UPDATE GEOTECHNICAL REPORT

LA MEDIA ROAD AND TRUCK ROUTE IMPROVEMENTS
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

RICK ENGINEERING COMPANY
SAN DIEGO, CALIFORNIA

MAY 8, 2020
REVISED OCTOBER 19, 2020
PROJECT NO. G1283-32-05

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Project No. G1283-32-05
May 8, 2020
Revised October 19, 2020

Rick Engineering Company
5620 Friars Road
San Diego, California 92110

Attention: Mr. Raun Connely

Subject: UPDATE GEOTECHNICAL REPORT
LA MEDIA ROAD AND TRUCK ROUTE IMPROVEMENTS
SAN DIEGO, CALIFORNIA

References:

1. *Geotechnical Investigation, Metropolitan Airpark, Phases 1A and 1B Off-Site Roadway Improvements, San Diego, California*, prepared by Geocon Incorporated, dated December 21, 2016.
2. *Update Geotechnical Report, La Media Road and Truck Route Improvements, San Diego, California*, prepared by Geocon Incorporated, dated May 8, 2020 (Project No. G1283-32-05).
3. *Plans for the Construction of La Media Road and Truck Route Improvements, San Diego, California,* prepared by Rick Engineering Company, undated.

Dear Mr. Connely:

In accordance with your request, we have reviewed the referenced plans and prepared this addendum to Reference No. 2 providing updated geotechnical design criteria in accordance with the 2019 California Building Code (2019 CBC). We are also providing revised roadway structural sections using Caltrans Highway Design Manual guidelines instead of the City of San Diego Public Roadway standards and foundation criteria for proposed box culverts. This revised report was prepared to include traffic indices up to 17 for roadway design. Additional and/or revised recommendations considering the box culverts are also provided herein.

Based upon our review of the project plans and the information contained within the referenced geotechnical reports, it is the opinion of Geocon Incorporated that the plans and details have been prepared in substantial conformance with recommendations presented in the referenced geotechnical reports.

Our review was limited to geotechnical aspects of project development and did not include the review of other details on the referenced plans. Geocon Incorporated has no opinion regarding other details found on the referenced plans, civil, structural, or otherwise, that do not directly pertain to geotechnical aspects of site development.

It is our opinion that the conclusions and recommendations contained in the referenced reports remain applicable unless superseded below.

1. SEISMIC DESIGN CRITERIA

Table 1.1 summarizes site-specific design criteria obtained from the 2019 California Building Code (CBC; Based on the 2018 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. We used the computer program *U.S. Seismic Design Maps*, provided by the Structural Engineers Association (SEA) to calculate the seismic design parameters. The short spectral response uses a period of 0.2 seconds. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2019 CBC and Table 20.3-1 of ASCE 7-16. The values presented herein are for the risk-targeted maximum considered earthquake (MCE_R). Sites designated as Site Class D, E and F may require additional analyses if requested by the project structural engineer and client.

TABLE 1.1
2019 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2019 CBC Reference
Site Class	C	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.709g	Figure 1613.2.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.265g	Figure 1613.2.1(2)
Site Coefficient, F_A	1.216	Table 1613.2.3(1)
Site Coefficient, F_V	1.5	Table 1613.2.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.863g	Section 1613.2.3 (Eqn 16-36)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.397g	Section 1613.2.3 (Eqn 16-37)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.575g	Section 1613.2.4 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.265g	Section 1613.2.4 (Eqn 16-39)

* Using the code-based values presented in this table, in lieu of a performing a ground motion hazard analysis, requires the exceptions outlined in ASCE 7-16 Section 11.4.8 be followed by the project structural engineer. Per Section 11.4.8 of ASCE/SEI 7-16, a ground motion hazard analysis should be performed for projects for Site Class “E” sites with Ss greater than or equal to 1.0g and for Site Class “D” and “E” sites with S1 greater than 0.2g; however, Section 11.4.8 also provides exceptions which indicates that the ground motion hazard analysis may be waived provided the exceptions are followed.

Table 1.2 presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

TABLE 1.2
2019 CBC SITE ACCELERATION PARAMETERS

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.308g	Figure 22-7
Site Coefficient, F_{PGA}	1.2	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.37g	Section 11.8.3 (Eqn 11.8-1)

Conformance to the criteria in Tables 1.2 and 1.3 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur in the event of a large earthquake. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category of II and resulting in a Seismic Design Category D. Table 1.3 presents a summary of the risk categories in accordance with ASCE 7-16.

TABLE 1.3
ASCE 7-16 RISK CATEGORIES

Risk Category	Building Use	Examples
I	Low risk to Human Life at Failure	Barn, Storage Shelter
II	Nominal Risk to Human Life at Failure (Buildings Not Designated as I, III or IV)	Residential, Commercial and Industrial Buildings
III	Substantial Risk to Human Life at Failure	Theaters, Lecture Halls, Dining Halls, Schools, Prisons, Small Healthcare Facilities, Infrastructure Plants, Storage for Explosives/Toxins
IV	Essential Facilities	Hazardous Material Facilities, Hospitals, Fire and Rescue, Emergency Shelters, Police Stations, Power Stations, Aviation Control Facilities, National Defense, Water Storage

2. CONCLUSIONS AND RECOMMENDATIONS

2.1 General

2.1.1 No soil or geologic conditions were encountered that, in the opinion of Geocon Incorporated, would preclude the proposed widening and improvements of the subject roadways, provided the recommendations of this report are followed. The conclusions and recommendations presented in the referenced geotechnical investigation remain applicable unless superseded herein.

2.1.2 The roadways are generally underlain by fill and Very Old Paralic Deposits. The fill was observed in either a completely end-dumped/loose condition, such as roadside berms, or placed as compacted fill beneath roadways. Because documentation was not readily available, all the fill materials were identified as undocumented. The Very Old Paralic Deposits, although considered highly expansive, are considered suitable for the support of the proposed roadway improvements if properly compacted. The upper approximately 2 feet of the undocumented fill or Very Old Paralic Deposits present in roadway areas may require remedial grading. Some deeper areas of unsuitable material may also be encountered. During roadway grading, compaction testing should be performed to evaluate the suitability of the undocumented fill. The end dumped stockpiles of loose fill placed as roadside berms should be completely removed and compacted. The actual extent of unsuitable soil removal will be determined in the field by the geotechnical engineer and/or engineering geologist during grading operations.

2.1.3 Several alternative pavement section recommendations are presented herein, considering the in-situ soil subgrade conditions, lime-treated soil subgrade, and geotextile reinforced pavement sections. Although the City of San Diego has not previously been receptive to approving alternative pavement sections using chemical stabilization or geogrid reinforcement, recent discussions with the City have been positive since the 2018 Whitebook considers both chemical stabilization and geotextile-reinforced pavement sections as acceptable alternatives. The City of San Diego or applicable governing jurisdiction should be consulted regarding selection of the most appropriate pavement section.

2.1.4 Please note that the City of San Diego may enforce a requirement to remove and replace expansive sidewalk subgrade soil with very low expansive soil (EI less than 20). The depth of required removal is based on the expansion potential of the sidewalk subgrade. Based on the 2018 Whitebook, Section 301-1.2, Table 2 presents the minimum removal depths based on expansion index.

TABLE 2
SIDEWALK SUBGRADE REMOVAL DEPTHS BASED ON EXPANSION INDEX
2018 WHITEBOOK SECTION 301-1.2

Expansion Index (EI) of Native Subgrade Soil	Minimum Depth of Subgrade to be Removed and Replaced (in)
0-50	None
51 – 90	18
91 – 130	24
Greater Than 130	36

NOTES:

1. Removal shall extend beyond edge of sidewalk a horizontal distance equivalent to the depth of removal.
2. Decomposed granite (DG) shall be used as backfill material in the parkway at commercial locations or high pedestrian traffic areas.

2.2 Grading

2.2.1 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.

2.2.2 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.

2.2.3 Abandoned foundations and buried utilities (if encountered) should be removed and the subsequent depressions and/or trenches should be filled with properly compacted material as part of the remedial grading.

2.2.4 Site preparation should begin with the removal of all deleterious material and vegetation. 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. Material generated during stripping and/or site demolition should be exported from the site.

2.2.5 All potentially compressible surficial deposits, including topsoil and loose portions of undocumented fill present within areas where structural improvements are planned should be removed to firm ground and properly compacted prior to placing additional fill and/or structural loads. We expect the upper 2 feet of existing undocumented fill or Very Old Paralic Deposits will require remedial grading prior to fill placement. The actual extent of unsuitable soil removal will be determined in the field by the geotechnical engineer and/or engineering geologist during grading operations. Overly wet, surficial materials will require drying and/or mixing with drier soils to facilitate proper compaction.

2.2.6 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 generally suitable for re-use as fill if free from vegetation, debris and other deleterious material. However, the mudstone unit of the Very Old Paralic Deposits is a highly expansive clay. The lower portions may be saturated. 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.

2.2.7 Rock fragments greater than 8 inches in maximum dimension should not be placed within 3 feet of finish street subgrade. Rock greater than 12 inches in maximum dimension should not be placed within 10 feet of finish grade or within 2 feet of all utilities. Placement of oversize material within fills should be conducted in accordance with the recommendations in Appendix C. Grading operations on the site should be scheduled such that oversize materials are placed in designated rock disposal areas and/or deeper fills.

2.2.8 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.

2.3 Exterior Concrete Flatwork

2.3.1 All exterior concrete flatwork not subject to vehicular traffic should conform to the following recommendations. Slab panels in excess of 8 feet square should be at least 4 inches thick and reinforced with 6x6-W2.9/W2.9 (6x6-6/6) welded wire mesh or No. 3 steel reinforcing bars at 24-inches on center both directions 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.

2.3.2 The recommendations presented herein are intended to reduce the potential for cracking of slabs and foundations as a result of differential 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 10 feet. A 5-foot joint spacing should be considered if the tolerance for cracking is low. 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.

2.4 Culverts

2.4.1 The proposed culverts may be supported on conventional continuous and/or isolated spread footings founded in the Very Old Paralic Deposits gravel/sand member. The following foundation recommendations are considered appropriate for the culverts with the assumption that the soil conditions within 2 feet of finish pad subgrade consist of “very low” to “low” expansive soil (Expansion Index no greater than 50). Additional design parameters are presented in Section 2.6, *Retaining Walls and Lateral Loads*.

2.4.2 If the highly expansive mudstone member of the Very Old Paralic Deposits is exposed at planned culvert footing grade, these soils should be completely removed within the footing footprint. The deepened excavation may be filled with a 2-sack sand-cement slurry up to bottom of planned footing grade. Alternatively, low expansion (EI less than 50) soil fill or aggregate base may be placed and compacted to at least 90 percent relative compaction. As an alternative to full depth removal, the upper 2 feet of highly expansive clay exposed below the culvert foundations may be removed and replaced with a 2-sack sand-cement slurry, low expansion compacted soil fill, or aggregate base.

2.4.3 Continuous footings should be at least 12 inches wide and should extend at least 12 inches below lowest adjacent grade. Isolated spread footings should be at least 24 inches wide and should extend at least 12 inches below lowest adjacent grade. Steel reinforcement for continuous footings should consist of at least two No. 4 steel-reinforcing bars placed horizontally in the footings, one near the top and one near the bottom.

2.4.4 The minimum foundation dimensions and steel reinforcement recommendations presented above are for soil characteristics only and are not intended to replace reinforcement required for structural considerations. Actual reinforcement of the foundations should be designed by the project structural engineer.

2.4.5 If rip-rap is used adjacent to culverts, the footings should be deepened at least 12-inches below the rip-rap.

2.4.6 The recommended allowable bearing capacity for foundations bearing in compacted fill or Very Old Paralic Deposits (sand-gravel member) designed as recommended above is 2,000 pounds per square foot (psf). The allowable soil bearing pressure may be increased by an additional 500 psf for each additional foot of depth and 300 psf for each additional foot of width, to a maximum allowable bearing capacity of 4,000 psf.

2.4.7 The allowable bearing pressures recommended for continuous strip footings and isolated spread footings may be increased by up to one-third for transient loads due to wind or seismic forces.

2.4.8 Footings that must be placed within 7 feet of the top of slopes should be extended in depth such that the outer bottom edge of the footing is at least 7 feet horizontally inside the face of the slope.

2.4.9 Foundation excavations should be observed by a representative of Geocon Incorporated prior to the placement of reinforcing steel or concrete to determine whether the exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

2.4.10 Prior to concrete placement, the upper 1 foot of subgrade should be compacted to at least 90 percent of the maximum dry density at slightly over optimum moisture content. Soils placed below optimum moisture content should be reworked and retested prior to placing concrete.

2.4.11 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil, differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations and concrete structures placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

2.4.12 Additional foundation recommendations can be provided based on the subgrade soil conditions encountered at each culvert.

2.4.13 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

2.5 Preliminary Public Road Pavement Recommendations-In-Situ Soils

2.5.1 The following preliminary pavement section recommendations are presented considering the in-situ soil subgrade soil conditions expected beneath the subject public streets. The final pavement sections will be determined by the City of San Diego Materials Testing Laboratory or other governing jurisdiction and will depend upon the actual soil conditions exposed at subgrade elevation and the results of additional Resistance Value (R-Value) tests of the subgrade soils. The flexible pavement sections provided in Table 2.5 below are based on the laboratory R-Value test results and the *California Department of Transportation Highway Design Manual;* Section 608.4. If rigid concrete pavement is planned in areas exhibiting highly expansive soils with R-Values less than 20, either chemical stabilization or removal of the highly expansive soil is required. Alternative subgrade stabilization recommendations can be provided upon request.

TABLE 2.5
ANTICIPATED FLEXIBLE PAVEMENT STRUCTURAL SECTIONS

Street Classification	Traffic Index (TI)	R-Value	Asphalt Concrete (inches)	Class II Aggregate Base (inches)
Local (Ind)	8.5	5	5	20
Collector	9.0	5	5.5	21
Collector (Comm/Ind)	9.5	5	6	22
Major (4-lane)	10.5	5	6.5	25
Major (6-lane)	11.0	5	7	26
Primary Arterial	11.5	5	7	28
Expressway	12.0	5	7.5	29
Expressway	12.5	5	8	29
Expressway	13.0	5	8	31
Expressway	14.5	5	9	35
Expressway	15.5	5	9.5	38
Expressway	16.0	5	10	39
Expressway	16.5	5	10	40
Expressway	17.0	5	10.5	41

2.5.2 Prior to placing base materials, the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by

ASTM D 1557. The depth of compaction should be at least 12 inches. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

2.5.3 Class 2 aggregate 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 (Greenbook).*

2.6 Preliminary Public Road Pavement Recommendations – Lime Treated Soils

2.6.1 The following preliminary pavement section recommendations are presented considering chemically-stabilized subgrade soil conditions using a 4 percent quick lime content (percent by dry weight) beneath the subject streets to increase the design R-value above 50. The final pavement section design will depend upon the actual soil conditions exposed at subgrade elevation and the results of additional Resistance Value (R-Value) tests of the subgrade soils. The minimum depth of lime-treated subgrade soil ranges between 18 and 30 inches, depending on the traffic index. The pavement sections provided in Tables 2.6.1, and 2.6.2 through 2.6.2, are based on the laboratory R-Value test results and the Caltrans Highway Design Manual considering flexible and rigid pavement, respectively.

TABLE 2.6.1
ANTICIPATED FLEXIBLE PAVEMENT STRUCTURAL SECTION FOR LIME-TREATED SUBGRADE

Street Classification	Traffic Index (TI)	R-Value	Asphalt Concrete (inches)	Class II Aggregate Base (inches)	Lime-Treated Subgrade Thickness (in)
Local (Ind)	8.5	50	5	6	18
Collector	9.0	50	5.5	7	18
Collector (Comm/Ind)	9.5	50	6	7	18
Major (4-lane)	10.5	50	6.5	8	18
Major (6-lane)	11.0	50	7	8	18
Primary Arterial	11.5	50	7	10	18
Expressway	12.0	50	7.5	10	24
Expressway	12.5	50	8	10	24
Expressway	13.0	50	8	11	24
Expressway	14.5	50	9	12	30
Expressway	15.5	50	9.5	13	30
Expressway	16.0	50	10	13	30
Expressway	16.5	50	10	15	30
Expressway	17.0	50	10.5	15	30

TABLE 2.6.2
ANTICIPATED JOINTED PLAIN CONCRETE PAVEMENT (JPCP) RECOMMENDATIONS FOR LIME-TREATED SUBGRADE
(TYPE I SUBGRADE)

Street Classification	Traffic Index (TI)	Assumed R-Value	Portland Cement Concrete - JPCP$^{(1)}$ (inches)	Class II Aggregate Base$^{(2)}$ (inches)	Lime-Treated Subgrade Thickness (in)
Local (Ind)	8.5	50	8.5	6	18
Collector	9.0	50	8.5	6	18
Collector (Comm/Ind)	9.5	50	9	8	18
Major (4-lane)	10.5	50	10	9	18
Major (6-lane)	11.0	50	10	9	18

[1] Concrete shall be 560-B-3250 minimum MR ≥ 600 psi. This analysis assumes the construction of concrete shoulders. JPCP - Jointed Plain Concrete Pavement. Thicknesses shown for JPCP are for dowelled pavement. Transverse joint spacing is 13.5 feet (average). Dowel bar size is 1.5 inches. For addition details, see CalTrans Highway Design Manual, dated July 1, 2020.

[2] Class II aggregate base may be substituted for 3-inches of hot mix asphalt –Type A (HMA-A).

TABLE 2.6.3
ANTICIPATED JOINTED PLANE CONCRETE PAVEMENT (JPCP) RECOMMENDATIONS FOR LIME-TREATED SUBGRADE
(TYPE I SUBGRADE)

Street Classification	Traffic Index (TI)	Assumed R-Value	Portland Cement Concrete JPCP$^{(1)}$ (inches)	Asphalt Concrete $^{(2)}$ (inches)	Lime-Treated Subgrade Thickness (in)
Primary Arterial	11.5	50	10	3	18
Expressway	12.0	50	10	3	24
Expressway	12.5	50	10.5	3	24
Expressway	13.0	50	10.5	3	24
Expressway	14.5	50	11	3	30
Expressway	15.5	50	11	3	30
Expressway	16.0	50	11	3	30
Expressway	16.5	50	11.5	3	30
Expressway	17.0	50	11.5	3	30

[1] Concrete shall be 560-B-3250 minimum MR ≥ 600 psi. This analysis assumes the construction of concrete shoulders. Thicknesses shown for JPCP are for dowelled pavement. Transverse joint spacing is 13.5 feet (average). Dowel bar size is 1.5 inches. For addition details, see CalTrans Highway Design Manual, dated July 1, 2020.

[2] Asphalt concrete may be substituted with a 5-inch thick lean concrete base.

2.6.2 Prior to placing aggregate base materials, the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by ASTM D 1557. The depth of compaction should be at least 12 inches. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

2.6.3 The lime-treated subgrade soils should be placed and compacted in accordance with the recommendations contained in Section 24 of the *Caltrans Manual* and Section 301-5 of the *Standard Specifications for Public Works Construction.*

2.6.4 Cement-treated aggregate base should conform to Section 200-3 of the City of San Diego *Standards Specifications For Public Works Construction* (2018 edition *Whitebook*) 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 (Greenbook).*

2.7 Preliminary Public Road Pavement Recommendations – Geogrid Reinforcement

2.7.1 The following preliminary pavement section recommendations are presented considering geogrid-stabilized subgrade soil conditions using one layer of geogrid reinforcement beneath the aggregate base on the subject streets. For preliminary design, Tensar TriAx TX5 geogrid was used. Based on the Caltrans Highway Design Manual Section 614.5, a subgrade enhancement geotextile (SEG) increases the design R-Value to 20. The final pavement section design will depend upon the actual soil conditions exposed at subgrade elevation and the results of additional Resistance Value (R-Value) tests of the subgrade soils. The pavement sections provided in Table 2.7 below are based on the laboratory R-Value test results and the Caltrans Highway Design Manual.

TABLE 2.7
ANTICIPATED PAVEMENT STRUCTURAL SECTION (USING SUBGRADE ENHANCEMENT GEOTEXTILE)

Street Classification	Traffic Index (TI)	R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Local (Ind)	8.5	20	5	15
Collector	9.0	20	5.5	16
Collector (Comm/Ind)	9.5	20	6	17
Major (4-lane)	10.5	20	6.5	19
Major (6-lane)	11.0	20	7	20
Primary Arterial	11.5	20	7	22
Expressway	12.0	20	7.5	22
Expressway	12.5	20	8	23
Expressway	13.0	20	8	24
Expressway	14.5	20	9	27
Expressway	15.5	20	9.5	30
Expressway	16.0	20	10	30
Expressway	16.5	20	10	32
Expressway	17.0	20	10.5	32

2.7.2 Prior to placing base materials, the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by ASTM D 1557. The depth of compaction should be at least 12 inches. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

2.7.3 Class 2 aggregate 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 (Greenbook).*

2.8 Preliminary Public Road Pavement Recommendations - Culverts

2.8.1 We understand that flexible pavement is desired above the proposed box culverts. In addition, the structural engineer has requested a 6-inch layer of Class II aggregate base above the top of culvert. Presented in Table 2.8 is a recommended flexible pavement section over the proposed box culverts considering a Traffic Index of 17.0. It should be noted that the box culverts were designed to include the truck traffic loads. The recommended asphalt concrete thickness is the same as the adjacent pavement.

TABLE 2.8
ANTICIPATED PAVEMENT STRUCTURAL SECTION (USING SUBGRADE ENHANCEMENT GEOTEXTILE)

Street Classification	Traffic Index (TI)	R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Expressway	17.0	NA	10.5	6

2.8.2 Recommendations for flexible pavement on each side of the proposed box culverts are presented in Sections 2.5 through 2.7. However, to help prevent reflective cracking at the transition from the box culvert to the conventional pavement section, we recommend adding a pavement reinforcement layer, such as Mirafi FGC100, Mirafi PGM-G, or equivalent. The reinforcement layer should be installed in accordance with the manufacturer’s guidelines. At a minimum, the reinforcement layer should extend at least 2 feet on each side of the transition and should be placed with at least 2 inches of asphalt concrete above or below.

2.8.3 Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

2.8.4 Class 2 aggregate 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 (Greenbook).*

2.9 Retaining Walls and Lateral Loads

2.9.1 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid with a density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. For undrained conditions, the active soil pressure should be increased to 85 and 100 pcf for level and 2:1 sloping conditions, respectively. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion

Index ≤50 and are properly drained. Geocon Incorporated should be consulted for additional recommendations if backfill materials have an EI >50.

2.9.2 Where walls are restrained from movement at the top, an additional uniform pressure of 8H psf (where H equals the height of the retaining wall portion of the wall in feet) should be added to the active soil pressure where the wall possesses a height of 8 feet or less and 12H where the wall is greater than 8 feet. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to two feet of fill soil should be added (total unit weight of soil should be taken as 130 pcf).

2.9.3 Soil contemplated for use as retaining wall backfill, including import materials, should be identified in the field prior to backfill. 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. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site 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 on-site soil for use as wall backfill if standard wall designs will be used.

2.9.4 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The wall designer should provide appropriate lateral deflection quantities for planned retaining walls structures, if applicable. These lateral values should be considered when planning types of improvements above retaining wall structures.

2.9.5 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 property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI ≤50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.

2.9.6 In general, wall foundations having a minimum depth and width of one foot may be designed for an allowable soil bearing pressure of 2,000 psf, provided the soil within three feet below the base of the wall has an Expansion Index ≤ 90. The recommended allowable soil bearing pressure may be increased by 300 psf and 500 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable soil bearing pressure of 4,000 psf.

2.9.7 The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is anticipated. As a minimum, wall footings should be deepened such that the bottom outside edge of the footing is at least seven feet from the face of slope when located adjacent and/or at the top of descending slopes.

2.9.8 The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613.3.5 of the 2019 CBC or Section 11.6 of ASCE 7-10. For structures assigned to 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 2019 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 16H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.37g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

2.9.9 For resistance to lateral loads, a passive earth pressure equivalent to a fluid density of 300 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soils or undisturbed formation materials. This value should be decreased to 200 pcf if hydrostatic pressure build-up is possible. The passive pressure assumes a horizontal surface extending away from the base of the wall at least five feet or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance. Where walls are planned adjacent to and/or on descending slopes, a passive pressure of 150 pcf should be used in design.

2.9.10 An ultimate friction coefficient of 0.35 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the passive earth pressure when determining resistance to lateral loads.

2.9.11 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 12 feet. In the event that walls higher than 12 feet are planned, Geocon Incorporated should be consulted for additional recommendations.

2.10 Site Drainage and Moisture Protection

2.10.1 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 2019 CBC Section 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 conduits that carry runoff away from the proposed structure.

2.10.2 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.

2.11 Slope Maintenance

2.11.1 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.

2.12 Grading and Foundation Plan Review

2.12.1 The geotechnical engineer and engineering geologist should review the grading and foundation plans prior to final City submittal to check their compliance with the recommendations of this report and to determine the need for additional comments, recommendations and/or analysis.

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

Very truly yours,

GEOCON INCORPORATED

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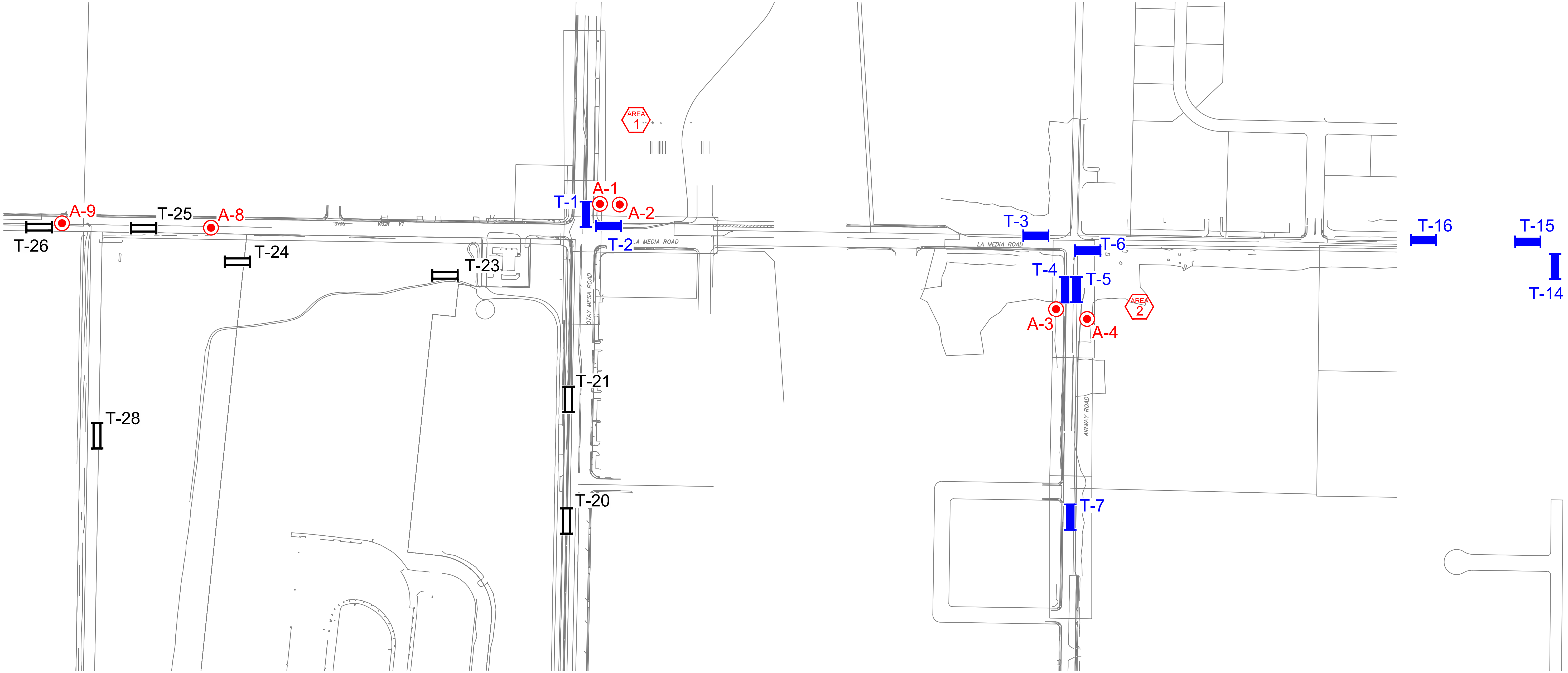
LA MEDIA ROAD AND
TRUCK ROUTE IMPROVEMENTS
SAN DIEGO, CALIFORNIA



SCALE 1"=540'

GEOCON LEGEND

A-7 ● ....APPROX. LOCATION OF PERMEABILITY TEST

T-15 ▬ ....APPROX. LOCATION OF EXPLORATORY TEST PIT

T-62 ⊢⊣ ....APPROX. LOCATION OF EXPLORATORY TRENCH PERFORMED BY GEOCON (July, 2014)

AREA 6 ....GENERALIZED AREA FOR STORM WATER BMP EVALUATION

SITE PLAN

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159
PROJECT NO. G1283 - 32 - 05
FIGURE 1
DATE 10 - 19 - 2020

Plotted:10/16/2020 3:22PM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G1283-42-05 (Truck Route Improvement)\G1283-32-05 Site Plan (Truck Route Improvement).20.dwg

APPENDIX A

APPENDIX A

STORM WATER MANAGEMENT INVESTIGATION

FOR

LA MEDIA ROAD AND TRUCK ROUTE IMPROVEMENTS
SAN DIEGO, CALIFORNIA

PROJECT NO. G1283-32-05

APPENDIX A

STORM WATER MANAGEMENT INVESTIGATION

We understand storm water management devices are being proposed in accordance with the *2018 City of San Diego Storm Water Standards Manual*. If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table A-1 presents the descriptions of the hydrologic soil groups. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

TABLE A-1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The subject roadways are or will be generally underlain by compacted fill and the Very Old Paralic Deposits mudstone member. The USDA Web Soil Survey indicates the roadways are underlain with several surficial units identified as Salinas Clay (ScA), Stockpen gravelly clay loam (SuA and SuB), Huerhuero loam (HrC), and Olivenhain cobbly loam (Of). All of these units are classified as Soil Group D, except for the Salinas Clay which was identified as Soil Group C. We have separated the roadways into 2 general locations. Tables A-2 and A-3 presents the information from the USDA website for the subject roadway sections.

TABLE A-2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP (LA MEDIA ROAD AT OTAY MESA BLVD)

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (inches/hour)
Salinas Clay	ScA	23	C	0.20 – 0.57
Stockpen gravelly clay loam	SuB	77	D	0.0 – 0.06

TABLE A-3
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP (AIRWAY ROAD AT LA MEDIA ROAD)

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (inches/hour)
Huerhuero loam	HrC	51	D	0.0 – 0.06
Stockpen gravelly clay loam	SuB	49	D	0.0 – 0.06

In-Situ Testing

The infiltration rate, percolation rates and saturated hydraulic conductivity are different and have different meanings. Percolation rates tend to overestimate infiltration rates and saturated hydraulic conductivities by a factor of 10 or more. Table A-4 describes the differences in the definitions.

TABLE A-4
SOIL PERMEABILITY DEFINITIONS

Term	Definition
Infiltration Rate	The observation of the flow of water through a material into the ground downward into a given soil structure under long term conditions. This is a function of layering of soil, density, pore space, discontinuities and initial moisture content.
Percolation Rate	The observation of the flow of water through a material into the ground downward and laterally into a given soil structure under long term conditions. This is a function of layering of soil, density, pore space, discontinuities and initial moisture content.
Saturated Hydraulic Conductivity (k_{SAT}, Permeability)	The volume of water that will move in a porous medium under a hydraulic gradient through a unit area. This is a function of density, structure, stratification, fines content and discontinuities. It is also a function of the properties of the liquid as well as of the porous medium.

The degree of soil compaction or in-situ density has a significant impact on soil permeability and infiltration. Based on our experience and other studies we performed, an increase in compaction results in a decrease in soil permeability.

We performed 6 permeability tests for this portion of roadway, 5 constant-head borehole tests (A-1 through A-4 and A-8) and one open pit constant head test (A-9), at locations shown on the attached Site Plan, Figure 1. Tests A-1 through A-4 and A-8 utilized a 4-inch diameter hand auger. Due to cobbles preventing hand augering, an open pit test was performed at location A-9 after the cobbles were extracted from the test location. The results of the tests provide parameters for the saturated hydraulic conductivity characteristics of on-site soil and geologic units. Table A-5 presents the results of the estimated field saturated hydraulic conductivity and estimated infiltration rates obtained from the Aardvark Permeameter tests. The field sheets are presented herein. We applied a feasibility factor of safety of 2 to the field results for use in preparation of Worksheet C.4-1. Based on a discussion in the County of Riverside *Design Handbook for Low Impact Development Best Management Practices*, the infiltration rate should be considered equal to the saturated hydraulic conductivity rate.

TABLE A-5
FIELD PERMEAMETER INFILTRATION TEST RESULTS

Test No.	**Geologic Unit**	**Test Depth (feet)**	**Field-Saturated Hydraulic Conductivity, k_{sat} (inch/hour)**	**Worksheet[1] Saturated Hydraulic Conductivity, k_{sat} (inch/hour)**
A-1	Qudf	2.5	0.49	0.25
A-2	Qudf	2.5	0.12	0.06
A-3	Qvop	2.5	0.004	0.002
A-4	Qvop	2.5	0.20	0.10
A-8	Qvop	3.67	0.028	0.014
A-9	Qvop	2.25	0.00	0.00

[1] Using a factor of safety of 2 for Worksheet C.4-1.

STORM WATER MANAGEMENT CONCLUSIONS

The Site Plan, Figure 1, depicts the existing roadways, the locations of the field excavations and the in-situ infiltration test locations. Based on the soil and geologic conditions, the roadside BMP’s exhibit a “No Infiltration” condition, as discussed below.

Soil Types

Proposed Compacted Fill – Compacted fill will be placed beneath the roadways to achieve finish grades. The compacted fill will be underlain by Very Old Paralic Deposits (Mudstone Member). The proposed storm water BMP's will be founded in either compacted fill placed above the mudstone member, or will be founded in the mudstone member. The compacted fill will be comprised of on-site soil generally consisting of highly expansive sandy/silty clay. The fill will be compacted to a dry density of at least 90 percent of the laboratory maximum dry density. In our experience, compacted fill does not possess infiltration rates appropriate for infiltration BMP's. Hazards that occur as a result of fill saturation include a potential for swelling of the expansive soils and lateral water migration into public and private improvements. The potential for heaving and lateral water migration to adversely impact existing or proposed structures, foundations, utilities, and roadways, is high. Therefore, full and partial infiltration should be considered infeasible.

Section D.4.2 of the *2018 Storm Water Standards* (SWS) provides a discussion regarding fill materials used for infiltration. The SWS states:

- *For engineered fills, infiltration rates may still be quite uncertain due to layering and heterogeneities introduced as part of construction that cannot be precisely controlled.* Due to these uncertainties, full and partial infiltration should be considered geotechnically infeasible and liners and subdrains should be used in areas where infiltration BMP's are founded in compacted fill.

- *Where possible, infiltration BMPs on fill material should be designed such that their infiltrating surface extends into native soils.* The underlying Very Old Paralic Deposits (mudstone member) below the compacted fill is expected between 0 to 10 feet below proposed finish grades after remedial grading is performed. Full and partial infiltration should be considered geotechnically infeasible within the compacted fill and liners and subdrains should be used.

- *Because of the uncertainty of fill parameters as well as potential compaction of the native soils, an infiltration BMP may not be feasible.* Therefore, full and partial infiltration should be considered geotechnically infeasible and liners and subdrains should be used in the fill areas.

- *If the source of fill material is defined and this material is known to be of a granular nature and that the native soils below are permeable and will not be highly compacted, infiltration through compacted fill materials may still be feasible. In this case, a project phasing approach could be used including the following general steps, (1) collect samples from areas expected to be used for fill, (2) remold samples to approximately the proposed degree of compaction and measure the saturated hydraulic conductivity of remolded samples using laboratory methods, (3) if infiltration rates appear adequate for infiltration, then apply an appropriate factor of safety and use the initial rates for preliminary design, (4) following placement of fill, conduct in-situ testing to refine design infiltration rates and adjust the design as needed*. However, based on the discussion above, it is our opinion that infiltrating into compacted fill should be considered geotechnically infeasible and liners and subdrains should be used.

Very Old Paralic Deposits (Mudstone Member) – Quaternary-age Very Old Paralic Deposits underlie the surficial soils beneath the roadways. Historically this unit has been mapped in published literature and geotechnical reports as a terrace, channel, lacustrine, playa and estuarine deposits as well as the Lindavista Formation. In addition, this unit is characteristically known in the Otay Mesa area for having two entirely different lithological units, i.e. the mudstone member and the gravel/sand member. The mudstone member is approximately 10 feet thick and overlies the gravel/sand member. The mudstone is characterized as brown to reddish brown or gray to greenish gray, highly plastic clay with trace amounts of gravel. Based on laboratory testing the *mudstone member* has a *high* to *very high* expansion potential (EI greater than 90). The permeability characteristics of this mudstone are very low. There is a very high probability that water infiltration will induce heaving of the highly expansive soils. In addition, the potential for lateral water migration to adversely impact public and private utilities and improvements is high. Full and partial infiltration should be considered infeasible.

Infiltration Rates

The results of the factored infiltration rates ranged between 0.000 and 0.25 inches per hour. Therefore, based on the results of the infiltration testing, full infiltration should be considered infeasible.

Groundwater Elevations

We did not encounter groundwater during our field exploration. Groundwater is not expected to be a geotechnical constraint. We expect to encounter groundwater greater than 100 feet below the ground surface.

Soil or Groundwater Contamination

Soil or groundwater contamination is not expected.

New or Existing Utilities

Existing utilities are present within right of ways adjacent to the existing streets, generally beneath sidewalks and roadways. Full or partial infiltration within 10 feet of existing or proposed utilities should be avoided to prevent lateral water migration into the permeable trench backfill materials.

Existing and Planned Structures

Commercial and industrial developments either currently exist or will be constructed adjacent to the subject roadways. If water is allowed to infiltrate into the soil, the water could migrate laterally and impact adjacent properties in the vicinity of the roadways. The water migration may also impact buildings and improvements in the area.

Slopes

The Otay Mesa area in the vicinity of the subject streets is relatively flat and significant slopes do not exist adjacent to the roadways.

Recommendations

Liners and subdrains should be incorporated into the design and construction of any planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC) to prevent water migration. The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 4 inches in diameter and consist of Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. Seams and penetrations of the liners should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1 or I-8) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process. We have included two separate worksheets, one for each general roadway location/intersection.

The regional storm water standards also have a worksheet (Worksheet D.5-1 or Form I-9) that helps the project civil engineer estimate the factor of safety based on several factors. Table A-6 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE A-6
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., Infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Based on our geotechnical investigation and the information in Table A-6, Table A-7 presents the estimated factor values for the evaluation of the factor of safety. This table only provides the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate.

TABLE A-7
FACTOR OF SAFETY WORKSHEET DESIGN VALUES – PART A[1]

Suitability Assessment Factor Category	**Assigned Weight (w)**	**Factor Value (v)**	**Product (p = w x v)**
Assessment Methods	0.25	2	0.50
Predominant Soil Texture	0.25	3	0.75
Site Soil Variability	0.25	2	0.50
Depth to Groundwater/ Impervious Layer	0.25	1	0.25
Suitability Assessment Safety Factor, $S_A = \sum p$			2.00

[1] The project civil engineer should complete Worksheet D.5-1 or Form I-9 using the data on this table. Additional information is required to evaluate the design factor of safety.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions[1]	Worksheet C.4-1: Form I-8A[2]
Part 1 - Full Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
roadside BMP's	Planning
Criteria 1: Infiltration Rate Screening	

1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[3]? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ○ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ● No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ○ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ○ Yes; Continue to Step 1C. ○ No; Skip to Step 1D.
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ○ No; full infiltration is not required. Answer "No" to Criteria 1 Result.
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ○ Yes; continue to Step 1E. ○ No; select an appropriate infiltration testing method.

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[1] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[2] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

[3] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ○ Yes; continue to Step 1F. ○ No; conduct appropriate number of tests.
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ○ Yes; continue to Step 1G. ○ No; select appropriate factor of safety.
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ○ Yes; answer "Yes" to Criteria 1 Result. ○ No; answer "No" to Criteria 1 Result.
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ○ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ● No; full infiltration is not required. Skip to Part 1 Result.

Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.

Based on results of permeability testing in six locations near the footprints of the proposed BMP's, the unfactored infiltration rate of the Very Old Paralic Deposits (mudstone) was measured to range between 0.0 inches/hour and 0.28 inches/hour using a constant head borehole test method. If applying a feasibility factor of safety of 2, the infiltration rate would range between 0.0 iph and 0.14 iph with an average of 0.03 iph. In addition, the USDA website indicates the underlying soils belong to Salinas Clay, Huerhuero loam and Stockpen gravelly clay loam and are identified as Hydrologic Soil Groups C and D, which are not considered suitable for infiltration BMP's. Information collected from the USDA website is attached. The infiltration test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity is equal to the unfactored infiltration rate.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 2: Geologic/Geotechnical Screening			
2A	If all questions in Step 2A are answered “Yes,” continue to Step 2B. For any “No” answer in Step 2A answer “No” to Criteria 2, and submit an “Infiltration Feasibility Condition Letter” that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	● Yes	○ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	● Yes	○ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	● Yes	○ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered “Yes,” then answer “Yes” to Criteria 2 Result. If there are “No” answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	● Yes	○ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	● No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	● Yes	○ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○ Yes	● No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	● Yes	○ No
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	● Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	○ Yes	● No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	● No

Summarize findings and basis; provide references to related reports or exhibits.

The underlying soils are highly expansive. Based on the consolidation test results, soaking the underlying expansive soils may result in heaving on the order of 2 to 4 percent of the thickness of the clayey soil, or approximately 3 to 6 inches.

Part 1 Result – Full Infiltration Geotechnical Screening [4]	Result
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	○ Full infiltration Condition ● Complete Part 2

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[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

<table>
<tr><td colspan="2">Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions</td><td>Worksheet C.4-1: Form I-8A[2]</td></tr>
<tr><td colspan="3">Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria</td></tr>
<tr><td colspan="2">DMA(s) Being Analyzed:</td><td>Project Phase:</td></tr>
<tr><td colspan="2">All roadside BMP's</td><td>Planning</td></tr>
<tr><td colspan="3">Criteria 3 : Infiltration Rate Screening</td></tr>
<tr><td>3A</td><td colspan="2">NRCS Type C, D, or “urban/unclassified”: Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or “urban/unclassified” and corroborated by available site soil data?
○ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result.
○ Yes; the site is mapped as D soils or “urban/unclassified” and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result.
● No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.</td></tr>
<tr><td>3B</td><td colspan="2">Infiltration Testing Result: Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr?
○ Yes; the site may support partial infiltration. Answer “Yes” to Criteria 3 Result.
● No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer “No” to Criteria 3 Result.</td></tr>
<tr><td>Criteria 3 Result</td><td colspan="2">Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP?
○ Yes; Continue to Criteria 4.
● No: Skip to Part 2 Result.</td></tr>
<tr><td colspan="3">Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).
Based on results of permeability testing in six locations near the footprints of the proposed BMP’s, the unfactored infiltration rate of the Very Old Paralic Deposits (mudstone) was measured to range between 0.0 inches/hour and 0.28 inches/hour using a constant head borehole test method. If applying a feasibility factor of safety of 2, the infiltration rate would range between 0.0 iph and 0.14 iph, with an average rate of 0.03 iph. In addition, the USDA website indicates the underlying soils belong to Salinas Clay, Huerhuero loam and Stockpen gravelly clay loam and are identified as Hydrologic Soil Groups C and D, which are not considered suitable for infiltration BMP’s. Information collected from the USDA website is attached. The infiltration test results are attached.</td></tr>
</table>

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		**Worksheet C.4-1: Form I-8A[2]**	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	○ Yes	○ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	○ Yes	○ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	○ Yes	○ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	○ Yes	○ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	○ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	○ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		**Worksheet C.4-1: Form I-8A[2]**	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○ Yes	○ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	○ Yes	○ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	○ Yes	○ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	○ Yes	○ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
Summarize findings and basis; provide references to related reports or exhibits. The underlying soils are highly expansive. Based on the consolidation test results, soaking the underlying expansive soils may result in heaving on the order of 2 to 4 percent of the thickness of the clayey soil, or approximately 3 to 6 inches.	

Part 2 – Partial Infiltration Geotechnical Screening Result[5]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	○ Partial Infiltration Condition ● No Infiltration Condition

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[5] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions	**Worksheet C.4-2: Form I-8B[2]**
Part 1 - Full Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
Criteria 1: Groundwater Screening	
1A	**Groundwater Depth.** Is the depth to seasonally high groundwater tables (normal high depth during the wet season) beneath the base of any full infiltration BMP greater than 10 feet? ○ Yes; continue to Step 1B. ○ No; The depth to groundwater is less than or equal to 10 feet, but site layout changes or reasonable mitigation measures can be proposed to support full infiltration BMPs. Continue to step 1B. ○ No; The depth to groundwater is less than or equal to 10 feet and site layout changes or reasonable mitigation measures cannot be proposed to support full infiltration BMPs. Answer "No" for Criteria 1 Result.
1B	**Contaminated Soil/Groundwater.** Are proposed full infiltration BMPs at least 250 feet away from contaminated soil or groundwater sites? This can be confirmed using GeoTracker (geotracker.waterboards.ca.gov) to identify open contaminated sites. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP. ○ Yes; continue to Step 1C. ○ No; However, site layout changes or reasonable mitigation measures can be proposed to support full infiltration BMPs. Continue to Step 1C. ○ No; Site layout changes or reasonable mitigation measures cannot be proposed to support full infiltration BMPs. Answer "No" to Criteria 1 Result.

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[1] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, part 3, or Part 4 determines a full, partial, or no infiltration condition.

[2] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions	**Worksheet C.4-2: Form I-8B[2]**
1C	**Inadequate Soil Treatment Capacity.** Are full infiltration BMPs proposed in DMA soils that have adequate soil treatment capacity? The DMA has adequate soil treatment capacity if **ALL** of the following criteria (detailed in C.2.2.1) for all soil layers beneath the infiltrating surface are met: • USDA texture class is sandy loam or loam or silt loam or silt or sandy clay loam or clay loam or silty clay loam or sandy clay or silty clay or clay; and • Cation Exchange Capacity (CEC) greater than 5 milliequivalents/100g; and • Soil organic matter is greater than 1%; and • Groundwater table is equal to or greater than 10 feet beneath the base of the full infiltration BMP. ○ Yes; continue to Step 1D. ○ No; However, site layout changes or reasonable mitigation measures can be proposed to support full infiltration BMPs. Continue to Step 1D. ○ No; Site layout changes or reasonable mitigation measures cannot be proposed to support full infiltration BMPs. Answer "No" to Criteria 1 Result.
1D	**Other Groundwater Contamination Hazards.** Are there site-specific groundwater contamination hazards not already mentioned (refer to Appendix C.2.2) that can be reasonably mitigated to support full infiltration BMPs? ○ Yes; there are other contamination hazards identified that can be mitigated. Answer "Yes" to Criteria 1 Result. ○ No; there are other contamination hazards identified that cannot be mitigated. Answer "No" to Criteria 1 Result. ○ N/A; no contamination hazards are identified. Answer "Yes" to Criteria 1 Result.
Criteria 1 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination that cannot be reasonably mitigated to an acceptable level? See Appendix C.2.2.8 for a list of typically reasonable and typically unreasonable mitigation measures. ○ Yes; Continue to Part 1, Criteria 2. ○ No; Continue to Part 1 Result.

Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions	Worksheet C.4-2: Form I-8B[2]
Summarize groundwater quality and any mitigation measures proposed. Documentation should focus on groundwater table, mapped soil types and contaminated site locations.	

Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions	Worksheet C.4-2: Form I-8B[2]
Criteria 2: Water Balance Screening	
2A	**Ephemeral Stream Setback.** Does the proposed full infiltration BMP meet both the following? • The full infiltration BMP is located at least 250 feet away from an ephemeral stream; **AND** • The bottom surface of the full infiltration BMP is at a depth 20 feet or greater from seasonally high groundwater tables. ○ Yes; Answer "Yes" to Criteria 2 Result. ○ No; Continue to Step 2B.
2B	**Mitigation Measures.** Can site layout changes be proposed to support full infiltration BMPs? ○ Yes; the site can be reconfigured to mitigate potential water balance issues. Answer "Yes" to Criteria 2 Result. ○ No; the site cannot be reconfigured to mitigate potential water balance issues. Continue to Step 2C and provide discussion.
2C	**Additional studies.** Do additional studies support full infiltration BMPs? In the event that water balance effects are used to reject full infiltration (anticipated to be rare), additional analysis shall be completed and documented by a qualified professional indicating the site-specific information evaluated and the technical basis for this finding. ○ Yes; Answer "Yes" to Criteria 2 Result. ○ No; Answer "No" to Criteria 2 Result.
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams? ○ Yes; Continue to Part 1 Result. ○ No; Continue to Part 1 Result.

Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions	Worksheet C.4-2: Form I-8B[2]

Summarize potential water balance effects. Documentation should focus on mapping and soil data regarding proximity to ephemeral streams and groundwater depth.

Part 1 – Full Infiltration Groundwater and Water Balance Screening Result[3]	Result
If answers to Criteria 1 and 2 are "Yes", a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration based on groundwater conditions. If answer to Criteria 1 or Criteria 2 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design based on groundwater conditions. Proceed to Part 2.	○ Full Infiltration ○ Complete Part 2

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[3] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions	**Worksheet C.4-2: Form I-8B[2]**
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
Criteria 3: Groundwater Screening	

Contaminated Soil/Groundwater. Are partial infiltration BMPs proposed at least 100 feet away from contaminated soil or groundwater sites? This can be confirmed using GeoTracker (geotracker.waterboards.ca.gov) to identify open contaminated sites. This criterion is intentionally a smaller radius than full infiltration, as the potential quantity of infiltration from partial infiltration BMPs is smaller.

○ Yes; Answer “Yes” to Criteria 3 Result.

○ No; However, site layout changes can be proposed to avoid contaminated soils or soils that lack adequate treatment capacity. Select “Yes” to Criteria 3 Result. It is a requirement for the SWQMP preparer to identify potential mitigation measures.

○ No; Contaminated soils or soils that lack adequate treatment capacity cannot be avoided and partial infiltration BMPs are not feasible. Select “No” to Criteria 3 Result.

Criteria 3 Result: Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing risk of groundwater contamination that cannot be reasonably mitigated to an acceptable level?

○ Yes; Continue to Part 2, Criteria 4.

○ No; Skip to Part 2 Result.

Summarize findings and basis. Documentation should focus on mapped soil types and contaminated site locations.

Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions	Worksheet C.4-2: Form I-8B[2]

Criteria 4: Water Balance Screening

Additional studies. In the event that water balance effects are used to reject partial infiltration (anticipated to be rare), a qualified professional must provide an analysis of the incremental effects of partial infiltration BMPs on the water balance compared to incidental infiltration under a no infiltration scenario (e.g. precipitation, irrigation, etc.).

Criteria 4 Result: Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams?

○ Yes: Continue to Part 2 Result.

○ No: Continue to Part 2 Result.

Summarize potential water balance effects. Documentation should focus on mapping and soil data regarding proximity to ephemeral streams and groundwater depth.

Part 2 – Partial Infiltration Groundwater and Water Balance Screening Result[4]	Result
If answers to Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration based on groundwater and water balance conditions. If answer to Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site. The feasibility screening category is No Infiltration based on groundwater or water balance condition.	○ Partial Infiltration Condition ○ No Infiltration Condition

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[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

GEOCON

Aardvark Permeameter Data Analysis

Project Name: MAP Off-Site Roadway
Date: 12/13/2016
Project Number: G1283-32-04
By: TM
Borehole Location: A-1
Ref. EL (feet, MSL): 491.0
Bottom EL (feet, MSL): 488.5

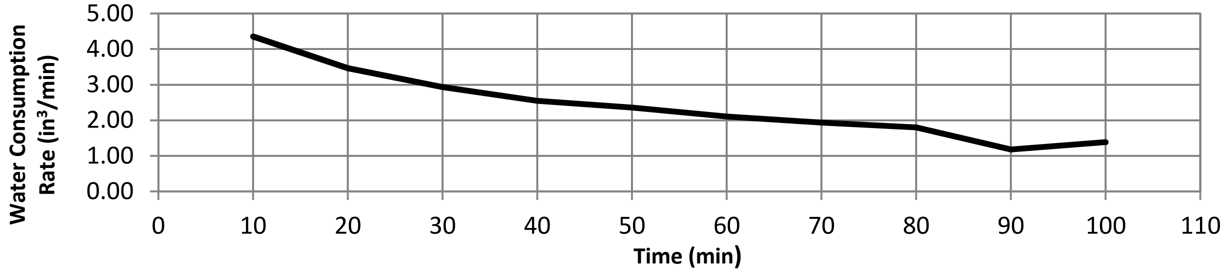
Borehole Diameter (inches): 4.00
Borehole Depth, **H** (feet): 2.50
Distance Between Reservoir & Top of Borehole (feet) 2.17
Depth to Water Table, **s** (feet): 100
Height APM Raised from Bottom (inches): 1.00

Wetted Area, **A** (in^2): 71.12

Distance Between Resevoir and APM, **D** (feet): 3.98
Head Height, **h** (inches): 4.66
Distance Between Constant Head and Water Table, **L** (inches): 1175

Reading	Time (min)	Time Elapsed (min)	Reservoir Water Weight (g)	Resevoir Water Weight (lbs)	Interval Water Consumption (lbs)	Total Water Consumption (lbs)	*Water Consumption Rate (in^3/min)
1	0.00			24.000			
2	10.00	10.00		22.430	1.57	1.57	4.35
3	20.00	10.00		21.180	1.25	2.82	3.46
4	30.00	10.00		20.120	1.06	3.88	2.94
5	40.00	10.00		19.200	0.92	4.80	2.55
6	50.00	10.00		18.350	0.85	5.65	2.36
7	60.00	10.00		17.590	0.76	6.41	2.11
8	70.00	10.00		16.890	0.70	7.11	1.94
9	80.00	10.00		16.240	0.65	7.76	1.80
10	90.00	10.00		15.815	0.42	8.19	1.18
11	100.00	10.00		15.315	0.50	8.69	1.39
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Steady Flow Rate, Q (in^3/min): 1.20



Field-Saturated Hydraulic Conductivity - Infiltration Rate

Case 1: L/h > 3 K_{sat} = 0.0081 in/min 0.49 in/hr

GEOCON

Aardvark Permeameter Data Analysis

Project Name: MAP Off-Site Roadway
Date: 12/13/2016
Project Number: G1283-32-04
By: TM
Borehole Location: A-2
Ref. EL (feet, MSL): 488.0
Bottom EL (feet, MSL): 485.5

Borehole Diameter (inches): 4.00
Borehole Depth, **H** (feet): 2.50
Distance Between Reservoir & Top of Borehole (feet) 2.33
Depth to Water Table, **s** (feet): 100
Height APM Raised from Bottom (inches): 1.00

Wetted Area, **A** (in^2): 71.20

Distance Between Resevoir and APM, **D** (feet): 4.14
Head Height, **h** (inches): 4.67
Distance Between Constant Head and Water Table, **L** (inches): 1175

Reading	Time (min)	Time Elapsed (min)	Reservoir Water Weight (g)	Resevoir Water Weight (lbs)	Interval Water Consumption (lbs)	Total Water Consumption (lbs)	*Water Consumption Rate (in^3/min)
1	0.00			23.480			
2	10.00	10.00		23.175	0.31	0.31	0.85
3	20.00	10.00		22.950	0.23	0.53	0.62
4	30.00	10.00		22.730	0.22	0.75	0.61
5	40.00	10.00		22.510	0.22	0.97	0.61
6	50.00	10.00		22.295	0.22	1.19	0.60
7	60.00	10.00		22.095	0.20	1.39	0.55
8	70.00	10.00		21.930	0.16	1.55	0.46
9	80.00	10.00		21.785	0.15	1.70	0.40
10	90.00	10.00		21.660	0.13	1.82	0.35
11	100.00	10.00		21.545	0.11	1.94	0.32
12							
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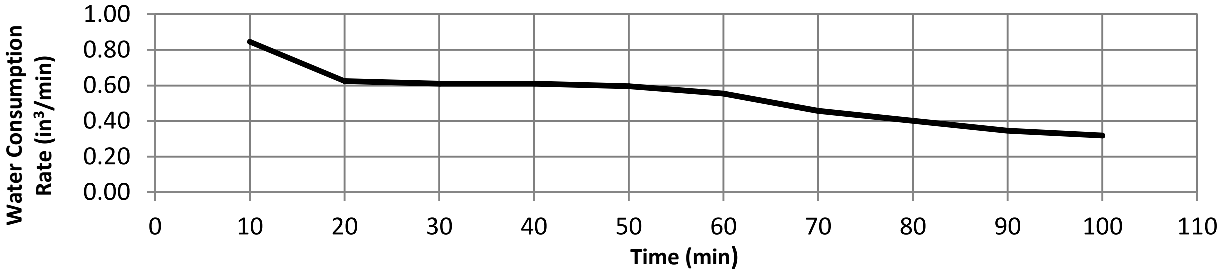
22							
23							
24							
25							

Steady Flow Rate, Q (in^3/min): 0.30

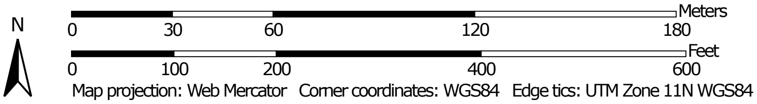


Field-Saturated Hydraulic Conductivity - Infiltration Rate

Case 1: L/h > 3 **K_{sat} =** 0.0020 in/min 0.12 in/hr

Soil Map—San Diego County Area, California
(M.A.P. Off-Site Roadway Study)

Map Scale: 1:2,250 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ScA	Salinas clay, 0 to 2 percent slopes	5.9	23.4%
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes	19.2	76.6%
Totals for Area of Interest		**25.1**	**100.0%**

San Diego County Area, California

ScA—Salinas clay, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hbgh
Elevation: 50 to 300 feet
Mean annual precipitation: 12 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Salinas and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salinas

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 22 inches: clay
H2 - 22 to 46 inches: clay loam, clay
H2 - 22 to 46 inches: loam, clay loam
H3 - 46 to 64 inches:
H3 - 46 to 64 inches:

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 16.2 inches)

Interpretive groups

Land capability classification (irrigated): 2s

Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Diablo
Percent of map unit: 5 percent
Hydric soil rating: No

Huerhuero
Percent of map unit: 5 percent
Hydric soil rating: No

Tujunga
Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

San Diego County Area, California

SuB—Stockpen gravelly clay loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hbgt
Elevation: 700 feet
Mean annual precipitation: 11 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 320 to 340 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Stockpen and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockpen

Setting

Landform: Marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 3 inches: gravelly clay loam
H2 - 3 to 21 inches: gravelly clay
H3 - 21 to 60 inches: clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Huerhuero

Percent of map unit: 5 percent
Hydric soil rating: No

Salinas

Percent of map unit: 5 percent
Hydric soil rating: No

Diablo

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

GEOCON

Aardvark Permeameter Data Analysis

Project Name: MAP Off-Site Roadway
Date: 12/13/2016
Project Number: G1283-32-04
By: TM
Borehole Location: A-3
Ref. EL (feet, MSL): 479.0
Bottom EL (feet, MSL): 476.5

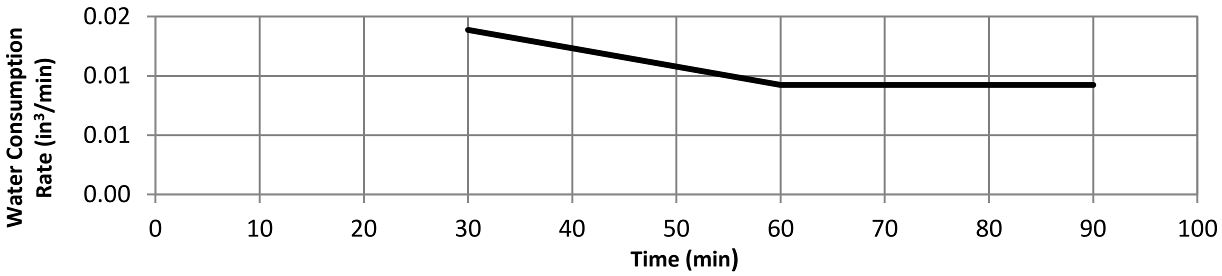
Borehole Diameter (inches): 4.00
Borehole Depth, **H** (feet): 2.50
Distance Between Reservoir & Top of Borehole (feet) 2.42
Depth to Water Table, **s** (feet): 100
Height APM Raised from Bottom (inches): 1.00

Wetted Area, **A** (in^2): 71.24

Distance Between Resevoir and APM, **D** (feet): 4.23
Head Height, **h** (inches): 4.67
Distance Between Constant Head and Water Table, **L** (inches): 1175

Reading	Time (min)	Time Elapsed (min)	Reservoir Water Weight (g)	Resevoir Water Weight (lbs)	Interval Water Consumption (lbs)	Total Water Consumption (lbs)	*Water Consumption Rate (in^3/min)
1	0.00			18.425			
2	30.00	30.00		18.410	0.02	0.02	0.01
3	60.00	30.00		18.400	0.01	0.03	0.01
4	90.00	30.00		18.390	0.01	0.04	0.01
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Steady Flow Rate, Q (in^3/min): 0.01



Field-Saturated Hydraulic Conductivity - Infiltration Rate

Case 1: L/h > 3 **K_{sat} =** 0.0001 in/min 0.004 in/hr

GEOCON

Aardvark Permeameter Data Analysis

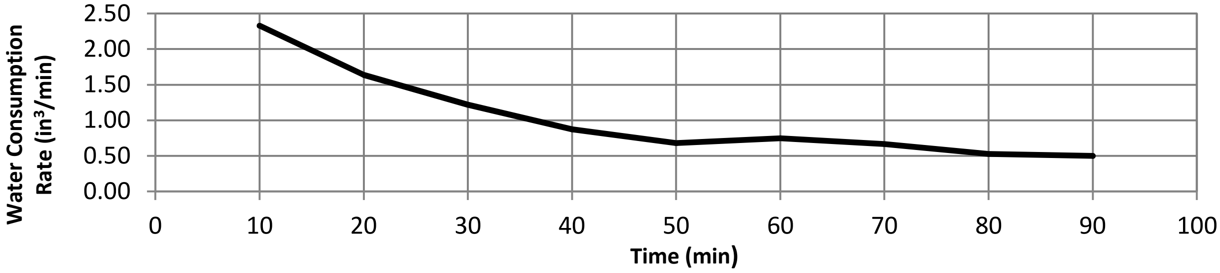
Project Name: MAP Off-Site Roadway
Project Number: G1283-32-04
Borehole Location: A-4
Date: 12/13/2016
By: TM
Ref. EL (feet, MSL): 477.0
Bottom EL (feet, MSL): 474.5

Borehole Diameter (inches): 4.00
Borehole Depth, **H** (feet): 2.50
Distance Between Reservoir & Top of Borehole (feet) 2.33
Depth to Water Table, **s** (feet): 100
Height APM Raised from Bottom (inches): 1.00
Wetted Area, **A** (in^2): 71.20

Distance Between Resevoir and APM, **D** (feet): 4.14
Head Height, **h** (inches): 4.67
Distance Between Constant Head and Water Table, **L** (inches): 1175

Reading	Time (min)	Time Elapsed (min)	Reservoir Water Weight (g)	Resevoir Water Weight (lbs)	Interval Water Consumption (lbs)	Total Water Consumption (lbs)	*Water Consumption Rate (in^3/min)
1	0.00			23.710			
2	10.00	10.00		22.870	0.84	0.84	2.33
3	20.00	10.00		22.280	0.59	1.43	1.64
4	30.00	10.00		21.840	0.44	1.87	1.22
5	40.00	10.00		21.525	0.32	2.19	0.87
6	50.00	10.00		21.280	0.24	2.43	0.68
7	60.00	10.00		21.010	0.27	2.70	0.75
8	70.00	10.00		20.770	0.24	2.94	0.67
9	80.00	10.00		20.580	0.19	3.13	0.53
10	90.00	10.00		20.400	0.18	3.31	0.50
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Steady Flow Rate, Q (in^3/min): 0.50



Field-Saturated Hydraulic Conductivity - Infiltration Rate

Case 1: L/h > 3 K_{sat} = 0.0034 in/min 0.20 in/hr

Soil Map—San Diego County Area, California
(M.A.P. Off-Site Roadway Study)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
HrC	Huerhuero loam, 2 to 9 percent slopes	12.1	51.3%
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes	11.5	48.7%
Totals for Area of Interest		**23.6**	**100.0%**

San Diego County Area, California

HrC—Huerhuero loam, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbcm
Elevation: 1,100 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Huerhuero and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huerhuero

Setting

Landform: Marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 12 inches: loam
H2 - 12 to 55 inches: clay loam, clay
H2 - 12 to 55 inches: stratified sand to sandy loam
H3 - 55 to 72 inches:

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 25.0
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYPAN (1975) (R019XD061CA)

Hydric soil rating: No

Minor Components

Las flores
Percent of map unit: 5 percent
Hydric soil rating: No

Stockpen
Percent of map unit: 5 percent
Hydric soil rating: No

Olivenhain
Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed, ponded
Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

San Diego County Area, California

SuB—Stockpen gravelly clay loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hbgt
Elevation: 700 feet
Mean annual precipitation: 11 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 320 to 340 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Stockpen and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockpen

Setting

Landform: Marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 3 inches: gravelly clay loam
H2 - 3 to 21 inches: gravelly clay
H3 - 21 to 60 inches: clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Huerhuero
Percent of map unit: 5 percent
Hydric soil rating: No

Salinas
Percent of map unit: 5 percent
Hydric soil rating: No

Diablo
Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed, ponded
Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

GEOCON

Aardvark Permeameter Data Analysis

Project Name: Metropolitan Airpark
Project Number: G1283-32-04
Borehole Location: A-8

Date: 1/10/2017
By: JML
Ref. EL (feet, MSL): 500.0
Bottom EL (feet, MSL): 499.7

Borehole Diameter, d (in.): 4.00
Borehole Depth, **H** (feet): 3.67
Distance Between Reservoir & Top of Borehole (in.) 32.00
Depth to Water Table, **s** (feet): 100.00
Height APM Raised from Bottom (in.): 1.00
Pressure Reducer Used: No

Wetted Area, **A** (in^2): 72.06

Distance Between Resevoir and APM Float, **D** (in.): 70.25
Head Height Calculated, **h** (in.): 4.73
Head Height Recorded, **h** (in.): 4.50
Distance Between Constant Head and Water Table, **L** (in.): 1160.73

Reading	**Time (min)**	**Time Elapsed (min)**	**Reservoir Water Weight (g)**	**Resevoir Water Weight (lbs)**	**Interval Water Consumption (lbs)**	**Total Water Consumption (lbs)**	***Water Consumption Rate (in^3/min)**
1	0.00			20.035			
2	1.00	1.00		20.015	0.020	0.020	0.554
3	2.00	1.00		20.000	0.015	0.035	0.415
4	3.00	1.00		19.995	0.005	0.040	0.138
5	4.00	1.00		19.990	0.005	0.045	0.138
6	6.00	2.00		19.985	0.005	0.050	0.069
7	8.00	2.00		19.980	0.005	0.055	0.069
8	10.00	2.00		19.975	0.005	0.060	0.069
9	12.00	2.00		19.970	0.005	0.065	0.069
10	14.00	2.00		19.965	0.005	0.070	0.069
11	16.00	2.00		19.960	0.005	0.075	0.069
12	18.00	2.00		19.955	0.005	0.080	0.069
13	20.00	2.00		19.950	0.005	0.085	0.069
14							
15							
16							
17							
18							
19							
20							
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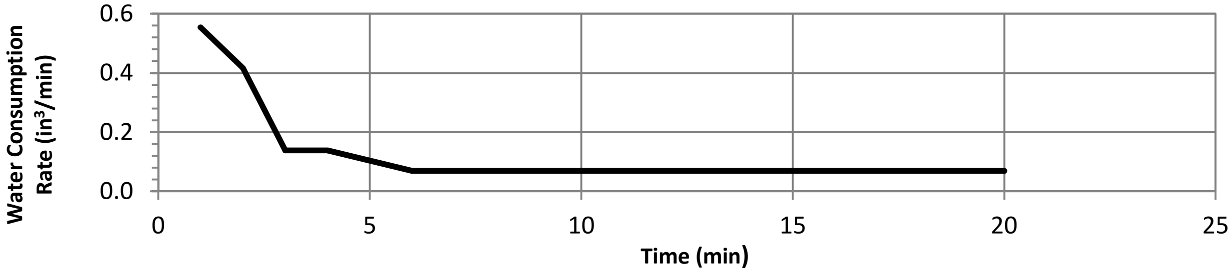
22							
23							
24							
25							
26							
27							
28							

Steady Flow Rate, Q (in^3/min): 0.069



Field-Saturated Hydraulic Conductivity (Infiltration Rate)

Case 1: L/h > 3 K_{sat} = 4.59E-04 in/min 0.028 in/hr

GEOCON

Excavation Percolation Test (Falling Head)

Project Name: Metropolitan Airpark
Project Number: G1283-32-04
Open-Pit Location: A-9

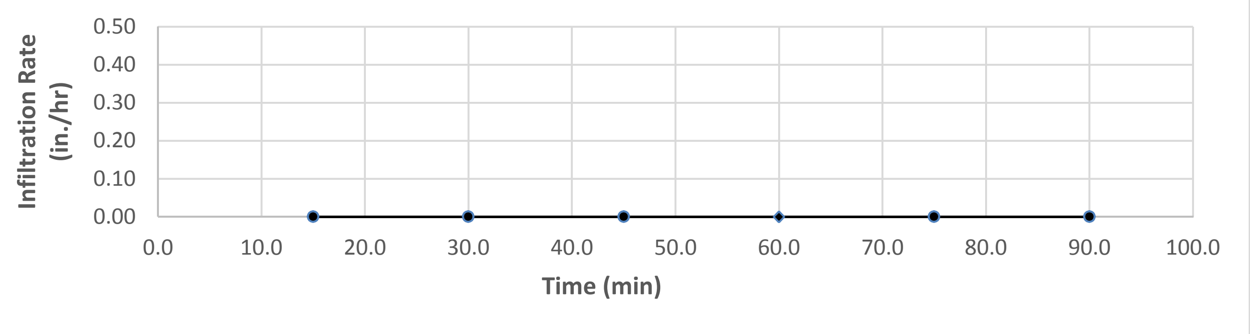
Date: 1/10/2017
By: JML

Test Hole Length (in.) 8.0
Test Hole Width (in.) 8.0
Test Hole Diameter, *DIA* (in.)
Test Hole Depth (in.) 27.0

Test Hole Area, *A* , (in.^{2}) 64.0
Test Hole Volume (in.^{3}) 1728.0

if applicable

							Δt/ΔD	**Δv ／Δt**	***(Q/A)*60***
Reading	**Time, *t* (min)**	**Depth of Water, D (in.)**	**Δ*t* (min)**	**Δ*D* (in.)**	**Wetted Area, *A* $_{wet}$ (in.^{2})**	**Change in Volume, Δ*v* (in.^{3})**	**Percolation Rate (min/in.)**	**Flow Rate, *Q* (in.^{3}/min)**	**Infiltration Rate, *I* $_t$ (in./hr)**
1	0.0	10.13	0.00						
2	15.0	10.13	15.00	0.00	388.00	0.00	0.00	0.00	0.00
3	30.0	10.13	15.00	0.00	388.00	0.00	0.00	0.00	0.00
4	45.0	10.13	15.00	0.00	388.00	0.00	0.00	0.00	0.00
5	60.0	10.13	15.00	0.00	388.00	0.00	0.00	0.00	0.00
6	75.0	10.13	15.00	0.00	388.00	0.00	0.00	0.00	0.00
7	90.0	10.13	15.00	0.00	388.00	0.00	0.00	0.00	0.00



Percolation Rate (Minutes/Inch) = 0.0

Soil Infiltration Rate (Inches/Hour) = 0.00

Soil Map—San Diego County Area, California
(MAP - Phase 1A - La Media Road)

Map Scale: 1:5,260 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- ▭ Area of Interest (AOI)

Soils

- ▭ Soil Map Unit Polygons
- 〰 Soil Map Unit Lines
- ■ Soil Map Unit Points

Special Point Features

- ◎ Blowout
- ☒ Borrow Pit
- ✱ Clay Spot
- ◇ Closed Depression
- ✕ Gravel Pit
- ∴ Gravelly Spot
- ● Landfill
- Λ Lava Flow
- ⫫ Marsh or swamp
- ⚒ Mine or Quarry
- ◉ Miscellaneous Water
- ○ Perennial Water
- ∨ Rock Outcrop
- + Saline Spot
- ⁘ Sandy Spot
- ⊖ Severely Eroded Spot
- ◇ Sinkhole
- ⋗ Slide or Slip
- ∅ Sodic Spot
- ≡ Spoil Area
- ◊ Stony Spot
- ◊◊ Very Stony Spot
- ψ Wet Spot
- △ Other
- ⁃ Special Line Features

Water Features

- ∼ Streams and Canals

Transportation

- ┼┼┼ Rails
- 〰 Interstate Highways
- 〰 US Routes
- 〰 Major Roads
- 〰 Local Roads

Background

- ▩ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ScA	Salinas clay, 0 to 2 percent slopes	0.0	0.0%
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes	24.9	100.0%
Totals for Area of Interest		**24.9**	**100.0%**

San Diego County Area, California

SuB—Stockpen gravelly clay loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hbgt
Elevation: 700 feet
Mean annual precipitation: 11 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 320 to 340 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Stockpen and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockpen

Setting

Landform: Marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 3 inches: gravelly clay loam
H2 - 3 to 21 inches: gravelly clay
H3 - 21 to 60 inches: clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Huerhuero

Percent of map unit: 5 percent
Hydric soil rating: No

Salinas

Percent of map unit: 5 percent
Hydric soil rating: No

Diablo

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

APPENDIX B

APPENDIX B

SELECTED TRENCH LOGS FROM PREVIOUS STUDY

FOR

LA MEDIA ROAD AND TRUCK ROUTE IMPROVEMENTS
SAN DIEGO, CALIFORNIA

PROJECT NO. G1283-32-05

PROJECT NO. G1283-32-04

TRENCH T 1

ELEV. (MSL.)________ DATE COMPLETED 10-13-2016

EQUIPMENT 410 G BACKHOE BY: J. PAGNILLO

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	**UNDOCUMENTED FILL** Loose/soft, moist, dark brown, Clayey, fine to coarse SAND/Sandy CLAY with little gravel, trace trash			
2	T1-1 ▨							
					-Becomes medium dense/medium stiff			
4								
6								
				CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Firm, moist to wet, dark brown, fine to medium Sandy CLAY			
8								
10								
12								
				SC	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Firm, moist to wet, reddish brown, Clayey SAND			
14					TRENCH TERMINATED AT 14 FEET Groundwater not encountered			

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

G1283-32-04.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. G1283-32-04

TRENCH T 2

ELEV. (MSL.)________ DATE COMPLETED 10-13-2016

EQUIPMENT 410 G BACKHOE BY: J. PAGNILLO

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	**UNDOCUMENTED FILL** Loose, dry, light grayish brown, Silty, fine to medium SAND with little gravel			
	T2-1 ⊠							
2								
					-Becomes damp, silty sand/sandy clay mixture			
4								
6				CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Firm, moist, dark brown, fine to medium Sandy CLAY			
8								
10				GC/GM	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Dense, moist, reddish brown, Clayey, fine to coarse SAND with cobble up to 6" diameter			

TRENCH TERMINATED AT 11 FEET
Groundwater not encountered

Figure A-7,
Log of Trench T 2, Page 1 of 1

G1283-32-04.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

TRENCH T 3

ELEV. (MSL.)________ DATE COMPLETED **10-13-2016**

EQUIPMENT **410 G BACKHOE** BY: **J. PAGNILLO**

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	**UNDOCUMENTED FILL** Medium dense, dry, Clayey SAND			
2	T3-1 ☒			CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Firm to stiff, moist, dark brown, Sandy CLAY			
4								
6					-Becomes dark reddish brown, fine to coarse Sandy CLAY			
8				GC/GM	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Dense, moist, reddish brown, Clayey, fine to coarse SAND with cobble up to 12" diameter			
					TRENCH TERMINATED AT 9 FEET Groundwater not encountered			

Figure A-8,
Log of Trench T 3, Page 1 of 1

G1283-32-04.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. G1283-32-04

TRENCH T 4

ELEV. (MSL.)________ DATE COMPLETED **10-13-2016**

EQUIPMENT **410 G BACKHOE** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Very soft, wet, dark brown, Sandy CLAY			
2					-Becomes firm			
4								
6				GC/GM	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Dense, wet, reddish brown, Clayey, fine to coarse SAND with cobble up to 10" diameter			

TRENCH TERMINATED AT 7 FEET
Groundwater not encountered

Figure A-9,
Log of Trench T 4, Page 1 of 1

G1283-32-04.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. G1283-32-04

TRENCH T 5

ELEV. (MSL.)________ DATE COMPLETED **10-13-2016**

EQUIPMENT **410 G BACKHOE** BY: **J. PAGNILLO**

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	**UNDOCUMENTED FILL** Loose, wet, dark, grayish brown, Clayey, fine to coarse SAND with cobble			
				CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Soft, wet, dark brown, Sandy CLAY			
2	▨							
					-Becomes firm			
4								
6				GC/GM	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Dense, wet, reddish brown, Clayey, fine to coarse SAND with cobble up to 10" diameter			

TRENCH TERMINATED AT 7 FEET
Groundwater not encountered

Figure A-10,
Log of Trench T 5, Page 1 of 1

G1283-32-04.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. G1283-32-04

TRENCH T 6

ELEV. (MSL.)________ DATE COMPLETED 10-13-2016

EQUIPMENT 410 G BACKHOE BY: J. PAGNILLO

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	**UNDOCUMENTED FILL** Loose to medium dense, damp, dark reddish brown, Sandy CLAY			
2								
				CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Firm, moist, brown, Sandy CLAY with trace gravel and cobble			
4								
6								
8								
10				GC/GM	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Dense, moist, dark reddish brown, Clayey, fine to coarse SAND with cobble up to 10" diameter			

TRENCH TERMINATED AT 11 FEET
Groundwater not encountered

Figure A-11,
Log of Trench T 6, Page 1 of 1

G1283-32-04.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. G1283-32-04

TRENCH T 14

ELEV. (MSL.)_______ DATE COMPLETED **10-14-2016**

EQUIPMENT **410 G BACKHOE** BY: **J. PAGNILLO**

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	**UNDOCUMENTED FILL** Loose to medium dense, damp, light brown, Clayey, fine to medium SAND; mix with dark brown fine sandy clay			
2								
4				CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Firm, moist, dark brown, fine to medium Sandy CLAY			
6					-Becomes mixed with light brown Clayey, fine to medium SAND			
	T14-1 ▨			SM	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Dense, damp, light brown, Silty, fine to medium SAND			
8								
					TRENCH TERMINATED AT 9 FEET Groundwater not encountered			

Figure A-19,
Log of Trench T 14, Page 1 of 1

G1283-32-04.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. G1283-32-04

TRENCH T 15

ELEV. (MSL.)________ DATE COMPLETED **10-14-2016**

EQUIPMENT **410 G BACKHOE** BY: **J. PAGNILLO**

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	**UNDOCUMENTED FILL** Loose to medium dense, damp, light brown, Clayey, fine to medium SAND; mixed with dark brown Sandy CLAY			
	T15-1 ▨							
2								
4				CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Firm to stiff, moist, dark brown, fine to medium Sandy CLAY			
	T15-2 ▨							
6								
8								
					-Becomes brown Sandy CLAY			
10				SC	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Very dense, moist, light brown, Clayey, fine to medium SAND			
	T15-3 ▨							
12								
					TRENCH TERMINATED AT 13 FEET Groundwater not encountered			

Figure A-20,
Log of Trench T 15, Page 1 of 1

G1283-32-04.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. G1283-32-04

TRENCH T 16

ELEV. (MSL.)_______ DATE COMPLETED 10-14-2016

EQUIPMENT 410 G BACKHOE BY: J. PAGNILLO

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	**UNDOCUMENTED FILL** Loose to medium dense, damp, brown to dark brown, Clayey, fine to medium SAND; mixed with dark brown sandy clay and trace asphalt fragments up to 4" diameter			
4		▨		CH	**VERY OLD PARALIC DEPOSITS (Mudstone Member)** Stiff to very stiff, damp, dark brown, fine to medium Sandy CLAY			
6		▨		SC	**VERY OLD PARALIC DEPOSITS (Gravel/Sand Member)** Very dense, damp, light brown, Clayey, fine to medium SAND; difficult digging			
					TRENCH TERMINATED AT 7 FEET Groundwater not encountered			

Figure A-21,
Log of Trench T 16, Page 1 of 1

G1283-32-04.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. G1283-32-04

TRENCH T 21

ELEV. (MSL.) 493 DATE COMPLETED 07-17-2014

EQUIPMENT JD 410 G RUBBER TIRE BACKHOE BY: R. GARCIA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T21-1			CL	**UNDOCUMENTED FILL** Stiff, dry, dark brown, Sandy CLAY with gravel -Becomes very stiff, damp to moist, and reddish brown with no gravel below 1-foot			
2								
	T21-2							
4								
6				CH	**TOPSOIL** Stiff, very moist, dark gray, plastic CLAY			
				CH	**VERY OLD PARALIC DEPOSIT (MUDSTONE MEMBER)** Stiff, very moist, greenish gray, highly plastic CLAY			
8								
					TRENCH TERMINATED AT 8.5 FEET			

Figure A-48,
Log of Trench T 21, Page 1 of 1

G1283-32-04 (FROM 02 PHASE).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. G1283-32-02

TRENCH T 23

ELEV. (MSL.) 491 DATE COMPLETED 07-07-2014

EQUIPMENT JD 410 G RUBBER TIRE BACKHOE BY: R. GARCIA

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 to damp, dark gray, Sandy CLAY with few gravels			
2	T23-1			CH	**VERY OLD PARALIC DEPOSIT (MUDSTONE MEMBER)** Stiff, very moist, brownish gray, highly plastic CLAY			
4								
	T23-2							
6				SM/SC	**VERY OLD PARALIC DEPOSIT (GRAVEL/SAND MEMBER)** Dense, very moist, orange, Silty/Clayey, fine to coarse SAND with gravel and cobble size rock fragments			
8	T23-3							
10				GM	Very dense, moist, orange, Silty/fine to coarse, Sandy GRAVEL with gravel and cobble size rock fragments			
12								
14					-Gravel and cobble content increases below 14 feet			
16					-Becomes very moist with gravel, cobble and boulder size rock fragments up to 14 inches present below 15 feet			
18					TRENCH TERMINATED AT 18 FEET			

Figure A-50,
Log of Trench T 23, Page 1 of 1

G1283-32-02_METROPOLITAN AIRPARK.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. G1283-32-02

TRENCH T 24

ELEV. (MSL.) 499 DATE COMPLETED 07-07-2014

EQUIPMENT JD 410 G RUBBER TIRE BACKHOE BY: R. GARCIA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CH	**TOPSOIL** Soft, dry to damp, dark brown-gray, plastic CLAY with gravel and desiccation cracks present to 2 feet			
2	◪ T24-1			CH	**VERY OLD PARALIC DEPOSIT (MUDSTONE MEMBER)** Stiff, very moist, gray, highly plastic CLAY			
4								
6	◪ T24-2							
8				GM/GC	**VERY OLD PARALIC DEPOSIT (GRAVEL/SAND MEMBER)** Very dense, moist, orange, Clayey/fine to coarse, Sandy GRAVEL with gravel and cobble size rock fragments up to 6 inches			
10								
12	☒ T24-3			SC	Very dense, very moist, orange, Clayey, fine to coarse, SAND with gravel			
14								
16								
18					TRENCH TERMINATED AT 18 FEET			

Figure A-51,
Log of Trench T 24, Page 1 of 1

G1283-32-02_METROPOLITAN AIRPARK.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. G1283-32-04

TRENCH T 25

ELEV. (MSL.) 504 DATE COMPLETED 07-08-2014

EQUIPMENT JD 410 G RUBBER TIRE BACKHOE BY: R. GARCIA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				GM	**UNDOCUMENTED FILL** Loose, dry, gray, fine to coarse, Sandy GRAVEL			
				CL	**TOPSOIL** Soft, damp, brown, Sandy CLAY with gravel			
2	T25-1 ⊠			SC	Medium dense, damp, orange, Clayey, fine to coarse SAND with gravel and cobble size rock fragments up to 6 inches from 3 to 4 feet			
4								
				CH	**VERY OLD PARALIC DEPOSIT (MUDSTONE MEMBER)** Stiff, very moist, greenish gray, highly plastic CLAY			
6	T25-2 ◪							
				SC	**VERY OLD PARALIC DEPOSIT (GRAVEL/SAND MEMBER)** Very dense, damp, orange, Clayey/fine to coarse, SAND with gravel and cobble size rock fragments			
8					TRENCH TERMINATED AT 8 FEET			

Figure A-52,
Log of Trench T 25, Page 1 of 1

G1283-32-04 (FROM 02 PHASE).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. G1283-32-04

TRENCH T 26

ELEV. (MSL.) 508 DATE COMPLETED 07-08-2014

EQUIPMENT JD 410 G RUBBER TIRE BACKHOE BY: R. GARCIA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T26-1 ▨			SC	**UNDOCUMENTED FILL** Loose, damp, brown, Clayey, fine to coarse SAND with few gravel and cobble size rock fragments up to 8 inches from 2 to 3 feet			
2								
	T26-2 ▨			CH	**VERY OLD PARALIC DEPOSIT (MUDSTONE MEMBER)** Stiff to very stiff, very moist, greenish gray, highly plastic CLAY			
4	T26-3 ◣							
6								
	T26-4 ◣							
8								
10	T26-5 ◣							
				SC	**VERY OLD PARALIC DEPOSIT (GRAVEL/SAND MEMBER)** Very dense, very moist, orange, Clayey, fine to coarse SAND with gravel			
12					TRENCH TERMINATED AT 12 FEET			

Figure A-53,
Log of Trench T 26, Page 1 of 1

G1283-32-04 (FROM 02 PHASE).GPJ

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

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GEOCON

TRENCH T 28

ELEV. (MSL.) **510** DATE COMPLETED **07-07-2014**

EQUIPMENT **JD 410 G RUBBER TIRE BACKHOE** BY: **R. GARCIA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T28-1 ◣			SM	**UNDOCUMENTED FILL** Medium dense, damp, olive brown, Silty, fine to coarse SAND with gravel			
	T28-2 ☒			CL	Soft, moist, dark gray, Sandy CLAY with wood/mulch/compost			
2				CH	**TOPSOIL** Firm, very moist, dark gray, plastic CLAY			
4	T28-3 ◣			CH	**VERY OLD PARALIC DEPOSIT (MUDSTONE MEMBER)** Stiff, very moist, gray, highly plastic CLAY			
6								
	T28-4 ◣							
8								
10								
				GC/GM	**VERY OLD PARALIC DEPOSIT (GRAVEL/SAND MEMBER)** Very dense, very moist, orange, Clayey/fine to coarse, Sandy GRAVEL with gravel and cobble size rock fragments up to 8 inches			
12								
					TRENCH TERMINATED AT 13 FEET			

Figure A-55,
Log of Trench T 28, Page 1 of 1

G1283-32-04 (FROM 02 PHASE).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 C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

LA MEDIA ROAD AND TRUCK ROUTE
SAN DIEGO, CALIFORNIA

PROJECT NO. G1283-32-05

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

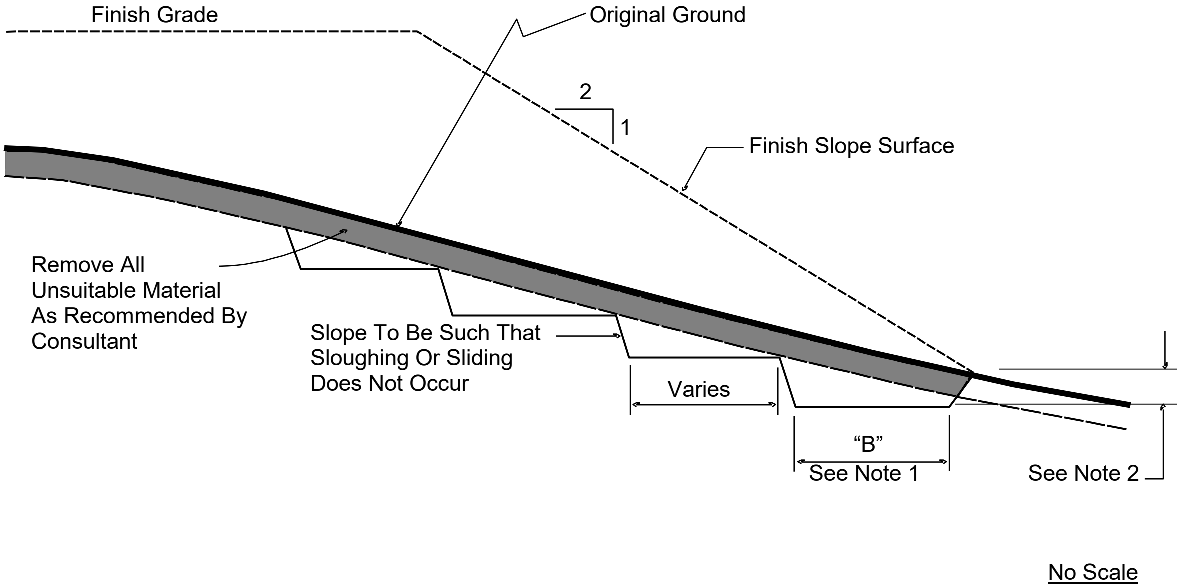
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material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



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.

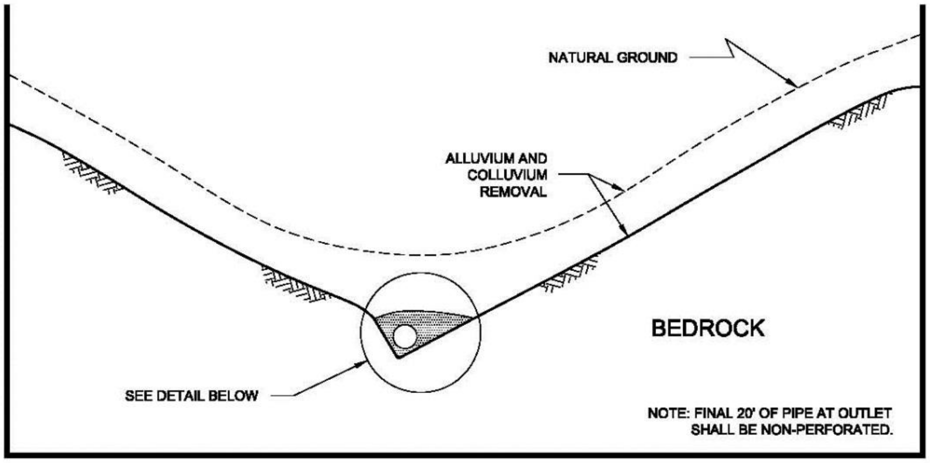
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant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

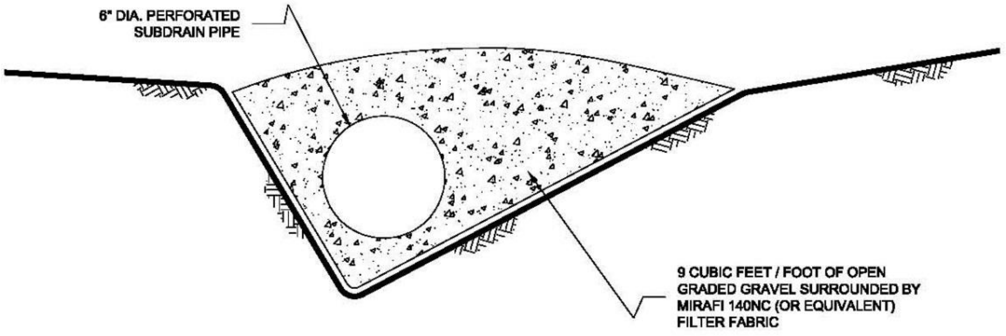
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

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:

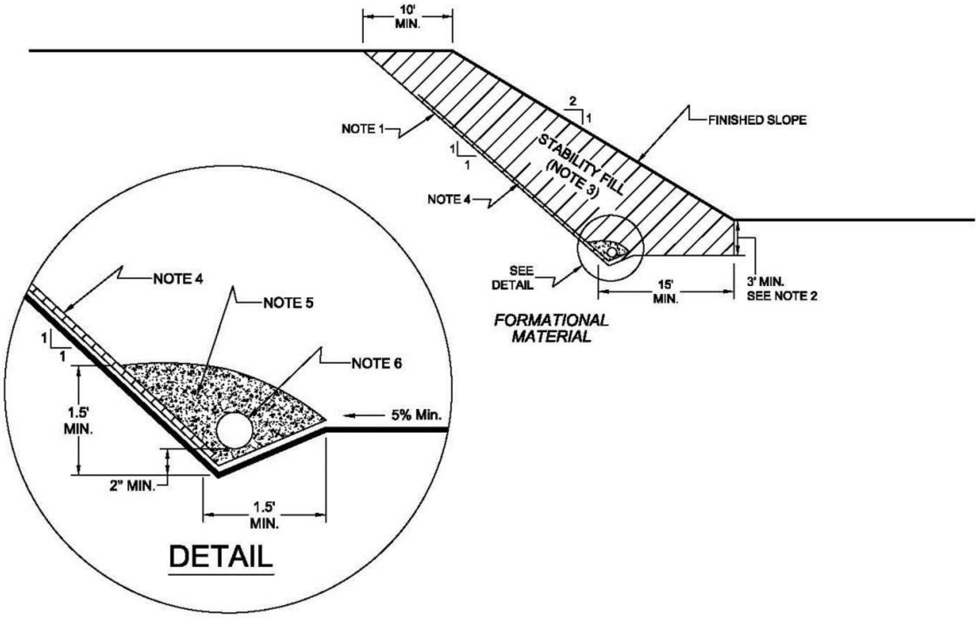
1......8-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

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

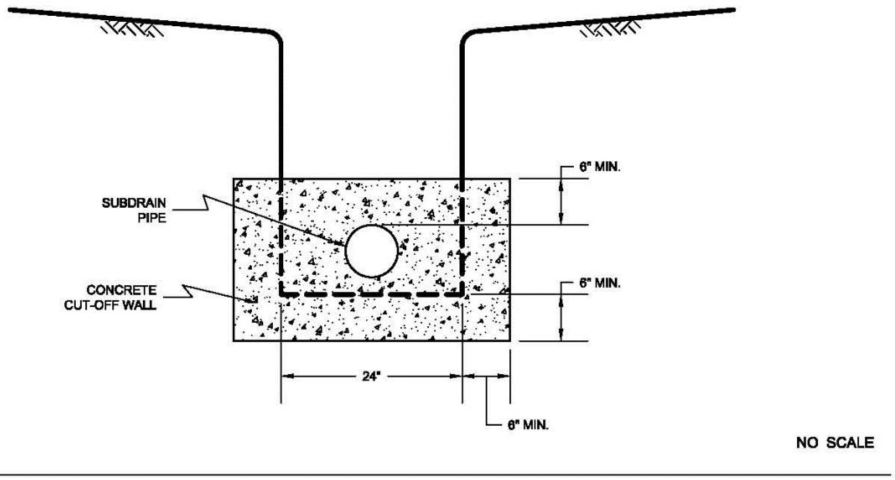
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing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

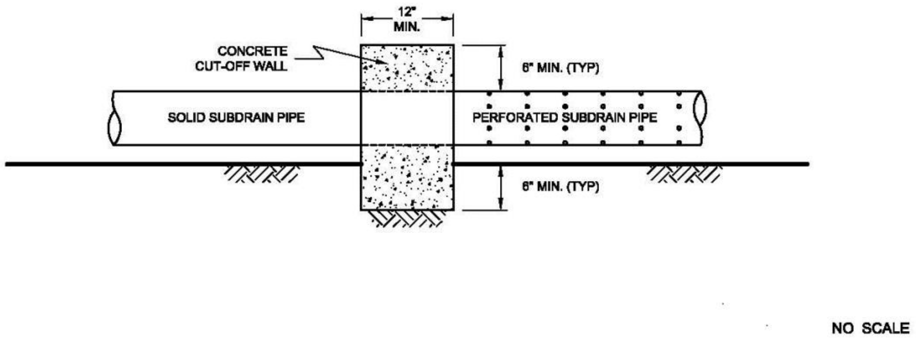
7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



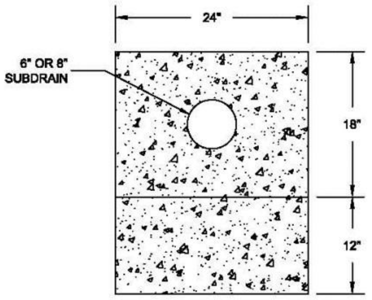
SIDE VIEW



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

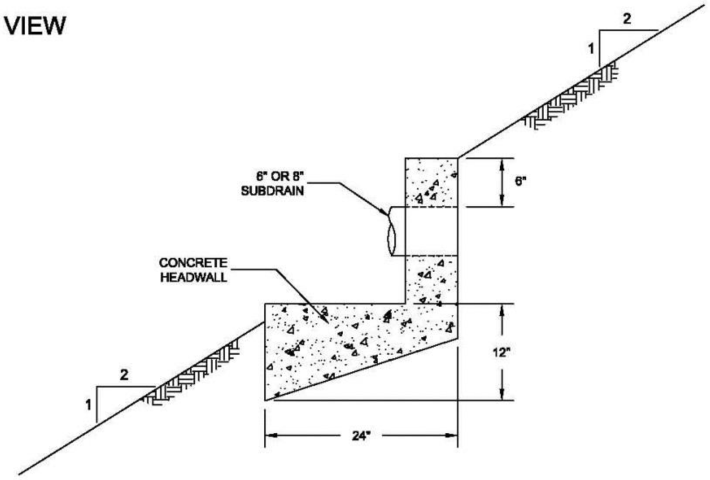
TYPICAL HEADWALL DETAIL

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.