NGA USGS 2008 (g)
Newport-Inglewood/Rose Canyon	12	7.5	0.25	0.20	0.25
Rose Canyon	12	6.9	0.21	0.17	0.19
Coronado Bank	19	7.4	0.20	0.14	0.17
Palos Verdes/Coronado Banks	19	7.7	0.21	0.15	0.19
Elsinore	41	7.85	0.14	0.09	0.11
Earthquake Valley	44	6.8	0.08	0.06	0.05

We used the computer program *EZ-FRISK* to perform a probabilistic seismic hazard analysis. The computer program *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the slip rate. The program accounts for earthquake magnitude as a function of fault rupture length, and site acceleration estimates are made using the earthquake magnitude and 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 considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by *Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2007) NGA USGS 2008* in the analysis. Table 6.1.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

TABLE 6.1.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, (2008) NGA USGS 2008 (g)	Campbell-Bozorgnia, (2008) NGA USGS 2008 (g)	Chiou-Youngs, (2007), NGA USGS 2008 (g)
2% in a 50 Year Period	0.41	0.34	0.39
5% in a 50 Year Period	.031	0.25	0.28
10% in a 50 Year Period	0.23	0.20	0.21

The California Geologic Survey (CGS) provides a program that calculates the ground motion for a 10 percent of probability of exceedence in a 50-year period based on an average of several attenuation relationships. Table 6.1.3 presents the calculated results from the Probabilistic Seismic Hazards Mapping Ground Motion Page from the CGS website.

TABLE 6.1.3
PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
CALIFORNIA GEOLOGIC SURVEY

Calculated Acceleration (g) Firm Rock	Calculated Acceleration (g) Formational soil	Calculated Acceleration (g) Fill
0.21	0.23	0.27

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 soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the most current adopted guidelines of the California Building Code (CBC).

6.2 Liquefaction

Due to the lack of a permanent near-surface groundwater table and the dense nature of proposed compacted fill and the soil of the Old Terrace Deposits and Otay Formation, the risk associated with liquefaction hazard at the site is low.

6.3 Tsunamis and Seiches

The site is located approximately 12 miles from the Pacific Ocean at an elevation of more than 520 feet above Mean Sea Level. The risk associated with inundation hazard due to tsunamis is low.

The site is not located downstream from any large bodies of water. Therefore, risk associated with inundation hazard due to seiche is low.

6.4 Landslides

Based on our review of the referenced geologic literature and our previous investigations on the property, landslide deposits have not been mapped on the site. The risk associated with ground movement hazard due to landslide is low.

6.5 Subsidence and Seismic Settlement

Based on the subsurface conditions encountered during our field investigation, the risk associated with ground subsidence or seismic settlement hazard is low.

6.6 Flooding

The site is not located within an active drainage or floodplain; therefore, the risk associated with inundation hazard due to flooding is low.

6.7 Expansive Soil

Based on our experience and laboratory testing performed at the site and in nearby projects, existing topsoil, alluvium/colluvium and the clayey soil of the Otay Formation, exhibit a *high* to *very high* expansion potential (Expansion Index higher than 90). The Old Terrace Deposits and the sandy soil of the Otay Formation exhibits *low to medium* expansion potential (Expansion Index from 21 to 90).

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 No soil or geologic conditions were encountered that would preclude the proposed development, provided the recommendations presented herein are implemented in design and construction of the project.

7.1.2 Our field investigation indicates that the site is underlain by weak and highly expansive claystones and potentially compressible, undocumented fill soils, topsoils, alluvial/colluvial deposits that will require special consideration during grading operations. Formational soils of the Old Terrace Deposits and Otay Formation underlie the surficial materials and extend to the maximum depth of exploration. The undocumented fill soils, topsoils, alluvial/colluvial deposits and the weathered soil of the Otay Formation are unsuitable in their present condition to receive settlement-sensitive improvements and/or additional structural fill soils. The remedial grading recommendations presented in the *Grading* section should be closely followed to properly compact the surficial soils. The soils of the Old Terrace Deposits and unweathered Otay Formation should provide adequate soil support characteristics in their natural state and where placed as properly-compacted fill.

7.1.3 Weak, highly-expansive, bentonitic claystones may be present within 10 feet of subgrade in Lot 17. Bentonite claystones exposed within 10 feet of proposed grade on the sheet graded lots and 6 feet from subgrade in proposed road ways should be removed and replaced with *low*-expansive materials.

7.1.4 We expect anticipated that weak claystones may be present on some of the cut slopes that may require stabilization measures in the form of buttresses or stability fills. Cut slopes should be observed by our project Engineering Geologist during grading operations to check that the soil and geologic conditions are as anticipated in this report.

7.1.5 The undocumented fill soils contain considerable amounts of trash and debris. Extensive sorting and/or export of these soils should be anticipated during grading operations.

7.1.6 The cut operations in the area underlain by Old Terrace Deposits will generate oversize rocks that will require special handling and placement. All oversize materials should be placed in accordance with the grading specifications contained in Appendix C.

7.1.7 Highly expansive soils will be encountered within the topsoils, alluvial and alluvial/colluvial deposits as well as in the soils of the Otay Formation. Highly expansive

soils should be placed in the deeper portions of the fill areas. We expect, however, that there are sufficient *low* to *medium* expansive soils available for capping purposes on the site to mitigate the adverse impact of expansive soils.

7.1.8 Perched groundwater may be present within the low-lying alluvial/colluvial areas. Hence, remedial measures in the form of subdrains may be required where filling of the drainage courses is planned. The need for subdrains will be determined upon our review of the final grading plan.

7.1.9 In general, the undisturbed soils are expected to exhibit low erosion potential. However, fill areas or areas stripped of native vegetation will require special consideration to reduce the erosion potential. In this regard, desilting basins, improved surface drainage, and early planting of erosion-resistant ground covers are recommended.

7.1.10 Subsurface conditions observed may be extrapolated to reflect general soil and geologic conditions; however, variations in subsurface conditions between trench and boring locations should be anticipated. The Geologic Map, attached as Figure 2, presents the areal extent of the geologic conditions encountered. Cross-sections A-A', B-B', C-C', D-D', Figures 3 and 4, respectively, present the general soil conditions encountered.

7.1.11 No significant geologic hazard that would adversely affect he proposed project were observed or are known to exist on the site.

7.2 Soil and Excavation Characteristics

7.2.1 Onsite soils can be excavated with moderate to heavy effort with conventional heavy-duty equipment.

7.2.2 Based on our experience in the area and laboratory tests, the soil encountered during the field investigation is considered to be *expansive* (expansion index [EI] higher than 20) as defined by 2013 California Building Code (CBC) Section 1805.5.3. Table 7.2 presents soil classifications based on the Expansion Index.

TABLE 7.2
SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2010 CBC Expansion Classification
0-20	Very Low	Non-Expansive
21-50	Low	Expansive
51-90	Medium	
91-130	High	
Greater than 130	Very High	

7.3 Temporary Excavations

7.3.1 Temporary excavations should be conducted in conformance with OSHA requirements. Existing undocumented fill, topsoil, alluvium/colluvium and the weathered soil of the Otay Formation can be considered Type B soil in accordance with OSHA guidelines. The Old Terrrace Deposits and the Otay Formation can be considered Type A soil. In general, special shoring will not be necessary if temporary excavations are less than 3 feet high. Temporary excavation depths greater than 3 feet should be laid back at an appropriate inclination or shored. The soils exposed in these excavations should not become saturated or allowed to dry. Surcharge loads should not be permitted within a distance equal to the depth of the excavation from the top of the excavation. The top of the excavation should be a minimum of 15 feet from the edge of existing improvements. Excavations steeper than those recommended or closer than 15 feet from an existing surface improvement should be shored in accordance with applicable OSHA codes and regulations.

7.4 Slope Stability

7.4.1 Slope stability analyses using laboratory shear strength information and experience with similar soil conditions in nearby areas indicate that 2:1 (horizontal:vertical) fill slopes constructed of on-site granular materials should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions for heights of 40 feet. The 2:1 cut slopes are expected to be excavated predominantly in the Otay Formation. Based on the calculations and experience with similar conditions, 2:1 cut slopes to the planned heights should possess a factor of safety of at least 1.5 with respect to slope stability if free of adversely oriented bedding, joints or fractures. Slope stability calculations for deep-seated and surficial stability conditions are presented on Figures 5 through 8.

7.4.2 Keying and benching operations during grading of the slopes should be performed in accordance with Appendix C. Due to the presence of highly weathered Otay Formation at some locations, keying operations may extend deeper than normal (on the order of 3 to 5 feet).

7.4.3 Cut slopes within the Otay Formation may require further evaluation due to the possible presence of claystone and siltstone lenses. Stability fills may be necessary to prevent surficial sloughage of the slope faces. The potential presence of bentonitic clay lenses and the associated slope stability considerations can be addressed at the time of grading.

7.4.4 We recommend that all cut slope excavations be observed during grading by our engineering geologist to check that soil and geologic conditions do not differ significantly from those anticipated.

7.4.5 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soils with an Expansion Index of less than 90 or at least 35 percent sand size particles should be acceptable as "granular" fill. Slopes should be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet and should be track-walked at the completion of each slope such that the fill soils are uniformly compacted to at least 90 percent relative compaction to the face of the finished slope.

7.4.6 All slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion. Slope planting should generally consist of drought-tolerant plants having a variable root depth. Slope watering should be kept to a minimum to just support the plant growth.

7.5 Bulking and Shrinkage

7.5.1 Estimates of embankment bulking and shrinkage factors are typically based on comparing laboratory compaction tests with the density of the material in its natural state as encountered in the test borings and trenches. Variations in existing soil density, as well as in compacted fill densities, render shrinkage value estimates very approximate. As an example, the contractor can compact the fill soils 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 our experience on nearby sites, in our opinion the following shrinkage factors can be used as a basis for estimating how

much the on-site soils may shrink or swell (bulk) when excavated from their existing state and placed as compacted fills.

TABLE 7.5
SHRINKAGE AND BULK FACTORS

Soil Unit	Shrink/Bulk Factor
Undocumented Fill Soil	15 to 20 percent Shrink
Topsoil, Alluvium/Colluvium	10 to 15 percent Shrink
Otay Formation	5 to 10 percent Bulk
Old Terrace Deposits	10 to 15 percent Bulk

7.6 Grading

7.6.1. All grading should be performed in accordance with the *Recommend Grading Specifications* contained in Appendix C and the County of San Diego Grading Ordinances. Where the recommendations of Appendix C conflict with this section of the report, the recommendations of this section take precedence.

7.6.2 Earthwork should be observed by, and compacted fill tested by, representatives of Geocon Incorporated.

7.6.3 A preconstruction conference should be held at the site prior to the beginning of grading operations with the developer, contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling requirements can be discussed at that time.

7.6.4 Site preparation should begin with the removal of all deleterious matter and vegetation. The depth of removal should be such that material to be used in fills is free of organic matter. Any existing underground improvements (not projected to remain should be removed and the resulting depressions properly backfilled in accordance with the procedures described herein. Material generated during stripping operations and/or site demolition should be exported from the site.

7.6.5 All undocumented fill, topsoils, and colluvial/alluvial deposits not removed by planned grading should be removed to firm natural ground and properly compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557 at moisture contents 1 to 3 percent above optimum.

7.6.6 The upper 5 to 8 feet of the Otay Formation is highly weathered and will require removal and compaction as compacted fill. The actual depth of removal will be evaluated in the field during grading operations.

7.6.7 After all unsuitable soils and deleterious material have been removed, areas planned to receive structural fill soils and/or settlement-sensitive improvements should be scarified to a depth of approximately 12 inches, moisture conditioned to 1 to 3 percent above optimum moisture content, and recompacted to a minimum of 90 percent of the dry density determined by ASTM D 1557.

7.6.8 The site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, native site soils are suitable for reuse as fill if free from vegetation, debris and other deleterious matter. Layers of fill should be no thicker than will allow for adequate bonding and compaction. All fill (including backfill and scarified ground surfaces) should be compacted to at least 90 percent of maximum dry density at optimum moisture content or above, as determined in accordance with the ASTM D 1557, at moisture contents ranging from 1 to 3 percent above the optimum content. Fill soils placed at moisture contents outside this range of moisture content may be considered unacceptable at the discretion of the geotechnical engineer.

7.6.9 Highly-expansive soils (EI >90) should not be placed within the upper 5 feet of finished pad grade. Bentonite with *critically high* expansive potential should not be placed within 10 feet of finish grade. Similarly, cut lots containing highly expansive soils within 5 feet of finish grade should be undercut 5 feet and capped with *low* to *medium* (EI between 21 and 90) expansive materials.

7.6.10 Where bentonite materials are present within 10 feet of finish grade on cut lots, this condition should be evaluated on an individual lot basis and mitigative measures provided in updated geotechnical reports once building location and anticipated structural loading are determined.

7.7 Seismic Design Criteria

7.7.1 We used the computer program *U.S. Seismic Design Maps*, provided by the USGS. Table 7.7.1 summarizes site-specific design criteria obtained from the 2013 California Building Code (CBC; Based on the 2012 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements should be designed using a Site Class D. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2013 CBC and Table 20.3-1 of ASCE 7-10. The values presented

in Table 7.7.1 are for the risk-targeted maximum considered earthquake (MCE_R). The values presented in Table 7.7.1 are for preliminary purposes. Once specific grading plans with building locations are developed for each lot, Geocon Incorporated should be contracted to provide specific seismic design criteria.

TABLE 7.7.1
2013 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2013 CBC Reference
Site Class	D	Table 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.808 g	Figure 1613..3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.310 g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.177	Table 1613.3.3(1)
Site Coefficient, F_V	1.780	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.951 g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.552 g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.634 g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.368 g	Section 1613.3.4 (Eqn 16-40)

7.7.2 Table 7.7.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 7.7.2
2013 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.313 g	Figure 22-7
Site Coefficient, F_{PGA}	1.187	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.372 g	Section 11.8.3 (Eqn 11.8-1)

7.7.3 Conformance to the criteria in Tables 7.7.1 and 7.7.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will

not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive.

7.8 Foundation Recommendations

7.8.1 Continuous footings or isolated spread footings for one- and/or two-story structures should be at least 12 inches wide and should extend at least 18 inches below lowest adjacent pad grade into properly compacted fill soils as recommended in Section 7.6. Isolated spread footings for one- and/or two-story structures should be at least 2 feet wide and extend 18 inches below lowest adjacent pad grade into properly compacted fill soils. Figure 9 presents a footing dimension detail depicting lowest adjacent grade. Minimum continuous footing reinforcement for one- and/or two-story structures should consist of four No. 4 steel-reinforcing bars placed horizontally in the footings; two near the top and two near the bottom.

7.8.2 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. Actual reinforcement of the foundations should be designed by the project structural engineer.

7.8.3 The recommended allowable bearing capacity for foundations designed as recommended above is 2,500 pounds per square foot for 18-inch-deep footings. 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.

7.8.4 Footing excavations should be observed by a representative of Geocon Incorporated prior to placing reinforcing steel to verify that soil conditions are similar to those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

7.9 Concrete Slabs-on-Grade

7.9.1 Interior concrete slabs-on-grade should be at least 5 inches thick. Where heavy concentrated floor loads are anticipated, the slab thickness should be increased to 6 inches and should be underlain by 4 inches of Class 2 base material compacted to at least 95 percent relative compaction. The allowable soil bearing pressure under slabs with import, *low* expansive soils is 1,500 pounds per square foot.

7.9.2 Minimum reinforcement of slabs-on-grade placed on *low* to *medium* expansive soil should consist of No. 3 reinforcing bars placed at 18 inches on center in both horizontal directions. The concrete slabs-on-grade should also be doweled into the foundation system to prevent vertical movement between the slabs, footings, and walls.

7.9.3 The concrete slab-on-grade recommendations are minimums based on soil support characteristics only. We recommend that the project structural engineer evaluate the structural requirements of the concrete slabs for supporting equipment and storage loads.

7.9.4 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). In addition, the membrane should be installed in accordance with manufacturer's recommendations and ASTM requirements and installed in a manner that prevents puncture. The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

7.9.5 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. It is common to have 3 to 4 inches of sand for 5-inch thick slabs in the southern California region. However, we should be contacted to provide recommendations if the bedding sand is thicker than 6 inches. The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

7.9.6 All exterior concrete flatwork not subject to vehicular traffic should be a minimum of 4 inches thick and conform to the following recommendations. Slab panels in excess of 8 feet square should be reinforced with 6x6-W2.9/W2.9 (6x6-6/6) welded wire mesh to reduce the potential for cracking. In addition, all concrete flatwork should be provided with crack-control joints to reduce and/or control shrinkage cracking. Crack-control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack-control spacing. Subgrade soils for exterior slabs should be compacted in accordance with criteria presented in the grading section of this report. The subgrade soils should not be allowed to dry prior to placing concrete.

7.9.7 The recommendations presented herein are intended to reduce the potential for cracking of slabs and foundations as a result of differential soil movement. However, even with the incorporation of these recommendations, foundations and slabs-on-grade will still exhibit some cracking. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack-control joints and proper concrete placement and curing. Crack-control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Cement Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

7.10 Lateral Loads for Retaining Walls

7.10.1 Retaining walls that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) 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 pcf. Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. Expansive soil should not be used as backfill material behind retaining walls. Soil placed for retaining wall backfill should have an Expansion Index less than 50. Existing soils exhibited a *low* to *high* expansion potential. Therefore, stockpiling of *low* expansive soils encountered during grading or import of *low* expansive granular soil may be required for retaining wall backfill.

7.10.2 Where walls are restrained from movement at the top, an active soil pressure equivalent to the pressure exerted by a fluid density of 60 pcf should be used for horizontal backfill. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to 2 feet of fill soil should be added (unit weight 125 pcf).

7.10.3 Soil contemplated for use as retaining wall backfill should be identified in the field prior to backfilling. At that time, Geocon Incorporated should obtain samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. County of San Diego or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, onsite soil to be used as backfill may or may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the onsite soil for use as wall backfill if standard wall designs will be used.

7.10.4 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 (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the structures adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI of less than 50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. A typical retaining wall drainage detail is presented on Figure 10, attached. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.

7.10.5 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2013 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall. A seismic load of 17H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.372g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

7.10.6 To resist lateral loads, a passive pressure equivalent to the pressure exerted by a fluid density of 300 pcf should be used for design of footings or shear keys poured neat against properly compacted granular fill soils. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

7.10.7 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.4 should be used for design. To resist lateral loads, the passive resistance can be combined with friction.

7.10.8 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 are planned, Geocon Incorporated should be consulted for additional recommendations.

7.11 Preliminary Pavement Recommendations

7.11.1 The following recommendations are for preliminary purposes and are provided for private driveways and parking areas. The final pavement section design will depend upon soil conditions exposed at subgrade elevation and the results of Resistance Value (R-Value) tests. The following preliminary pavement section recommendations are based on an assumed R-Value of 15. Sections are presented for both flexible (asphalt concrete) and rigid (Portland cement concrete) pavement.

7.11.2 The pavement sections for public streets will be determined by the County of San Diego Materials Testing and Engineering Department. The final pavement sections of public streets will be dependent on the traffic index designated by the County of San Diego Materials Testing and Engineering Department and the R-Value laboratory test results of the exposed subgrade soils.

TABLE 7.11.1
FLEXIBLE PAVEMENT SECTIONS RECOMMENDATIONS

Location	Assumed Traffic Index (TI)	Assumed R-Value	Asphalt Concrete Thickness (inches)	Class 2 Aggregate Base Thickness (inches)
Parking stalls for automobiles and light-duty vehicles	4.5	15	3	6.0
Driveways for automobiles and light-duty vehicles	5.5	15	3	10.0
Driveways and parking areas for heavy-duty trucks and fire lanes	7.0	15	4	13.0

TABLE 7.11.2
RIGID PAVEMENT SECTIONS RECOMMENDATIONS

Location	Average Daily[1] Truck Traffic (ADTT assumed)	Assumed R-Value	Portland Cement Concrete[2] (inches)	Class 2 Aggregate Base Thickness (inches)
Parking stalls[3] for automobiles and light-duty vehicles	25-100	20	5	4
Driveways[3] for automobiles and light-duty vehicles	300-500	20	6†	4
Driveways and parking areas for heavy-duty trucks and fire lanes	100-500	20	7‡	4

[1]ADTT values have been assumed for planning purposes herein and should be confirmed by the design team during future plan development.

[2]Concrete shall have a minimum $M_R \geq 600$ psi**.** This analysis assumes the construction of concrete shoulders.

[3]Parking stalls and driveways assume typical light truck and car traffic.

†Slabs should be reinforced with No. 3 reinforcing bars at 24 inches on center in both horizontal directions.

‡Slabs should be reinforced with No. 4 reinforcing bars at 24 inches on center in both horizontal directions.

7.11.3 The subgrade soils should be compacted to a minimum relative compaction of 95 percent at 1 to 3 percent above the optimum moisture content. The depth of subgrade compaction should be approximately 12 inches.

7.11.4 Class 2 base should conform to Section 26-1.-02B of the *Standard Specifications for The State of California Department of Transportation (Caltrans)* and should be compacted to a minimum of 95 percent of the maximum dry density at near optimum moisture content. The asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Green Book)*.

7.11.5 Where trash bin enclosures are planned within asphalt paved areas, we recommend that the pavement sections be equivalent to the heavy-duty truck categories presented in the respective tables. The concrete should extend into the roadway sufficiently so that all wheels of the trash truck are on the concrete when loading.

7.11.6 Rigid Portland cement concrete sections were evaluated using methods suggested by the American Concrete Institute *Guide for Design and Construction of Concrete Parking Lots (ACI330R-08).*

7.11.7 Construction joints should be provided at a maximum spacing of 12 feet each way to control shrinkage. Installation of these types of joints should be made immediately after concrete finishing.

7.11.8 Construction jointing, doweling, and reinforcing should be provided in accordance with recommendations of the American Concrete Institute.

7.11.9 The performance of asphalt concrete pavements and Portland cement concrete pavements is highly dependent upon providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement will likely result in pavement distress and subgrade failure. If planter islands are proposed, the perimeter curb should extend at least 12 inches below proposed subgrade elevations. In addition, the surface drainage within the planter should be such that ponding will not occur.

7.11.10 Our experience indicates that even with these provisions, a groundwater condition can develop as a result of increased irrigation, landscaping and surface runoff.

7.12 Bio-Retention Basin and Bio-Swale Recommendations

7.12.1 The site will be underlain by compacted fill, Old Terrace Deposits and Otay Formation. Based on our experience with the onsite soils and infiltration testing in nearby projects, the onsite soil has very low permeability and generally very low infiltration characteristics. It is our opinion the existing soil is unsuitable for infiltration of storm water runoff.

7.12.2 Any bio-retention basins, bioswales, and bio-remediation areas should be designed by the project civil engineer and reviewed by Geocon Incorporated. Typically, bioswales consist of a surface layer of vegetation underlain by clean sand. A subdrain should be provided beneath the sand layer. Water should not be allowed to infiltrate adjacent to the planned improvements. We recommend that retention basins, be properly lined to prevent water infiltration into the underlying soil. Prior to discharging into the storm drain pipe or other approved outlet structure, a seepage cutoff wall should be constructed at the interface between the subdrain and storm drainpipe. The concrete cut-off wall should extend at least 6 inches beyond the perimeter of the gravel-packed subdrain system. Figure 11 presents a typical bioswale detail.

7.12.3 The landscape architect should be consulted to provide the appropriate plant recommendations if a vegetated swale is to be implemented. If drought resistant plants are not used, irrigation may be required.

7.13 Drainage and Maintenance

7.13.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2013 CBC 1803.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into storm drains and conduits that carry runoff away from the proposed structure.

7.13.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

7.13.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

7.14 Grading and Foundation Plan Review

7.14.1 Geocon Incorporated should review the grading plans and foundation plans prior to final design submittal to determine if additional analysis and/or recommendations are required.

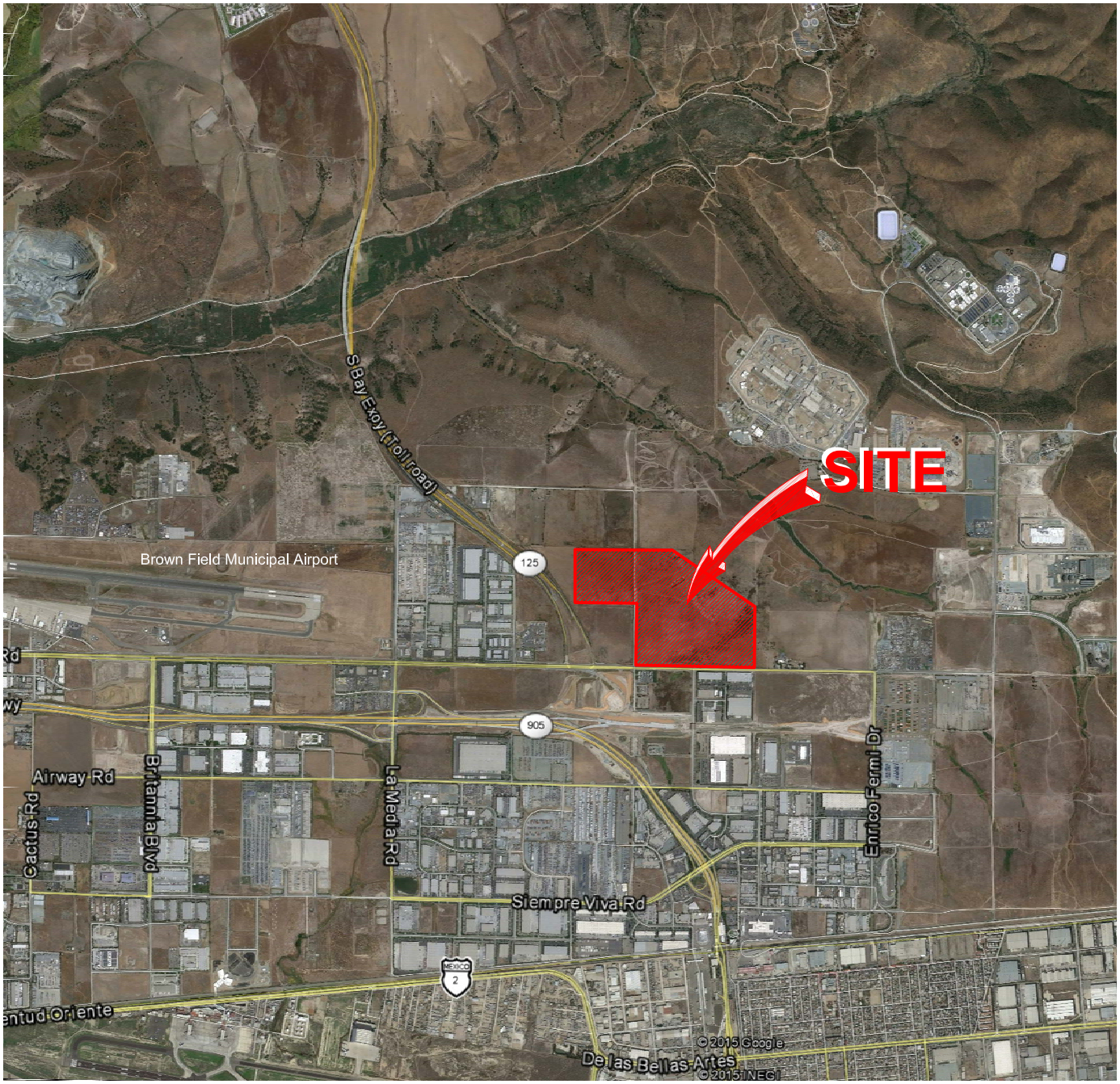
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. 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 Incorporated 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 Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner or 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.

4. 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 be 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.



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N

NO SCALE

VICINITY MAP

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EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

RG / RS		DSK/GTYPD

DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG. 1

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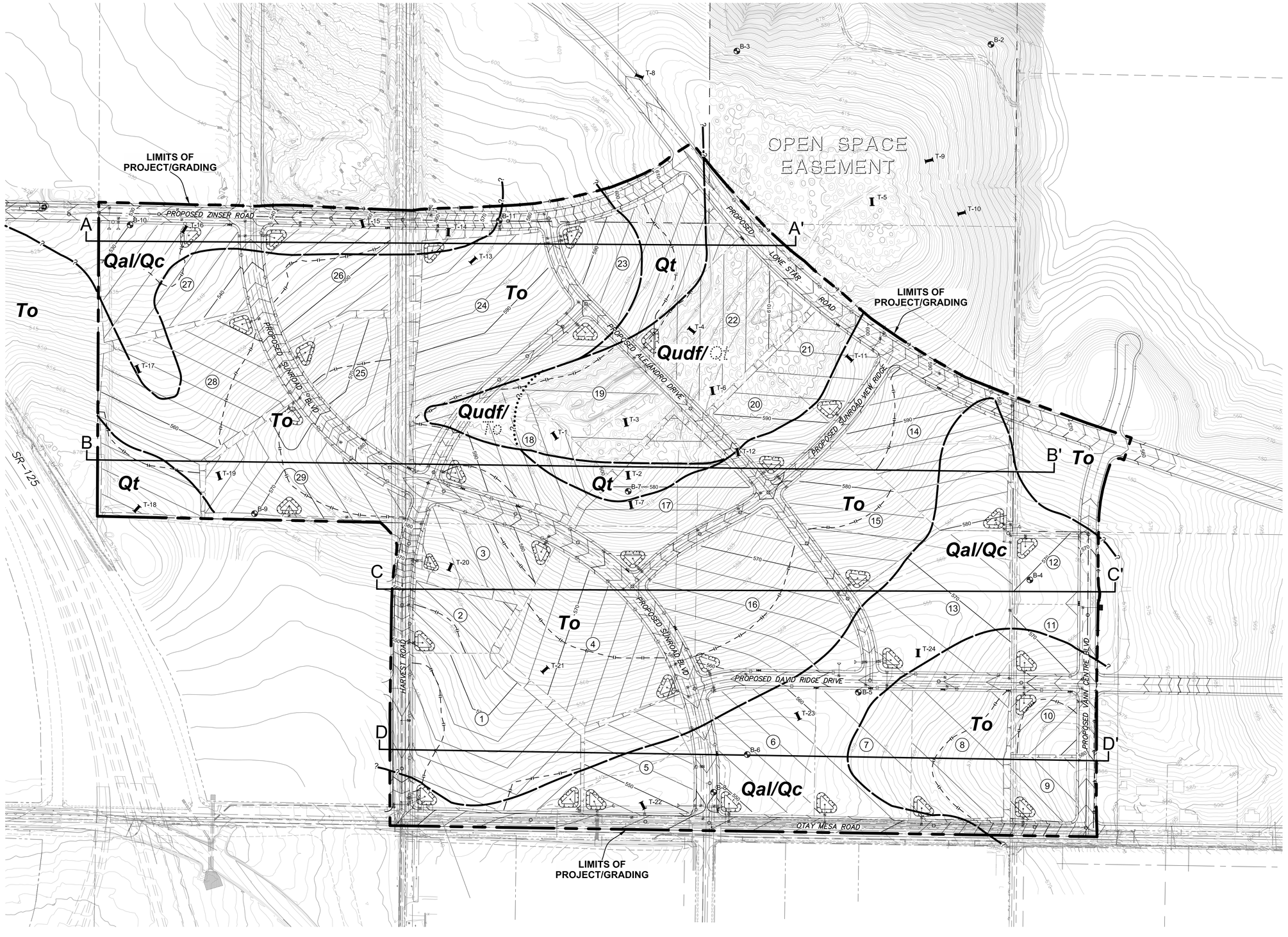

0' 200' 400' 600' 800'

SCALE : 1" = 200'

GEOCON LEGEND

- ***Qudf*** .....UNDOCUMENTED FILL
- ***Qal/Qc*** .....ALLUVIUM/COLLUVIUM (Undifferentiated)
- ***Qt*** .....OLD TERRACE DEPOSITS (Dotted Where Buried)
- ***To*** .....OTAY FORMATION
- B-11 .....APPROX. LOCATION OF LARGE DIAMETER BORING (FEB 26, 1999)
- T-26 .....APPROX. LOCATION OF TRENCH (FEB 26, 1999)
- D D' .....APPROX. LOCATION OF GEOLOGIC CROSS-SECTION
- .....APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried; Queried Where Uncertain)

GEOLOGIC MAP

EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

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SCALE	1" = 200'	DATE	07 - 20 - 2015
PROJECT NO.	06263 - 42 - 03	FIGURE	2
SHEET	1 OF 1		

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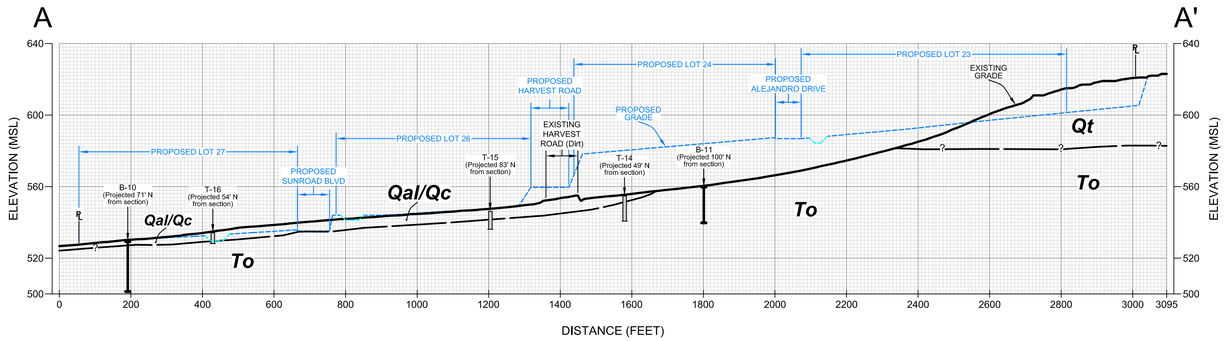

GEOLOGIC CROSS-SECTION A-A'

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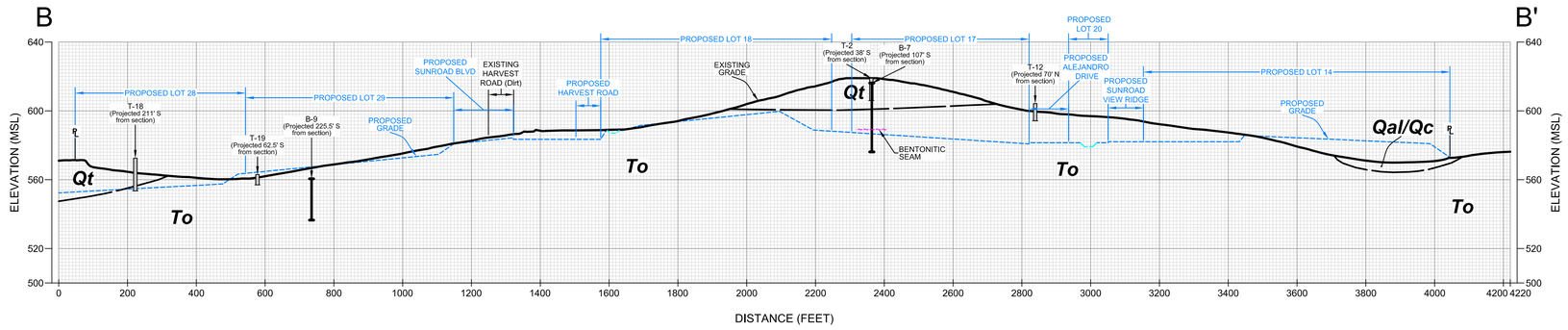

GEOLOGIC CROSS-SECTION B-B'

SCALE: 1" = 200' (Horiz.); 1" = 40' (Vert.)

GEOCON LEGEND

- Qal/Qc ..... ALLUVIUM/COLLUVIUM (Undifferentiated)
- Qt ..... OLD TERRACE DEPOSITS
- To ..... OTAY FORMATION
- B-11 ..... APPROX. LOCATION OF LARGE DIAMETER BORING (FEB 26, 1999)
- T-20 ..... APPROX. LOCATION OF TRENCH (FEB 26, 1999)
- ..... APPROX. LOCATION OF PROPOSED GRADE
- ..... APPROX. LOCATION OF PROPOSED DESILTIN BASIN
- ..... APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)

GEOLOGIC CROSS - SECTIONS

EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

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SCALE	1" = 200' (Horiz.) 1" = 40' (Vert.)	DATE	07 - 20 - 2015
PROJECT NO.	06263 - 42 - 03	FIGURE	3
SHEET	1 OF 1		

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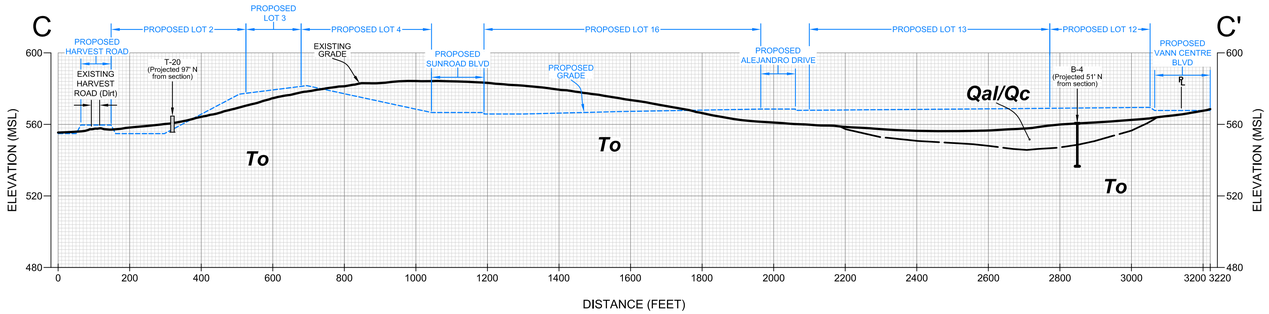

GEOLOGIC CROSS-SECTION C-C'

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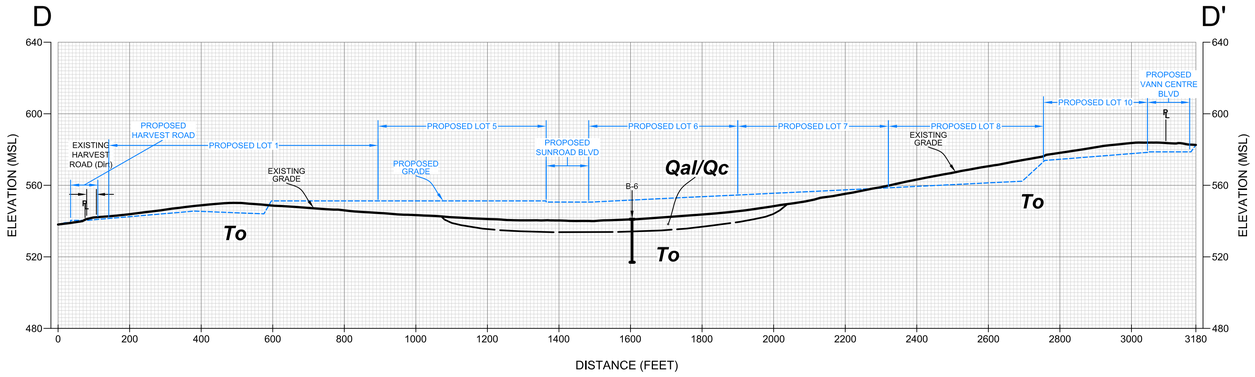

GEOLOGIC CROSS-SECTION D-D'

SCALE: 1" = 200' (Horiz.); 1" = 40' (Vert.)

GEOCON LEGEND

- *Qal/Qc* .....ALLUVIUM/COLLUVIUM (Undifferentiated)
- *Qt* .....OLD TERRACE DEPOSITS
- *To* .....OTAY FORMATION
- B-11 .....APPROX. LOCATION OF LARGE DIAMETER BORING (FEB 26, 1999)
- T-20 .....APPROX. LOCATION OF TRENCH (FEB 26, 1999)
- .....APPROX. LOCATION OF PROPOSED GRADE
- .....APPROX. LOCATION OF PROPOSED DESILTIN BASIN
- .....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)

GEOLOGIC CROSS - SECTIONS

EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

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SCALE	1" = 200' (Horiz.) 1" = 40' (Vert.)	DATE	07 - 20 - 2015
PROJECT NO.	06263 - 42 - 03		FIGURE 4
SHEET	1 OF 1		

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ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	40 feet
SLOPE INCLINATION	2 : 1 (Horizontal : Vertical)		
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	118.3 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	35 degrees
APPARENT COHESION	C	=	150 pounds per square foot
NO SEEPAGE FORCES			

ANALYSIS :

$\gamma_{c\phi}$	=	$\frac{\gamma_t H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\gamma_{c\phi}$	=	22.1	CALCULATED USING EQ. (3-3)
Ncf	=	60	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	1.9	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - FILL SLOPES

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EAST OTAY MESA CENTER MIXED-USE
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RG / RS		DSK/GTYPD	DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG. 5

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ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	Infinite
DEPTH OF SATURATION	Z	=	3 feet
SLOPE INCLINATION	2 : 1 (Horizontal : Vertical)		
SLOPE ANGLE	i	=	26.6 degrees
UNIT WEIGHT OF WATER	γ_w	=	62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	118.3 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	35 degrees
APPARENT COHESION	C	=	150 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$FS = \frac{C + (\gamma_t - \gamma_w)\ Z\ cos^2\ i\ tan\ \phi}{\gamma_t\ Z\ sin\ i\ cos\ i} = 2.1$$

REFERENCES :

1.....Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62

2.....Skempton, A. W., and F.A. Delory, *Stability of Natural Slopes in London Clay*, Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81

SURFICIAL SLOPE STABILITY ANALYSIS - FILL SLOPES

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EAST OTAY MESA CENTER MIXED-USE
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RG / RS		DSK/GTYPD	DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG. 6

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ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= 40 feet
SLOPE INCLINATION	2 : 1 (Horizontal : Vertical)	
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 132.3 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 35 degrees
APPARENT COHESION	C	= 500 pounds per square foot
NO SEEPAGE FORCES		

ANALYSIS :

$\gamma_{c\phi}$	=	$\frac{\gamma_t H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\lambda_{c\phi}$	=	7.0	CALCULATED USING EQ. (3-3)
Ncf	=	25	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	2.5	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - CUT SLOPES

GEOCON INCORPORATED

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974

PHONE 858 558-6900 - FAX 858 558-6159

EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

RG / RS		DSK/GTYPD	DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG. 7

Plotted:07/17/2015 1:57PM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\06263-42-03 East Otay Mesa Center Mixed Use\DETAILS\06263-42-03_(SSAC).dwg

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= Infinite
DEPTH OF SATURATION	Z	= 3 feet
SLOPE INCLINATION	2 : 1 (Horizontal : Vertical)	
SLOPE ANGLE	i	= 26.6 degrees
UNIT WEIGHT OF WATER	γ_w	= 62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 132.3 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 35 degrees
APPARENT COHESION	C	= 350 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$FS = \frac{C + (\gamma_t - \gamma_w)\ Z\ cos^2\ i\ tan\ \phi}{\gamma_t\ Z\ sin\ i\ cos\ i} = 4.1$$

REFERENCES :

1.....Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62

2.....Skempton, A. W., and F.A. Delory, *Stability of Natural Slopes in London Clay*, Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81

SURFICIAL SLOPE STABILITY ANALYSIS - CUT SLOPES

GEOCON INCORPORATED

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

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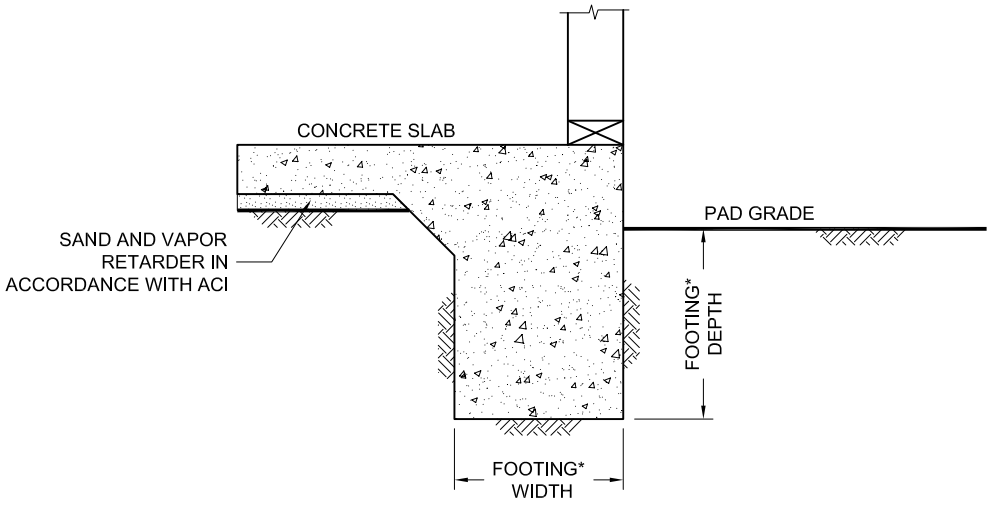
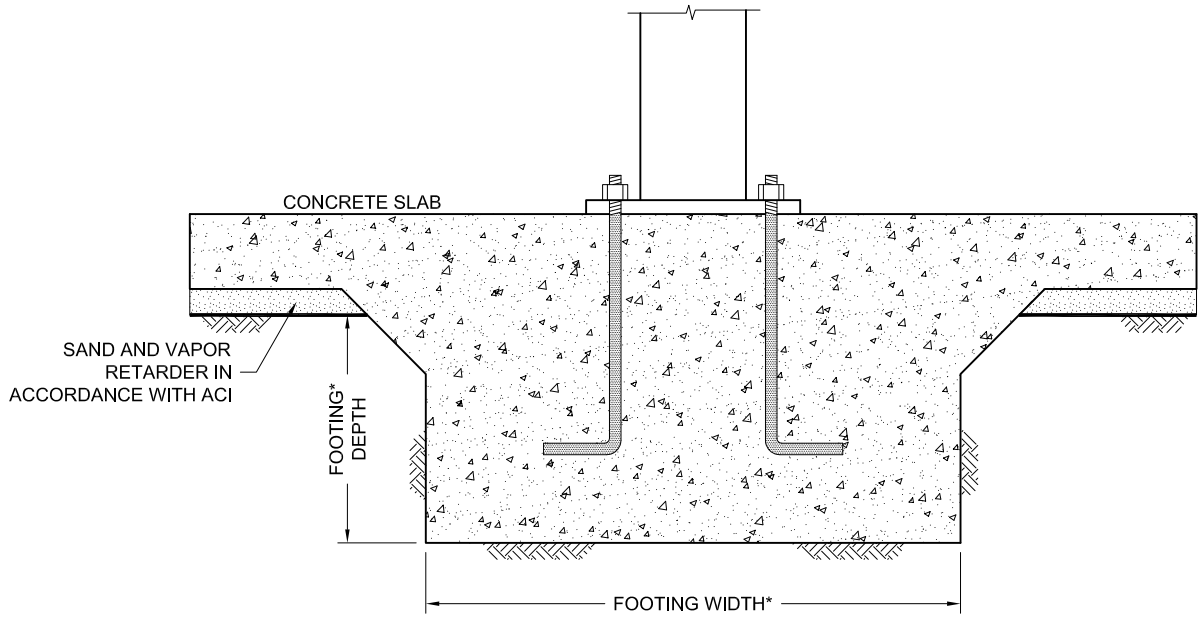
EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

RG / RS		DSK/GTYPD	DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG. 8

Plotted:07/17/2015 1:51PM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\06263-42-03 East Otay Mesa Center Mixed Use\DETAILS\06263-42-03_(SFSSA).(CUT-SLOPE).dwg





*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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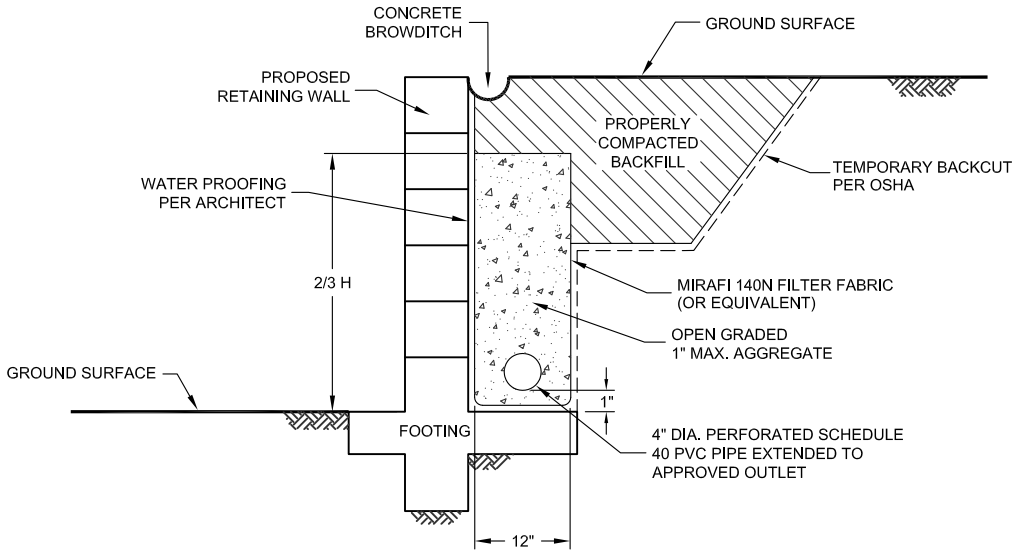
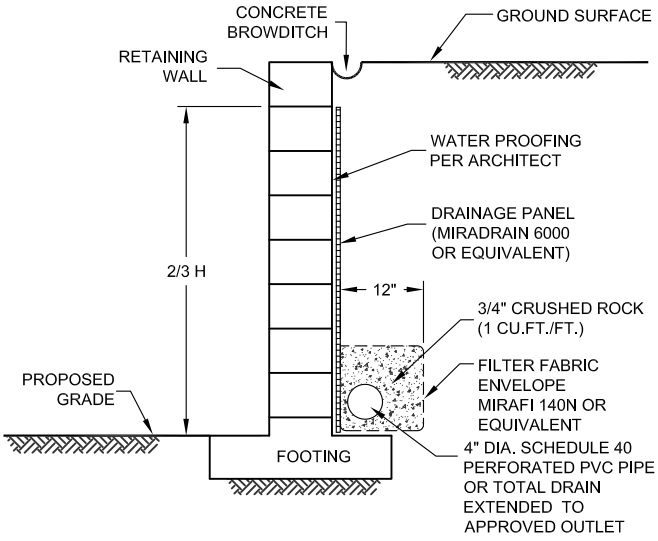
EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

RG / RS		DSK/GTYPD	DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG. 9

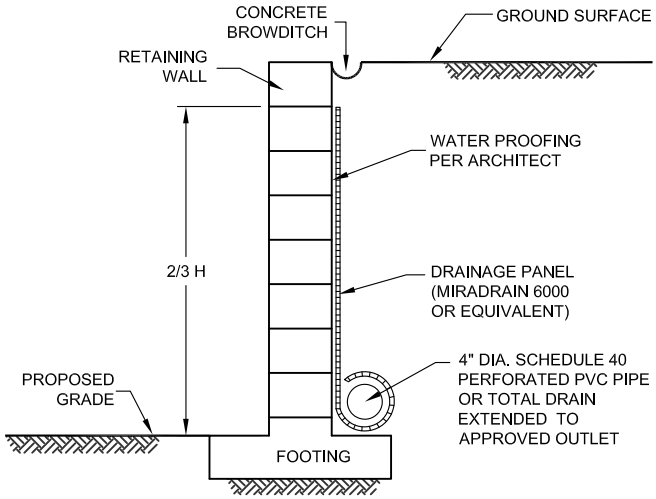
Plotted:07/17/2015 1:46PM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\06263-42-03 East Otay Mesa Center Mixed Use\DETAILS\06263-42-03_(COLFOOT2).dwg





NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING



NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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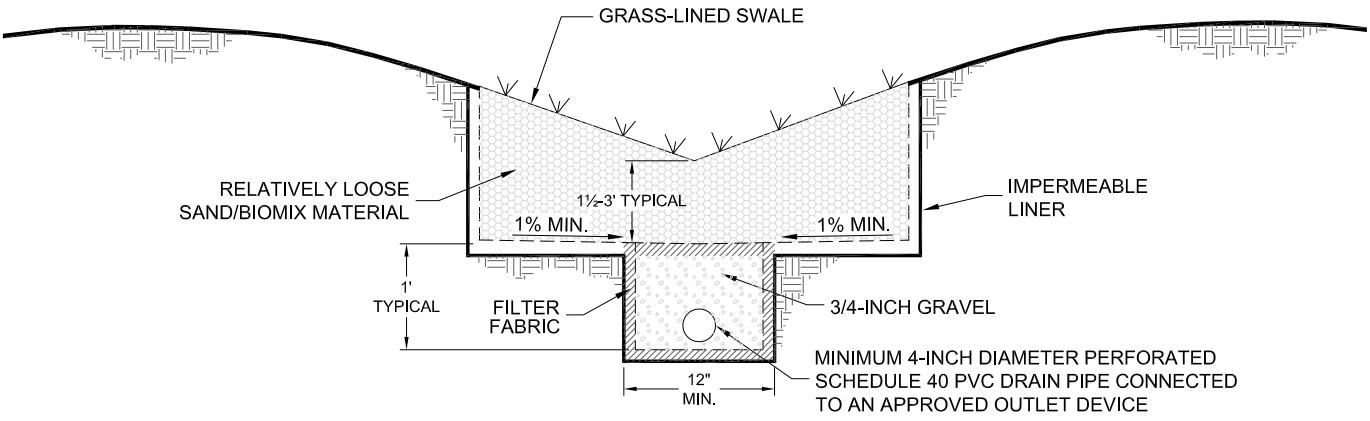
EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

RG / RS		DSK/GTYPD	DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG.10

Plotted:07/17/2015 1:47PM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\06263-42-03 East Otay Mesa Center Mixed Use\DETAILS\06263-42-03_(RWDD7A).dwg



NO SCALE

VEGETATED SWALE BIOFILTER DETAIL

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PHONE 858 558-6900 - FAX 858 558-6159

RG / CW		DSK/GTYPD

EAST OTAY MESA CENTER MIXED-USE
SAN DIEGO, CALIFORNIA

DATE 07 - 20 - 2015	PROJECT NO. 06263 - 42 - 03	FIG. 11

Y:\PROJECTS\06263-42-03 East Otay Mesa Center Mixed Use\DETAILS\VSBD_2 (Bioswale).dwg

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The field investigation was performed between September 7 and September 20, 1990, and consisted of geologic mapping of 11 large-diameter exploratory borings and 26 exploratory trenches at the approximate locations shown on the attached Geologic Map, Figure 2 (Map Pocket). The borings were advanced to depths ranging from 20 feet to 90 feet below existing grade utilizing an E100 drill-rig equipped with a 30-inch-diameter bucket auger. The trenches were excavated utilizing a John Deere 710 backhoe and/or a John Deere 555 trackhoe.

Relatively undisturbed samples were obtained from the borings by driving a three-inch O. D. split-tube sampler into the soil mass with blows from the drill rig's Kelly bar falling 12 inches. The sampler was equipped with 1-inch by 2⅜-inch brass sampler rings to facilitate removal and testing. Disturbed samples of prevailing soils were also obtained from the borings and trenches.

The soil conditions encountered in the trenches were visually examined, classified, and logged in general conformance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D 2844). The logs of the exploratory borings and trenches are presented on Figures A-1 through A-45. The logs depict the various soil types encountered and indicate the depths at which samples were obtained.

FILE NO. 04581-03-01

BORING B 1

ELEVATION 572 DATE COMPLETED 9/10/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			MATERIAL DESCRIPTION			
0–2		CL	**TOPSOIL** Soft, dry, dark gray, Sandy CLAY			
4–6	B1-1	SM	**OTAY FORMATION** Highly weathered, fractured, dry, whitish gray Silty fine SANDSTONE interbedded with Sandy SILTSTONE	3/12"	103.3	16.1
8–10		CL	Hard, humid, fractured purplish CLAYSTONE, bedding attitude near horizontal			
12	B1-2	SM	Very dense, humid, light gray Silty fine SANDSTONE	3/12"	105.8	16.6
14	B1-4	ML	Purplish sandy siltstone from 14 to 15 feet			
16–18	B1-3	SM	Very dense, humid, light gray Silty fine SANDSTONE	5/12"	108.7	16.2
20–22	B1-5	ML	Very stiff to hard, humid, purplish-brown Clayey SILTSTONE. Contact gradational	3/12"	84.1	35.8
22		CH	Bentonite layer approximately 6 inches thick, attitude horizontal. Shear zone bedding plane fault 1/2 inch thick - horizontal			
24–26	B1-6	ML	Hard, humid, pinkish-gray, Clayey SILTSTONE	13/12"	125.7	10.5
28		SM	Grades into massive, gray, very fine silty sandstone at 27 feet			
28	B1-7	ML	Grades into hard, purplish siltstone	10/12"	114.8	17.1

Figure A-1 Log of Test Boring B 1, page 1 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 1

ELEVATION 572 DATE COMPLETED 9/10/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30				SM	at 29 feet Grades into hard, purplish siltstone at 29 feet (continued)			
32				SM	Very dense, moist, light gray, massive, fine Silty SANDSTONE			
34				CL	Hard claystone layer. Attitude near horizontal			
36				SM	Very dense, moist, light gray, massive, fine Silty SANDSTONE			
38				CL	Hard claystone bed from 38.5 to 39.5 feet			
40	B1-8			SM	Very dense, moist, light gray, massive, fine Silty SANDSTONE	20/12"	129.3	6.0
42				SP	Very hard, well-cemented sandstone from 42.5 to 43.5			
44				SM	Very dense, moist, light gray, massive, fine Silty SANDSTONE			
46				SM	Very hard, moist, massive, light gray Sandy SILTSTONE			
48								
50	B1-9			SM	Very dense, moist, gray, massive fine Silty SANDSTONE	17/12"	106.6	20.6
52								
54								
56				CL	Very hard, massive, humid, purplish brown Silty CLAYSTONE			
58				CH	Very hard, purplish-gray, Bentonitic CLAY conchoidal fracturing			

Figure A-2 Log of Test Boring B 1, page 2 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 1

ELEVATION 572 DATE COMPLETED 9/10/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	B1-10			CH	Very hard, purplish-gray, Bentonitic CLAY conchoidal fracturing (continued)	11/12"	65.5	54.6
62					Hard, pink BENTONITE			
64				ML	Shear zone, soft, highly remolded 1 to 3 inch thick. Attitude near horizontal 62 to 63 feet			
66					Very dense, moist, massive, dark gray fine Silty SANDSTONE			
68					Grades into very hard, light brown siltstone at 63.5 feet			
70								
72	B1-11			SM	Very dense, moist, massive, brownish-gray, very fine, Silty SANDSTONE		126.9	6.6
74								
76				SM	Very hard, moist, purplish-brown, massive Sandy SILTSTONE			
78								
80	B1-12			SM	Very dense, massive, fine SANDSTONE		117.1	13.3
82								
84				SM	Very hard, humid, massive, Sandy SILTSTONE			
86								
88								
					TRENCH TERMINATED AT 90 FEET		92.5	27.0

Figure A-3 Log of Test Boring B 1, page 3 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 2

ELEVATION 576 DATE COMPLETED 9/11/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Loose, dry, dark gray Silty CLAY			
4				SM	**OTAY FORMATION** Medium dense, humid, fractured, weathered light grayish-brown Silty SANDSTONE			
6	B2-1					3/12"	102.6	17.4
8				CL	Hard, humid, purple, massive CLAYSTONE			
10	B2-2			SM	Grades into very dense massive, Silty SANDSTONE	9/12"	118.2	11.9
12								
14				CL	Hard, humid, purple claystone from 12.5 to 14 feet			
16	B2-3			SM	Grades into very dense massive, Silty SANDSTONE	8/12"	122.2	11.4
18								
20	B2-4			CL	Hard, purple, humid claystone from 19.5 to 20.5 feet	7/12"	108.9	19.0
22				SM	Grades into very dense massive, Silty SANDSTONE			
24								
26	B2-5			CH	Hard pink bentonite bed approximately horizontal from 24.5 to 25.5 feet	6/12"	111.3	11.4
				SM				
28				SP	Grades into very dense massive, Silty SANDSTONE			
				SM				
					Hard, well-cemented sandstone from			

Figure A-4 Log of Test Boring B 2, page 1 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 2

ELEVATION 576 DATE COMPLETED 9/11/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B2-6			SM	27 to 28 feet Very dense, massive, Silty SANDSTONE (continued)	14/12"	118.4	10.3
32				CL	Hard, humid, brown Sandy CLAYSTONE			
34				SM	Very dense, humid, massive, light gray, very fine Silty SANDSTONE			
36								
38								
40	B2-7						105.7	9.8
42								
44								
46				CL	Hard, humid, dark gray Silty CLAYSTONE			
48								
50	B2-8			SM	Very dense, humid, massive, light gray, medium cemented, very fine Silty SANDSTONE	9/12"	103.3	13.9
52								
54								
56				CL	Hard, humid, purple, CLAYSTONE Grades into hard, dark gray bentonitic claystone at 56.5 feet			
58				CH	Hard, brittle, pinkish-brown BENTONITE			

Figure A-5 Log of Test Boring B 2, page 2 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 2

ELEVATION 576 DATE COMPLETED 9/11/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	B2-9						64.4	57.4
62				SP	Very dense, humid, gray, massive fine SANDSTONE			
64								
66								
68								
					BORING TERMINATED AT 69 FEET			

Figure A-6 Log of Test Boring B 2, page 3 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 3

ELEVATION 606 DATE COMPLETED 9/12/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Soft, dry, blackish-brown Sandy CLAY			
4				SC	**OTAY FORMATION** Fractured, weathered, dry, whitish-tan Clayey SANDSTONE			
6	B3-1					2/12"	99.2	20.6
8				SM	Very dense, moist, light gray, fine, massive, Silty SANDSTONE			
10				ML	Stiff, humid, light brown SILTSTONE (volcanic tuff)			
12	B3-2			SM	Very dense, moist, light gray, fine, massive, Silty SANDSTONE	6/12"	111.7	11.5
14	B3-3			CL	Hard, humid, purplish-brown CLAYSTONE	8/12"	112.7	15.1
16				SM	Very dense, moist, light gray, fine, massive, Silty SANDSTONE			
18								
20	B3-4					7/12"	113.5	9.9
22				SP	Well cemented SANDSTONE from 21 to 21.5 feet			
				SM				
24				CL	Very dense, moist, light gray, fine, massive, Silty SANDSTONE			
26	B3-5				Hard, humid, purple, massive CLAYSTONE	16/12"	114.4	13.2
				SP	Very dense, humid, light gray, fine SANDSTONE			
28				CL	Hard, humid, light brown, massive CLAYSTONE			

Figure A-7 Log of Test Boring B 3, page 1 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 3

ELEVATION 606 DATE COMPLETED 9/12/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B3-6			SM	Hard, humid, massive, light gray Sandy SILTSTONE	14/12"	119.3	12.4
32								
34								
36				SM	Very dense, moist, light gray, very fine Silty SANDSTONE			
38					Hard, well cemented concretions from 37.5 to 39 feet			
40	B3-7			CL/SM	Hard purplish CLAYSTONE interbedded with very dense, light gray Silty SANDSTONE. Thickness of beds 1 to 2 feet, Contact gradational, general attitude near horizontal.		99.7	13.2
42								
44								
46								
48	B3-10				Shear zone. Bedding plane fault. Thickness approximately 1 inch. Attitude horizontal. Developed along purplish claystone (above) and gray siltstone (below) from 47.5 to 47.75 feet			
50	B3-8			SM-ML	Very dense, humid, light gray, fine Silty SANDSTONE interbedded with gray Shaley SILTSTONE	23/12"	116.6	14.9
52								
54				CL	Very hard, humid, purplish-brown CLAYSTONE, grades into clayey sandstone			
56				SM	Very dense, humid, massive, light gray, fine Silty SANDSTONE. Occasional cemented zones.			
58								

Figure A-8 Log of Test Boring B 3, page 2 of 3

ECKE

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.

FILE NO. 04581-03-01

BORING B 3

ELEVATION 606 DATE COMPLETED 9/12/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60								
	B3-9			SM	Very dense, humid, massive, light gray, fine Silty SANDSTONE. Occasional cemented zones. (continued)		105.7	13.2
62								
64								
66								
68								
70	B3-11			CL	Hard, humid, purplish-brown CLAYSTONE	20/12"	110.9	18.5
72								
74				SM	Very dense, humid, light gray Silty SANDSTONE with occasional siltstone zones			
76								
				CH	Hard, brittle, pinkish-brown bentonite seam. Thickness approximately 4 inches, poorly developed shear zone. Attitude near horizontal from 76.5 to 77 feet			
78				SM				
80	B3-12				Very dense, humid, light gray Silty SANDSTONE with occasional siltstone zones	50/12"	114.4	11.0
					BORING TERMINATED AT 81 FEET			

Figure A-9 Log of Test Boring B 3, page 3 of 3

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 4

ELEVATION 559 DATE COMPLETED 9/12/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL/ALLUVIUM/COLLUVIUM** Soft, dry, dark gray Sandy CLAY			
4					**OTAY FORMATION** Highly weathered, moist, whitish-tan			
6	B4-1			SM	Sandy SILT	2/12"	107.9	17.6
8				SM	Medium dense, humid, light gray Silty SAND			
10	B4-2			SM	Stiff, moist, fine Sandy SILTSTONE (volcanic tuff) Poorly developed shear zone attitude horizontal at 10 feet	1/12"	91.3	30.5
12				SM-ML	Very dense, moist, light grayish-brown, massive, very fine Silty SANDSTONE/ SILTSTONE			
14								
16	B4-3					4/12"	100.8	23.8
18				CL	Very hard, humid, purple-brown massive CLAYSTONE			
20	B4-4					4/12"	103.0	23.2
22				SM	Very dense, moist, massive, trace Silty SANDSTONE with trace of silt			
24								
					BORING TERMINATED AT 25 FEET			

Figure A-10 Log of Test Boring B 4, page 1 of 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 5

ELEVATION 547 DATE COMPLETED 9/12/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			MATERIAL DESCRIPTION			
0		CL	**TOPSOIL/ALLUVIUM/COLLUVIUM** Soft, dry, dark gray Sandy CLAY			
2			Becomes moist, blackish-gray clay at 2.5 feet			
4						
6	B5-1	CL/SM	**OTAY FORMATION** Soft, moist to wet, mottled, highly weathered bioturbated CLAY Medium dense, moist, grayish-brown fine Silty SAND CaCO3 concentrations from 8 to 8.5 feet	1/12"	104.2	19.3
8						
10	B5-2	CL	Stiff, moist, purple-brown CLAYSTONE Well cemented concretion from 11 to 11.5 feet	3/12"	94.9	20.8
12						
14		SM	Very stiff, moist, dark gray, Sandy SILTSTONE			
16						
18	B5-3	ML	Hard, humid, gray SILTSTONE		103.2	20.9
20			Light seepage at 20 feet			
22	B5-4				102.5	22.8
24						
			BORING TERMINATED AT 25 FEET			

Figure A-11 Log of Test Boring B 5, page 1 of 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 6

ELEVATION 539 DATE COMPLETED 9/12/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			MATERIAL DESCRIPTION			
0		CL	**ALLUVIUM\COLLUVIUM** Medium stiff, dry-slightly damp, red-brown to gray-brown Sandy CLAY Very gravelly at 2.5 feet			
4		CL	**OTAY FORMATION** Medium stiff, moist, mottled red-brown and light tan Silty CLAY with CaCO3 seams; some interbedded medium dense, moist, gray-brown Silty fine SAND; highly weathered Becomes stiff at 5 feet			
6	B6-1			1/12"	102.3	21.1
8			Stiff moist-wet, light tan SILTSTONE			
10	B6-2	ML	Becomes wet from 11 to 11.5 feet	4/12"	108.5	20.5
12			Very dense, moist-wet, gray micaceous SANDSTONE, some interbedded hardened red-brown oxidized layers			
14		SM	Becomes saturated at 14 feet			
16	B6-3			3/12"	109.1	18.3
18			Highly cemented sandstone at 18.5 feet			
20		CL	Stiff, saturated, light red-brown CLAYSTONE			
20	B6-4			5/12"	106.4	21.1
22		SM	Dense, saturated dark gray SANDSTONE			
24						
			BORING TERMINATED AT 25 FEET			

Figure A-12 Log of Test Boring B 6, page 1 of 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 7

ELEVATION 615 DATE COMPLETED 9/13/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			MATERIAL DESCRIPTION			
0–2		CL	**TOPSOIL** Soft, dry, dark gray Sandy CLAY			
2			Cobbles at 2.5 feet			
4–6	B7-1	ML	**OTAY FORMATION** Highly weathered, dry, whitish-tan, fractured calichified SILTSTONE. Numerous krotovinas along the topsoil contact	4/12"	91.7	15.5
8		SM	Stiff, humid, dark gray, fractured Sandy SILTSTONE			
10	B7-2	SM	Very dense, humid, light gray, massive weakly cemented fine Silty SANDSTONE	5/12"	109.7	12.0
12						
14		ML	Hard, humid, dark gray Sandy SILTSTONE. Bedding near horizontal.			
16	B7-3	SM	Very dense, humid, light gray, massive weakly cemented fine Silty SANDSTONE	10/12"	126.6	11.3
18						
20	B7-4			10/12"	118.6	11.8
22		SM				
24		SM-CL	Volcanic tuff bed. Attitude horizontal from 22.5 to 23 feet			
26	B7-5		Very stiff to hard, humid, purplish-brown Sandy SILTSTONE/CLAYSTONE	14/12"	124.8	10.6
28		SM	Very dense, humid, light gray, fine Silty SANDSTONE Bentonitic tuff seam. from 27.5 to 28 feet, Attitude horizontal Purple, hard, claystone from 28 to 28.5 feet			

Figure A-13 Log of Test Boring B 7, page 1 of 2

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 7

ELEVATION 615 DATE COMPLETED 9/13/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B7-6			SM	Very dense, humid, light gray, fine Silty SANDSTONE (continued)	10/12"	109.3	22.2
32				CL	Hard, humid, purplish-brown, Silty CLAYSTONE			
				SP				
34				ML	Very dense, humid, gray massive SANDSTONE			
36				SP	Hard, purplish-brown siltstone from 34 to 35 feet			
38					Very dense, gray, massive SANDSTONE			
40					BORING TERMINATED AT 40 FEET			

Figure A-14 Log of Test Boring B 7, page 2 of 2

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 8

ELEVATION 539 DATE COMPLETED 9/13/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		CL	**TOPSOIL** Loose, slightly damp to damp, yellow-brown CLAY with minor caliche, abundant grass and root matter			
2		CL				
4	B8-1		**ALLUVIUM/COLLUVIUM** Stiff, damp, brown, Sandy CLAY with Becomes dark brown CaCO3, from 3 to 4 feet	1/12"	110.9	12.1
6	B8-4	CL				
	B8-2	SM	Dense, damp, gray-brown, Clayey fine to medium SAND with CaCo3	PUSH	87.8	31.7
8		SM	Stiff, moist, brown Sandy CLAY			
10	B8-3	SM	**OTAY FORMATION** Highly weathered, dense, moist, gray-brown Silty SAND with sub-horizontal layers of highly weathered white volcanic tuff Stiff, hard, moist, light gray-pinkish gray volcanic tuff at 8 feet	2/12"	97.1	26.6
12						
14			Dense to hard, damp to moist, gray-brown Silty fine SAND with few interbedded layers of volcanic tuff			
16	B8-5			4/12"	105.9	20.1
18			Standing water at 19 feet			
20			BORING TERMINATED AT 20 FEET			

Figure A-15 Log of Test Boring B 8, page 1 of 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 9

ELEVATION 553 DATE COMPLETED 9/13/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		SC	**TOPSOIL** Loose, dry, dark brown, Clayey SAND with trace gravel			
2		CL	**COLLUVIUM** Stiff, damp, dark brown Sandy CLAY			
4			Stiff mottled dark red-brown and light tan sandy clay at 4 feet			
6	B9-1	SM	**OTAY FORMATION** Highly weathered, interbedded dense, damp gray SANDSTONE	2/12"	104.8	11.5
8			Krotovina at 5.5 feet			
10	B9-2	SP	Very dense, damp, light brownish-gray SANDSTONE	3/12"	107.0	13.6
12						
14						
16	B9-3	SM-ML	Very dense to hard, damp, light pinkish-gray, tuffaceous SANDSTONE	5/12"	111.9	10.7
18		SP	Stiff, hard, damp, purplish-gray to white volcanic tuff SILTSTONE			
			Very dense, damp, light gray-brown interlayered with pinkish-brown SANDSTONE			
20	B9-4	CL	Medium stiff, damp to moist, light slightly pinkish-tan CLAYSTONE/BENTONITE	7/12"	110.9	18.3
22		SP	Hard, damp, medium gray-brown SANDSTONE			
24						
			BORING TERMINATED AT 25 FEET			

Figure A-16 Log of Test Boring B 9, page 1 of 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 10

ELEVATION 518 DATE COMPLETED 9/13/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		CL	**TOPSOIL** Loose, fractured, stiff, damp dark brown Sandy CLAY with little gravel			
2		CL	**ALLUVIUM/COLLUVIUM** Stiff, damp, dark brown, Sandy CLAY with gravel, subangular clasts to 3 inches.			
4						
6	B10-1 B10-2	CL	Base of gravels at 2.5 feet	PUSH	89.6	27.4
8		SP	**OTAY FORMATION** Stiff, mottled gray-brown to dark brown, Silty CLAY, highly weathered			
10	B10-3	ML	Dense, moist, interbedded gray-brown SANDSTONE with brown siltstone/claystone Becomes very dense to hard, damp, gray-brown sandstone, finely bedded Highly cemented layer 4 to 6 inch thick at 9 feet	2/12"	94.1	29.9
12						
14		SM	Stiff, moist, light purplish-tan SILTSTONE Becomes medium stiff, finely bedded at 11.5 feet			
16	B10-4		Very dense to hard, moist, medium gray-brown SANDSTONE 6 inch thick siltstone layer at 13 feet Highly cemented layer 1 to 2 inch thick at 17.5 feet	2/12"	99.1	25.5
18						
20	B10-5		Siltstone layer 2 to 3 inch thick at 20 feet	6/12"	105.3	20.4
22			Siltstone layer 2 to 3 inch thick at 22 feet			
24						
26			Siltstone layer 2 to 3 inch thick, very hard at 25 feet			
28			BORING TERMINATED AT 28.5 FEET			

Figure A-17 Log of Test Boring B 10, page 1 of 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

BORING B 11

ELEVATION 558 DATE COMPLETED 9/13/90

EQUIPMENT E-100 BUCKET DRILL

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		CL	**TOPSOIL**			
2		CL	Highly fractured, stiff, slightly damp, dark brown, slightly gravelly, Sandy CLAY			
4		CL	**ALLUVIUM/COLLUVIUM** Stiff, damp, moist, dark brown, fine Sandy CLAY with little gravel			
6	B11-1	SM	Stiff, damp, grayish brown, CLAY, gravelly in lower 6 inches to 1 foot (subangular clasts to 5 inches)	2/12"	100.0	11.6
8		SM-CL				
10	B11-2	SP	**OTAY FORMATION** Very dense, damp, gray brown Silty SANDSTONE			
12		ML-CL	Medium stiff, damp, mottled purplish brown and light tan, SILTSTONE/ CLAYSTONE -Becomes stiff, at 7 feet	1/12"	96.4	23.2
14			Very dense, slightly damp, gray brown SANDSTONE			
16	B11-3	SM	Stiff to very stiff, damp, grayish tan and dark purplish brown SILTSTONE/ CLAYSTONE with interbedded, discontinuous seams of white volcanic tuff siltstone	8/12"	123.2	12.7
18		CL	Very dense to hard, damp, gray brown SANDSTONE			
20		ML	Very stiff, damp, light reddish brown CLAYSTONE with pressure faces			
			Hard, slightly damp, dark gray brown SILTSTONE			
			BORING TERMINATED AT 20 FEET			

Figure A-18 Log of Test Boring B 11, page 1 of 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

TRENCH T 1

ELEVATION 607 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

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	**TOPSOIL** Loose, dry, slightly damp gray-brown, slightly Clayey fine to coarse SAND			
2				SC				
4				SM	**FLUVIAL TERRACE DEPOSITS** Soft-medium, stiff, damp-moist, dark gray-brown, Clayey fine to medium SAND with abundant subangular cobbles			
6				SM	**OTAY FORMATION** Medium dense, damp, mottled white and light yellow-brown SANDSTONE with CaCO3			
8				SM	Medium dense, dense, damp light gray Silty fine to coarse SAND			
					Very dense, damp, white - to light tan Silty SANDSTONE			
					TRENCH TERMINATED AT 9.5 FEET			

Figure A-19, Log of Test Trench T 1

ECKE

SAMPLE SYMBOLS: ☐ ... SAMPLING UNSUCCESSFUL; ◧ ... STANDARD PENETRATION TEST; ■ ... DRIVE SAMPLE (UNDISTURBED); ⊠ ... DISTURBED OR BAG SAMPLE; ▨ ... CHUNK SAMPLE; ▼ ... WATER TABLE OR SEEPAGE

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FILE NO. 04581-03-01

TRENCH T 2

ELEVATION 620 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Dark blackish-gray, soft, dry Sandy CLAY			
4				SW	**FLUVIAL TERRACE DEPOSITS** Dense, dry, whitish-gray, weathered SAND/COBBLES			
6				SW	Very dense, humid, light brown, cohesionless SAND/COBBLE (subrounded metavolcanic rock fragments)			
8								
10								
12	T2-1			SC	**OTAY FORMATION** Very dense, moist, light gray medium-cemented Clayey SANDSTONE			
					TRENCH TERMINATED AT 12.5 FEET			

Figure A-20, Log of Test Trench T 2

ECKE

SAMPLE SYMBOLS

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

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FILE NO. 04581-03-01

TRENCH T 3

ELEVATION 611 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				SC	**TOPSOIL** Loose, slightly-damp, gray-brown, Clayey SAND Becomes dark-brown at 1 foot			
4				SW	**FLUVIAL TERRACE DEPOSITS** Dense, damp-moist, yellow-brown, slightly clayey, Gravelly SAND with some cobble to 10 inches Becomes gravelly sand with cobble, no clay at 6 feet			
6	T3-1							
8								
10								
12	T3-2			SM	**OTAY FORMATION** Dense, damp, light gray, Silty SANDSTONE			
					TRENCH TERMINATED AT 12 FEET			

Figure A-21, Log of Test Trench T 3

ECKE

SAMPLE SYMBOLS

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

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FILE NO. 04581-03-01

TRENCH T 4

ELEVATION 611 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				SC-SM	**TOPSOIL/COLLUVIUM** Loose,to medium-dense, damp-dry, gray-brown Clayey, Silty SAND			
4	T4-1			CL	**FLUVIAL TERRACE DEPOSITS** Medium stiff,to stiff, moist, dark reddish-brown Sandy CLAY Becomes cobbly (metavolcanic rock fragments) at 4 feet			
6	T4-2			SM/SW	Dense, damp, light reddish-brown Silty, Gravelly SAND with cobbles Cobble size increases with depth			
8								
10					Boulders to 3 feet at 10 feet			
					TRENCH TERMINATED AT 11 FEET REFUSAL			

Figure A-22, Log of Test Trench T 4

ECKE

SAMPLE SYMBOLS

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

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FILE NO. 04581-03-01

TRENCH T 5

ELEVATION 627 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

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-SC	**TOPSOIL** Loose, dryish damp, gray-brown Silty SAND			
2				SW	Becomes dark brown, clayey with abundant cobbles			
4					**TERRACE DEPOSITS** Dense, damp, light yellowish, reddish-brown, SAND/COBBLE to greater than 12 inches, Subangular Boulders to 2 feet, at 4.5 feet			
6								
8	T5-1			SM-SW	**OTAY FORMATION** Very dense, damp, light gray-brown, weakly cemented SANDSTONE			
10								
					TRENCH TERMINATED AT 10.5 FEET			

Figure A-23, Log of Test Trench T 5

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 8

ELEVATION 607 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

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	**TOPSOIL** Loose to medium dense, damp, dark gray-brown clayey SAND with trace gravel			
2				SC-CL	**FLUVIAL TERRACE DEPOSITS** Medium dense, damp, gray-brown, Clayey SAND/Sandy CLAY with cobbles (meta-volcanic rock fragments)			
4				CL				
				SM				
6				SC-CL	Medium stiff, damp-moist dark red-brown Sandy CLAY			
				SM	**OTAY FORMATION** Very dense, slightly damp, light greenish-gray Silty SANDSTONE			
8					Medium dense, medium stiff, damp-moist, reddish brown, Clayey SAND/Sandy CLAY			
					Medium dense to dense, damp, white light gray-brown mottled CaCO3 cemented SANDSTONE			
					TRENCH TERMINATED AT 8.5 FEET			

Figure A-27, Log of Test Trench T 8

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 9

ELEVATION 610 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2	T9-1			SC	**TOPSOIL** Loose-medium dense, damp dark brown, Clayey SAND with cobbles, few boulders			
4				CL	**TERRACE DEPOSITS** Medium stiff, damp, yellow brown, Sandy CLAY			
6				CL	**OTAY FORMATION** Stiff, damp, pale yellow-brown Sandy CLAY with clay films on ped faces			
8				SP	Very dense, damp, light brown SANDSTONE			
10					TRENCH TERMINATED AT 10 FEET			

Figure A-28, Log of Test Trench T 9

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 10

ELEVATION 600 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				SC-CL	**TOPSOIL** Loose, damp, dark gray-brown, Clayey SAND/Sandy CLAY			
4				CL	**OTAY FORMATION** Medium dense, weathered, damp white-light tan, Sandy CLAY			
6				CL-SM CL/ML	Dense, damp, light gray-tan, Sandy CLAYSTONE/SILTSTONE			

TRENCH TERMINATED AT 7 FEET

Figure A-29, Log of Test Trench T 10

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 11

ELEVATION 612 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

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-CL	**TOPSOIL** Loose to medium dense, dry-damp, dark brown Clayey SAND with subangular to subrounded cobbles Becomes stiff sandy clay at 1.5 feet			
2								
				SC				
4				SM	**OTAY FORMATION** Weathered, medium dense, damp, yellow-brown Clayey SAND			
6								
				CL-ML	Dense, damp, yellowish gray-brown SANDSTONE			
8					Dense, slightly damp, tan SILTSTONE/ CLAYSTONE			
					TRENCH TERMINATED AT 9 FEET			

Figure A-30, Log of Test Trench T 11

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 12

ELEVATION 605 DATE COMPLETED 9/7/90

EQUIPMENT JD 710 BACKHOE

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-CL	**TOPSOIL** Loose to medium dense, damp, dark brown, Clayey SAND Becomes stiff sandy clay at 1.5 feet			
2								
4				SW-SM	**OTAY FORMATION** Dense, damp, yellow-brown, Silty fine to coarse SAND			
6				SM	Very dense, damp, gray-brown SANDSTONE			
				CL-ML	Medium dense, damp-moist, yellow-brown SILTSTONE/CLAYSTONE			
8								
10					TRENCH TERMINATED AT 10 FEET			

Figure A-31, Log of Test Trench T 12

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 13

ELEVATION 560 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACK HOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2	T13-1			CL	**TOPSOIL** Loose, damp, dark brown Sandy CLAY			
4				CL	**OTAY FORMATION** Medium stiff, damp, mottled white to medium tan Sandy CLAY			
6				CL-ML	Dense, dry to slightly damp, light tan SILTSTONE/CLAYSTONE			
					TRENCH TERMINATED AT 7.5 FEET			

Figure A-32, Log of Test Trench T 13

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 14

ELEVATION 553 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**ALLUVIUM/COLLUVIUM** Soft to medium stiff, humid, blackish-gray Sandy CLAY			
4				CL	Stiff, moist, dark brown Sandy CLAY/ COBBLES			
6				CL				
				SC	Stiff, blackish-brown Sandy CLAY			
8				SC	**OTAY FORMATION** Dense, moist, whitish-brown, weathered Clayey SANDSTONE			
10					Very dense, moist, grayish-light brown medium to weakly cemented, poorly graded fine Clayey SANDSTONE			
12								
					TRENCH TERMINATED AT 13 FEET			

Figure A-33, Log of Test Trench T 14

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 15

ELEVATION 544 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM/COLLUVIUM** Soft, dry to humid, blackish-gray Sandy CLAY Numerous $CaCO_3$ concentrations from 2 to 3 feet			
2								
4				SC	Medium dense, moist, dark brown Clayey SAND/COBBLES			
				CL				
6				SC	Stiff moist, black CLAY			
8				SM	**OTAY FORMATION** Dense, moist, weathered, light brown Clayey SANDSTONE			
10					Very dense, moist, grayish-brown, poorly graded weakly cemented Silty SANDSTONE			
					TRENCH TERMINATED AT 10 FEET			

Figure A-34, Log of Test Trench T 15

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 16

ELEVATION 532 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM/COLLUVIUM** Soft, dry, dark-gray, Sandy CLAY			
2				SC	Medium dense, moist, reddish-brown, Clayey SAND, some cobbles			
4				SC	**OTAY FORMATION** Medium dense, moist, light-brown Clayey SANDSTONE			
6					TRENCH TERMINATED AT 6 FEET			

Figure A-35, Log of Test Trench T 16

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 17

ELEVATION 548 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Medium stiff to stiff, humid, blackish gray, Sandy CLAY, with some cobbles			
4				SC	**OTAY FORMATION** Dense, moist, light brown, poorly graded, Clayey SANDSTONE			
6					TRENCH TERMINATED AT 6 FEET			

Figure A-36, Log of Test Trench T 17

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 18

ELEVATION 575 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Soft, dry, dark gray, Sandy CLAY with cobbles			
4								
6				SW	**FLUVIAL TERRACE DEPOSITS** Very dense, moist reddish-brown, well graded cohesionless SAND/COBBLES, occasional boulders Becomes moderately cemented, very slow trenching at 6.5 feet			
8								
10								
12								
14								
16								
18				SM	**OTAY FORMATION** Dense, moist, light gray, massive, fine SANDSTONE			
					TRENCH TERMINATED AT 19 FEET			

Figure A-37, Log of Test Trench T 18

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 19

ELEVATION 564 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Soft, dry, dark grayish-brown Sandy CLAY			
2				SM	**OTAY FORMATION** Dense, light brown, dry, highly weathered SANDSTONE			
4								
6				SM	Dense, humid, grayish-brown, massive Silty SANDSTONE			
					TRENCH TERMINATED AT 6 FEET			

Figure A-38, Log of Test Trench T 19

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 20

ELEVATION 562 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Soft, humid, blackish-gray Sandy CLAY			
2								
4				SM	**OTAY FORMATION** Medium dense, dry, whitish, light brown, highly weathered, Silty SANDSTONE			
6				SP	Very dense, humid, grayish-brown, massive SANDSTONE			
					TRENCH TERMINATED AT 7 FEET			

Figure A-39, Log of Test Trench T 20

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 21

ELEVATION 563 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Soft, humid, dark gray, Sandy CLAY			
4				ML	**OTAY FORMATION** Medium dense, dry, whitish-tan, highly weathered SILTSTONE			
6				SM	Dense, humid, whitish-gray Silty SANDSTONE			
					TRENCH TERMINATED AT 7 FEET			

Figure A-40, Log of Test Trench T 21

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 22

ELEVATION 537 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**ALLUVIUM/COLLUVIUM** Soft, moist, blackish-brown Sandy CLAY			
4								
6				SC	**OTAY FORMATION** Highly weathered, moist, mottled whitish-tan, brown Clayey SAND, highly bioturbated			
8								
10				SM	Dense, moist to wet, gray, weakly cemented, fine Silty SANDSTONE			
					TRENCH TERMINATED AT 11 FEET			

Figure A-41, Log of Test Trench T 22

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 23

ELEVATION 544 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**ALLUVIUM/COLLUVIUM** Soft, moist, blackish-brown Sandy CLAY			
4								
6				SW	Medium dense, moist, reddish-brown fine to coarse SAND with cobbles			
8				SM	**OTAY FORMATION** Medium dense, wet, grayish-brown weathered, Silty SANDSTONE			
					TRENCH TERMINATED AT 9 FEET			

Figure A-42, Log of Test Trench T 23

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 24

ELEVATION 550 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**ALLUVIUM/COLLUVIUM** Soft, dry, dark grayish-black Silty CLAY			
4				SC	**OTAY FORMATION** Medium dense, moist, highly weathered, grayish-brown, Clayey SANDSTONE			
6				SM	Dense, moist, gray, fine, Silty SANDSTONE			
8					TRENCH TERMINATED AT 8 FEET			

Figure A-43, Log of Test Trench T 24

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 25

ELEVATION 442 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Soft, dry, black Sandy CLAY, rare cobbles Becomes moist at 2 feet			
4				SM	**OTAY FORMATION** Highly weathered, humid, whitish, Silty SANDSTONE			
6								
8				CH	Thin bentonite layer from 7 to 7.5 feet			
					SANTIAGO PEAK VOLCANICS Hard metavolcanic ROCK			
					TRENCH TERMINATED AT 9 FEET			

Figure A-44, Log of Test Trench T 25

ECKE

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.

FILE NO. 04581-03-01

TRENCH T 26

ELEVATION 445 DATE COMPLETED 9/10/90

EQUIPMENT JD 555 TRACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				CL	**TOPSOIL** Soft, dry, grayish-black Sandy CLAY, with angular boulders			
4				SM	**OTAY FORMATION** Highly weathered, dry, whitish-brown Sandy SILTSTONE			
6					Very dense, hard, moist, massive light gray Silty SANDSTONE			
8				SM				
10				CH	Hard, pinkish-brown bentonite from 10.5 to 11 feet			
12					**SANTIAGO PEAK VOLCANICS** Very hard, metavolcanic ROCK			
					TRENCH TERMINATED AT 12 FEET			

Figure A-45, Log of Test Trench T 26

ECKE

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.

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). The maximum dry density and optimum moisture content of samples were determined in accordance with Test Procedure D1557-78, Method A. In addition, relatively undisturbed ring samples were tested for in-place moisture and density, shear strength and consolidation characteristics. Expansion Index tests were also performed on six samples collected from the exploratory excavations. The results of the tests are presented in tabular and graphical form herein. Moisture-density relationships are presented on the boring logs.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY
AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557-91

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
T2-1	Light gray, Clayey SAND	113.7	15.5
T3-1	Yellowish-brown, well graded SAND	131.1	7.3
T9-1	Light brown CLAY	112.2	16.0
T13-1	Dark brown, Sandy CLAY	114.5	14.9
B1-4	Purplish, Sandy SILT	108.7	15.3
B8-4	Dark brown, Sandy CLAY	117.1	15.1

TABLE B-II
SUMMARY OF IN-PLACE MOISTURE DENSITY
AND DIRECT SHEAR TEST RESULTS

Sample No.	Depth (feet)	Dry Density (pcf)	Moisture Content (%)	Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
T2-1*	12	102.7	15.2	150	35
T3-1*	6	117.7	7.6	120	38
T9-1*	6	101.3	15.7	590	15
B1-10	60	65.5	54.6	2315	6
B2-2	10	118.2	11.9	530	35
B3-5	25	114.4	13.2	1460	11

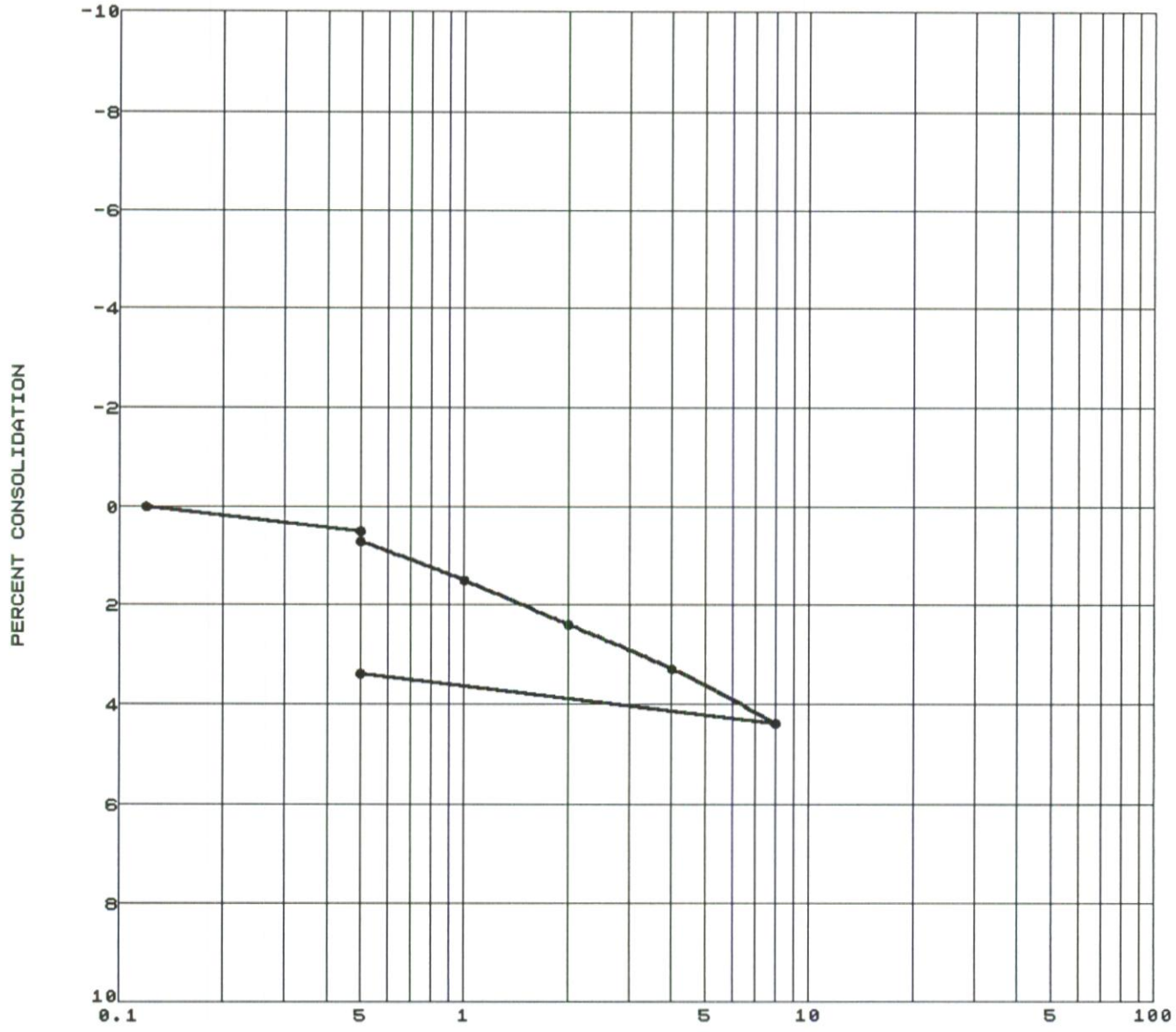
*Soil sample remolded approximately to 90 percent relative density at near optimum moisture content.

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index
	Before Test	After Test		
T2-1	11.0	23.2	106.1	6
T3-1	6.4	13.2	125.1	0
T9-1	11.9	36.4	102.4	160
T13-1	11.7	34.9	103.8	115
B1-4	10.5	32.3	106.7	63
B8-4	9.2	31.4	111.8	88

File No. 04581-03-01

SAMPLE NO. B6-1



Initial Dry Density (pcf)	102.3	Initial Saturation (%)	87.2
Initial Water Content (%)	21.1	Sample Saturated at (ksf)	0.5

CONSOLIDATION CURVE

RANCON OTAY MESA

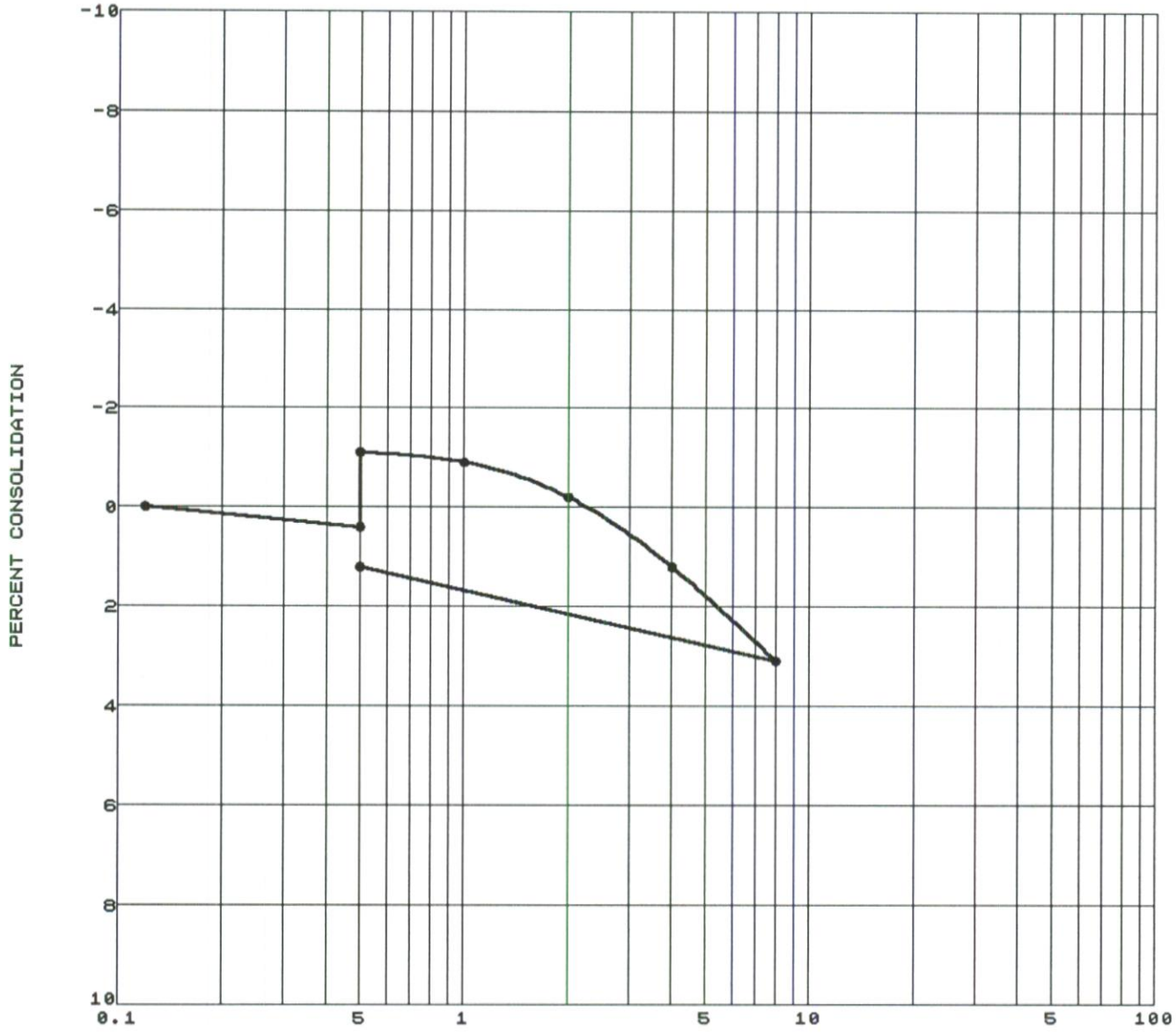
SAN DIEGO COUNTY, CALIFORNIA

ECKE

Figure B-1

File No. 04581-03-01

SAMPLE NO. B8-1



Initial Dry Density (pcf)	110.9	Initial Saturation (%)	67.2
Initial Water Content (%)	12.1	Sample Saturated at (ksf)	0.5

CONSOLIDATION CURVE

RANCON OTAY MESA

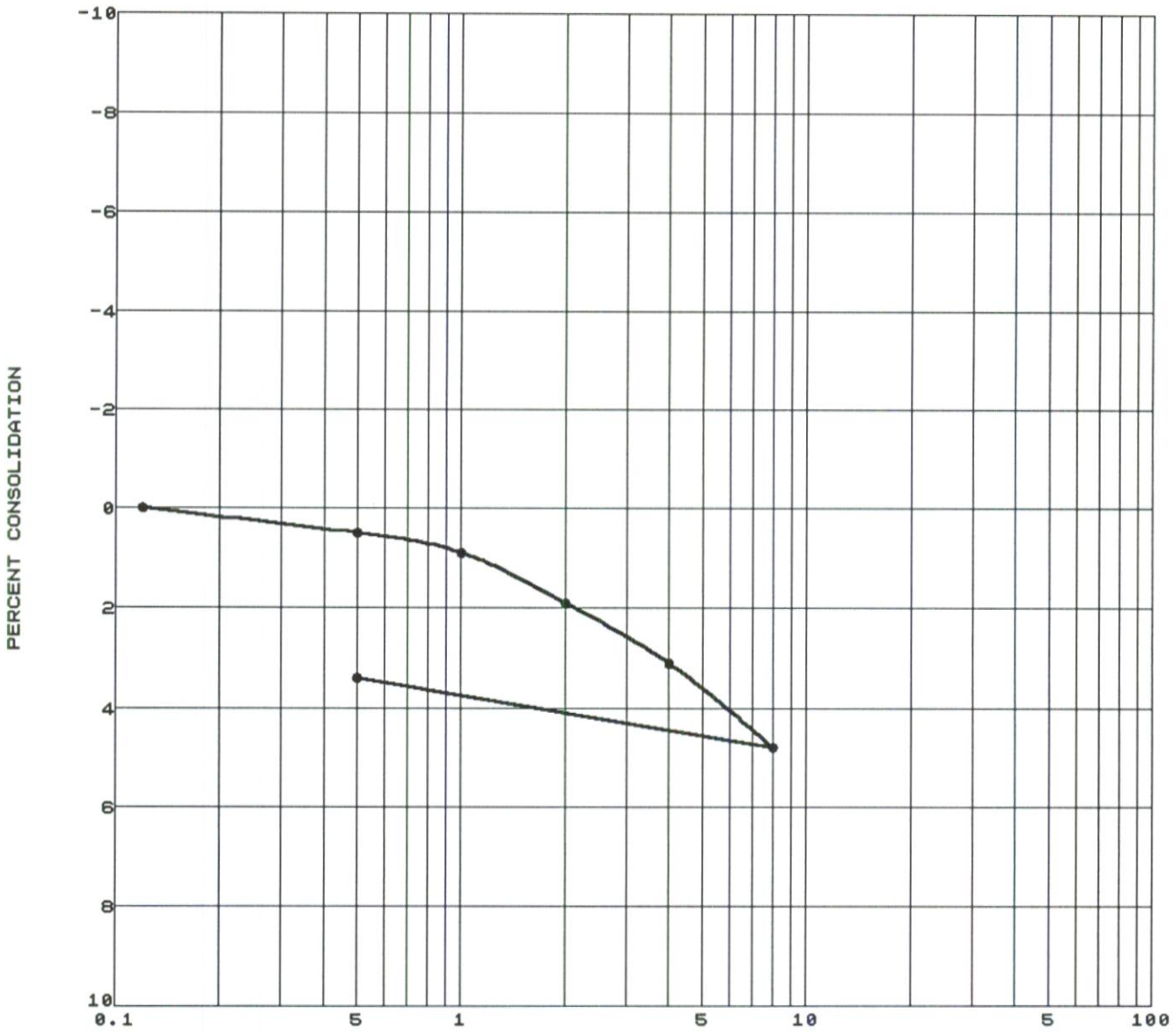
SAN DIEGO COUNTY, CALIFORNIA

ECKE

Figure B-2

File No. 04581-03-01

SAMPLE NO. B8-2



Initial Dry Density (pcf)	87.8	Initial Saturation (%)	92.9
Initial Water Content (%)	31.7	Sample Saturated at (ksf)	0.5

CONSOLIDATION CURVE

RANCON OTAY MESA

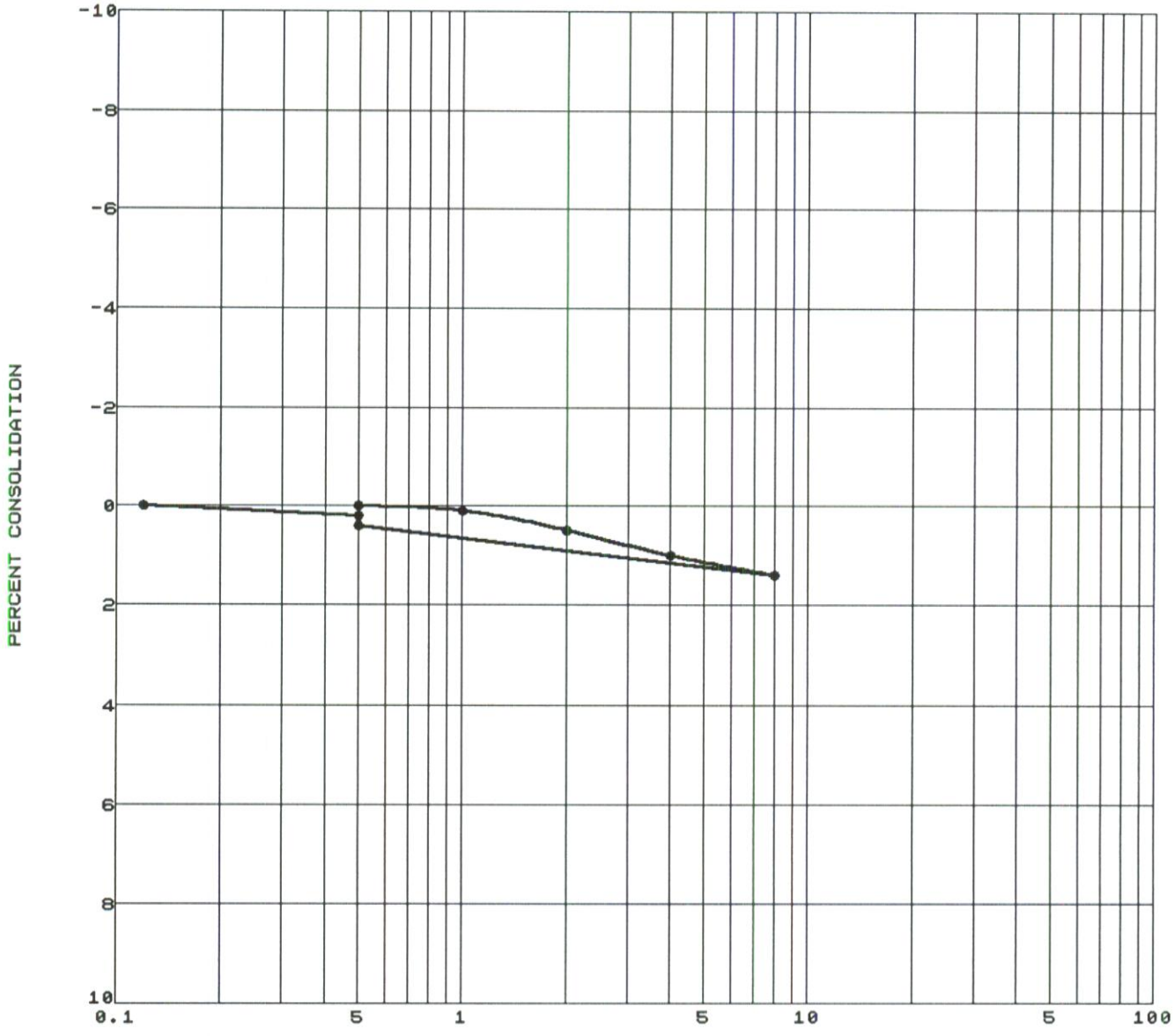
SAN DIEGO COUNTY, CALIFORNIA

ECKE

Figure B-3

File No. 04581-03-01

SAMPLE NO. B9-1



Initial Dry Density (pcf)	104.8	Initial Saturation (%)	57.7
Initial Water Content (%)	11.5	Sample Saturated at (ksf)	0.5

CONSOLIDATION CURVE

RANCON OTAY MESA

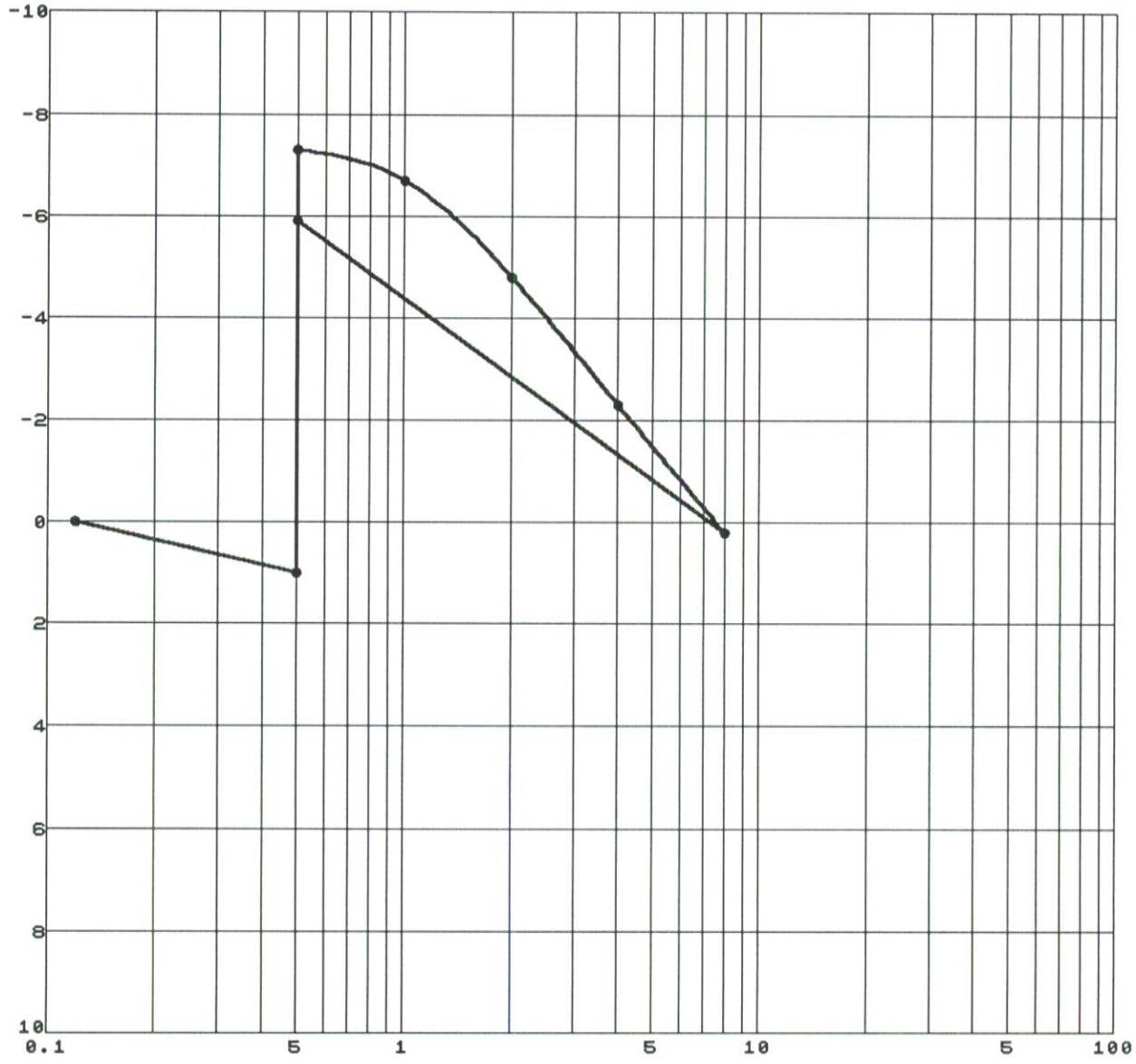
SAN DIEGO COUNTY, CALIFORNIA

ECKE

Figure B-4

File No. 04581-03-01

SAMPLE NO. B10-1



Initial Dry Density (pcf)	89.6	Initial Saturation (%)	85.0
Initial Water Content (%)	27.4	Sample Saturated at (ksf)	0.5

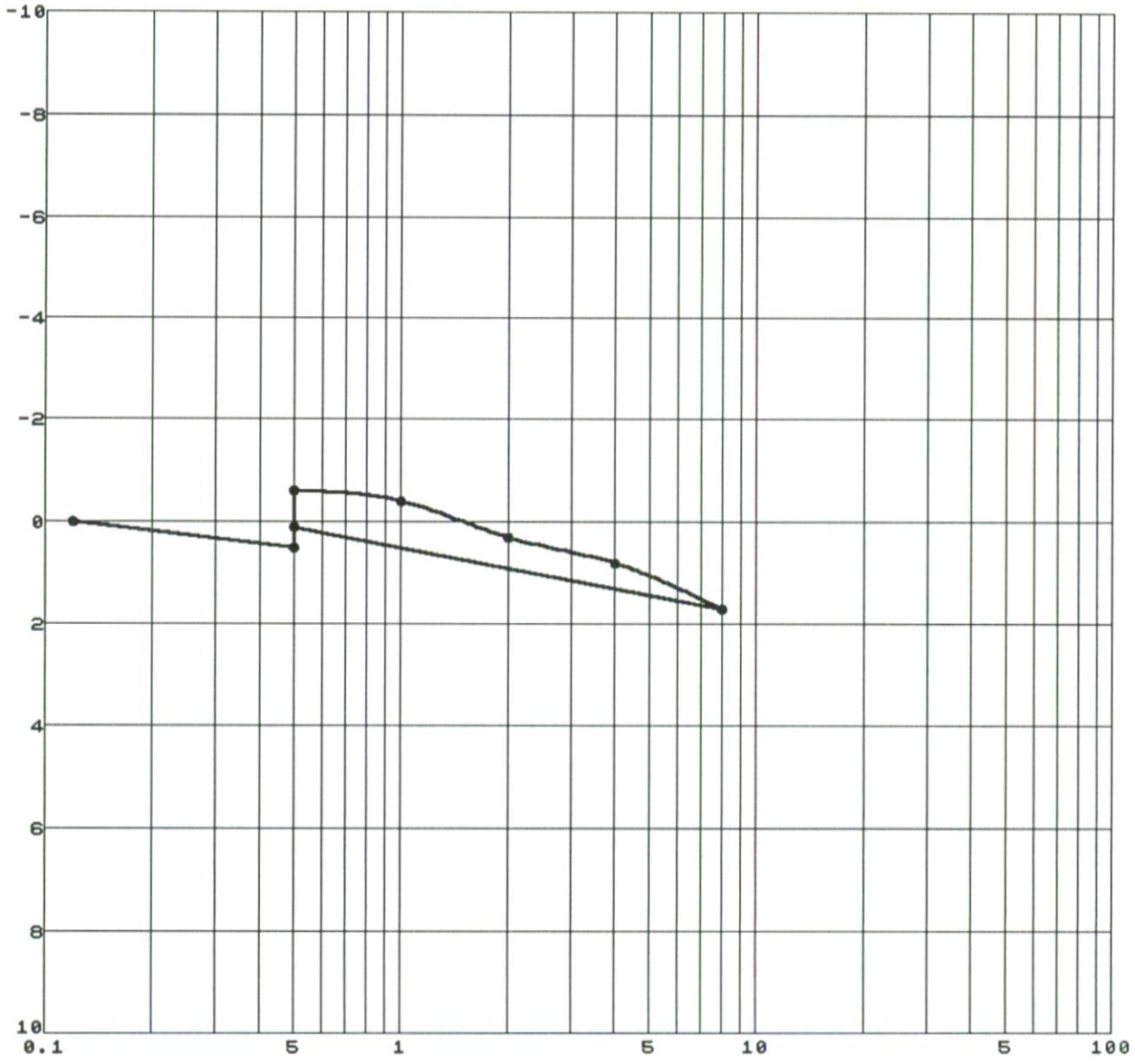
CONSOLIDATION CURVE

RANCON OTAY MESA

SAN DIEGO COUNTY, CALIFORNIA

File No. 04581-03-01

SAMPLE NO. B11-1



Initial Dry Density (pcf)	100.0	Initial Saturation (%)	56.6
Initial Water Content (%)	11.6	Sample Saturated at (ksf)	0.5

CONSOLIDATION CURVE

RANCON OTAY MESA

SAN DIEGO COUNTY, CALIFORNIA

ECKE

Figure B-6

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

EAST OTAY MESA CENTER MIXED-USE
OTAY MESA AND HARVEST ROADS
SAN DIEGO COUNTY, CALIFORNIA

PROJECT NO. 06263-42-03

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. 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. The Consultant should provide adequate testing and observation services so that they may assess whether, in their 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 them 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, and/or adverse weather 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 grading 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 ¾ 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 ¾ 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 Samples of soil materials to be used for fill should 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

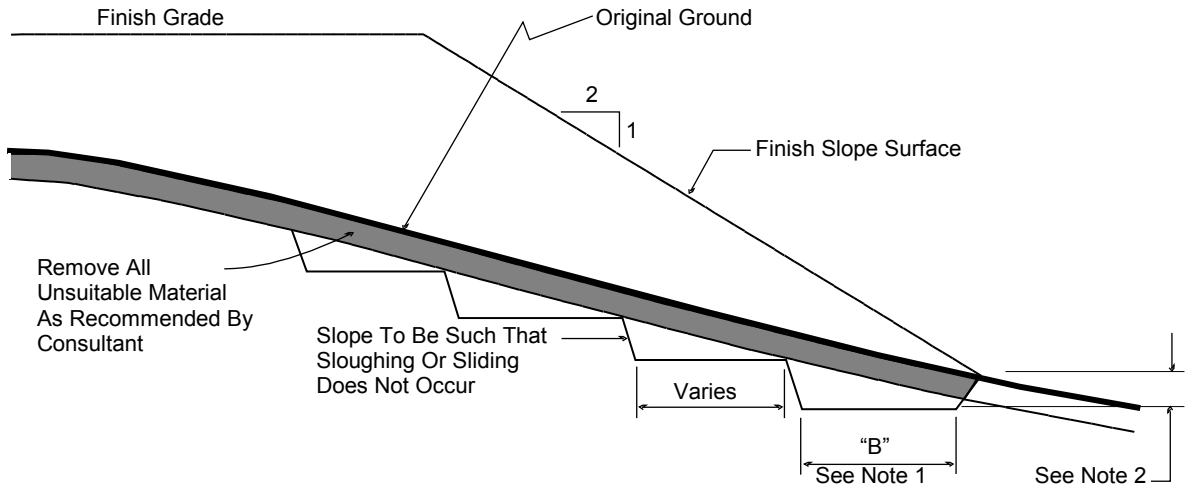
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ 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 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that 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 and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should 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 5:1 (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, 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 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 and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 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 D 1557.

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 D 1557. 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 Where practical, soils having an Expansion Index greater than 50 should be 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 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

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). 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 should 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 D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should 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 should be present during *rock* fill operations to observe 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.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their 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.

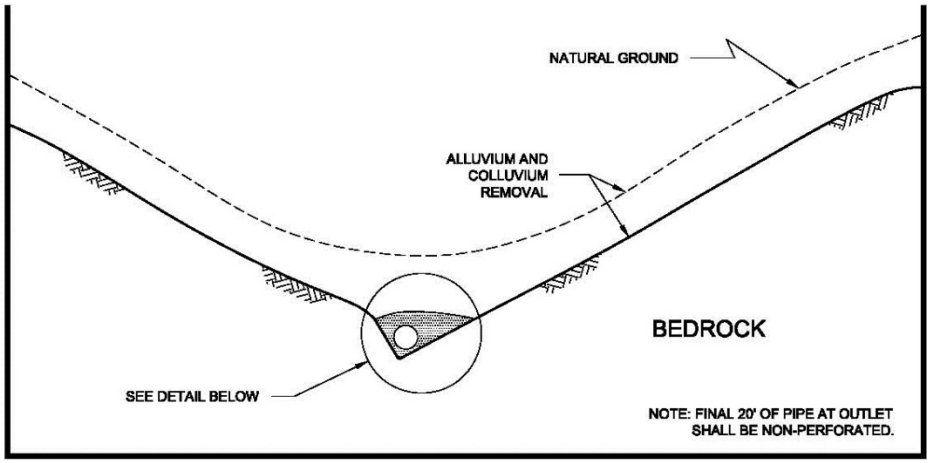
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant 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.

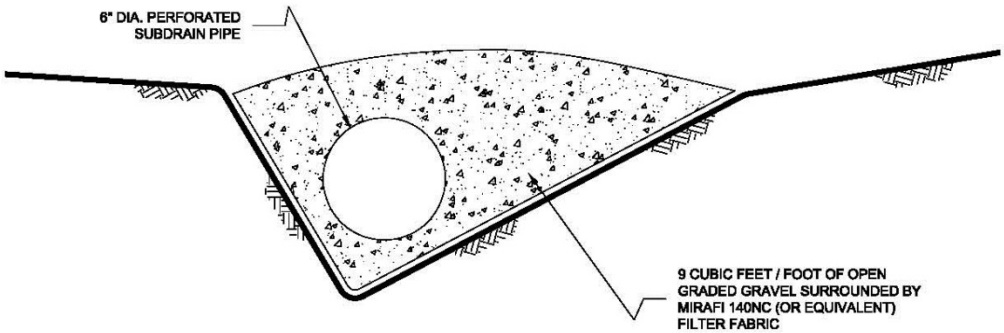
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

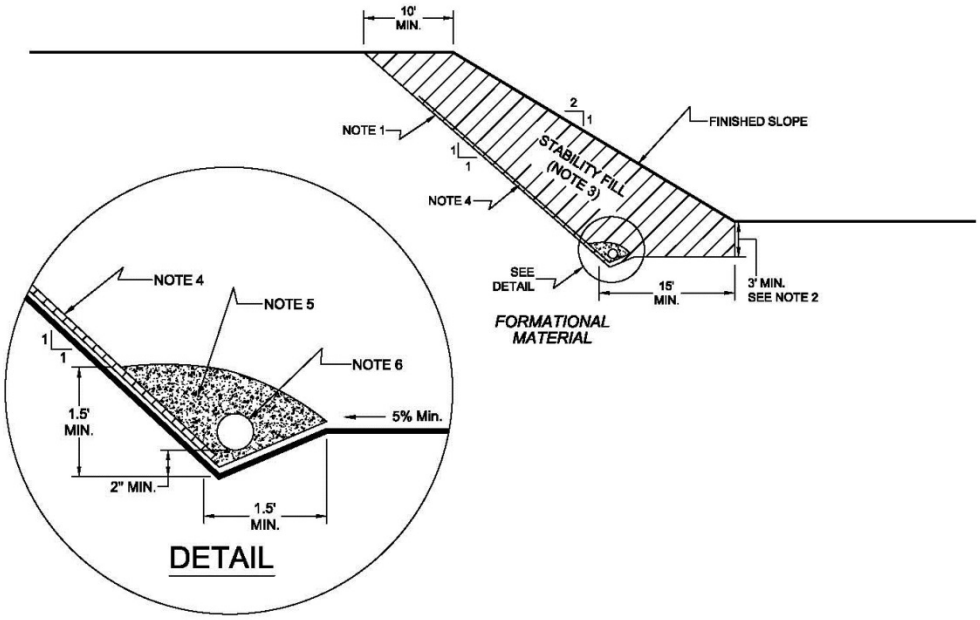
1.....6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS
IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS
LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

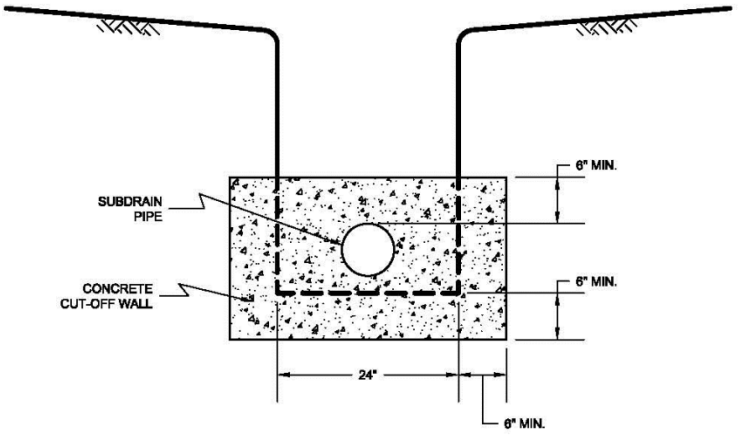
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

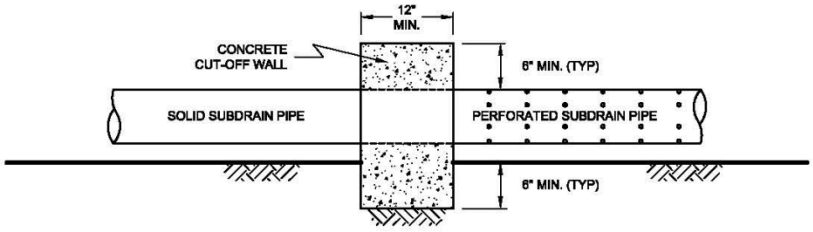
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW

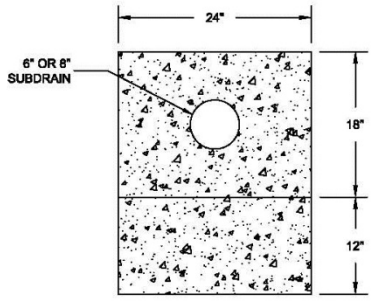


NO SCALE

7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

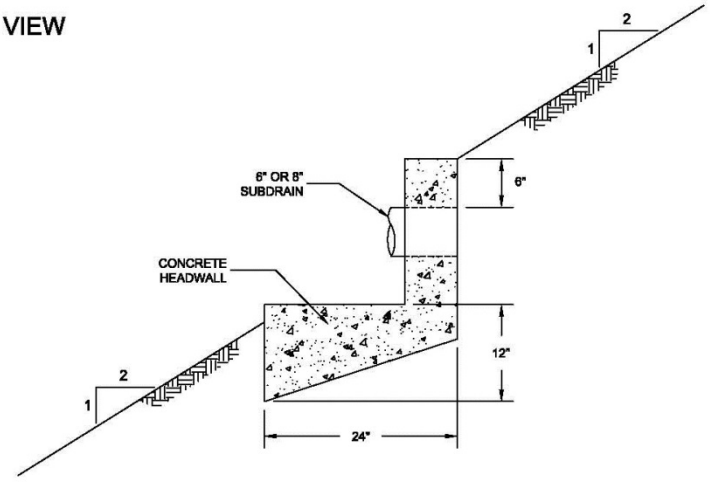
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's 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 should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion 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.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should 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. When observations 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.

8.4 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.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)*.

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 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.

9.2 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.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 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.

10.2 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.

LIST OF REFERENCES

Anderson, J. G. (1984), *Synthesis of Seismicity and Geological Data in California,* U.S. Geological Survey Open-file Report 84-424, pp. 1-186;

Boore, D. M., and Atkinson, G. M (2007), *Boore-Atkinson NGA Ground Motion Relations for the Geometric Mean Horizontal Component of Peak and Spectral Ground Motion Parameters*, Report Number PEER 2007/01;

California Division of Mines and Geology (1996), *Probabilistic Seismic Hazard Assessment for the State of California,* Open File Report 96-08;

California Geological Survey (2013), *Probabilistic Seismic Hazards Mapping Ground Motion Page*, www.conservation.ca.gov/cgs/rghm/pshamap/pshamap.asp;

Chiou, B. S. -J., and Youngs, R. R. (2008), *A NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra,* Earthquake Spectra, 24(1);

Geocon Incorporated (1999), *Updated Geotechnical Investigation for Sunroad Centrum (Rancon Otay Mesa,* Project No. 06263-22-01;

Geocon Incorporated (1990), *Soil and Geologic Investigation for Rancon Otay Mesa, San Diego County, California,* Project No. 04581-03-01;

Geocon Incorporated (1989), *Geotechnical Investigation for Planning Purposes, Ecke Ranch, Otay Mesa, San Diego County, California;*

Hart, M. W. (2000), *Bedding-Parallel Shear Zones as Landslide Mechanisms in Horizontal Sedimentary Rocks*, Environmental & Engineering Geoscience, Vol. VI, No. 2, pp195-113;

Jennings, C. W. (1994), *Fault Activity Map of California ad Adjacent Areas,* California Division of Mines and Geology;

Kennedy, M. P., and Tan, S. S. (2008), *Geologic Map of the San Diego 30' x 60' Quadrangle, California*, USGS Regional Geologic Map Series, 1:100,000 Scale, Map No. 3;

Risk Engineering (2015), *EZ-FRISK, Version 7.65*;

Wesnousky, S. G. (1986), *Earthquakes, Quaternary Faults, and Seismic Hazard in California*, Journal of Geophysical Research, Vol. 91, No. B12, pp. 12, 587, 631.