GEOTECHNICAL INVESTIGATION

SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL,
SAN DIEGO COUNTY, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

LOS ANGELES TURF CLUB, INC.
ARCADIA, CALIFORNIA

JULY 16, 2019
PROJECT NO. G2406-32-01

Project No. G2406-32-01
July 16, 2019

Los Angeles Turf Club, Inc.
285 West Huntington Drive
Arcadia, California, 91007

Attention: Mr. Frank De Marco

Subject: GEOTECHNICAL INVESTIGATION
SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

Dear Mr. De Marco:

In accordance with your request, and our Proposal No. LG-19187 dated May 16, 2019, we have performed a geotechnical investigation on the subject property in San Diego, California. The accompanying report presents the results of our study and our conclusions and recommendations pertaining to the geotechnical aspects of project grading as presently proposed. The results of our study indicate that the site can be graded as planned, provided the recommendations of this report are followed.

If there are 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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GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation within the eastern portion of the San Luis Rey Training Center located in the Bonsall community of northern San Diego County, California (see *Vicinity Map*, Figure 1). The purpose of this study was to evaluate the soil and geologic conditions in two areas of proposed remedial grading where over-steepened slopes are present and provide specific geotechnical recommendations pertaining to grading these areas as proposed based.

The scope of our study consisted of the following:

- Reviewing satellite imagery, previous geotechnical reports and readily available published and unpublished geologic literature.
- Excavating thirteen exploratory trenches to evaluate the general extent and condition of surficial deposits across the site (see Appendix A for trench logs).
- Performing laboratory tests on selected soil samples collected to evaluate their physical properties (see Appendix B).
- Preparing this report presenting our exploratory information and our conclusions and recommendations regarding the geotechnical aspects of developing the site as presently proposed. The approximate locations of the subsurface excavations are shown on the *Geologic Maps*, Figures 2 and 3.

2. SITE AND PROJECT DESCRIPTION

The project encompasses two areas of partially developed land located within the San Luis Rey Training Center in the Bonsall community of northern San Diego County, California (see Vicinity Map, Figure 1). Both areas were previously graded during on-going operations at the training center. Area 1 was essentially used as a borrow site and stockpile area. Area 2 was graded to allow access to the northern portion of the property between the arena and property boundary. These grading activities resulted in non-compliant slope inclinations. We understand the proposed remedial grading is intended to correct the non-compliant grading by creating 2:1 (horizontal:vertical) cut and fill slopes.

Area 1 consists of a relatively level graded pad west of the proposed grading with gently to moderately sloping natural ground to the east. A steep cut slope excavation exposing granitic rock is present on the western edge of the proposed grading and a near vertical excavation is located to the east. The overall area is bounded by unimproved access roads to the north, east and south. Proposed grading consists of excavating and filling both areas to create a relatively level pad. Excavations on the order of 15 feet deep are proposed with 2:1 (horizontal:vertical) cut and fill slopes up to approximately 20 feet and 7 feet, respectively.

Area 2 is located adjacent to an existing off-site residence and driveway east of an unimproved access road and small equestrian arena. This area is currently used as a storage area and access road. Previous grading adjacent to the eastern property line has resulted in an approximately 1:1 (horizontal:vertical) or steeper cut slope. Proposed remedial work in this area consists of constructing a mechanically stabilized earth (MSE) retaining wall with 2:1 sloping conditions above in order to maintain the existing 24-foot-wide fire access road. The maximum wall height is shown as approximately 12 feet high.

No structures are currently proposed. We understand that future development may include a barn at Area 1. Remedial grading recommendations and foundation design parameters for these improvements will be provided in an update report when plans are available.

The descriptions contained herein are based upon discussions with you, the site reconnaissance and a review of the proposed grading plans. If project details vary significantly from those outlined herein, Geocon Incorporated should be notified for review and possible revisions to this report prior to final design submittal.

3. SOIL AND GEOLOGIC CONDITIONS

Two surficial soil types and one geologic formation were encountered during the field investigation. The surficial deposits consist of undocumented fill and colluvium. The formational unit consists of granitic rock. Each of the geologic units is described below in order of increasing age. The approximate extent of the deposits are shown on the *Geologic Maps*.

3.1 Undocumented Fill (Qudf)

Undocumented fill was encountered in several of the exploratory trenches in Area 1 (T-4, T-6, and T-7) and was approximately 1 to 2 feet thick. A temporary stockpile was also observed. In general, this material is characterized as loose, dry to damp, dark brown, silty fine to medium sand. This material will require removal and compaction prior to placing additional fill or structural loads.

3.2 Colluvium (Qcol)

Colluvial deposits were encountered throughout the site overlying the granitic rock with a maximum thickness of over 15 feet. These deposits consist of loose to dense, dark brown to reddish brown, silty, fine to coarse sands and generally possess a low expansion potential. Based on our field observations and laboratory consolidation testing, the uppermost portions of the colluvium will require remedial grading in areas of proposed embankments or future structural improvements.

3.3 Granitic Rock (Kgr)

Cretaceous-age granitic rock was encountered underlying the colluvium throughout the project. The rock exposed in the exploratory trenches and observed at the surface exhibited a variable weathering pattern ranging from completely weathered decomposed granite to outcrops of slightly weathered, very strong, granitic rock. Granitic units generally exhibit adequate bearing and slope stability characteristics.

The soils derived from excavations within the granitic rock are anticipated to consist of low-expansive, silty, fine- to coarse-grained sands and should provide suitable foundation support in either a natural or properly compacted condition. It should be anticipated that excavations within the granitic rock may generate boulders and oversize materials (rocks greater than 12 inches in length) that will require special handling and placement. Excavation difficulty should be expected. A rippability evaluation was not part of the scope of this study.

4. GROUNDWATER

Groundwater was not encountered during the field investigation and is not anticipated to significantly impact project development as presently proposed. However, it is not uncommon for groundwater or seepage conditions to develop where none previously existed.

5. GEOLOGIC HAZARDS

5.1 Faulting

Based on our reconnaissance and a review of published geologic maps and reports, the site is not located on any known “active,” “potentially active” or “inactive” fault traces as defined by the California Geological Survey (CGS).

The Elsinore Fault, located approximately 12 miles east of the site, and the Newport-Inglewood Fault, located approximately 16 miles west of the site, are the closest known active faults. The CGS considers a fault seismically active when evidence suggests seismic activity within roughly the last 11,000 years.

5.2 Seismicity-Deterministic Analysis

We used the computer program *EZ-FRISK* (Version 7.65) to determine the distance of known faults to the site and to estimate ground accelerations at the site for the maximum anticipated seismic event.

According to the results of the computer program *EZ-FRISK* (Version 7.65), 10 known active faults are located within a search radius of 50 miles from the property. We used acceleration attenuation relationships developed by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008)

NGA USGS, and Chiou-Youngs (2008) NGA in our analysis. The nearest known active faults are the Elsinore and Newport-Inglewood Faults, located approximately 12 miles east and 16 miles west of the site, respectively, and are the dominant sources of potential ground motion. Table 5.2 lists the estimated maximum earthquake magnitudes and PGA's for the most dominant faults for the site location calculated for Site Class C as defined by Table 1613.3.2 of the 2016 California Building Code (CBC).

TABLE 5.2
DETERMINISTIC SPECTRA SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2007 (g)
Elsinore	12	7.85	0.43	0.32	0.44
Newport-Inglewood	16	7.5	0.33	0.24	0.29
Rose Canyon	17	6.9	0.25	0.19	0.20
Coronado Bank	33	7.4	0.19	0.13	0.14
Palos Verdes Connected	33	7.7	0.21	0.15	0.17
San Joaquin Hills	35	7.1	0.15	0.15	0.13
San Jacinto	35	7.88	0.22	0.15	0.19
Earthquake Valley	36	6.8	0.13	0.10	0.08
Palos Verdes	41	7.3	0.14	0.10	0.10
Chino	43	6.8	0.11	0.08	0.07

5.3 Seismicity-Probabilistic Analysis

We used the computer program *EZ-FRISK* (version 7.65) to perform a probabilistic seismic hazard analysis. *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the fault slip rate. The program accounts for earthquake magnitude as a function of rupture length. 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 (2008) NGA USGS 2008 in the analysis. Table 5.3 presents the

site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence for Site Class C.

TABLE 5.3
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2008 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.45	0.41	0.48
5% in a 50 Year Period	0.33	0.31	0.35
10% in a 50 Year Period	0.26	0.24	0.26

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 California Building Code (CBC) or County of San Diego guidelines.

5.4 Landslides

No evidence of ancient landslide deposits was encountered at the site during the geotechnical investigation.

5.5 Liquefaction and Seismically Induced Settlement

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If all four previous criteria are met, a seismic event could result in a rapid pore-water pressure increase from the earthquake-generated ground accelerations. Seismically induced settlement is settlement that may occur whether the potential for liquefaction exists or not. The potential for liquefaction and seismically induced settlement occurring within the site soils is considered to be “very low” due to the geologic conditions encountered, remedial grading recommended and the depth of groundwater.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 No soil or geologic conditions were encountered that, in the opinion of Geocon Incorporated, would preclude the development of the property as proposed, provided the recommendations of this report are followed.

6.1.2 The sites are underlain by undocumented fill, colluvium, and granitic rock. Based on our observations, the undocumented fill and upper portions of the colluvium will require removal and compaction. The medium dense to dense colluvium is generally considered suitable for additional loading.

6.1.3 With the exception of possible strong seismic shaking, no geologic hazards were observed or are known to exist based on our study that would adversely affect the proposed project. No special seismic design considerations, other than those recommended herein, are required.

6.2 Excavation and Soil Characteristics

6.2.1 Excavation of the undocumented fill soils and colluvial deposits should be possible with light to moderate effort using conventional heavy-duty equipment. Excavation difficulty should be expected for cuts in granitic rock.

6.2.2 The soils encountered in the field investigation are considered to be "non-expansive" (expansion index [EI] of less than 20) as defined by 2016 California Building Code (CBC) Section 1803.5.3 based on laboratory testing. Table 6.2 presents soil classifications based on the expansion index.

TABLE 6.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	ASTM 4829 Expansion Classification	2016 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

6.3 Slope Stability

6.3.1 Slope stability analyses for 2:1 cut and fill slopes were performed utilizing ultimate drained direct shear strength parameters from the laboratory test results. These analyses indicate that the proposed 2:1 cut and fill slopes, constructed of on-site materials, should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions to heights of at least 20 feet and 40 feet, respectively. Generalized slope stability calculations for both deep-seated and surficial slope stability are presented on Figures 4 through 6, respectively.

6.3.2 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 sloped. Alternatively, the fill slope may be over-built at least 3 feet and cut back to yield a properly compacted slope face.

6.3.3 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.

6.4 Grading Recommendations

6.4.1 All grading should be performed in accordance with the attached *Recommended Grading Specifications* (Appendix C). Where the recommendations of this section conflict with Appendix C, the recommendations of this section take precedence. All earthwork should be observed and all fills tested for proper compaction by Geocon Incorporated.

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

6.4.3 Site preparation should begin with the removal of any deleterious material and vegetation, if encountered. The depth of removal should be such that material exposed in cut areas or soils to be used as fill are relatively free of organic matter and construction debris. Material generated during stripping and/or site demolition should be exported from the site.

6.4.4 Undocumented fill or loose colluvium exposed within the grading limits should be removed and replaced as compacted fill. The actual extent of unsuitable soil removal will be determined in the field by the geotechnical engineer and/or engineering geologist.

6.4.5 After removal of unsuitable materials is performed, the site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, soils native to the site are suitable for re-use as fill if free from vegetation, debris and other deleterious material. 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 or above optimum moisture content, as determined in accordance with ASTM Test Procedure D1557. Fill materials below optimum moisture content will require additional moisture conditioning prior to placing additional fill.

6.4.6 Prior to placing fill, the ground surface should be scarified to a depth of 12 inches, moisture conditioned, and compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content, as determined by ASTM Test Method D 1557. Deeper processing and/or removal may be necessary in areas where loose, wet or dry soils are encountered.

6.4.7 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations in order to maintain safety and maintain the stability of adjacent existing improvements.

6.5 Mechanically-Stabilized Earth (MSE) Retaining Walls

6.5.1 The soil and geologic conditions in the vicinity of proposed MSE retaining walls are anticipated to consist of compacted fill (reinforced zone) and granitic rock (foundation and retained zones). A typical MSE retaining wall detail is presented as Figure 7. Granitic rock in the foundation and retained zones are expected to consist of dense to very dense, silty, fine to coarse sand. Based our experience with similar soil and geologic conditions, we recommend the following geotechnical parameters be used for design of the MSE retaining walls.

TABLE 6.5
MSE RETAINING WALL PARAMETERS

Parameter	Reinforced Zone	Retained Zone	Foundation Zone
Angle of Internal Friction	32 degrees	35 degrees	35 degrees
Cohesion	0 psf	0 psf	0 psf
Wet Unit Weight	130 pcf	130 pcf	130 pcf

6.5.2 The shear strength values used for the reinforced zone assume that predominately granular materials will be stockpiled for use as backfill. Geocon has no way of knowing whether these materials will actually be used as backfill behind the wall during construction. As such, once backfill materials have been selected and/or stockpiled, sufficient shear tests should be conducted on samples of the proposed backfill materials to verify they conform to actual design values. Results should be provided to the designer to re-evaluate stability of the walls. Dependent upon test results, the designer may require modifications to the original wall design (e.g., longer geogrid embedment lengths).

6.5.3 Backfill materials within the reinforced zone should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content in accordance with ASTM D 1557. This is applicable to the entire embedment length of the geogrid reinforcement. In addition, the wall designer has maximum particle size (typically 3-inches in size or less) and shape (angular/rounded) requirements for soil-rock fill within the reinforced zone. Typically, wall designers specify that heavy compaction equipment be excluded from within 3 feet of the face of the wall; however, smaller equipment (e.g., walk-behind, self-driven compactors or hand whackers) should be used to compact the materials without causing deformation of the wall. If the designer specifies no compactive effort for this zone, the materials are essentially not properly compacted and the geogrid within the uncompacted zone should not be relied upon for reinforcement and overall embedment lengths should be increased to account for the difference.

6.5.4 The wall designer should provide a drainage system sufficient to dissipate hydrostatic pressure behind the wall and to mitigate seepage through and beneath the wall. As such, a subdrain system consisting of a minimum 4-inch diameter, Schedule 40, perforated pvc pipe surrounded by at least 1 cubic foot of ¾-inch open-graded gravel and wrapped in filter fabric (Mirafi 140N or equivalent) should be incorporated into the wall design. In order to prevent soil piping into the open-graded gravel layer behind the wall, we recommend the filter fabric be extended to cover the entire gravel layer. The final segment of the subdrain should outlet into an approved drainage facility, such as storm drain or headwall structure. The final segment of the drain should consist of solid pvc pipe. At the transition between the solid and perforated pipe, a concrete cut-off wall should be added to direct the subsurface water into the solid pipe.

6.5.5 A peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.419g was calculated from ASCE 7-10 Section 11.8.3. The 2016 CBC seismic design parameters are provided herein.

6.5.6 Geosynthetic reinforcement must elongate to develop full tensile resistance. This elongation generally results in movement at the top of the wall. The amount of movement is dependent upon the height of the wall (e.g., higher walls rotate more), construction, and the type of geosynthetic used. In addition, over time reinforced-earth retaining walls have been known to exhibit creep and can undergo additional movement. Given this condition, the owner should be aware that structures and pavement placed within the reinforced and retained zones of the wall may undergo movement and should be designed to accommodate this movement.

6.6 Site Drainage and Moisture Protection

6.6.1 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 2016 CBC 1804.4 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 conduits that carry runoff away from the proposed structure.

6.6.2 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.

6.7 Slope Maintenance

6.7.1 Slopes that are steeper than 3:1 (horizontal:vertical) may, under conditions that are both difficult to prevent and predict, be susceptible to near-surface (surficial) slope instability. The instability is typically limited to the outer 3 feet of a portion of the slope and usually does not directly impact the improvements on the pad areas above or below the slope. The occurrence of surficial instability is more prevalent on fill slopes and is generally preceded by a period of heavy rainfall, excessive irrigation, or the migration of subsurface seepage. The disturbance and/or loosening of the surficial soils, as might result from root growth, soil expansion, or excavation for irrigation lines and slope planting, may also be a significant contributing factor to surficial instability. It is therefore recommended that, to the maximum extent practical: (a) disturbed/loosened surficial soils be either removed or properly recompacted, (b) irrigation systems be periodically inspected and maintained to eliminate leaks and excessive irrigation, and (c) surface drains on and adjacent to slopes be periodically maintained to preclude ponding or erosion. Although the incorporation of the above recommendations should reduce the potential for surficial slope instability, it will not

eliminate the possibility and, therefore, it may be necessary to rebuild or repair a portion of the project's slopes in the future.

6.8 Grading and Foundation Plan Review

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

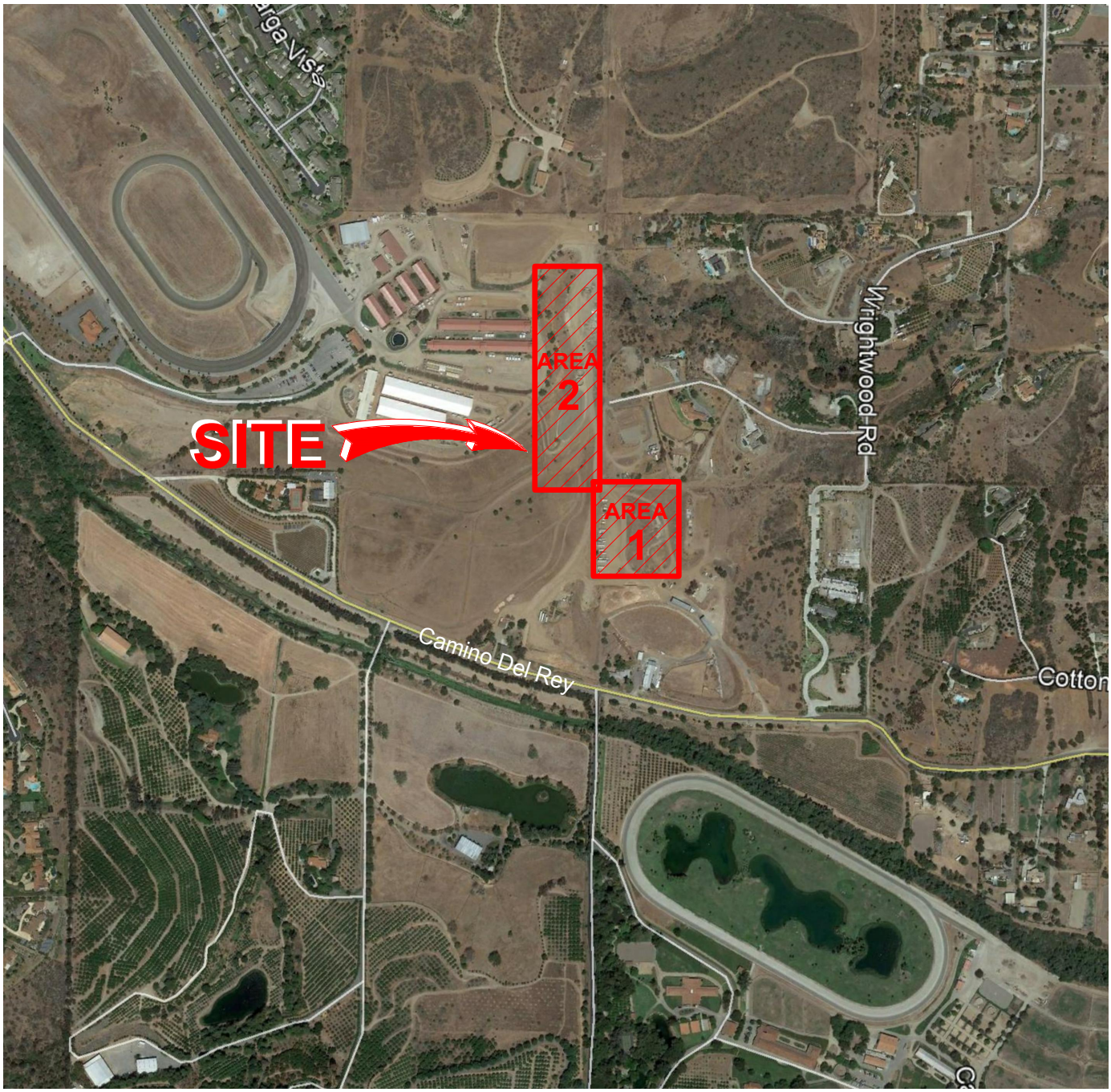
LIMITATIONS AND UNIFORMITY OF CONDITIONS

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 of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and that 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 are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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NO SCALE

VICINITY MAP

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SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

DG / CW		DSK/GTYPD

DATE 07 - 16 - 2019	PROJECT NO. G2406 - 32 - 01	FIG. 1

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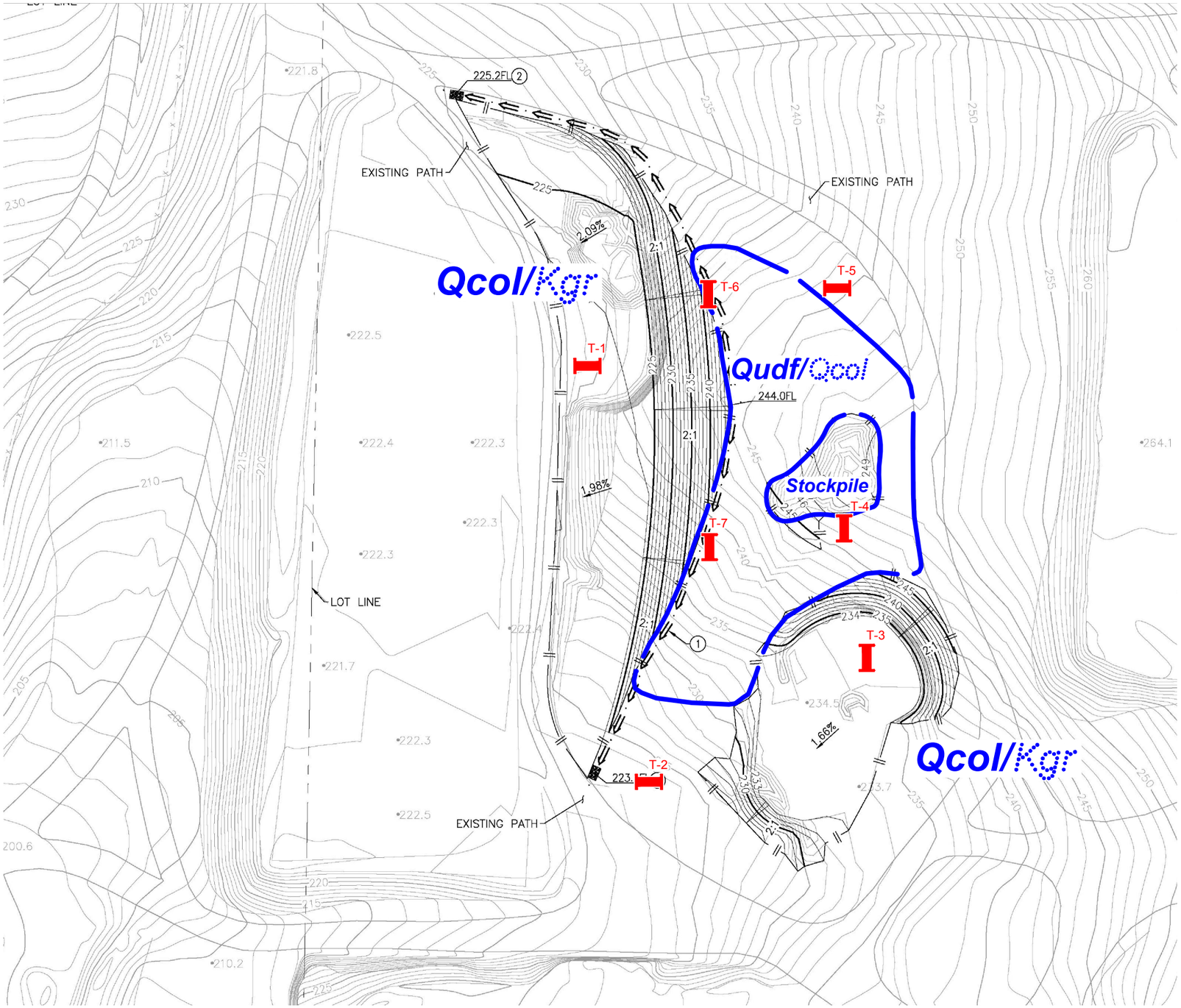
SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA
AREA 1



0’ 60’ 120’

SCALE 1”= 60’ (On 11x17)

GEOCON LEGEND

Qudf .....UNDOCUMENTED FILL

Qcol .....COLLUVIUM (Dotted Where Buried)

Kgr .....GRANITIC ROCK (Dotted Where Buried)

T-13 .....APPROX. LOCATION OF EXPLORATORY TRENCH

.....APPROX. LOCATION OF GEOLOGIC CONTACT

GEOCON INCORPORATED

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6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974

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FIGURE 2

DATE 07 - 16 - 2019

GEOLOGIC MAP

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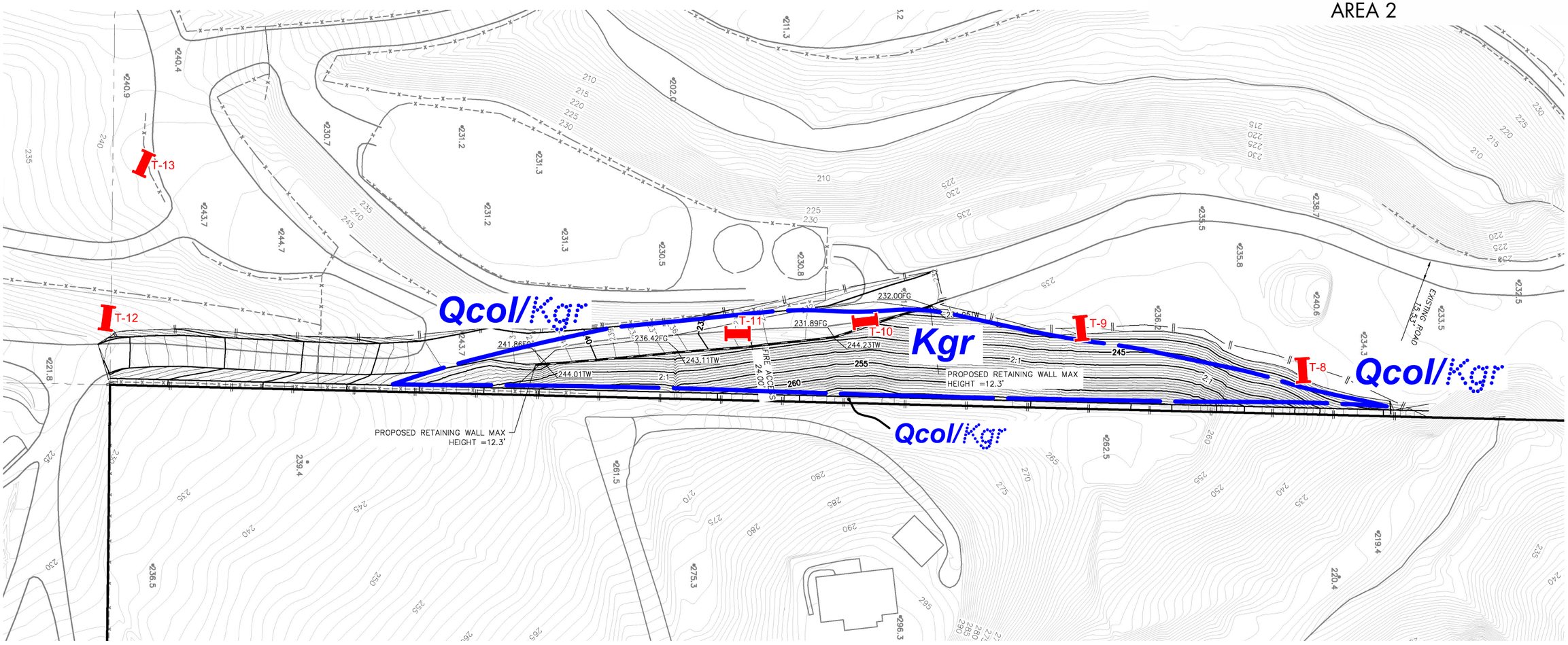
SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA
AREA 2



GEOCON LEGEND

Qudf	.....UNDOCUMENTED FILL
Qcol	.....COLLUVIUM (Dotted Where Buried)
Kgr	.....GRANITIC ROCK (Dotted Where Buried)
T-13	.....APPROX. LOCATION OF EXPLORATORY TRENCH
	.....APPROX. LOCATION OF GEOLOGIC CONTACT

0' 80' 160'
SCALE 1"= 80' (On 11x17)

GEOCON INCORPORATED
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FIGURE 3
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GEOLOGIC MAP

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ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	40 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)	
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	32 degrees
APPARENT COHESION	C	=	300 pounds per square foot
NO SEEPAGE FORCES			

ANALYSIS :

$\lambda_{c\phi}$	=	$\frac{\gamma_t H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\lambda_{c\phi}$	=	10.8	CALCULATED USING EQ. (3-3)
Ncf	=	35	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	2.0	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

GEOCON INCORPORATED

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974

PHONE 858 558-6900 - FAX 858 558-6159

SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

DG / CW		DSK/GTYPD	DATE 07 - 16 - 2019	PROJECT NO. G2406 - 32 - 01	FIG. 4

Plotted:07/16/2019 10:00AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2406-32-01 San Luis Rey Training Center\DETAILS\Slope Stability Analyses-Fill (SSA-F).dwg

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	20 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)	
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	38 degrees
APPARENT COHESION	C	=	200 pounds per square foot
NO SEEPAGE FORCES			

ANALYSIS :

$\lambda_{c\phi}$	=	$\frac{\gamma_t H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\lambda_{c\phi}$	=	10.2	CALCULATED USING EQ. (3-3)
Ncf	=	33	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

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EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

DG / CW		DSK/GTYPD	DATE 07 - 16 - 2019	PROJECT NO. G2406 - 32 - 01	FIG. 5

Plotted:07/16/2019 9:59AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2406-32-01 San Luis Rey Training Center\DETAILS\Slope Stability Analyses-Cut (SSA-C).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	=	130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	32 degrees
APPARENT COHESION	C	=	200 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$FS = \frac{C + (\gamma_t - \gamma_w)\ Z\ cos^2\ i\ tan\ \phi}{\gamma_t\ Z\ sin\ i\ cos\ i} = 1.9$$

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

GEOCON INCORPORATED

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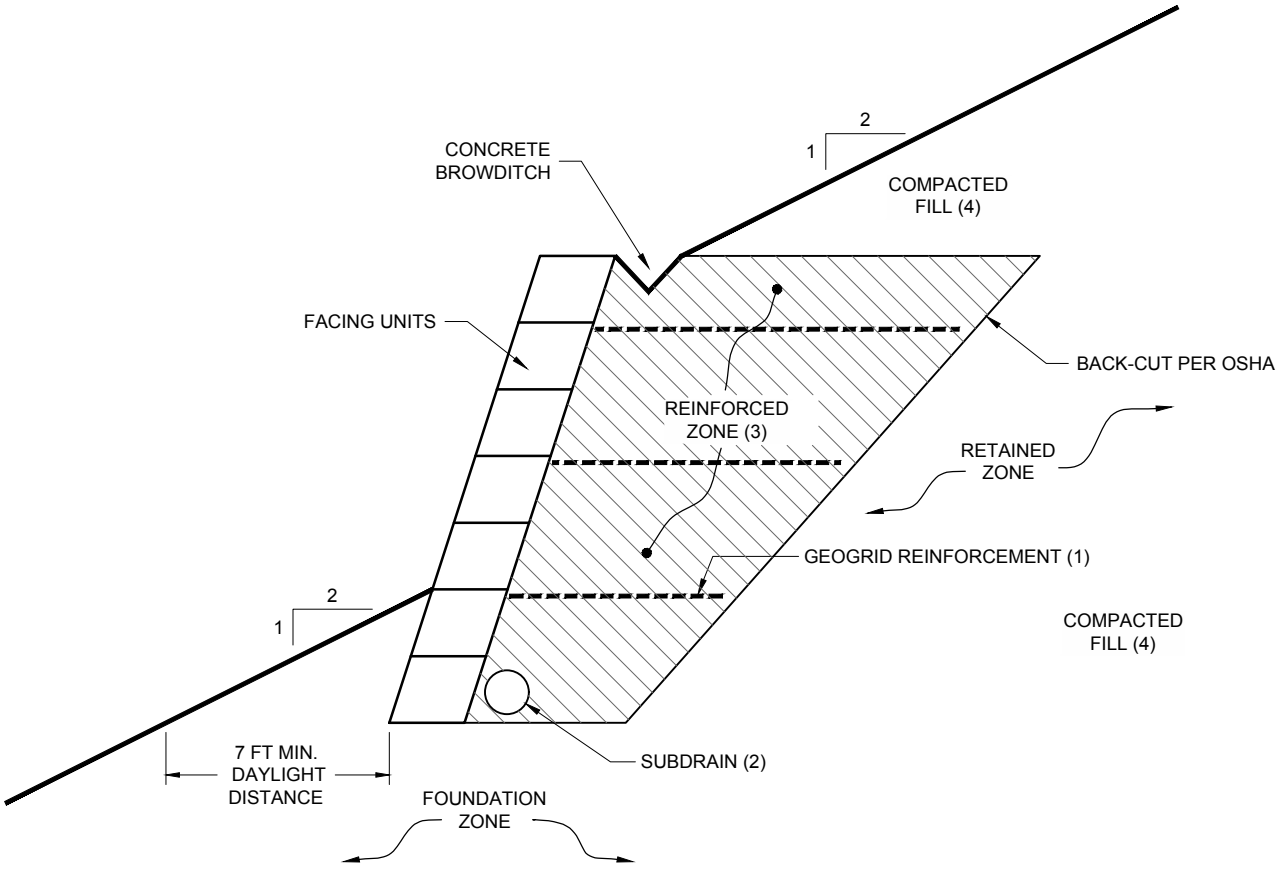
SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

DG / CW		DSK/GTYPD	DATE 07 - 16 - 2019	PROJECT NO. G2406 - 32 - 01	FIG. 6

Plotted:07/16/2019 10:01AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2406-32-01 San Luis Rey Training Center\DETAILS\Slope Stability Analyses-Surficial (SSAS).dwg



NOTES:

(1).....WALL DESIGN BY OTHERS

(2).....SUBDRAIN SHOULD CONSIST OF MIN. 4-INCH DIAMETER, SCHEDULE 40, PERFORATED PVC PIPE SURROUNDED BY AT LEAST 1 CUBIC FOOT OF OPEN GRADED GRAVEL WRAPPED IN FILTER FABRIC (SUCH AS MIRAFI 140N OR EQUIVALENT). SUBDRAIN SHOULD SLOPE AT MIN. 1% INCLINATION AND OUTLET TO APPROVED DRAINAGE FACILITY, SUCH AS STORM DRAIN BROW DITCH OR CONCRETE HEADWALL STRUCTURE.

(3).....REINFORCED ZONE BACKFILL COMPACTED TO AT LEAST 90% OF THE MAXIMUM DRY DENSITY AT NEAR TO SLIGHTLY OVER OPTIMUM MOISTURE CONTENT. UNLESS OTHERWISE NOTED BACKFILL SPECIFICATIONS TO BE PROVIDED BY MSE WALL CONSULTANT. BACKFILL MATERIAL TO BE TESTED FOR COMPLIANCE TO PROJECT SPECIFICATIONS.

(4).....COMPACTED FILL PLACED AT LEAST 90% OF THE MAXIMUM DRY DENSITY AT NEAR TO SLIGHTLY OVER OPTIMUM MOISTURE CONTENT.

NO SCALE

TYPICAL MSE RETAINING WALL DETAIL

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EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

DG / CW		DSK/GTYPD	DATE 07 - 16 - 2019	PROJECT NO. G2406 - 32 - 01	FIG. 7

Plotted:07/16/2019 9:58AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2406-32-01 San Luis Rey Training Center\DETAILS\MSE Wall Detail (TM).dwg

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The field investigations were performed on June 7 and 24, 2019, and consisted of a visual site reconnaissance and advancing 13 exploratory trenches (Trench Nos. T-1 through T-13) in Areas 1 and 2. The approximate locations of the trenches are shown on the *Geologic Maps*, Figures 2 and 3.

The exploratory trenches were performed by Hillside Excavation and advanced to a depth of approximately 18 feet using a John Deere 240G backhoe with a 24" bucket. Bulk samples were obtained for laboratory testing. Relatively undisturbed samples were obtained by driving a California split-spoon (CAL) into the "undisturbed" soil mass. The CAL sampler was equipped with 1-inch by 2⅜-inch, brass sampler rings to facilitate removal and testing.

The soils encountered in the excavations were visually classified and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual Manual Procedure D 2488).

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 1 ELEV. (MSL.) 225' DATE COMPLETED 06-07-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty fine to coarse SAND			
	T1-1				-Becomes medium dense to dense, damp to moist			
2								
4	T1-2				**GRANITIC ROCK (Kgr)** Completely weathered, gray, weak to moderately weak GRANITIC ROCK, excavates as silty fine to coarse sand			
					TRENCH TERMINATED AT 5.5 FEET No groundwater encountered			

Figure A-1,
Log of Trench T 1, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2 ELEV. (MSL.) 223' DATE COMPLETED 06-07-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, dry, dark brown, Silty fine to medium SAND			
					-Becomes medium dense, damp to moist			
2	T2-1							
4								
	T2-2						113.7	9.6
6					-Becomes medium dense, moist, reddish brown, Silty fine to coarse SAND; pieces of weathered rock			
8								
10		+ +			**GRANITIC ROCK (Kgr)** Completely weathered, gray, weak to moderately weak GRANITIC ROCK, excavates as silty, fine to coarse sand			
					TRENCH TERMINATED AT 10.5 FEET No groundwater encountered			

Figure A-2,
Log of Trench T 2, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

TRENCH T 3

ELEV. (MSL.) **235'** DATE COMPLETED **06-07-2019**

EQUIPMENT **JD410G BACKHOE 24"BUCKET** BY: **D. GITHENS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T3-1			SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty fine to coarse SAND; small pieces of weathered rock -Becomes medium dense, damp to moist		113.7	7.0
2	T3-2				**GRANITIC ROCK (Kgr)** Completely weathered, gray, weak to moderately weak GRANITIC ROCK, excavates as silty fine to coarse sand			
4					TRENCH TERMINATED AT 4 FEET No groundwater encountered Backfilled with spoils			

Figure A-3,
Log of Trench T 3, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 4 ELEV. (MSL.) 245' DATE COMPLETED 06-07-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, moist, dark brown, Silty fine to medium SAND			
2				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty fine to coarse SAND -Becomes medium dense, moist			
4								
	T4-1						118.0	11.5
6								
					TRENCH TERMINATED AT 7.5 FEET No groundwater encountered Backfilled with spoils			

Figure A-4,
Log of Trench T 4, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

TRENCH T 5

ELEV. (MSL.) **245'** DATE COMPLETED **06-07-2019**

EQUIPMENT **JD410G BACKHOE 24"BUCKET** BY: **D. GITHENS**

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	**COLLUVIUM (Qcol)** Loose, damp, dark brown, Silty, fine to medium SAND			
2	T5-1				-Becomes medium dense, damp to moist			
4								
	T5-2						126.2	9.9
6	T5-3			SM	Medium dense, moist, reddish brown, Silty fine to coarse SAND			
8					**GRANITIC ROCK (Kgr)** Completely weathered, gray, weak to moderately weak GRANITIC ROCK, excavates at silty, fine to coarse sand			
10								
12					TRENCH TERMINATED AT 12 FEET No groundwater encountered Backfilled with spoils			

Figure A-5,
Log of Trench T 5, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 6 ELEV. (MSL.) 240' DATE COMPLETED 06-07-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (Qudf)** Loose, dry, light gray, Silty fine to medium SAND; organics			
				SM	**COLLUVIUM (Qcol)** Loose, damp, dark brown, Silty fine to medium SAND			
2					-Becomes medium dense, moist			
4	T6-1 T6-2				-Becomes reddish brown at 3.5 feet		108.7	11.1
					TRENCH TERMINATED AT 5 FEET Backfilled with trench spoils			

Figure A-6,
Log of Trench T 6, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 7 ELEV. (MSL.) 240' DATE COMPLETED 06-07-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**UNDOCUMENTED FILL (Qudf)** Loose, dry, gray, Silty fine to medium SAND with organics			
2				SM	**COLLUVIUM (Qcol)** Loose, dry, dark brown, Silty, fine to medium SAND -Becomes medium dense, damp to moist			
4	T7-1 T7-2				-Becomes reddish brown, fine to coarse		124.7	10.8
6					TRENCH TERMINATED AT 6 FEET No groundwater encountered Backfilled with spoils			

Figure A-7,
Log of Trench T 7, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 8 ELEV. (MSL.) 234' DATE COMPLETED 06-24-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T8-1			SM	**COLLUVIUM (Qcol)** Loose, dry, tan brown, Silty, fine to coarse SAND with little gravel -Becomes medium dense, damp			
2	T8-2				**GRANITIC ROCK (Kgr)** Completely weathered, mottled black and white, weak GRANITIC ROCK, excavates as silty, fine to coarse sand -Becomes moderately weak, highly weathered			
					TRENCH TERMINATED AT 3 FEET No groundwater encountered Backfilled with trench spoils			

Figure A-8,
Log of Trench T 8, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9 ELEV. (MSL.) 237' DATE COMPLETED 06-24-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T9-1			SM	**COLLUVIUM (Qcol)** Loose, dry, tan brown/orange, Silty, fine to coarse SAND			
					GRANITIC ROCK (Kgr) Completely weathered, mottled black and white, weak GRANITIC ROCK -Becomes strong, slightly weathered			
					TRENCH TERMINATED AT 1.5 FEET No groundwater encountered Backfilled with spoils			

Figure A-9,
Log of Trench T 9, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 10 ELEV. (MSL.) 231' DATE COMPLETED 06-24-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T10-1	+ + + + + + + + +			**GRANITIC ROCK (Kgr)** Completely weathered, orange-brown, weak GRANITIC ROCK; excavates to Silty, fine to coarse SAND			
2					-Becomes highly weathered			
					TRENCH TERMINATED AT 2.5 FEET No groundwater encountered Backfilled with spoils			

Figure A-10,
Log of Trench T 10, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 11** ELEV. (MSL.) **235'** DATE COMPLETED **06-24-2019** EQUIPMENT **JD410G BACKHOE 24"BUCKET** BY: **D. GITHENS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T11-1				**GRANITIC ROCK (Kgr)** Highly weathered, mottled white, black, and orange, weak GRANITIC ROCK, excavates to light gray, silty, fine to coarse sand			
					TRENCH TERMINATED AT 1.5 FEET No groundwater encountered Backfilled with spoils			

Figure A-11,
Log of Trench T 11, Page 1 of 1

G2406-32-01.GPJ

SAMPLE SYMBOLS

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

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

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 12 ELEV. (MSL.) 228' DATE COMPLETED 06-24-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T12-1			SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to coarse SAND			
2								
4					-Becomes medium dense, damp to moist at 4 feet			
6								
8	T12-2							
10								
12								
14								
	T12-3	+ + + + + +			**GRANITIC ROCK (Kgr)** Completely weathered, tan to brown, weak GRANITIC ROCK excavates to Silty, fine to coarse SAND			
16					TRENCH TERMINATED AT 16 FEET No groundwater encountered Backfilled with spoils			

Figure A-12,
Log of Trench T 12, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

PROJECT NO. G2406-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 13 ELEV. (MSL.) 242' DATE COMPLETED 06-24-2019 EQUIPMENT JD410G BACKHOE 24"BUCKET BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T13-1			SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to coarse SAND			
					-Becomes medium dense, damp at 1 foot			
2								
4					-Becomes light brown to brown			
6								
	T13-2							
8								
10								
12								
14								
16	T13-3							
18					TRENCH TERMINATED AT 18 FEET No groundwater encountered Backfilled with spoils			

Figure A-13,
Log of Trench T 13, Page 1 of 1

G2406-32-01.GPJ

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.

GEOCON

APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected bulk samples were tested for maximum dry density and optimum moisture content, moisture content and dry density relationships, shear strength, expansion potential, and water-soluble sulfate content. The results of our laboratory tests are summarized on Tables B-I through B-IV and Figures B-1 and B-2.

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

Sample No. (Geologic Unit)	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
T1-1	Reddish Brown, Silty, Fine to coarse SAND	136.8	9.1

TABLE B-II
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

Sample No.	Geologic Unit (Soil Class)	Dry Density (pcf)	Moisture Content (%)	Peak [Ultimate] Cohesion (psf)	Peak [Ultimate] Angle of Shear Resistance (degrees)
T1-1*	Qcol	123.3	9.2	370 [520]	38 [33]
T6-1	Qcol	108.7	11.1	270 [270]	44 [44]

* Samples remolded to approximately 90 percent relative compaction.

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

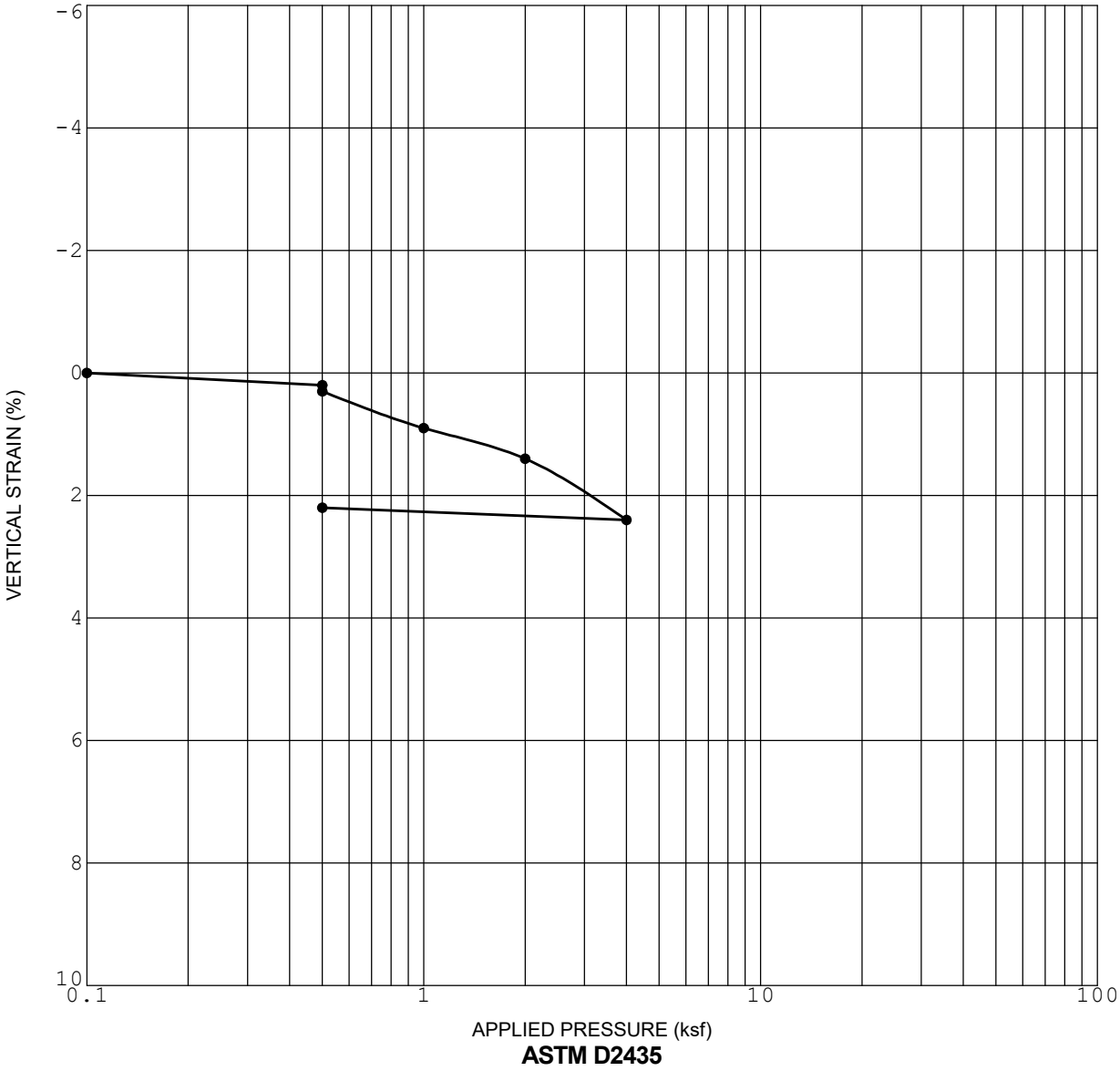
Sample No. (Geologic Unit)	Moisture Content		Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
T1-1	8.2	14.4	116.5	10

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

Sample No.	Water-Soluble Sulfate (%)	Sulfate Severity	Sulfate Class
T1-1	0.031	Not Applicable	S0

PROJECT NO. G2406-32-01

SAMPLE NO. T2-2



ASTM D2435

Initial Dry Density (pcf)	113.7	**Initial Saturation (%)**	55.7
Initial Water Content (%)	9.6	**Sample Saturated at (ksf)**	0.5

CONSOLIDATION CURVE

SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

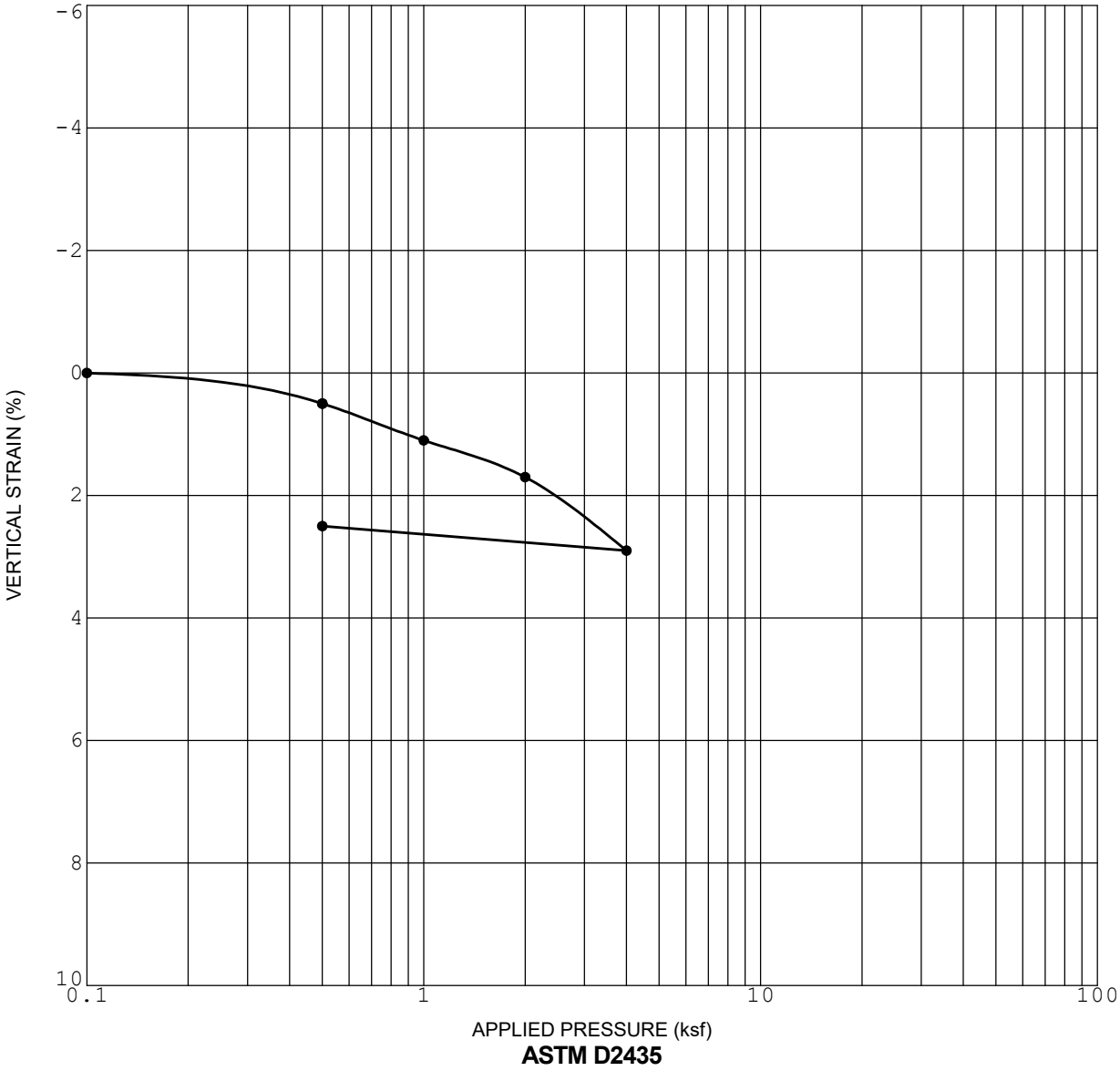
G2406-32-01.GPJ

Figure B-1

GEOCON

PROJECT NO. G2406-32-01

SAMPLE NO. T4-1



ASTM D2435

Initial Dry Density (pcf)	118.0	**Initial Saturation (%)**	75.6
Initial Water Content (%)	11.5	**Sample Saturated at (ksf)**	0.5

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G2406-32-01.GPJ

Figure B-2

GEOCON

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

SAN LUIS REY TRAINING CENTER
EASTERN REMEDIAL GRADING AREAS
BONSALL, SAN DIEGO COUNTY, CALIFORNIA

PROJECT NO. G2406-32-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. 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

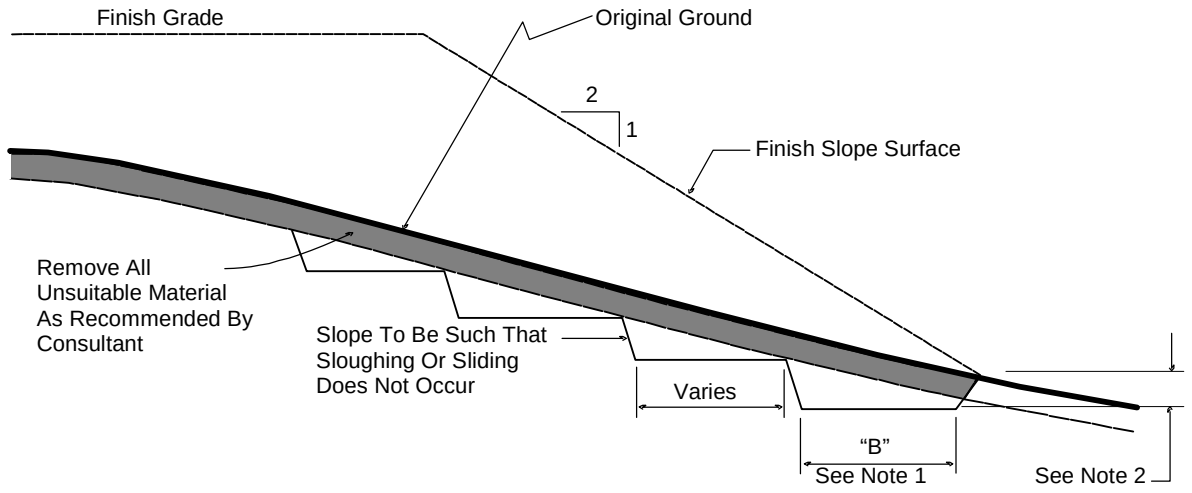
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material 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.

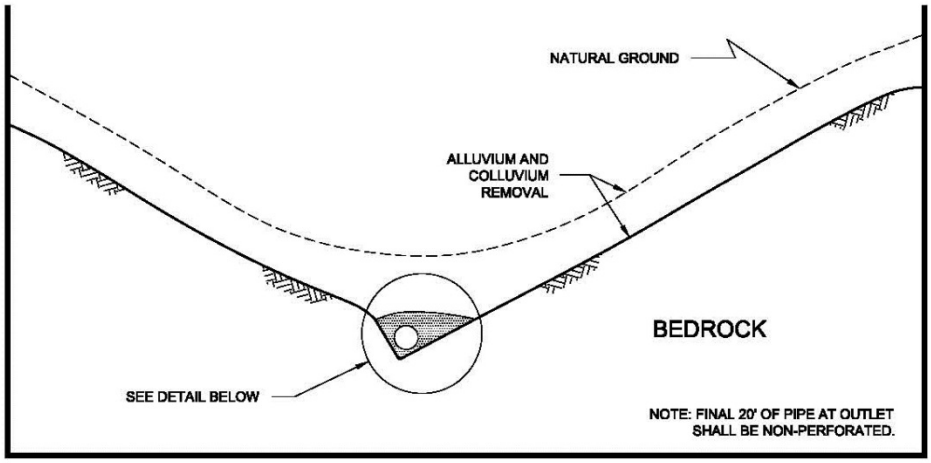
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant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

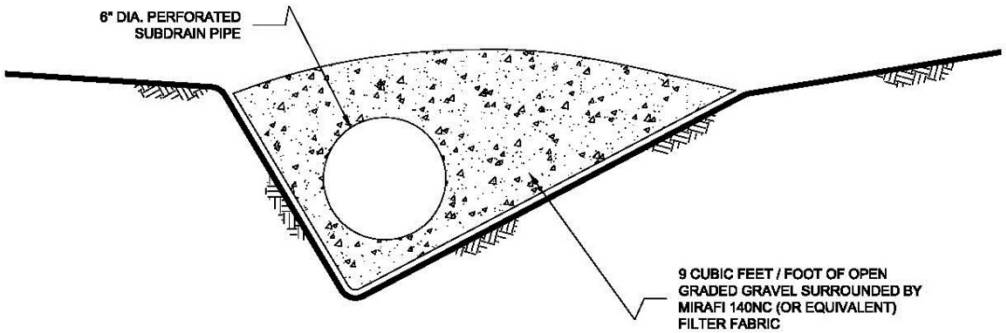
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

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:

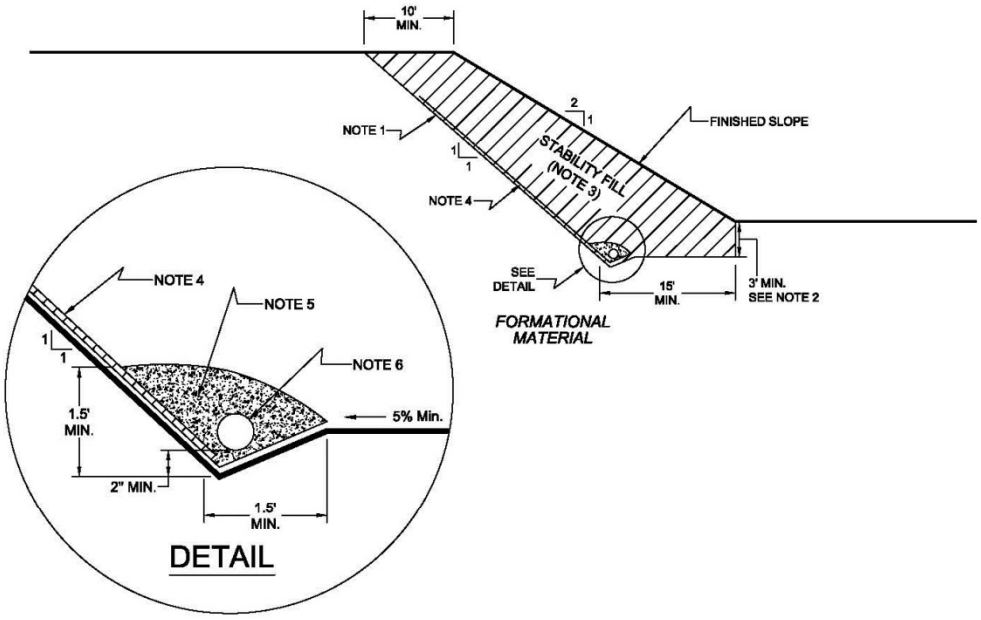
1.....6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS
IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

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

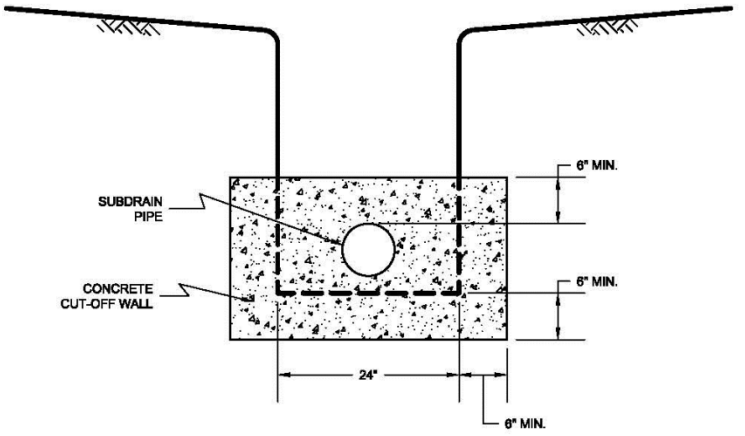
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing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

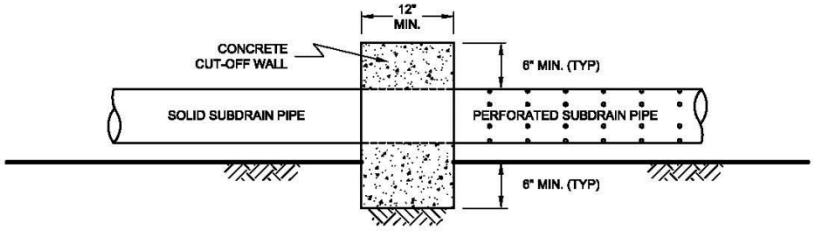
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW

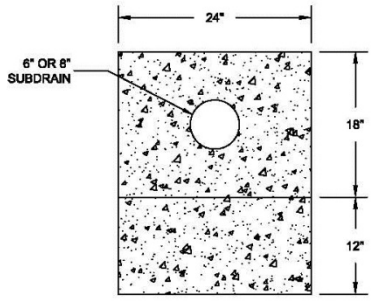


NO SCALE

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

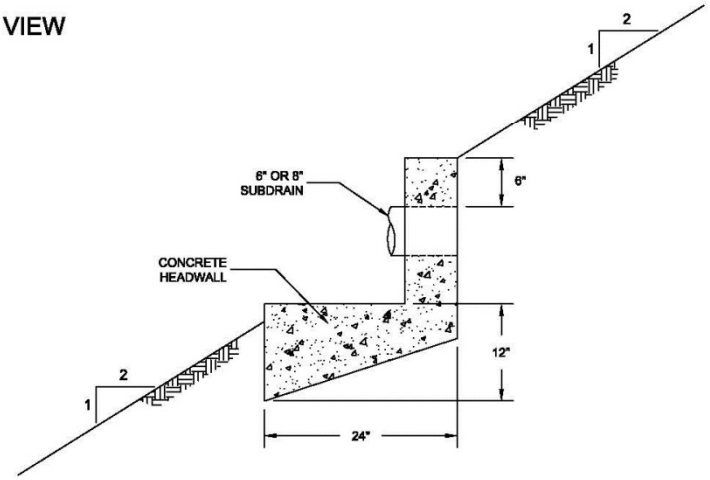
TYPICAL HEADWALL DETAIL

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.

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3. California Geological Survey (2003), *Seismic Shaking Hazards in California, Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003). 10% probability of being exceeded in 50 years.* (http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html).

4. Campbell, K. W., Y. Bozorgnia (2008), *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s,* Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.

5. *Fault Activity Map of California and Adjacent Areas*, California Division of Mines and Geology, compiled by C. W. Jennings, 1994.

6. http://www.historicaerials.com.

7. Kennedy, M. P., and S. S. Tan, *Geologic Map of the Oceanside 30'x60' Quadrangle, California,* USGS Regional Map Series Map No. 2, Scale 1:100,000, 2007.

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

9. Risk Engineering (2015), *EZ-FRISK (version 7.65).*

10. Unpublished reports and maps on file with Geocon Incorporated.

11. USGS (2011), Seismic Hazard Curves and Uniform Hazard Response Spectra (version 5.1.0, dated February 2, 2011), http://earthquake.usgs.gov/research/hazmaps/design/.