Stormwater Control Plan

For

Fort Ord Regional Trail and Greenway

Submitted to:
Transportation Agency for Monterey County (TAMC)
City of Seaside and
City of Del Rey Oaks

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Prepared by:
Whitson Engineers
6 Harris Court
Monterey, CA 93940

Phone: (831) 649-5225

Prepared for:
Transportation Agency for Monterey County
55-B Plaza Circle
Salinas, CA 93901

Phone: (831) 775-4416

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I. Project Data

Table 1. Project Data

Project Name/Number	Fort Ord Recreational Trail and Greenway
Project Location	Cities of Seaside & Del Rey Oaks; State Route 218; and Frog Pond Regional Park
Project Phase	1
Project Type	Construct a 1.5 mile-long paved bicycle and pedestrian trail.
Total Regulated Project Area (TRA)	131,200 sf
Total Exempt Project Area (TEA)	87,200 sf
Total Project Area (TPA = TRA + TEA)	218,400 sf
Total Existing Impervious Surface Area (TEI, sum of all impervious surfaces across the total project area)	99,500 sf [1]
Total Replaced Impervious Surface Area (TRI)	92,700 sf
Total "New" impervious Surface Area (TNI)	72,900 sf
Total Post-Project Impervious Surface Area (TIA)	165,600 sf [1]
Reduced Impervious Area Credit (RIAC=TEI–TIA, RIAC=0 when TIA>TEI)	0
Net Impervious Area (NIA = TIA – RIAC, Total Post-Project Impervious Surface Area less Reduced Impervious Area Credit, if any)	165,600 sf [1]
Performance Requirement No. (Tiers)	1, 2, 3, 4 and local jurisdiction requirements
Watershed Management Zone(s)	1
Design Storm Frequency and Rainfall Depth (inches) or Rainfall Intensity (inches/hr)	85th percentile rate = 0.2 in/hr 85th percentile, 24-hour depth = 0.8 in 95th percentile, 24-hour depth = 1.3 in 2-year, 24-hour depth = 1.82 in 10-year, 24-hour depth = 2.90 in

[1]Total areas are given for the Project Area, rather than the Parcel Area, since project spans multiple parcels and rights of way

II. Project Setting

II.A. Project Location and Description

The Fort Ord Regional Trail and Greenway project is a proposed 28-mile paved bicycle and pedestrian route through parks, and open spaces connecting the city of Seaside, Marina, Del Rey Oaks and Monterey. This Phase 1 project is composed of a 1.5-mile segment beginning at the intersection of Canyon Del Rey and North Fremont Street in the City of Seaside. The trail will run along State Route (SR) 218 to Work Memorial Park; then through the park to Angelus Way; then along Angelus Way to Del Rey Park; then through Del Rey Park to SR 218; then cross under SR 218 to the Frog Pond Wetland Preserve; then up Carlton Drive to Plumas Avenue, and along Plumas Avenue to Noche Buena Street.

The following relevant reports have been prepared for this project and are referenced in this Stormwater Control Plan:

- Geotechnical Data Report, by Mc Millen Jacobs Associates, dated 11/2021

The following other jurisdictional/regulatory agency permits are anticipated for this project (select the boxes for all permits that apply or select None):

☒ Construction General Permit, State Water Resources Control Board (CGP, SWRCB)
☐ Coastal Development Permit, California Coastal Commission
☒ California Fish & Wildlife, 1602 Streambed Alteration Permit
☐ Clean Water Act Section 10 Permit, US Army Corps of Engineers
☒ Clean Water Act Section 404 Permit, US Army Corps of Engineers
☒ Clean Water Act Section 401 Permit, Regional Water Quality Control Board
☐ Waste Discharge Requirements, Regional Water Quality Control Board
☒ Other (identify):
- City of Seaside Encroachment Permit
- City of Del Rey Oaks Encroachment Permit
- Caltrans Encroachment Permit
- Monterey Peninsula Regional Parks District Encroachment Permit
- Coastal Development Permit, City of Seaside (or Exemption)

☐ None are applicable to this Project.

II.B. Post-Construction Performance Requirements

This project is subject to the following Post-Construction Performance Requirements:

☒ PR1/Tier 1: Site Design and Runoff Reduction
☒ PR2/Tier 2: Water Quality Treatment
☒ PR3/Tier 3: Runoff Retention
☒ PR4/Tier 4: Peak Management
☐ PR5/Tier 5: Special Circumstances [specify type]
☒ Other: Agency requirements
- Caltrans – Highway Drainage and MS4 Permit Requirements
- City of Seaside – Flood Control
- City of Del Rey Oaks – Flood Control

II.B.1. Construction General Permit

The Project will be subject to the post-construction requirements found in the Construction General Permit (CGP) (Order No. 2009-0009-DWQ). The Project will satisfy the requirements of the CGP by utilizing the "more sophisticated, watershed process-based model" presented in this SWCP, rather than the Water Balance Calculator included in Appendix 2.1 of the CGP. The approach provided in this SWCP exceeds the requirements found in Appendix 2.1 of the CGP.

II.C. Jurisdictional Overview

The Project occurs within several jurisdictions and therefore will be subject to various storm water permits and drainage and flood control requirements, as outlined below.

II.C.1. City of Seaside

The project segments within the City of Seaside will be subject to the city's MS4 Permit (which require implementation of the Regional Post-Construction Requirements) as well as the city's flood control requirements. Compliance with City of Seaside requirements will be met by compliance with the PCRs.

II.C.2. City of Del Rey Oaks

The project segments within the City of Del Rey Oaks will be subject to the city's MS4 Permit (which require implementation of the Regional Post-Construction Requirements) as well as the city's flood control requirements. Compliance with City of Del Rey Oaks requirements will be met by compliance with the PCRs.

II.C.3. Caltrans (State Route 218)

Work within the Caltrans right of way (State Route 218) is subject to Caltrans requirements and the Caltrans MS4 Permit, and are addressed in the project's Storm Water Data Report (SWDR). An Encroachment Permit will be required for improvements proposed within Caltrans right of way. No Stormwater Control Measures (SCMs) are proposed within the Caltrans right-of-way. Work within the Caltrans right of way is not subject to the Regional Post-Construction Requirements.

II.D. Existing Site

The proposed trail occurs primarily within existing developed street and highway rights of way, as well as within three public park parcels. State Route 218 (Canyon Del Rey Boulevard) is an existing 2-to 4-lane highway. The various city streets within the City of Del Rey Oaks (Highland Street, Carlton Drive, and Work Avenue) are 2-lane streets with on-street parking and no sidewalks, 34 to 40 feet in paved width. Within City of Seaside, Plumas Avenue is an existing 2-lane street with on-street parking, sidewalk on one side, 26 to 32 feet in width curb-to-curb. The PG&E parcel along Plumas Avenue is unimproved except for the PG&E transmission towers and an AT&T communications facility.

II.E. FEMA Floodplain

Portions of the project, from approximately Station 53+00 to 205+00, are within FEMA Zone "AE" (Canyon Del Rey Creek), as described in the table below. The Project will not place any fill within the FEMA Floodway. The FEMA FIRMettes are included in Attachment D.

Table 2. Trail Segments within FEMA Zone AE

Trail Station	Notes
53+00 to 55+00 +/-	Trail is above the 100-year Base Flood Elevation (BFE), but toe of fill extends into the mapped extents of Zone AE.
56+00 to 59+00 +/-	Trail is lower than BFE, though outside the mapped extents of Zone AE
67+00 to 120+00	Trail uses existing Angelus Way; no improvements proposed in this trail section other than signing/striping. Angelus Way is lower than the BFE, though outside the mapped extents of Zone AE.
150+00 to 158+00 +/-	The proposed trail is lower than the FEMA BFE and within the mapped extents of Zone AE.
158+00 to 201+00 +/-	The proposed trail is lower than the BFE and is within the mapped extents of Zone AE as well as the Regulatory Floodway. Note, the FEMA mapping does not follow the actual channel alignment in this area; this is a mapping artifact. The proposed trail is outside the existing creek channel based on the project topographic mapping.
201+00 to 205+00 +/-	The proposed trail is lower than the BFE but outside the mapped extents of Zone AE. The FEMA BFE shows floodwaters overtopping State Route 218 during the 100-year flood event, therefore the BFE varies from 95’ on the upstream side of the highway to 88’ on the downstream side of the highway.

Figure 1. FEMA mapping at Work Memorial Park

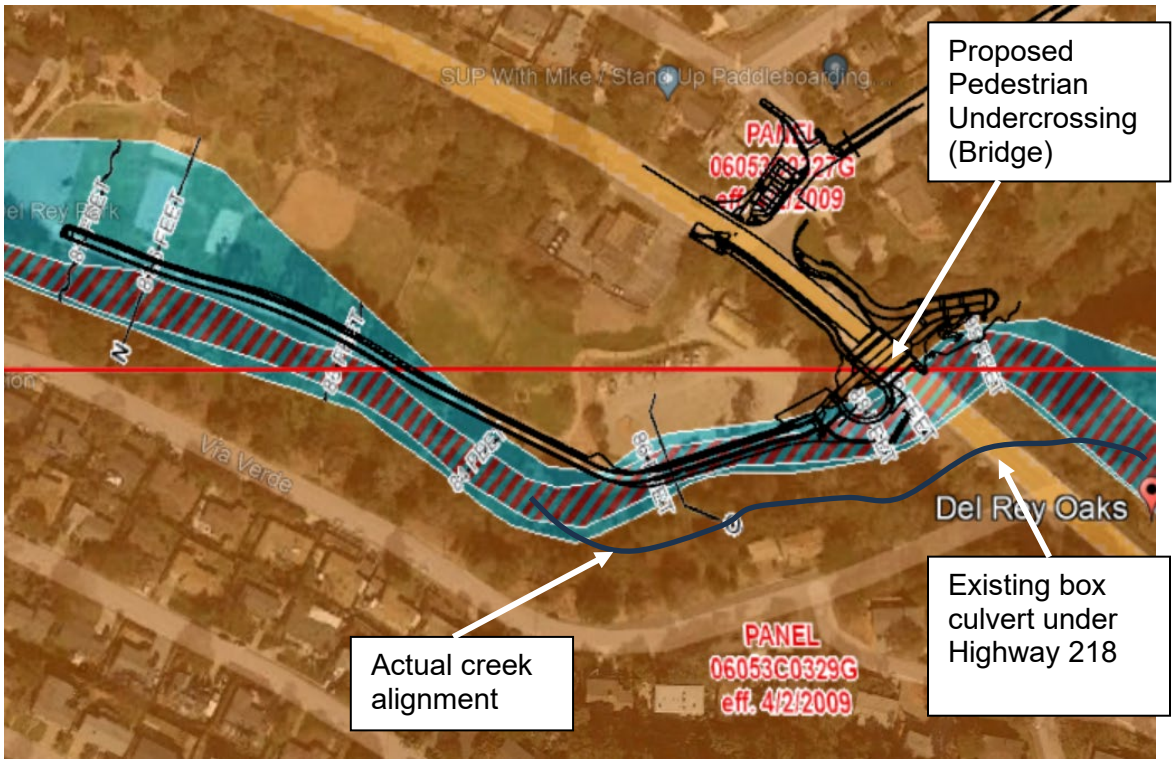


Figure 2. FEMA mapping at Del Rey Park and Frog Pond Wetland Preserve

II.F. Soils and Infiltration

A geotechnical investigation was conducted by Mc Millen Jacobs Associates, titled "Geotechnical Data Report" (November 2021). Infiltration testing was not performed.

The 1972 Soil Survey of Monterey County maps the soils within the project site as Arnold Loamy Sand (AkD / AkF), Baywood Sand (BbC), Oceano Loamy Sand (OaD), and Rindge Muck (Rb), as shown in the figure below.

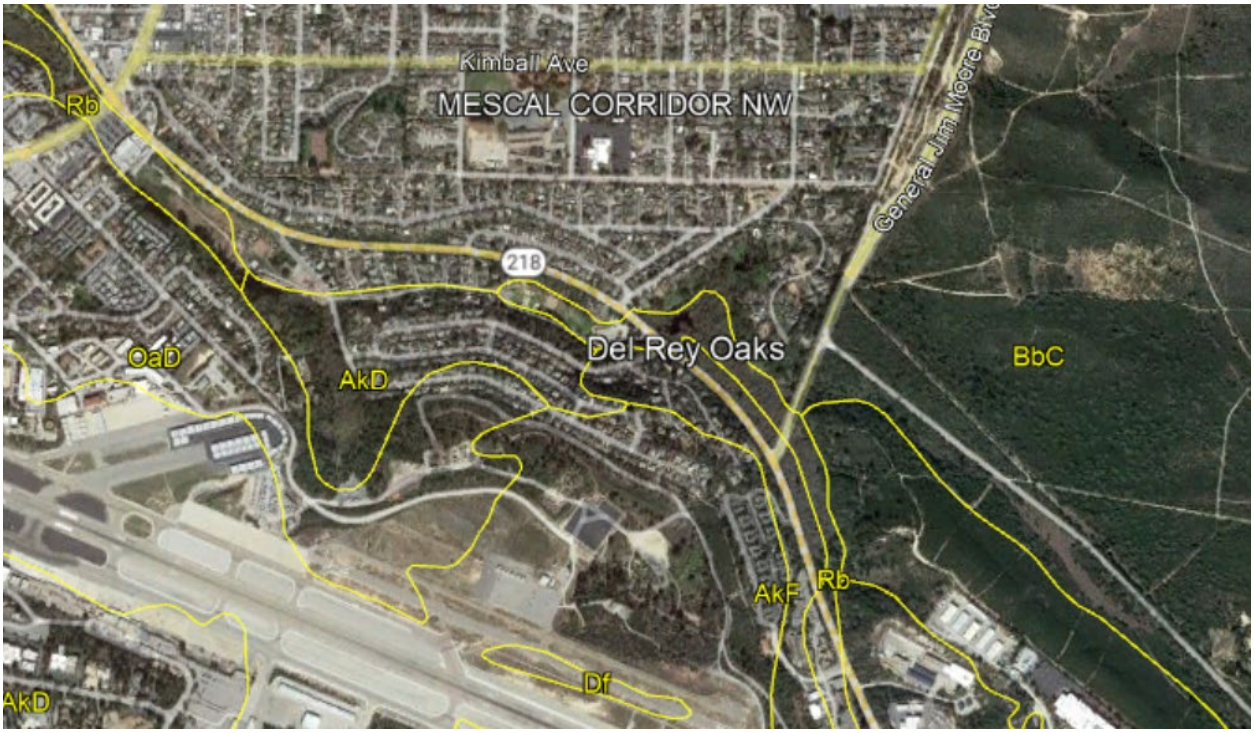


Figure 3. NRCS Soil Survey Map

Table 3. NRCS Soil Survey Soil Groups Characteristics

Symbol	Group Name	HSG	Comments
AkD	Arnold loamy sand, 9 to 20 percent slopes	A	Estimated permeability: 6 to 20 in/hr in upper 48".
AkF	Arnold loamy sand, 15 to 50 percent slopes		
BbC	Baywood sand, 2 to 15 percent slopes	A	Estimated permeability: 6 to 20 in/hr in upper 60".
Rb	Rindge muck 0 to 2 percent slopes	D	Estimated permeability: 6 to 20 in/hr in upper 60", but water table estimated to be less than 3 feet below grade.

A factored infiltration rate of 1 in/hr (after applying a "safety factor" of 1) is used for SCM 2d (bioretention pond) based on the Soil Survey data above. A factored design infiltration rate of 1

in/hr (after applying a “safety factor” of 2) is used for SCM 11d, which is a proposed underground chamber system (“deep” systems). This is much lower than the 6 to 20 in/hr reported by the Soil Survey and is intended to account for diminishing infiltration over the life of SCM 11d.

II.G. Setbacks to Structures and Slopes

No slopes of concern are located above or below proposed SCM 11d (underground chambers).

SCM 2d (bioretention pond) is located at the toe of an existing slope and adjacent to a proposed fill slope. The SCM is set back at least 15 feet from the proposed fill slope, with the trail located between the SCM and the fill slope.

All proposed infiltration-based SCMs are located at least 10’ away from buildings.

II.H. Domestic Water Wells

There are no identified public domestic water wells within 200’ of proposed storm water control measures. (See Attachment D.)

II.I. Utilities and Easements

Existing utilities and utility easements occur at various locations within and near the project area. The presence of existing utilities within the right of way is a primary limitation on the implementation of SCMs.

The proposed SCMs avoid conflicting with utilities and will not be placed over utilities or within utility easements.

Infiltration-based SCMs will be located at least 10’ horizontally away from potable water lines, 100’ horizontally away from domestic water wells, and 4’ horizontally away from other utilities.

II.J. Underground Hazardous Materials

There are no identified underground hazardous materials storage tanks, active hazardous waste sites, or active cleanup sites within 200’ of the project. (See Attachment D.)

II.K. Other Opportunities and Constraints for Stormwater Control

The existing site presents various opportunities and constraints for implementation of stormwater controls. The primary features are:

1. The primary constraint for this project is that, like all projects within the street right-of-way, the project area accepts a relatively large amount of run-on, with very little space within right-of-way to implement SCMs.
2. Existing street width is leveraged to reduce the amount of new impervious area created by the project. (This does come at the cost of reduced on-street parking.)
3. The other primary constraint is the relative steepness of the street grades within the project area, especially along Work Avenue, Carlton Drive, Highland Street and Plumas Avenue. It is difficult to implement SCMs on sloping terrain due to the need for SCMs to be installed level.
4. The proposed SCM’s were therefore strategically placed within the flatter segments of project: SCM 10a at Carlton Drive at Quendale Avenue, and SCM 11d and 11c at Plumas Avenue.
5. The soils throughout the project site have very high permeability. This significantly increases the feasibility of implementing infiltration-based SCMs.

III. Performance Requirement No. 1 (Tier 1): Site Design and Runoff Reduction

III.A. Design Strategies to Optimize Site Layout for Water Quality

III.A.1. Limitation of development envelope.

The Project Area (footprint) is limited to the minimum required for construction of the proposed recreational trails and associated site work. Existing trees and vegetation beyond the project area will be protected. The existing street width is leveraged to reduce the amount of new impervious area created by the project. (This does come at the cost of reduced on-street parking.)

III.A.2. Preservation of natural drainage features.

Portions of the proposed trail are located adjacent to Canyon Del Rey Creek and to the Frog Pond Wetland Preserve. Fencing will be provided along the limit of grading to ensure the project does not impact the creek or identified habitat areas outside the approved project footprint.

III.A.3. Setbacks from creeks, wetlands, and riparian habitats.

Portions of the proposed trail are located adjacent to Canyon Del Rey Creek and the Frog Pond Wetland Preserve. The proposed work meets all permit requirements for setbacks from creeks, wetlands and riparian habitats.

III.A.4. Minimization of imperviousness.

The project's New Impervious Area is minimized by developing the trail within existing pavement areas where possible (e.g. segments along Canyon del Rey Boulevard, Plumas Avenue and Carlton Drive) and by utilizing an appropriate (not excessive) pavement width.

III.B. Minimum Required Tier 1 Measures

All regulated projects are required to minimize stormwater runoff by implementing one (1) or more of the following Site Design Measures.

Table 4. Tier 1 Measures

Implemented	Measure
N/A	Direct roof runoff into cisterns or rain barrels for reuse. Notes: Buildings are not proposed.
N/A	Direct roof runoff onto vegetated areas safely away from building foundations and footings, consistent with the California Building Code. Notes: Buildings are not proposed.
Yes	Direct runoff from sidewalks, walkways and/or patios onto vegetated areas safely away from building foundations and footings, consistent with the California Building Code. Notes: Sidewalks, walkways and plazas will be sloped to drain to adjacent planter areas where feasible, as shown on the construction drawings.
N/A	Direct runoff from driveways and/or uncovered parking lots onto vegetated areas safely away from building foundations and footings, consistent with the California Building Code. Notes: Driveways and parking lots are not proposed.

Implemented	Measure
No	Construct bike lanes, driveways, uncovered parking lots, sidewalks, walkways and patios with permeable surfaces. Notes: Permeable pavements are not proposed.

IV. Post-Construction Drainage Design (Tier 2-4)

Onsite SCMs include one bioretention pond (SCM 2d), two high-flow tree box biofilters (SCMs 10a and 11c) and one underground chambers system (SCMs 11d). These systems are collectively sized to meet the Tier 2 (treatment), Tier 3 (retention) and Tier 4 (detention) requirements for the project as well as local flood control requirements.

Various system alternatives and locations were evaluated. The proposed system locations 1) are located adjacent to storm drains, 2) avoid the steep terrain found in many areas within the project, and 3) were placed where right-of-way was of sufficient width and character to allow for implementation of the proposed SCMs.

IV.A.1. Exempt Areas

Various areas are identified as Exempt from the Post Construction Requirements. Exempt areas do not need to demonstrate compliance with the Post Construction Requirements 1, 2 and 3, but are included in the Tier 4 (detention) calculations as well as in the local agency flood control calculations.

The following areas are identified as Exempt:

Table 5. Exempt New and Replaced Impervious Areas

PCR Reference	Description	Exempt Area (s.f.)
B.1.b.i.	Existing pavement replaced in-kind, with no change in drainage pattern. Examples include AC re-paving and curb ramp retrofits. Areas where paving type is changed (for example, curb bulb-outs) are not exempted.	35,400
B.1.b.ii.	Pedestrian areas that drain to adjacent landscaping.	51,800
	Total	**87,200**

A detailed area breakdown of exempt areas is provided in Attachment E.

IV.A.2. Self-Treating Areas (STAs)

A self-treating area (STA) only treats the rain falling on itself and does not receive stormwater runoff from other areas. They are a portion of a Regulated Project in which infiltration, evapotranspiration, and other natural processes remove pollutants from stormwater. The self-treating areas may include conserved natural open areas and areas planted with native, drought-tolerant or LID appropriate vegetation.

No additional stormwater management is required for self-treating areas. (CCRWQCB Resolution No. R3-2013-0032, Attachment 1, Section B.4.d.iv.1.)

The following areas are identified as STAs for purposes of SCM sizing:

Table 5A. Self Treating Areas

DMA	Description	Area (s.f.)
5700	Existing non-irrigated landscaped area	73,800
	Replaced landscaped area; will be seeded with drought-tolerant landscaping and non-irrigated.	13,600
	Total	**87,200**

IV.A.3. Self-Retaining Areas (SRAs)

Also called "zero discharge" areas, Self-Retaining Areas (SRAs) are designed to retain some amount of rainfall (by ponding and infiltration and/or evapotranspiration) without producing stormwater runoff. Self-Retaining Areas may include graded depressions with landscaping or pervious pavement.

Runoff from impervious surfaces, generated by the LID design rainfall event, may be directed to undisturbed or natural landscaped areas. If this runoff will be infiltrated and will not produce runoff to the storm drain system, or a surface receiving waterbody, or create nuisance ponding that may affect vegetation health or contribute to vector problems, then no additional stormwater management is required for these impervious surfaces. (CCRWQCB Resolution No. R3-2013-0032, Attachment 1, Section B.4.d.iv.2.)

No SRAs are identified for calculation purposes. This is a conservative approach for SCM sizing.

V. Stormwater Control Measures (SCMs)

Stormwater control measures integrated into project designs that emphasize protection of watershed processes through replication of predevelopment runoff patterns (rate, volume, duration). Physical control measures include, but are not limited to, bioretention/rain gardens, permeable pavements, dispersion, soil quality and depth, minimal excavation foundations, vegetated roofs, and water use.

V.A. Summary of Proposed Stormwater Control Measures

Mitigation for New and Replaced Impervious Areas are provided by a series of Stormwater Control Measures (SCMs) as outlined in the table below. Each SCM is designed to meet Post-Construction Requirements 2, 3 and/or 4, as shown in the Table.

Table 6. Summary of Proposed SCM's

SCM No.	Tributary DMA	SCM Owner	Type	Design Criteria
2d	PM0.118 & 5700	City of DRO	Non-Underdrained Bioretention Pond	PCR 2 (Treatment) + PCR 3 (Retention) + PCR 4 (Detention)
10a	25230	City of DRO	Tree Box Biofilter	PCR 2 (Treatment)
11c	31000A	City of Seaside	Tree Box Biofilter	PCR 2 (Treatment)
11d	31000A C3	City of Seaside	Underground Chambers	PCR 3 (Retention) + PCR 4 (Detention)
12a		City of DRO	Tree Box Biofilter	PCR 2 (Treatment)

V.B. Stormwater Control Measure Sizing Calculations

V.B.1. PCR 2 – Water Quality Treatment Calculations

SCM 2d is designed to meet PR #2 on a flow-rate basis. See Table 7**,** below for sizing calculations.

SCMs 10a, 11c, and 12a are also designed to meet PR #2 on a flow-rate basis. See Tables 8 – 11, below for sizing calculations.

Table 7. Bioretention Sizing Calculation for SCM 2d

DMA No.	DMA Area (SF)	Post-project surface type	Runoff factor	DMA Area x runoff factor	Bioretention Pond		
					0.2 in/hr, 85th Percentile Precipitation 5 in/hr, Design Media Treatment Rate		
PM0.118	100	New Impervious	1	100			
	100	Replaced Impervious	1	100			
	0	New Pervious	0.1	0			
	0	Replaced Pervious	0.1	0			
	12,600	Impervious Area to Remain	1	12,600			
	3,000	Pervious Area to Remain	0.1	300			
5700	0	New Impervious	1	0			
	0	Replaced Impervious	1	0			
	0	New Pervious	0.1	0			
	13,600	Replaced Pervious (STA)	0	0			
	4,700	Impervious Area to Remain	1	4,700			
	73,800	Pervious Area to Remain (STA)	0	0			
	800	Pond Itself	1	800	SCM Sizing Factor	Minimum Area (SF)	Proposed Area (SF)
			Total	18,600	0.04	744	800

Table 8. SCM 10a Equivalent Impervious Area (EIA) Calculation

Surface Type	Surface Area (s.f.)	Runoff Factor	Surface Area x Runoff Factor (s.f.)
New Impervious Area	200	1	200
Replaced Impervious Area	1,200	1	1,200
New Pervious Area	0	0.1	0
Replaced Pervious Area	0	0.1	0
Impervious Area to Remain	41,300	1	41,300
Pervious Area to Remain	23,500	0.1	2,350
Tree Box Filter Area	72[1]	1	72
Equivalent Impervious Area (EIA)			**45,122**

[1]Tree box area varies; see Table 11.
The largest area is used here, which is conservative.

Table 9. SCM 11c Equivalent Impervious Area (EIA) Calculation

Surface Type	Surface Area (s.f.)	Runoff Factor	Surface Area x Runoff Factor (s.f.)
New Impervious Area	4,500	1	4,500
Replaced Impervious Area	14,000	1	14,000
New Pervious Area	0	0.1	0
Replaced Pervious Area	0	0.1	0
Impervious Area to Remain	6,400	1	6,400
Pervious Area to Remain	0	0.1	0
Tree Box Filter Area	16[1]	1	16
Equivalent Impervious Area (EIA)			**24,916**

[1]Tree box area varies; see Table 11.
The largest area is used here, which is conservative.

Table 10. SCM 12a Equivalent Impervious Area (EIA) Calculation

Surface Type	Surface Area (s.f.)	Runoff Factor	Surface Area x Runoff Factor (s.f.)
New Impervious Area	0	1	0
Replaced Impervious Area	1,200	1	1,200
New Pervious Area	0	0.1	0
Replaced Pervious Area	0	0.1	0
Impervious Area to Remain	39,500	1	39,500
Pervious Area to Remain	0	0.1	0
Tree Box Filter Area	60[1]	1	60
Equivalent Impervious Area (EIA)			**40,760**

[1]Tree box area varies; see Table 11.
The largest area is used here, which is conservative.

Table 11. Tree Box Biofilter Sizing Calculation

SCM #	Manufacturer / Product	GULD Basic Treatment Flow Rate (in/hr) (1)	Minimum Area Required (s.f.)	Area Provided (Box Size) (s.f.)	Internal Overflow (c.f.s.)
10a	Contech Filterra	175	52	60 (6'x10')	None
	Oldcastle BioPod	153	59	60 (3) (6'x10')	
	Rotondo StormGarden	140	65	72 (6'x12')	
11c	Contech Filterra	175	29	40 (4'x10')	1.1
	Oldcastle BioPod	153	33	40 (4'x10')	
	Rotondo StormGarden	140	36	40 (4'x10')	
12a	Contech Filterra	175	47	48 (6'x8')	1.8
	Oldcastle BioPod	153	53	60 (6'x10')	
	Rotondo StormGarden	140	58	60 (6'x10')	

(1) System must be Washington State Department of Ecology GULD Certified.
(2) Minimum Area Required = EIA x (0.2 in/hr) / (Design Treatment Flow Rate)
(3) The BioPod system includes an internal overflow which occupies approximately 4 s.f.
(4) Overflow Capacity = EIA x 10-year, 15-minute peak precipitation (1.88 in/hr)

V.B.2. Tier 3 – Runoff Retention

The project's required retention volume is calculated using the Central Coast Region Stormwater Control Measure Sizing Calculator (see Attachment G). The volumes required and provided are summarized in the following table.

The proposed retention volumes will be provided in the drain rock reservoir within SCM 2d as well as within SCM 11d (underground chambers).

Table 12. Retention Volumes Required and Provided

SCM	Type	Retention Volume Required (c.f.)	Retention Volume Provided (c.f.)
2d	Bioretention Pond	648	1220 [1]
11d	Infiltration Trench	1482	1628 [2]

[1] Retention Volume Provided = 800 sf Pond Area x (18" Rock Reservoir x 0.35 void ratio + 24" BSM x 0.25 void ratio + 6" surface ponding)
[2] See Attachment F for volume calculations.

V.B.3. Tier 4 – Peak Flow Management and Flood Control

Runoff rates for the Project were evaluated for the Peak Flow and Flood Control design storm events listed below, in accordance with *Table 1. Routing Method Criteria*, as found in Regional Permit Attachment D. The specific Routing Method Criteria utilized are:

Table 13. Routing Method Criteria

Hydrograph Analysis Method	NRCS TR-55 (using the HEC-HMS computer program)
Pond Routing Method	Storage-Discharge
Rainfall Distribution	NRCS Type 1
Time of Concentration	15 minutes (10 minute Lag Time)
Time Increment	1 minute

The final pond routing results are summarized in the Table below. The detailed model inputs and results can be found in Attachment H.

Table 14. Peak Discharge Comparison

Storm Event	Pre-Project Peak Discharge (cfs)	Post-Project Peak Discharge (cfs)
2-Year	20.1	19.6
10-Year	32.5	32.2

The table above demonstrates that the peak discharges from the site post-project will be equal to or less than the peak discharges from the site pre-project.

VI. Site Source Control

VI.A. Site activities and potential sources of pollutants

Site elements and activities within the project area with the potential to pollute storm water runoff are provided in the following table.

Table 15. Potential Pollutant Sources and Source Controls

Potential Pollutant Source	Source control BMPs
Public Street Right of Way	**Design BMPs:** • Mark all inlets with the words “No Dumping! Flows to Bay” or similar. **Operational BMPs:** • Maintain and periodically repaint or replace inlet markings. • Perform street sweeping as required by the MS4 Permit
Landscape/ Outdoor Pesticide Use/Building and Grounds Maintenance	**Design BMPs:** • Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. • Landscaping is designed to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. • Where landscaped areas are used to retain or detain stormwater, plants that are tolerant of saturated soil conditions. • Pest-resistant plants were considered. • Plants are selected considering site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions. **Operational BMPs:** • Maintain landscaping using minimum or no pesticides. • Provide IPM information to new owners, lessees and operators • See applicable operational BMPs in Fact Sheet SC-41, “Building and Grounds Maintenance,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

VII. Structural Control Measures (SCM) Operations and Maintenance

VII.A. Ownership and Responsibility for SCM Maintenance in Perpetuity

The City of Seaside will own, operate and maintain SCMs 11c and 11d.

The City of Del Rey Oaks will own, operate and maintain SCMs 2d, 10a, and 12a.

VII.B. Summary of SCM Operations and Maintenance Requirements for Each SCM

An Operation and Maintenance Plan (O&M Plan) will be prepared and implemented for the facilities prior to final acceptance by the City. In general, maintenance activities will include:

- Bioretention Pond
  - Removal of trash, debris, dead vegetation, and accumulated sediment.
  - Replenish / replace plants, mulch, rock and other materials as needed
  - Visual inspections to ensure facility is operating as designed
- Tree Box Biofilter
  - Removal of trash, debris, dead vegetation, and accumulated sediment.
  - Replenish / replace plants, mulch, rock and other materials as needed
  - Visual inspections to ensure facility is operating as designed
- Underground Chambers
  - Removal of trash, debris, vegetation, and accumulated sediment.
  - Visual inspections to ensure facility is operating as designed

VIII. SCM Construction Plan Set Checklist

Table 16: Construction Plan Checklist

SCM #	SCM Description	Construction Plan Sheet		
		Plan	Profile	Detail
SCM 2d	Bioretention Pond	SW-102, C-104	SW-102	SW-501
SCM 10a	Tree Box Biofilter	SW-107	SW-107	SW-501
SCM 11c	Tree Box Biofilter	SW-108	SW-108	SW-501
SCM 11d	Underground Chamber	SW-108	SW-108	SW-108
SCM 12a	Tree Box Biofilter	SW-103	SW-103	SW-501

IX. Certification

I certify that the stormwater control facilities described in this Stormwater Control Plan have been designed to meet the following applicable Post-Construction Requirements in accordance with Central Coast Regional Water Quality Control Board Resolution No. R3-2013-0032, Attachment 1, Post-Construction Stormwater Management Requirements for Development Projects in the Central Coast Region (Check all that apply):

- ☒ PCR 1: Site Design and Runoff Reduction
- ☒ PCR 2: Water Quality Treatment
- ☒ PCR 3: Runoff Retention
- ☒ PCR 4: Peak Management
- ☐ PCR 5: Special Circumstances

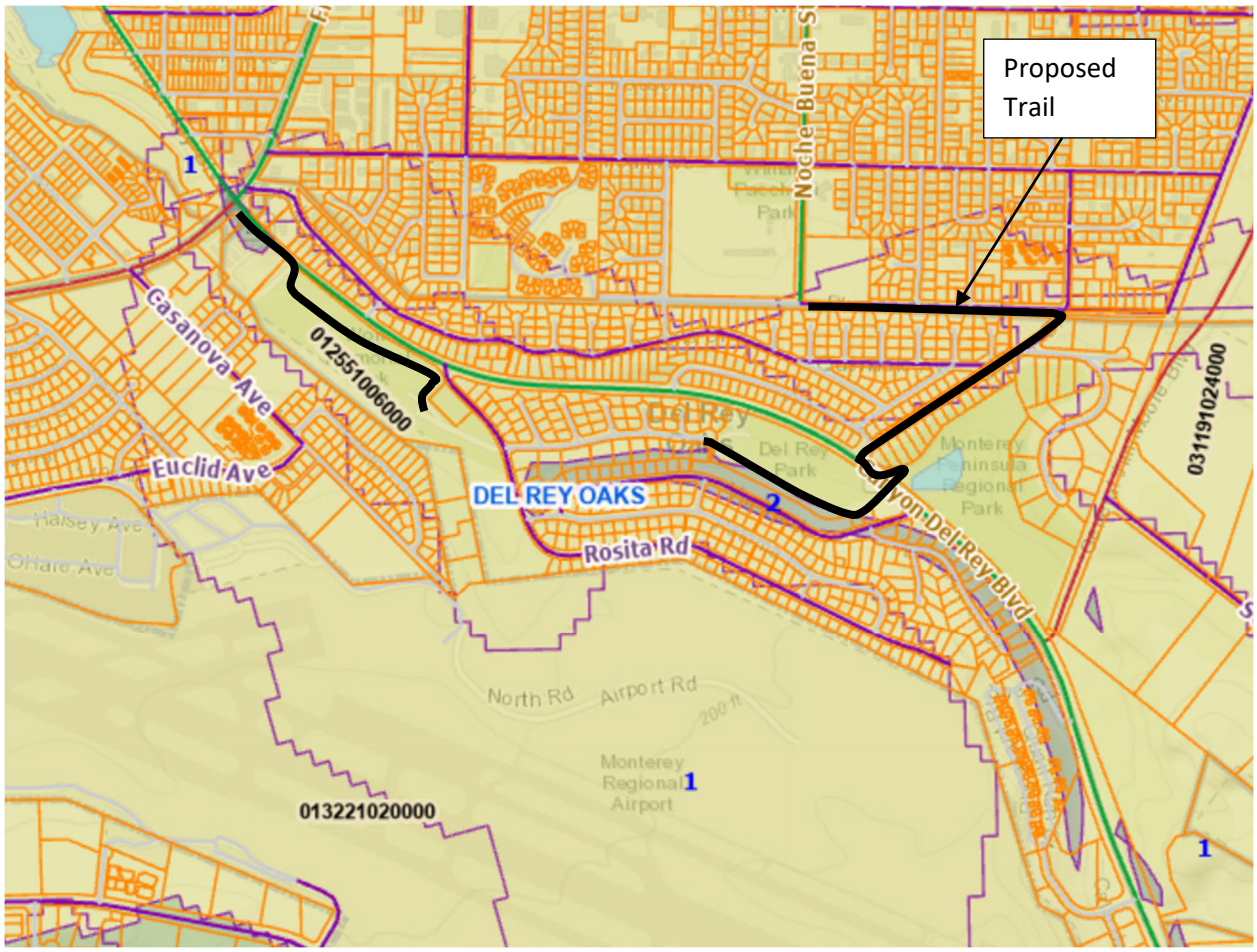
Richard P. Weber
Principal, Whitson Engineers

6/16/2023
date

Attachment A

WMZ & Groundwater Basin Map

Watershed Management Zone Map



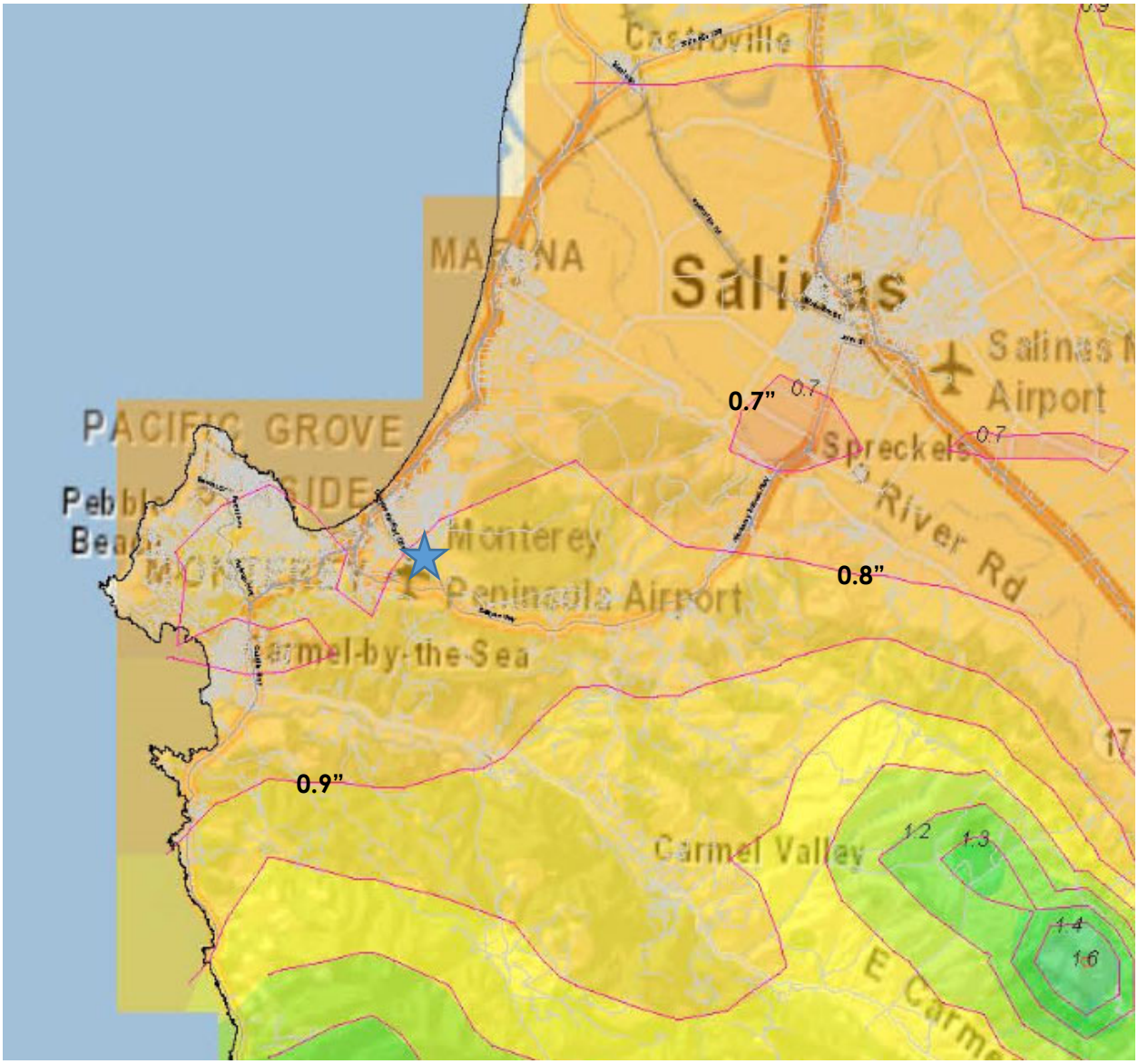
Watershed Management Zone (WMZ) = 1

Source: Monterey County GIS, Accessed 6/28/22

Attachment B

Precipitation

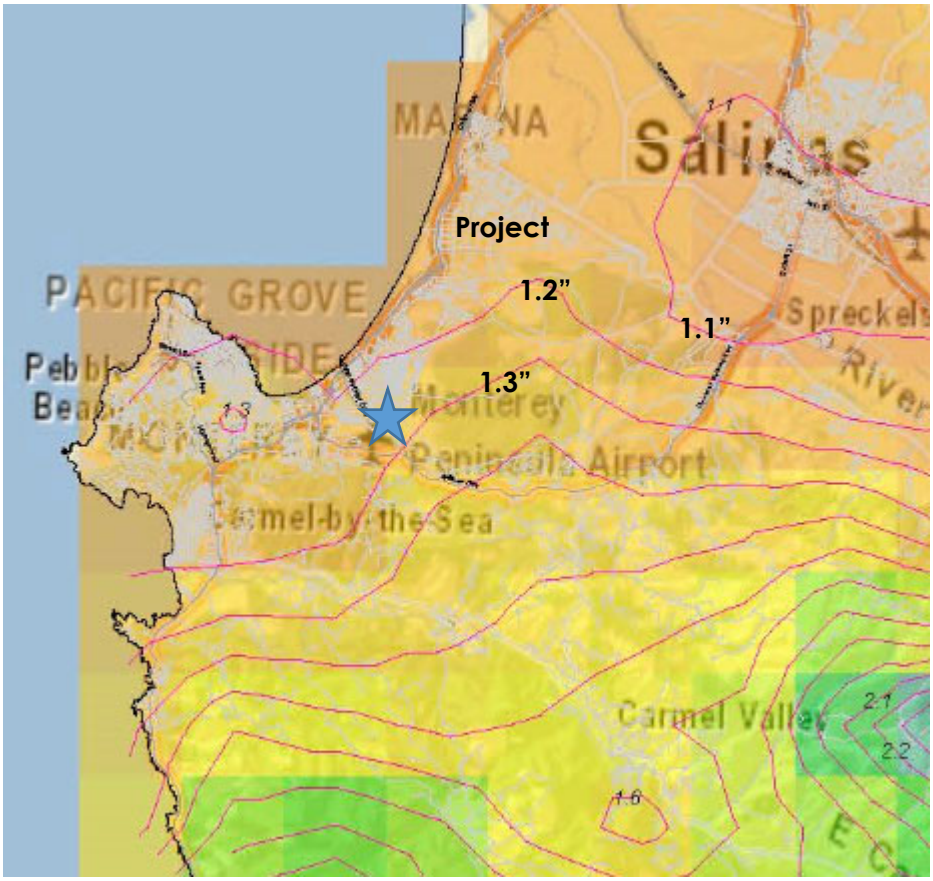
85th Percentile Precipitation Map



24-Hour Precipitation Depth at Project Site: 0.8"

Source: "Central Coast Region 85th Percentile 24-Hour Rainfall Depth", SWRCB

95th Percentile Precipitation Map



24-Hour Precipitation Depth at Project Site: 1.3”

Source: “Central Coast Region 95th Percentile 24-Hour Rainfall Depth”, SWRCB

NOAA Atlas 14, Volume 6, Version 2
Location name: Monterey, California, USA*
Latitude: 36.5959°, Longitude: -121.8374°
Elevation: 152.43 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.144 (0.126-0.165)	0.178 (0.156-0.205)	0.227 (0.198-0.263)	0.271 (0.234-0.317)	0.338 (0.281-0.410)	0.394 (0.320-0.490)	0.457 (0.360-0.585)	0.527 (0.403-0.697)	0.633 (0.461-0.877)	0.724 (0.507-1.04)
10-min	0.206 (0.181-0.237)	0.255 (0.223-0.294)	0.325 (0.284-0.376)	0.389 (0.336-0.454)	0.484 (0.402-0.587)	0.565 (0.459-0.703)	0.655 (0.517-0.838)	0.756 (0.577-0.999)	0.907 (0.661-1.26)	1.04 (0.727-1.50)
15-min	0.249 (0.218-0.287)	0.308 (0.270-0.355)	0.393 (0.344-0.455)	0.470 (0.406-0.549)	0.585 (0.487-0.710)	0.683 (0.555-0.850)	0.792 (0.625-1.01)	0.914 (0.698-1.21)	1.10 (0.799-1.52)	1.25 (0.879-1.81)
30-min	0.359 (0.315-0.414)	0.444 (0.389-0.512)	0.568 (0.496-0.657)	0.678 (0.586-0.792)	0.844 (0.702-1.02)	0.986 (0.800-1.23)	1.14 (0.901-1.46)	1.32 (1.01-1.74)	1.58 (1.15-2.19)	1.81 (1.27-2.61)
60-min	0.443 (0.388-0.510)	0.547 (0.479-0.631)	0.699 (0.610-0.809)	0.835 (0.722-0.975)	1.04 (0.865-1.26)	1.21 (0.985-1.51)	1.41 (1.11-1.80)	1.62 (1.24-2.15)	1.95 (1.42-2.70)	2.23 (1.56-3.21)
2-hr	0.606 (0.532-0.698)	0.746 (0.654-0.861)	0.945 (0.825-1.09)	1.12 (0.968-1.31)	1.38 (1.14-1.67)	1.59 (1.29-1.98)	1.82 (1.44-2.33)	2.08 (1.59-2.74)	2.45 (1.78-3.40)	2.76 (1.94-3.99)
3-hr	0.737 (0.647-0.849)	0.909 (0.796-1.05)	1.15 (1.00-1.33)	1.36 (1.18-1.59)	1.66 (1.38-2.02)	1.92 (1.55-2.38)	2.18 (1.72-2.80)	2.48 (1.89-3.28)	2.91 (2.12-4.03)	3.26 (2.29-4.71)
6-hr	0.945 (0.829-1.09)	1.18 (1.03-1.36)	1.50 (1.31-1.73)	1.77 (1.53-2.07)	2.17 (1.80-2.63)	2.48 (2.02-3.09)	2.82 (2.23-3.61)	3.19 (2.43-4.21)	3.71 (2.70-5.14)	4.13 (2.90-5.96)
12-hr	1.11 (0.975-1.28)	1.42 (1.24-1.64)	1.84 (1.61-2.13)	2.19 (1.90-2.56)	2.70 (2.25-3.28)	3.11 (2.52-3.86)	3.53 (2.79-4.52)	3.99 (3.05-5.28)	4.64 (3.38-6.44)	5.17 (3.62-7.46)
24-hr	1.46 (1.34-1.63)	1.92 (1.75-2.14)	2.53 (2.31-2.83)	3.04 (2.76-3.43)	3.76 (3.32-4.36)	4.34 (3.76-5.11)	4.94 (4.19-5.94)	5.58 (4.62-6.87)	6.48 (5.18-8.26)	7.20 (5.59-9.46)
2-day	1.83 (1.67-2.04)	2.41 (2.20-2.69)	3.19 (2.91-3.56)	3.82 (3.47-4.31)	4.70 (4.15-5.45)	5.39 (4.67-6.35)	6.10 (5.17-7.33)	6.84 (5.66-8.42)	7.85 (6.28-10.0)	8.66 (6.73-11.4)
3-day	2.09 (1.91-2.33)	2.77 (2.53-3.09)	3.65 (3.33-4.08)	4.37 (3.96-4.92)	5.35 (4.72-6.20)	6.11 (5.29-7.20)	6.88 (5.84-8.28)	7.68 (6.36-9.46)	8.77 (7.01-11.2)	9.62 (7.47-12.6)
4-day	2.29 (2.10-2.55)	3.04 (2.78-3.39)	4.01 (3.65-4.48)	4.79 (4.34-5.40)	5.86 (5.16-6.78)	6.67 (5.78-7.86)	7.50 (6.36-9.02)	8.35 (6.92-10.3)	9.50 (7.60-12.1)	10.4 (8.07-13.6)
7-day	2.80 (2.57-3.12)	3.75 (3.43-4.19)	4.97 (4.54-5.56)	5.95 (5.39-6.70)	7.26 (6.40-8.40)	8.25 (7.15-9.72)	9.25 (7.85-11.1)	10.3 (8.51-12.6)	11.6 (9.31-14.8)	12.7 (9.85-16.7)
10-day	3.16 (2.90-3.52)	4.25 (3.89-4.75)	5.65 (5.15-6.31)	6.76 (6.12-7.61)	8.24 (7.26-9.53)	9.35 (8.10-11.0)	10.5 (8.88-12.6)	11.6 (9.61-14.3)	13.1 (10.5-16.7)	14.3 (11.1-18.7)
20-day	4.18 (3.82-4.65)	5.62 (5.14-6.27)	7.45 (6.80-8.33)	8.89 (8.05-10.0)	10.8 (9.50-12.5)	12.2 (10.5-14.3)	13.6 (11.5-16.3)	15.0 (12.4-18.4)	16.8 (13.4-21.4)	18.2 (14.1-23.9)
30-day	5.07 (4.64-5.65)	6.78 (6.20-7.56)	8.92 (8.14-9.98)	10.6 (9.60-11.9)	12.8 (11.3-14.8)	14.4 (12.5-16.9)	16.0 (13.5-19.2)	17.5 (14.5-21.6)	19.6 (15.7-25.0)	21.1 (16.4-27.7)
45-day	6.39 (5.85-7.12)	8.44 (7.72-9.42)	11.0 (10.0-12.3)	13.0 (11.8-14.6)	15.5 (13.7-18.0)	17.4 (15.1-20.5)	19.2 (16.3-23.1)	21.0 (17.4-25.9)	23.3 (18.7-29.8)	25.1 (19.5-32.9)
60-day	7.66 (7.01-8.53)	9.99 (9.13-11.1)	12.9 (11.7-14.4)	15.1 (13.7-17.0)	17.9 (15.8-20.8)	20.0 (17.3-23.6)	22.0 (18.7-26.5)	24.0 (19.9-29.6)	26.5 (21.2-33.9)	28.4 (22.1-37.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

NOAA Atlas 14, Volume 6, Version 2
Location name: Monterey, California, USA*
Latitude: 36.5959°, Longitude: -121.8374°
Elevation: 152.43 ft**
* source: ESRI Maps
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POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.73** (1.51-1.98)	**2.14** (1.87-2.46)	**2.72** (2.38-3.16)	**3.25** (2.81-3.80)	**4.06** (3.37-4.92)	**4.73** (3.84-5.88)	**5.48** (4.32-7.02)	**6.32** (4.84-8.36)	**7.60** (5.53-10.5)	**8.69** (6.08-12.5)
10-min	**1.24** (1.09-1.42)	**1.53** (1.34-1.76)	**1.95** (1.70-2.26)	**2.33** (2.02-2.72)	**2.90** (2.41-3.52)	**3.39** (2.75-4.22)	**3.93** (3.10-5.03)	**4.54** (3.46-5.99)	**5.44** (3.97-7.55)	**6.22** (4.36-8.98)
15-min	**0.996** (0.872-1.15)	**1.23** (1.08-1.42)	**1.57** (1.38-1.82)	**1.88** (1.62-2.20)	**2.34** (1.95-2.84)	**2.73** (2.22-3.40)	**3.17** (2.50-4.05)	**3.66** (2.79-4.83)	**4.39** (3.20-6.08)	**5.02** (3.52-7.24)
30-min	**0.718** (0.630-0.828)	**0.888** (0.778-1.02)	**1.14** (0.992-1.31)	**1.36** (1.17-1.58)	**1.69** (1.40-2.05)	**1.97** (1.60-2.45)	**2.28** (1.80-2.92)	**2.64** (2.01-3.49)	**3.17** (2.31-4.39)	**3.62** (2.54-5.22)
60-min	**0.443** (0.388-0.510)	**0.547** (0.479-0.631)	**0.699** (0.610-0.809)	**0.835** (0.722-0.975)	**1.04** (0.865-1.26)	**1.21** (0.985-1.51)	**1.41** (1.11-1.80)	**1.62** (1.24-2.15)	**1.95** (1.42-2.70)	**2.23** (1.56-3.21)
2-hr	**0.303** (0.266-0.349)	**0.373** (0.327-0.430)	**0.472** (0.412-0.546)	**0.560** (0.484-0.654)	**0.688** (0.572-0.834)	**0.794** (0.644-0.988)	**0.910** (0.718-1.16)	**1.04** (0.792-1.37)	**1.22** (0.892-1.70)	**1.38** (0.968-1.99)
3-hr	**0.245** (0.215-0.283)	**0.303** (0.265-0.349)	**0.383** (0.335-0.443)	**0.453** (0.392-0.529)	**0.554** (0.461-0.673)	**0.638** (0.517-0.793)	**0.727** (0.574-0.931)	**0.826** (0.631-1.09)	**0.968** (0.705-1.34)	**1.09** (0.761-1.57)
6-hr	**0.158** (0.138-0.182)	**0.197** (0.172-0.227)	**0.250** (0.218-0.289)	**0.296** (0.256-0.346)	**0.362** (0.301-0.439)	**0.415** (0.337-0.516)	**0.471** (0.372-0.603)	**0.532** (0.406-0.703)	**0.619** (0.451-0.858)	**0.690** (0.484-0.996)
12-hr	**0.092** (0.081-0.106)	**0.118** (0.103-0.136)	**0.153** (0.133-0.177)	**0.182** (0.158-0.213)	**0.224** (0.186-0.272)	**0.258** (0.209-0.321)	**0.293** (0.231-0.375)	**0.331** (0.253-0.438)	**0.385** (0.281-0.534)	**0.429** (0.301-0.619)
24-hr	**0.061** (0.056-0.068)	**0.080** (0.073-0.089)	**0.105** (0.096-0.118)	**0.127** (0.115-0.143)	**0.157** (0.138-0.182)	**0.181** (0.157-0.213)	**0.206** (0.175-0.248)	**0.232** (0.193-0.286)	**0.270** (0.216-0.344)	**0.300** (0.233-0.394)
2-day	**0.038** (0.035-0.042)	**0.050** (0.046-0.056)	**0.066** (0.061-0.074)	**0.080** (0.072-0.090)	**0.098** (0.086-0.113)	**0.112** (0.097-0.132)	**0.127** (0.108-0.153)	**0.142** (0.118-0.175)	**0.164** (0.131-0.209)	**0.180** (0.140-0.237)
3-day	**0.029** (0.027-0.032)	**0.038** (0.035-0.043)	**0.051** (0.046-0.057)	**0.061** (0.055-0.068)	**0.074** (0.066-0.086)	**0.085** (0.073-0.100)	**0.096** (0.081-0.115)	**0.107** (0.088-0.131)	**0.122** (0.097-0.155)	**0.134** (0.104-0.175)
4-day	**0.024** (0.022-0.027)	**0.032** (0.029-0.035)	**0.042** (0.038-0.047)	**0.050** (0.045-0.056)	**0.061** (0.054-0.071)	**0.070** (0.060-0.082)	**0.078** (0.066-0.094)	**0.087** (0.072-0.107)	**0.099** (0.079-0.126)	**0.108** (0.084-0.142)
7-day	**0.017** (0.015-0.019)	**0.022** (0.020-0.025)	**0.030** (0.027-0.033)	**0.035** (0.032-0.040)	**0.043** (0.038-0.050)	**0.049** (0.043-0.058)	**0.055** (0.047-0.066)	**0.061** (0.051-0.075)	**0.069** (0.055-0.088)	**0.076** (0.059-0.099)
10-day	**0.013** (0.012-0.015)	**0.018** (0.016-0.020)	**0.024** (0.021-0.026)	**0.028** (0.026-0.032)	**0.034** (0.030-0.040)	**0.039** (0.034-0.046)	**0.044** (0.037-0.052)	**0.048** (0.040-0.060)	**0.055** (0.044-0.070)	**0.059** (0.046-0.078)
20-day	**0.009** (0.008-0.010)	**0.012** (0.011-0.013)	**0.016** (0.014-0.017)	**0.019** (0.017-0.021)	**0.022** (0.020-0.026)	**0.025** (0.022-0.030)	**0.028** (0.024-0.034)	**0.031** (0.026-0.038)	**0.035** (0.028-0.045)	**0.038** (0.029-0.050)
30-day	**0.007** (0.006-0.008)	**0.009** (0.009-0.010)	**0.012** (0.011-0.014)	**0.015** (0.013-0.017)	**0.018** (0.016-0.021)	**0.020** (0.017-0.024)	**0.022** (0.019-0.027)	**0.024** (0.020-0.030)	**0.027** (0.022-0.035)	**0.029** (0.023-0.039)
45-day	**0.006** (0.005-0.007)	**0.008** (0.007-0.009)	**0.010** (0.009-0.011)	**0.012** (0.011-0.014)	**0.014** (0.013-0.017)	**0.016** (0.014-0.019)	**0.018** (0.015-0.021)	**0.019** (0.016-0.024)	**0.022** (0.017-0.028)	**0.023** (0.018-0.030)
60-day	**0.005** (0.005-0.006)	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.010** (0.009-0.012)	**0.012** (0.011-0.014)	**0.014** (0.012-0.016)	**0.015** (0.013-0.018)	**0.017** (0.014-0.021)	**0.018** (0.015-0.024)	**0.020** (0.015-0.026)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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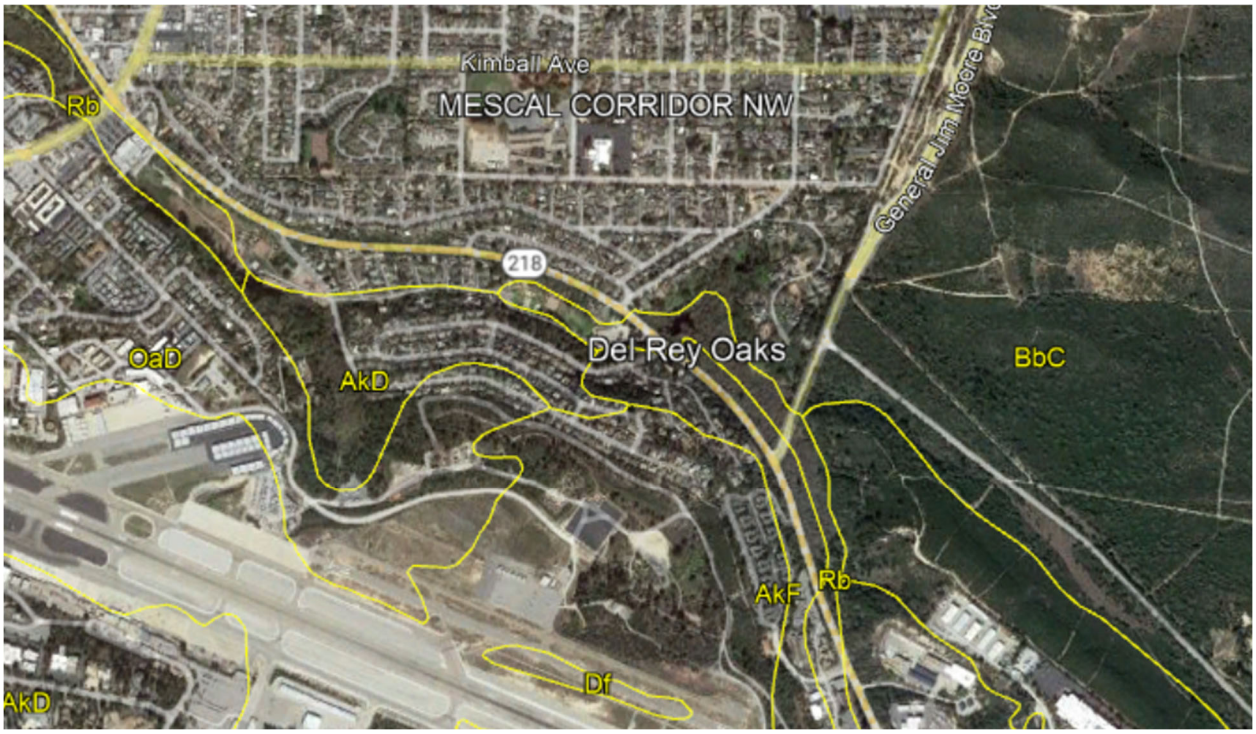
PF graphical

Attachment C

Soils

Monterey County Soil Survey



Soil Map Unit
AKD: Arnold loamy sand, 9 to 20 percent slopes (MLRA 15)
BcC: Baywood sand, 2 to 15 percent slopes
Rb: Rindge muck, 0 to 2 percent slopes (MLRA 14)

TABLE 7.—*Estimated physical and chemical properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil which may have different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column. The symbol < means less than; > means more than. The erosion tolerance factor (T) is for the entire profile]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
							Uncoated steel	Concrete	K	T
*Arnold: AkD, AkF, Am, Ar For San Andreas part of Am, see San Andreas series. For Santa Ynez part of Ar, see Santa Ynez series.	0–48 48	6.0–20.0	0.05–0.09	5.1–7.3	<2	Low	Moderate	Moderate	0.15	4
Baywood: BbC	0–60	6.0–20.0	0.05–0.11	5.1–7.8	<2	Low	High	Moderate	0.15	5
Rindge: Rb	0–60	6.0–20.0	0.26–0.30	4.5–6.5	<2	Very low	High	High		

TABLE 9.—*Soil and water features*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil which may have different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column. Absence of an entry indicates the feature is not a concern. See the definitions of "flooding" and "water table" in the Glossary for explanations of such terms as "rare," "brief," and "perched." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
*Arnold: AkD, AkF, Am, Ar For San Andreas part of Am and Santa Ynez part of Ar, see the San Andreas and Santa Ynez series.	B	None			>6.0			40–60	Rippable
Baywood: BbC	A	None			>6.0			>60	
Rindge: Rb	D	Common	Very long	Nov-Jun	0.0–3.0	Apparent	Jan-Dec	>60	

Source: USDA Soil Survey, 1978

TAMC
TRANSPORTATION AGENCY FOR MONTEREY COUNTY

GHD

Fort Ord Regional Trail & Greenway
Canyon Del Rey/SR 218 Segment

Geotechnical Data Report

Report Status – Draft

McMILLEN JACOBS ASSOCIATES

November 2021

November 11, 2021

Ms. Lindsey Van Parys
GHD
2200 21st Street
Sacramento, CA 95818

Subject: Geotechnical Data Report
Transportation Agency for Monterey County
Fort Ord Regional Trail & Greenway - Canyon Del Rey/SR218 Segment
Del Rey Oaks, California

Dear Ms. Lindsey,

This letter prefaces the accompanying draft Geotechnical Data Report for portions of the Transportation Agency for Monterey County's (TAMC) Canyon Del Rey/SR218 Segment of the Fort Ord Regional Trail & Greenway (FORTAG) project in the city of Del Rey Oaks, California. The report summarizes to-date findings of our geotechnical study.

We appreciate the opportunity to serve GHD and TAMC on this project. Please contact us if you have any questions about our draft report, or if you have geotechnical-related information that would be useful to incorporate into the final Geotechnical Data Report.

Sincerely,

McMILLEN JACOBS ASSOCIATES

Su Soe, PE Project Engineer	Dru R. Nielson, PG CEG Principal Geologist	Norman Joyal, PE GE Principal

Distribution: GHD (PDF)
File No.: 6231.0

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1.0 Introduction

This report summarizes findings of a geotechnical study of portions of the Transportation Agency for Monterey County's (TAMC) Canyon Del Rey/State Route 218 (SR218) Segment of the proposed Fort Ord Regional Trail & Greenway (FORTAG) project in the city of Del Rey Oaks, California. The entire FORTAG project is a 28-mile long proposed network of paved recreational trails and greenways connecting communities in and around the former location of the Fort Ord military base. Our geotechnical study and this report pertains to portions of the Canyon Del Rey/SR218 Segment of the FORTAG project that are located near exploratory borings B-1 through B-6 as illustrated in Figure 1, and as described herein. References to the project in the text in this report refer solely to portions of the Canyon Del Rey/SR218 Segment that were part of our geotechnical study.

2.0 Findings

Findings from our geotechnical study are summarized in the following sections.

2.1 Background

Historical topographic maps and aerial photographs of the project are provided in Figures 1, 2, and 3. Salient observations from these and other documents include the following:

- The project area is located along the Central Coast of California near Monterey Bay (Figure 1).
- Based on Google Earth data, the ground surface elevation at sites of exploration borings for the project range from 28 feet above mean sea level at boring B-1, to 130 feet above mean sea level at boring B-6.
- Many of the roadways in the project area, including what appears to be a former concrete roadway that is now buried below Canyon Del Rey Boulevard (SR218; see the log of boring B-5b in Appendix B) first appear on topographic maps dated after 1913 and by 1941 (Figure 2).
- Frog Creek is shown in the 1941 topographic map provided in Figure 2, as a tributary into Laguna del Rey Creek in the vicinity of the subject project's planned SR218 crossing.
- Based on a comparison of earlier topographic maps with the 1947 topographic map provided in Figure 2, and with the historical photos in Figure 3, grading related to the construction of Canyon Del Rey Boulevard (SR218) consisted of the placement of fill over (1) a former roadway, and (2) the tributary connection between Frog Creek and Laguna del Rey Creek (see the log of boring B-5 in Appendix B). This resulted in a closed depression (i.e., Frog Pond) that is indicated by the hachured 80-foot contour in the 1947 topographic map provided in Figure 2. This closed depression (now referred to as Frog Pond) rerouted drainage from Frog Creek to Laguna del Rey Creek through a culvert constructed upgradient of the original tributary connection and below Canyon Del Rey Boulevard at a location that is several tens of feet east of the planned SR218 tunnel crossing of this project.
- Historical aerial photographs of the project area in Figure 3 document residential development between1949 and 1956.

2.2 Subsurface Exploration

2.2.1 Project Exploration Borings

The location of exploration borings completed for the project are mapped in Figure 1. The logs of the borings are provided in Appendix B and a legend for the boring logs is provided in Appendix A. Table 1 summarizes the information from the boring logs.

Table 1. Partial Summary of Information from Project Borings

Boring[1]	Elevation[2] (ft)	Station[2]	BGS Depth[3] (ft)			Bedrock or USCS[4] Group Symbol	SPT[5] (N)	Qu[5] (ksf)	Notes[6]
			Total	to GW (Seepage) /Level	Interval (ft)				
B-1	28	?	10	5.0	0-5	SM	6	-	fill
					5-10	SP	3	-	
B-2	71	?	17.5	NE	0-16	SP-SM	49, 40	0.1	mica
					16-17.5	Bedrock	50/3"		Monterey Formation (?)
B-3	74	?	10	NE	0.0-5	SM	-	-	fill in upper 2.5'
					5-10	CH	5	1.1	Wc = 40, ɣd = 79 pcf
B-4	83	?	40	(10)/31.0	0-16	SM/SC	5, 7	-	fill in upper 5'
					16-17.5	ML	4	-	Wc = 43, ɣd = 74 pcf
					17.5-23.5	SM/SC	9	-	
					23.5-25.5	CL/CH	-	-	
					25.5-34.5	SP-SM	12, 20	-	
					34.5-37	MH	-	-	diatomite/bentonite (?)
					37-40	MH & PT	4	-	LL =112, PI = 42
B-5a	97	?	2	NE	0-2	SP	-	-	refusal in fill on concrete & metal
B-5b	97	?	40	26.0	0-3	SM	-	-	fill
					3-11.5	SP-SM/SP-SC	4	-	fill on concrete
					11.5-32	SM/SC	3, 4, 4, 5	-	Wc = 78, ɣd = 52 pcf
					32-40	MH & Bedrock	26, 27	0.4	Monterey Formation (?)
B-6	130	?	20	NE	0-4.5	SM	-	-	
					4.5-9.5	SP-SM/SP-SC	14	-	
					9.5-20	SM	51, 43	-	

[1] Drilled in August 2021. Complete logs and lab test results in Appendices B and C. See Figure 1 for mapped boring locations.
[2] Ground surface elevation from Google Earth (2021). ?- Station to be added in the final GDR from available GHD plans.
[3] BGS - Below ground surface. GW – Groundwater. NE - not encountered. Groundwater seepage depth during drilling and groundwater level depth measured in boring at time of backfilling, not necessarily the static groundwater level depth.
[4] Unified Soil Classification System (USCS) and group symbol defined in Appendix A.
[5] N = greatest ASTM D1586 Standard Penetration Test Blow Count for interval. Qu = unconfined compressive strength.
[6] Wc = moisture content. ɣd = dry density. See the complete boring logs in Appendix B, and laboratory test results in Appendix C.

2.2.2 Laboratory Tests

Moisture content, unit weight, Atterberg limits, grain size, unconfined compression, soil corrosion, and direct shear tests were performed on soil samples retrieved from project borings. The results of the tests are summarized in the boring logs provided in Appendix B, and in laboratory test results sheets provided in Appendix C.

2.3 Groundwater

The depth to groundwater (or lack thereof) was measured and logged in each exploration boring for the project during and immediately after drilling (see the individual logs of each boring in Appendix B). The logged groundwater measurements from each boring are summarized in Table 1.

2.4 Near Surface Soils

Near surface soils in the project area are mapped and described in Figure 4 as a combination of Arnold loamy sand, Baywood sand, Oceano loamy sand, and Rindge muck. Salient observations of near surface soil mapping and descriptions provided in Figure 4 include the following:

- The sand and loamy sand units typically consist of clayey to silty sand with 100% passing the No. 4 sieve (i.e., there is no gravel-sized or larger particles retained on the No. 4 sieve) and 5% to 40% silt- and clay-sized particles passing the No. 200 sieve.

- Bedrock is mapped to underlie Arnold loamy sands at depth to as shallow as 3.5 feet below the ground surface.

- Rindge muck is classified as Peat. Areas mapped with Rindge muck have a seasonal high water table between 0 and 6 feet below ground surface. Areas of Frog Pond and nearby Laguna del Rey Creek are mapped as Rindge muck.

Information pertaining to potential sources of contamination, obtained from the State of California's Department of Water Resources GeoTracker program, is also presented on Figure 4. This information indicates that cleanup sites are located on Fremont Boulevard, near the west end of the Canyon Del Rey/SR218 segment of the project.

2.5 Geology

Geology maps that include the project area have been completed by several authors (e.g., Hartwell et. al., 2016; Dibblee and Minch, 2007; Clark et. al., 1997; Dupre 1990; Dibblee et al., 1974), including those provided in Figures 5.1 and 5.2. The maps show and describe geologic mapping units that include (1) historic artificial fills, (2) recent and Quaternary stream channel, alluvial, alluvial fan, marine terrace, and dune-sand deposits, and (3) and southward dipping Miocene Monterey Formation. The Monterey Formation includes calcareous to siliceous claystone, siltstone, and sandstone; porcelanite; chert; diatomite; and bentonite.

An average shear-wave velocity map for the upper 30 meters (98 ft) of ground (Vs_{30}) in the project area is provided in Figure 6. The Vs_{30} in the project area is mapped to vary somewhere between 600 ft/sec to 2,500 ft/sec, which is consistent with a seismic Site Class C and D designation (see Table 2).

Table 2. Site Classification (adapted from ASCE 7-16 Table 20.3-1)

Site Class	Average Shear Wave Velocity for the Upper 30 Meters of Ground (V_{s30})	Generic Description
A	> 5,000 ft/s	hard rock
B	2,500 to 5,000 ft/s	rock
C	1,200 to 2,500 ft/s	very dense soil and soft rock
D	600 to 1,200 ft/s	stiff soil
E	< 600 ft/s	soft clay soil

2.6 Seismotectonics

Major plate boundary faults and lesser-known smaller faults near the project area are included in the U.S. Geological Survey's Fact Sheet 2016-3020 provided in Figure 7. The fact sheet shows the project area is bordered to the north by the Reliz fault (No. 27) and to the south by the Monterey Bay - Tularcitos fault (No. 29). As shown on Figure 5.1, the Chupines and Seaside faults are concealed faults (i.e., faults without a currently visible trace at the ground surface) that have been inferred by some geologists to occur between the Reliz and Monterey Bay-Tularcitos faults. The Chupines fault is considered to be a dextral-reverse slip fault, with both vertical and strike-slip components. Estimates of minimum vertical displacement on faults within the Chupines fault zone range from 600 to 1,000 feet. Relatively minor vertical movement on the fault (i.e., on the order of 600 to 1,000 feet) has been inferred to have internally displaced the Monterey formation near the project area at or near the planned SR218 crossing (Clark et al., 1997); however, its exact location relative to the crossing, if any, is concealed by recent soils, alluvium, and/or manmade fills as described in this report.

Clark et al. (2000) argues for Holocene activity (i.e., activity within the last 11,700 years) on the western extension of the Chupines fault in Monterey Bay based on (1) a report that the Chupines fault cuts Holocene deposits and the sea floor in the bay (McCulloch and Greene, 1989), and (2) the location of earthquake epicenters near the fault (e.g., see Figure 8). However, to-date, evidence has been insufficient for the U.S. Geological Survey (see Bryant, 2001) to map the Chupines fault as anything other than a Quaternary fault (i.e., a fault with displacement within the last 1.6 million years). The California Geological Survey has indicated that the Chupines fault is not well-defined and is not sufficiently active (see Bryant 1985). Consequently, the Chupines fault has not been classified as Holocene-active by the State of California, and the project area is therefore not located within an Earthquake Fault Zone that requires fault investigations pursuant to the Alquist-Priolo Earthquake Fault Zoning Act (see CGS 2018 and the California Public Resources Code, Division 2, Chapter 7.5).

Despite the absence of State of California mapped Holocene-active faults in the project area, the project will be subject to very strong to severe ground shaking during earthquakes on active seismogenic sources in the region. The anticipated peak ground acceleration with a 2% chance of exceedance in 50 years in the project area for a Site Class C/D condition is greater than 0.68g (Figure 9). Anticipated damages from ground shaking with an average peak acceleration in excess of 0.6g are described in Figure 10 for Class X

or above, and include open cracks in cement pavement and asphalt road surfaces or broad fissures in ground.

2.6.1 Liquefaction

Liquefaction is a phenomenon in which soils lose internal strength as a result of increased pore pressure generated by cyclic loading. Cyclic loading is commonly induced by ground shaking during earthquakes. Soils prone to liquefaction are saturated, noncohesive, relatively clay-free silt and sand layers of very loose density. A liquefaction potential map of the project area from Dupre (1990) is provided in Figure 11; it shows that the liquefaction susceptibility in the project area varies from very low to high. The eastern portions of the project area, that are at relatively high elevations, are mapped to have a low liquefaction susceptibility. The portions of the project that are at relatively low elevations (e.g., near Frog Pond and Laguna Del Rey Creek) have a medium to high liquefaction susceptibility. No liquefaction-related ground effects from historic earthquakes have been mapped in the project are (Youd and Hoose, 1978; Tinsley et al., 1998). However, as illustrated in Figure 11, ground settlement from liquefaction during historic earthquakes (e.g., the San Francisco earthquake in 1906 and/or the Loma Prieta Earthquake in 1989) in the region was mapped to have occurred in nearby Laguna Del Rey.

2.6.2 Tsunamis

A map of the project area from the California Emergency Management Agency (2009; Figure 12.1) shows that inundation by a tsunami would come close to, but stop short of, the western end of project. Local tsunami sources considered include offshore movements on reverse-thrust faults, restraining bends on strike-slip faults zone and submarine landslides. Distant tsunami sources that were considered include great subduction zone events that are known to have occurred historically (e.g., like the 1960 Chile and 1964 Alaska earthquakes).

2.7 Flooding

Areas of the project that are located within FEMA's 100-year flood zone, 500-year flood zone, and regulatory floodway areas are illustrated in Figure 12.1. Most of the project area is located in a 500-year flood hazard zone, with exceptions of areas at and near Frog Pond and along Laguna del Rey Creek, which are mapped to be within a 100-year flood zone.

2.8 Sea Level Rise

The Pacific Institute (2009) predicted that sea level rise along the California coast could increase by 55 inches by 2100, even without accounting for ice-melt from the glaciers on Antarctica and Greenland. The National Research Council (NRC, 2012) estimates that the sea level along California will rise by 17 to 66 inches by 2100. The mean sea level in Monterey Bay increased by approximately 0.053 inches per year between 1973 and 2016 (NOAA, 2018). Anticipated flooding from predicted seal-level rise near the project area is shown in Figure 12.2.

3.0 Limitations

This geotechnical data report has been prepared for the exclusive use of GHD and TAMC for portions of the Canyon Del Rey/SR 218 Segment of Fort Ord Regional Trail & Greenway (FORTAG) project in the city of Del Rey Oaks, California, as described herein. The original scope of our geotechnical study was

for the planned SR218 crossing (i.e., exploration borings B-4 and B-5 as mapped in Figure 1). Prior to our fieldwork in August 2021, our scope was expanded to include exploratory borings at the locations of B-1, B-2, B-3, and B-6. This geotechnical data report is based on our understanding of the project at the time of our fieldwork in August of 2021. Subsurface conditions at and between locations of project exploration borings may vary over time from that encountered and logged in the borings. Studies of the absence, existence, and effects of artificial contamination (e.g., from leaking underground storage tanks) and natural environmental conditions (e.g., from naturally occurring asbestos or soil corrosivity) on project construction, if any, are outside of our expertise and are not part of our scope of services. Any reference in this report to related data is solely provided as a value-added service.

The services rendered by McMillen Jacobs Associates have been performed in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing under similar conditions in the same area.

4.0 References

American Society of Civil Engineers (ASCE). 1976. *Subsurface Investigation for Design and Construction of Foundations of Buildings*. ASCE Manuals and Reports on Engineering Practice, No. 56.

American Society of Civil Engineers (ASCE). 2018. Minimum Design Loads for Buildings and Other Structures. ASCE 7-16.

ASTM International:

- ASTM D1586 – Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.
- ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.
- ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- ASTM D2488. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure.
- ASTM D3080M – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
- ASTM D7263 – Standard Test Methods for Laboratory Determination of Density and Unit Weight of Soil Specimens.

Bolt, Bruce A. 1993. *Earthquakes: A Primer*. San Francisco: W.H. Freeman and Company.

Branum, D., R. Chen, M. Petersen, and C. Wills. 2016 (rev.). Earthquake Shaking Potential for California, California Geological Survey, Map Sheet 48 (Revised 2016).

Bryant, W.A., compiler, 2001, Fault number 145a, Chupines fault zone, Del Rey Oaks section, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/faults/qfaults, accessed 11/04/2021.

Bryant, W.A., 1985, Faults in the Southern Monterey Bay Area, Monterey County; California Division of Mines and Geology (now the California Geological Survey) Fault Evaluation Report FER-167.

California Emergency Management Agency, 2021, Tsunami Inundation Map for Emergency Planning, State of California – County of Monterey. https://www.conservation.ca.gov/cgs/tsunami/maps

California Geological Survey (CGS), 2018, Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California; Special Publication 42.

California State Water Resources Control Board. Geotracker. 2021. http://geotracker.waterboards.ca.gov/.

Clark, J.C., Brabb, E.E., and L.I. Rosenberg 2000, Geologic map of the Spreckles 7.5-minute quadrangle, Monterey County, California: U.S. Geological Survey Miscellaneous Field Study MF-2349.

Clark, J.C., Dupre, W.R., and L.I. Rosenberg 1997, Geologic Map of the Monterey and Seaside 7.5-minute Quadrangles, Monterey County, California: U.S. Geological Survey Open-File Report 97-30. (don't include since shows landslide)

Dibblee, T.W. Jr., and J.A. Minch. 2007. Geologic Map of the Monterey and Seaside Quadrangles, Monterey County, California, Dibblee Geology Center Map #DF-346.

Dibblee, T.W. Jr., J.C. Clark., H.G. Greene., and O.E. Bowen, Jr. 1974. Preliminary Geologic Map of the Monterey and Seaside 7.5-minute Quadrangles, Monterey County, California, U.S. Geological Survey.

Dupre, W.R., 1990, Maps showing geology and liquefaction susceptibility of Quaternary deposits in the Monterey, Seaside, Spreckels and Carmel Valley Quadrangles, Monterey County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2096.

Federal Emergency Management Agency (FEMA). 2017. National Flood Insurance Program, Flood Insurance Rate Map, Monterey County, California., Panel 326 of 2050, Map No. 06053C0326H. https://msc.fema.gov/nfhl.

Federal Emergency Management Agency (FEMA). 2009. National Flood Insurance Program, Flood Insurance Rate Map, Monterey County, California., Panels 327, 328, and 329 of 2050, Map Nos. 06053C0327G, 06053C0328G, and 06053C0329G. https://msc.fema.gov/nfhl.

Hartwell, S.R., S.Y. Johnson., C.W. Davenport., and J.T. Watt. 2016. Offshore and Onshore Geology and Geomorphology, Offshore of Monterey Map Area, California, U.S. Geological Survey, Open-File Report 2016-1110, Sheet 10 of 10.

Heuer, R.E. 1974. Important ground parameters in soft ground tunneling. In *Proc. Of Specialty Conference on Subsurface Exploration for Underground Excavation and Heavy Construction*. New York, NY: ASCE, 41–55.

McCulloch, D.S., and Green, H.G., 1989, Geologic map of the central California continental margin, in Greene, H.G., and Kennedy, M.P., eds., Geology of the central California continental margin: California Division of Mines and Geology California Continental Margin Geologic Map Series, Map 5A, scale 1:250,000.

National Oceanographic Atmospheric Administration (NOAA), 2018. Mean Sea Level Trend, 9413450 Monterey, California. https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=9413450#.

National Research Council (NRC), 2012. Sea-Level Rise for Coasts of California, Oregon, and Washington: Past, Present, and Future. The National Academies Press, Washington, D.C.

Pacific Institute, California Climate Change Center, 2009. The Impacts of Sea-Level Rise on the California Coast.

Spall, H., and D.C. Schnabel. 1989. *Earthquakes & Volcanoes,* 21(1). U.S. Geological Survey.

Tinsley, J.C. III, Egan, J.A., Kayen, R.E., Bennett, M.J., Kropp, A., and T.L. Holzer, 1998, Appendix: Maps and Descriptions of Liquefaction and Associated Effects, in T.L. Holzer, ed., The Loma Prieta, California, Earthquake of October 17, 1989-Liquefaction; U.S. Geological Survey Professional Paper 1551-B.

U.S. Department of Agriculture (USDA) and National Agriculture Imagery Program (NAIP). 2005.

U.S. Department of Agriculture (USDA). Flight Dates. 5/14/1956 and 8/18/1949.

U.S. Geological Survey (USGS). 2016. Fact Sheet 2016-3020. https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.

U.S. Geological Survey (USGS). 2012. 7.5-min Quadrangle for Seaside.

U.S. Geological Survey (USGS). Flight Date. 7/18/1974.

U.S. Geological Survey (USGS). 1947. 7.5-min Quadrangle for Seaside.

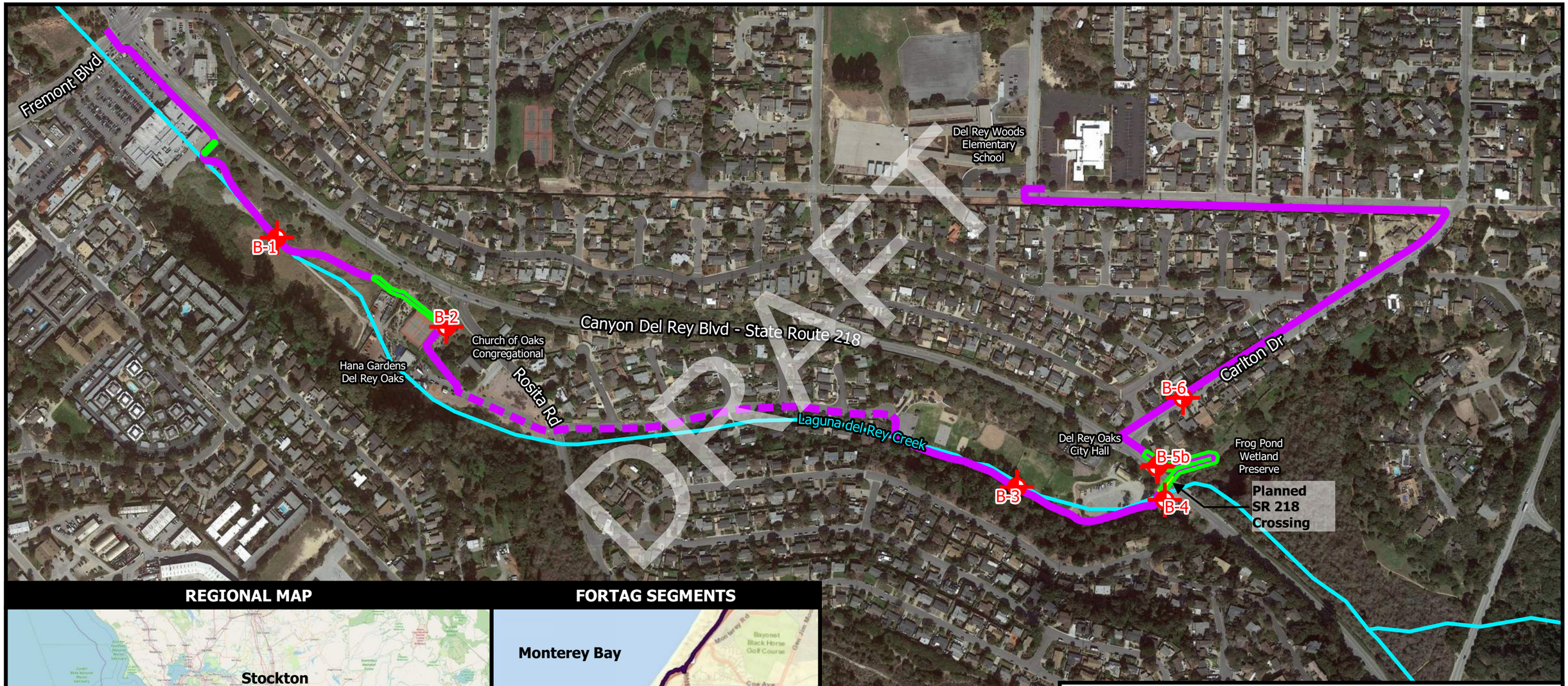
U.S. Geological Survey (USGS). 1941. 30-min Quadrangle for Monterey.

U.S. Geological Survey (USGS). 1913. 30-min Quadrangle for Monterey.

U.S. Soil/Natural Resources Conservation Service (NRCS). 2020. Web Soil Survey, U.S. Department of Agriculture. http://websoilsurvey.sc.egov.usda.gov.

Youd, T.L., and S.N. Hoose, 1978, Historic ground failures in northern California triggered by earthquakes; U.S. Geological Survey Professional Paper 993.

Figures



REGIONAL MAP

FORTAG SEGMENTS

Imagery provided by ESRI and its licensors, 2019.
Additional data provided by Alta Planning + Design, 2019.

LEGEND

- Boring locations (logs in Appendix A)
- Planned bike path
- Planned on-street bike path
- Planned retaining wall
- Drainageway

0 400 800 ft

N

Basemap modified from Google Satellite (2021)

McMILLEN JACOBS ASSOCIATES

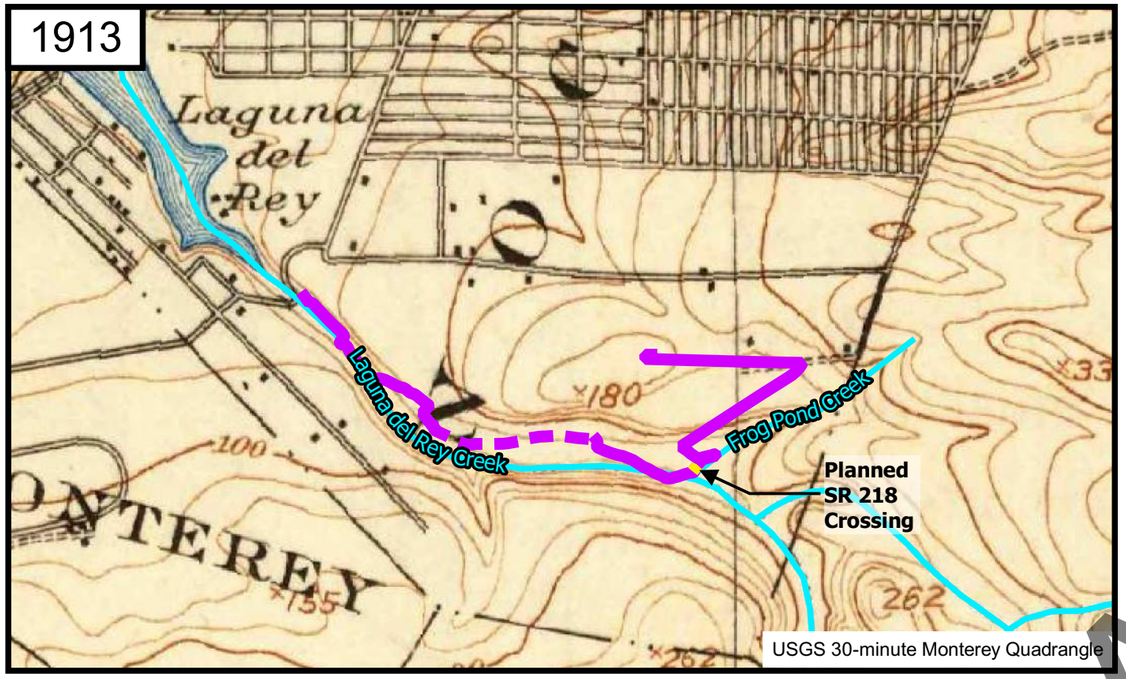
File No. 6231.0 | November 2021

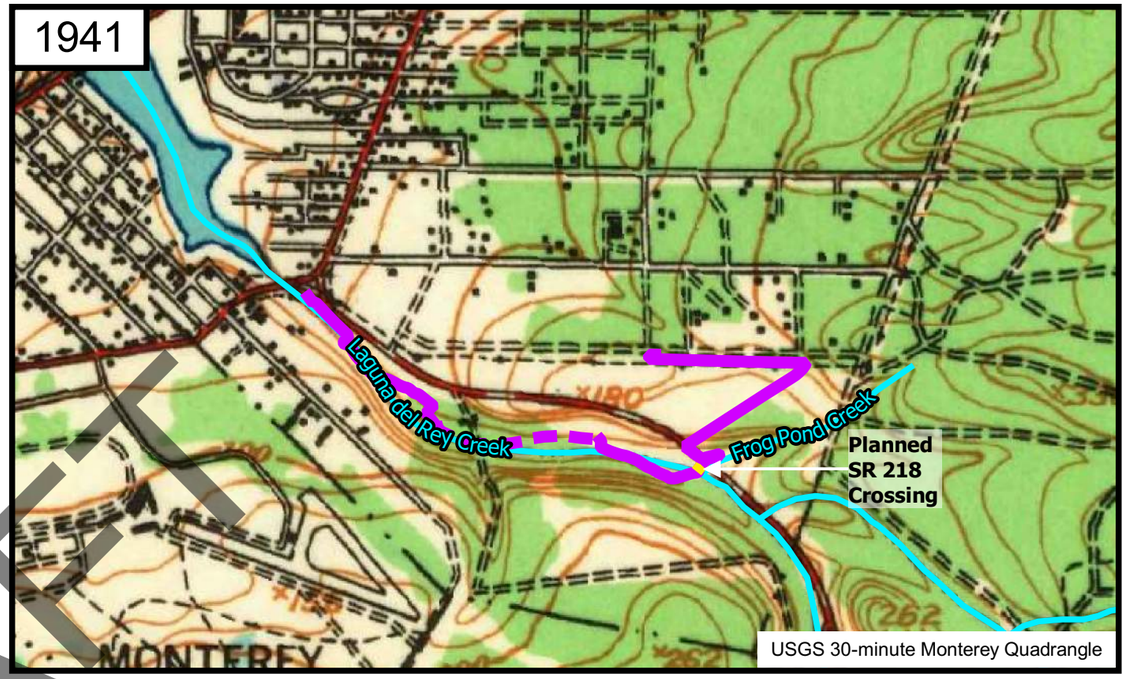
GHD

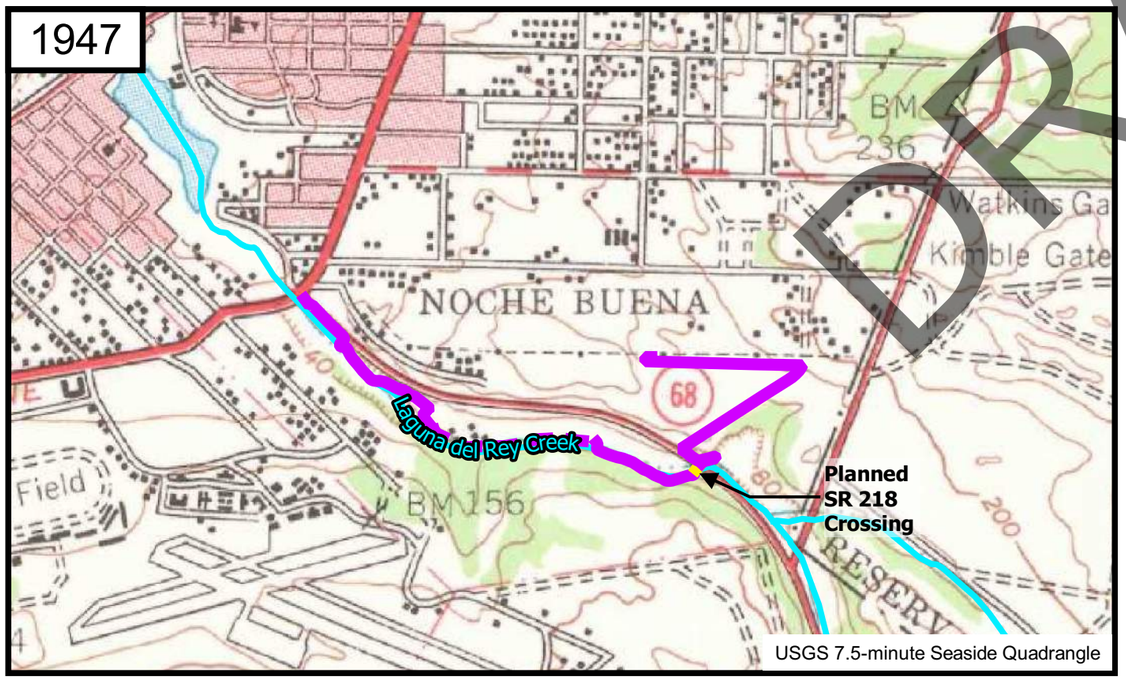
Transportation Agency for Monterey County
FORTAG - Canyon Del Rey/SR218 Segment
Del Rey Oaks, California

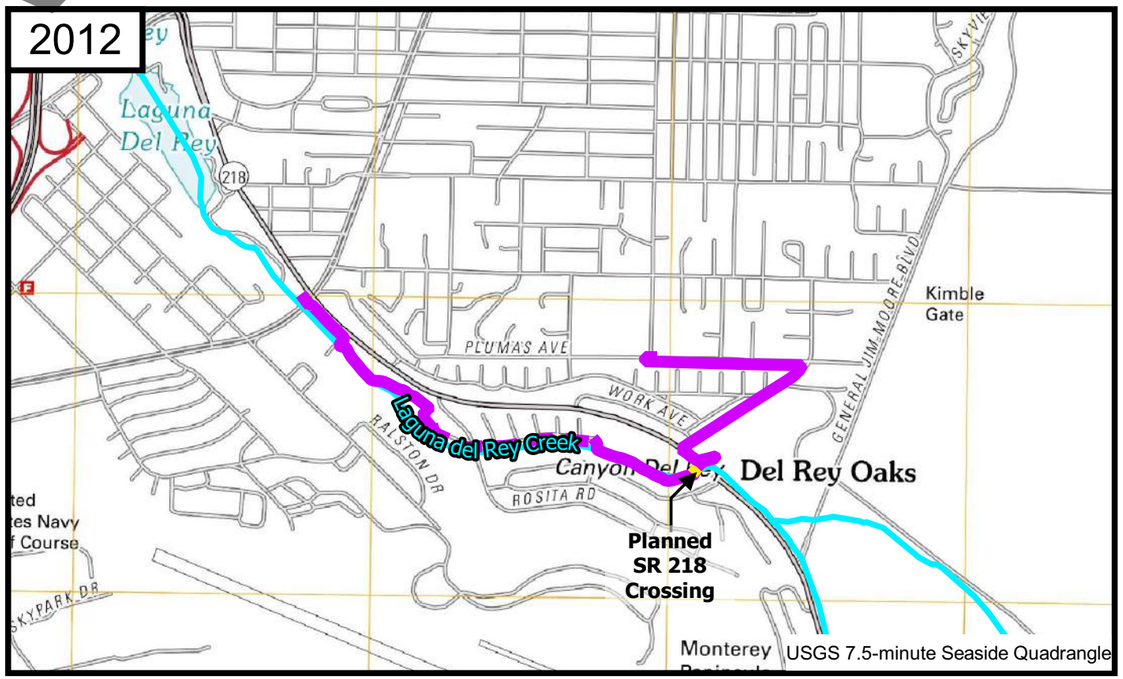
Project Area Map

Figure 1









DRAFT

Legend

- Drainageway
- Planned bike path
- Planned on-street bike path
- SR218 crossing

N

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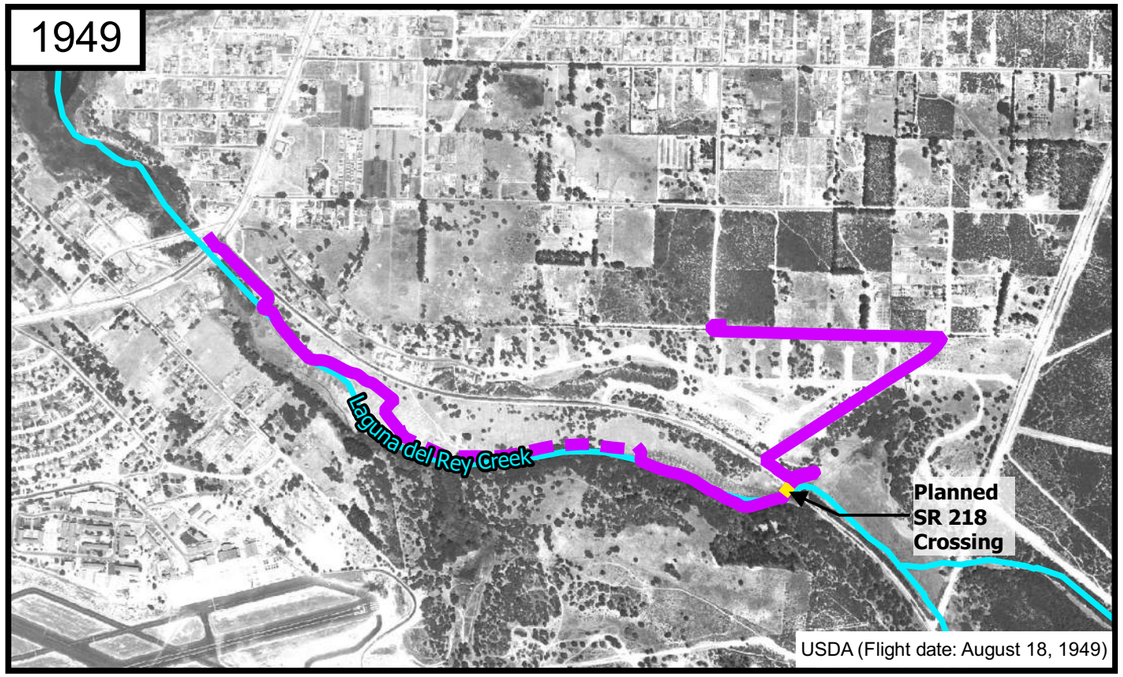
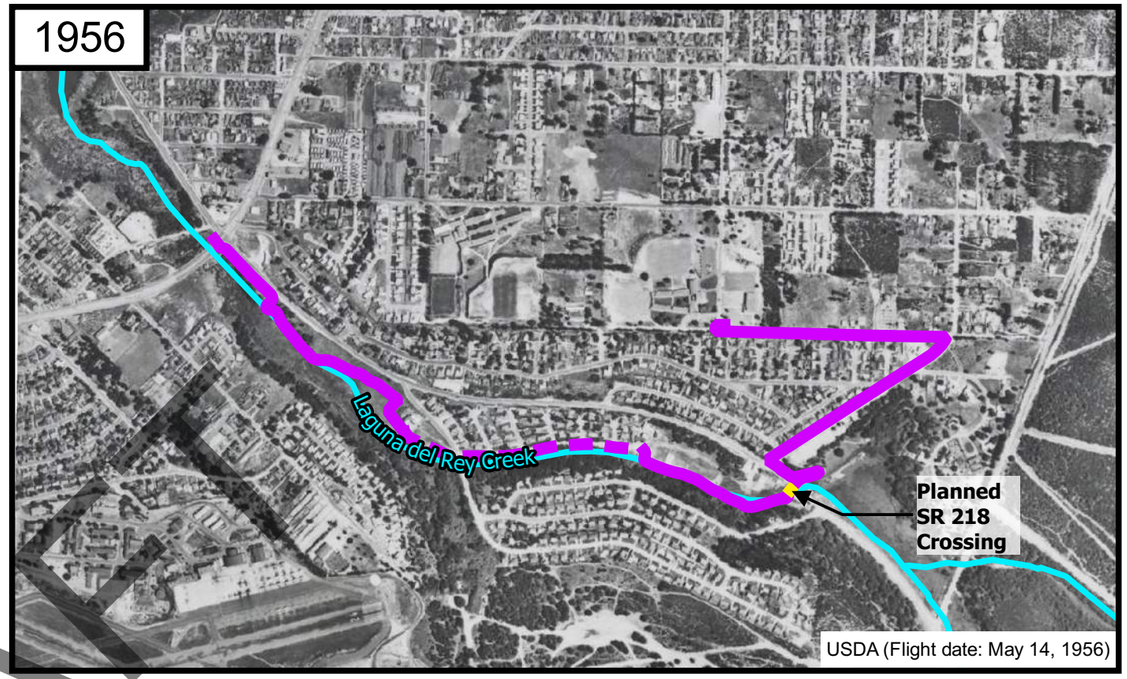
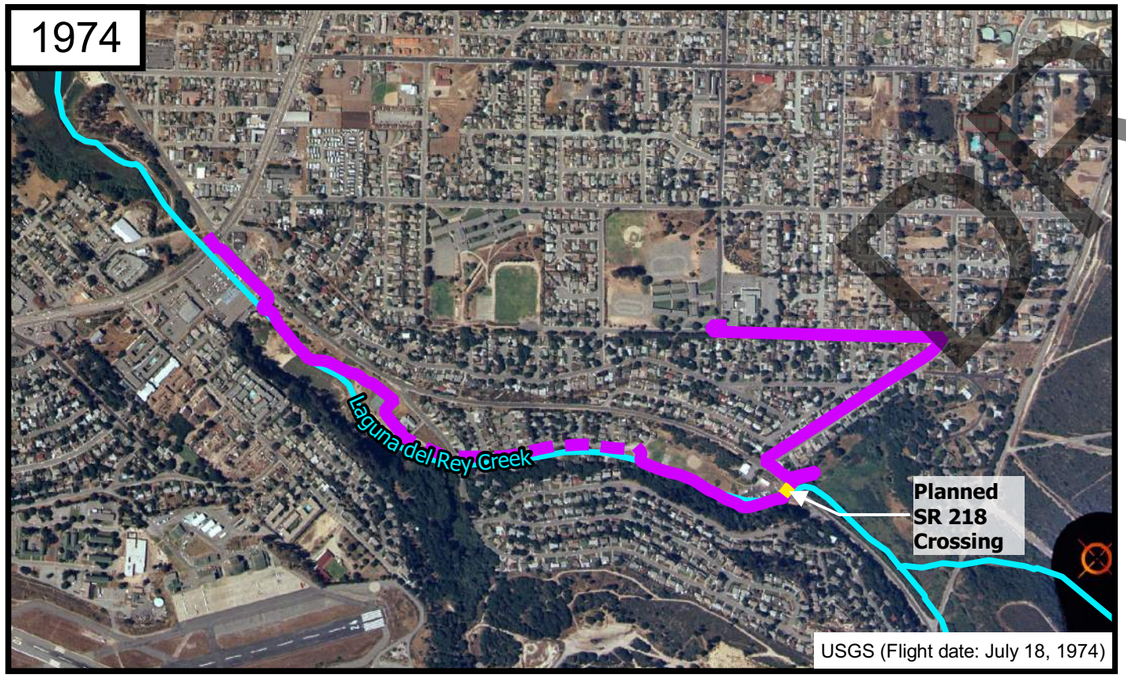
FORTAG - Canyon Del Rey/SR218 Segment
Monterey, California

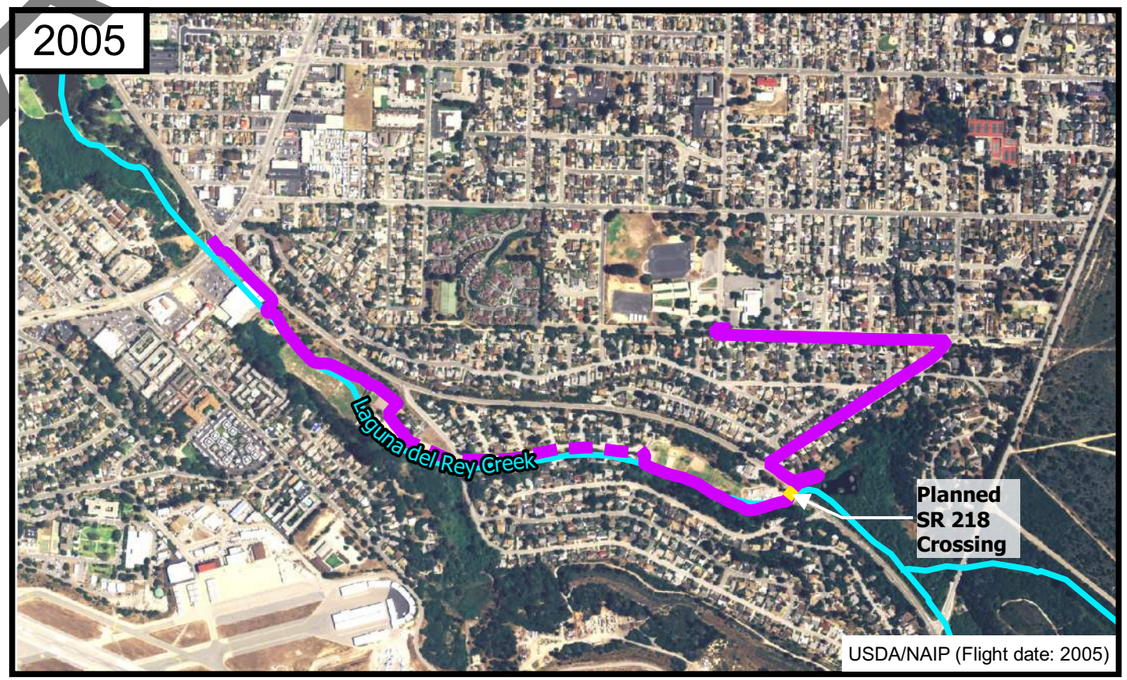
Historical Topographic Maps

Figure 2









Legend

- Drainageway
- Planned bike path
- Planned on-street bike path
- SR218 crossing

N

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FORTAG - Canyon Del Rey/SR218 Segment
Monterey, California

Historical Aerial Photographs

Figure 3

GEOTRACKER LEGEND:

- Leaking underground storage tank cleanup site
- Permitted underground storage tank
- Cleanup program site
- Department of Toxic Substance Control cleanup site
- Field point
- Closed site

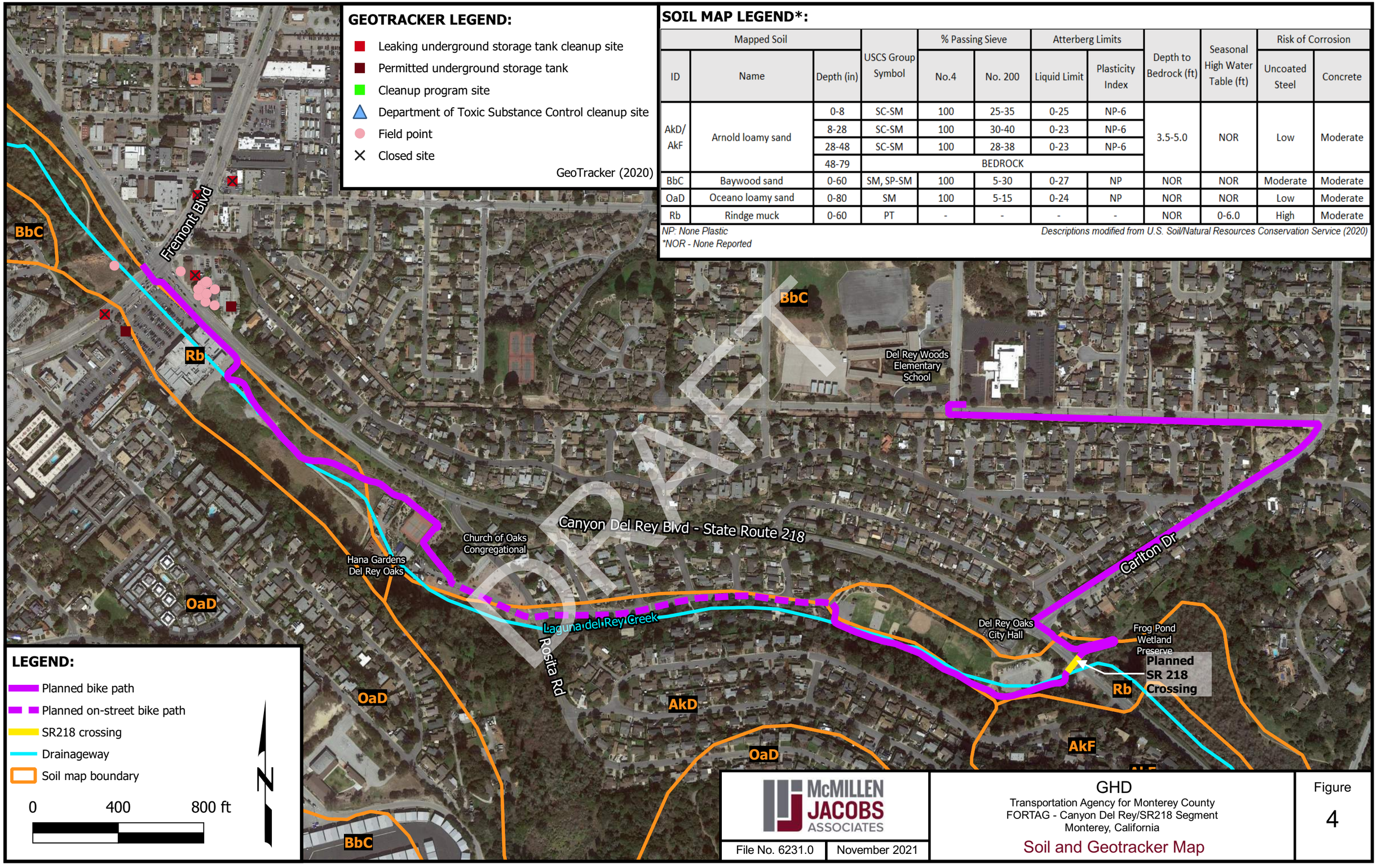
GeoTracker (2020)

SOIL MAP LEGEND*:

Mapped Soil			USCS Group Symbol	% Passing Sieve		Atterberg Limits		Depth to Bedrock (ft)	Seasonal High Water Table (ft)	Risk of Corrosion	
ID	Name	Depth (in)		No.4	No. 200	Liquid Limit	Plasticity Index			Uncoated Steel	Concrete
AkD/ AkF	Arnold loamy sand	0-8	SC-SM	100	25-35	0-25	NP-6	3.5-5.0	NOR	Low	Moderate
		8-28	SC-SM	100	30-40	0-23	NP-6				
		28-48	SC-SM	100	28-38	0-23	NP-6				
		48-79	BEDROCK								
BbC	Baywood sand	0-60	SM, SP-SM	100	5-30	0-27	NP	NOR	NOR	Moderate	Moderate
OaD	Oceano loamy sand	0-80	SM	100	5-15	0-24	NP	NOR	NOR	Low	Moderate
Rb	Rindge muck	0-60	PT	-	-	-	-	NOR	0-6.0	High	Moderate

NP: None Plastic
**NOR - None Reported*

Descriptions modified from U.S. Soil/Natural Resources Conservation Service (2020)



LEGEND:

- Planned bike path
- Planned on-street bike path
- SR218 crossing
- Drainageway
- Soil map boundary

0 400 800 ft

N

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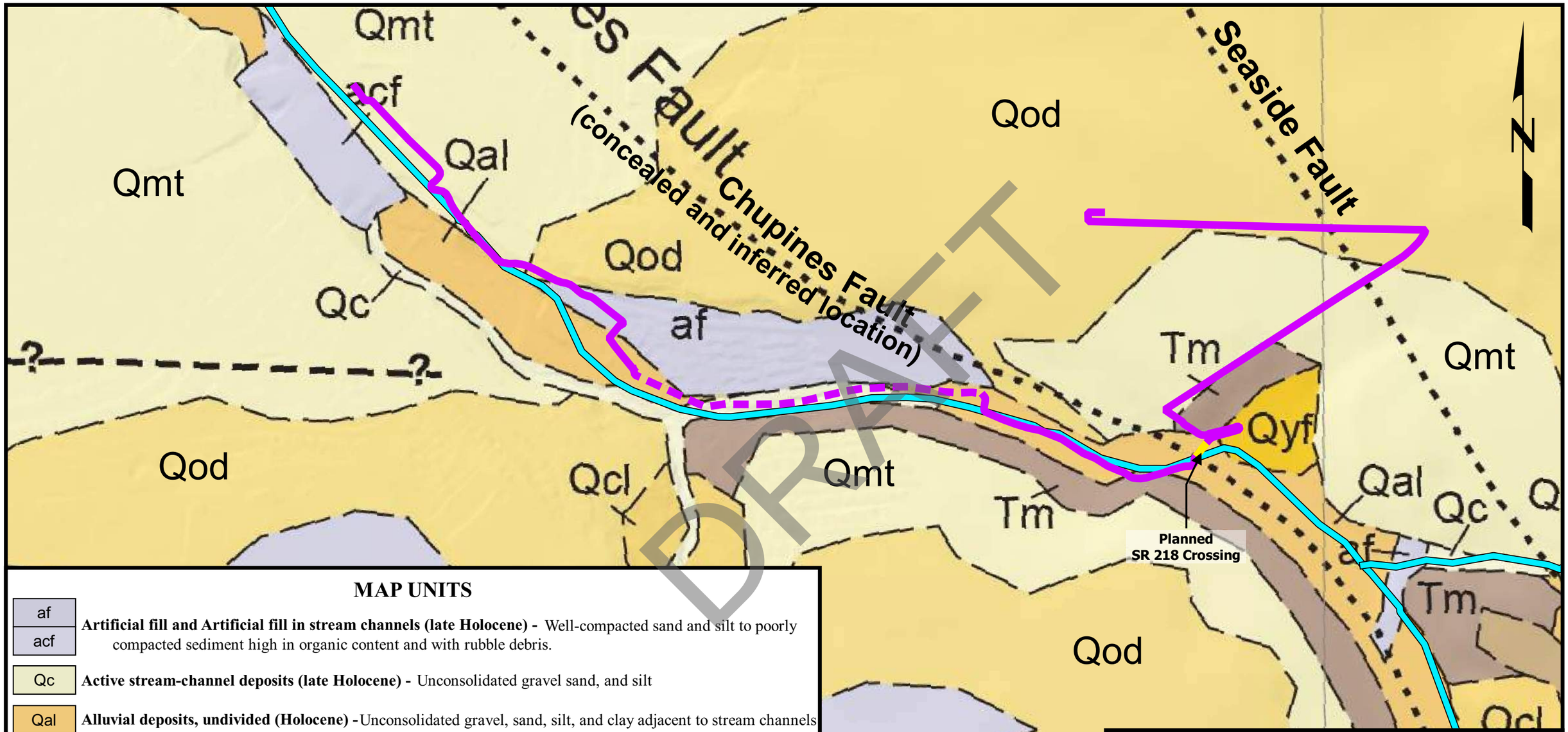
FORTAG - Canyon Del Rey/SR218 Segment
Monterey, California

Soil and Geotracker Map

Figure 4



MAP UNITS

af acf	**Artificial fill and Artificial fill in stream channels (late Holocene) -** Well-compacted sand and silt to poorly compacted sediment high in organic content and with rubble debris.
Qc	**Active stream-channel deposits (late Holocene) -** Unconsolidated gravel sand, and silt
Qal	**Alluvial deposits, undivided (Holocene) -** Unconsolidated gravel, sand, silt, and clay adjacent to stream channels
Qyf	**Alluvial fan deposits (Holocene) -** Unconsolidated, gravel, sand, and silt
Qcl	**Colluvium (Holocene) -** Loose to firm, unsorted clay, silt, sand, gravel, rock debris, and organic material
Qmt	**Marine-terrace deposits, undivided (Pleistocene) -** Semiconsolidated sand and gravel; queried where uncertain
Qod	**Older dune-sand deposits (Pleistocene) -** Very well-sorted, fine to medium sand; queried where uncertain
Tm	**Monterey Formation (Miocene) -** Pale-orange to white, porcelaneous shale interbedded with chert, mudstone, calcareous claystone, siltstone, and sandstone; some diatomaceous and tuffaceous/bentonitic volcanic ash

Map and descriptions modified from Hartwell et al., (2016)

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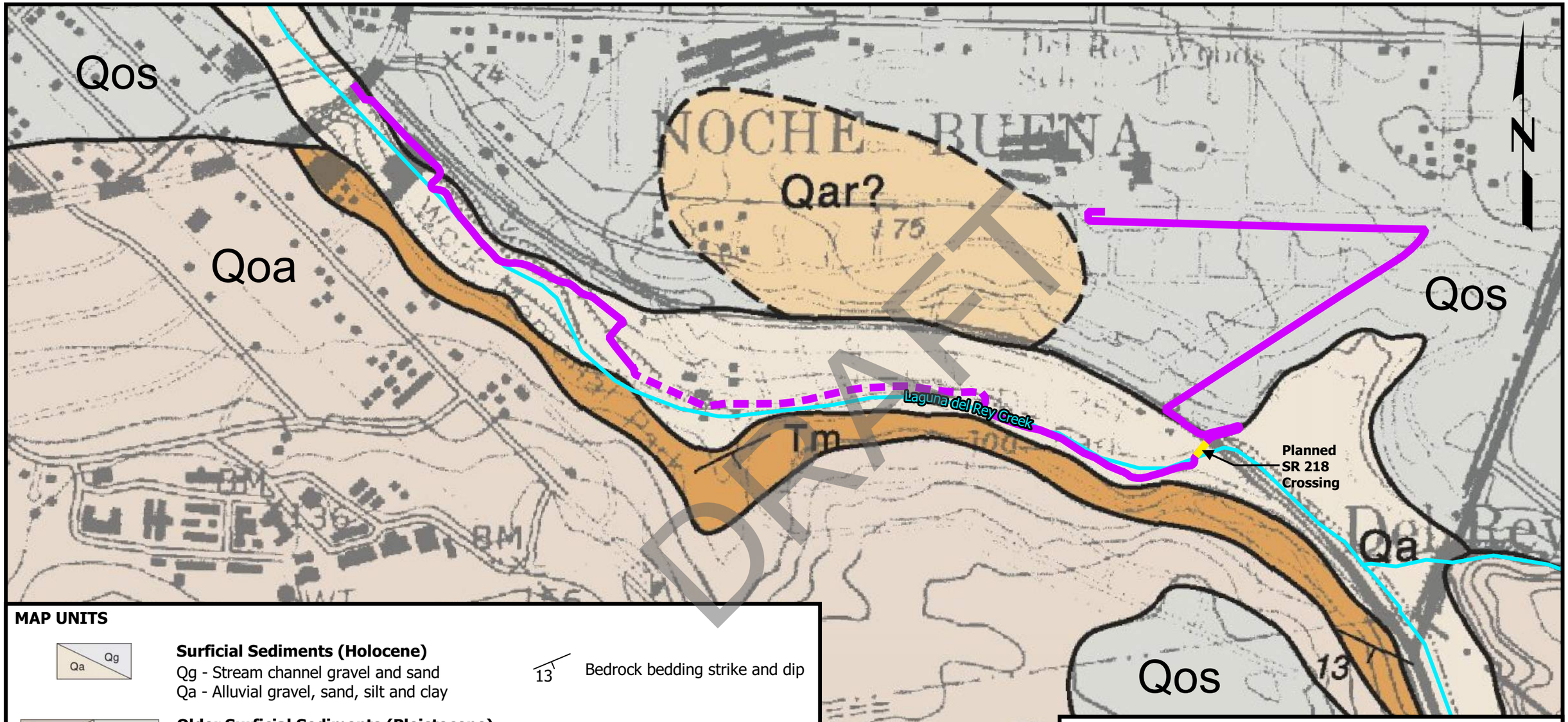
FORTAG - Canyon Del Rey/SR218 Segment
Monterey, California

Geologic Map

Figure 5.1



MAP UNITS

Surficial Sediments (Holocene)
Qg - Stream channel gravel and sand
Qa - Alluvial gravel, sand, silt and clay

13 Bedrock bedding strike and dip

Older Surficial Sediments (Pleistocene)
Qoa - Older alluvium and terrace gravel and sand
Qos - Older stabilized dune and drift sand
Qm - Marine terrace sand and gravel

Aromas Sand (Pleistocene)
Non-marine, wind-deposited, yellowish-brown to reddish brown fine sand; in places weakly indurated.

Monterey Formation (middle to late Miocene)
Marine biogenic and clastic deposits; including white-weathering siliceous shale, and white, soft and commonly silty diatomite and bentonite (volcanic ash fall tuff).

Descriptions modified from Dibblee et al., (1974) and Dibblee and Minch (2007)
Map modified from Dibblee and Minch (2007)

LEGEND
- Planned bike path
- Planned on-street bike path
- SR218 crossing
- Drainageway

0 500 1,000 ft

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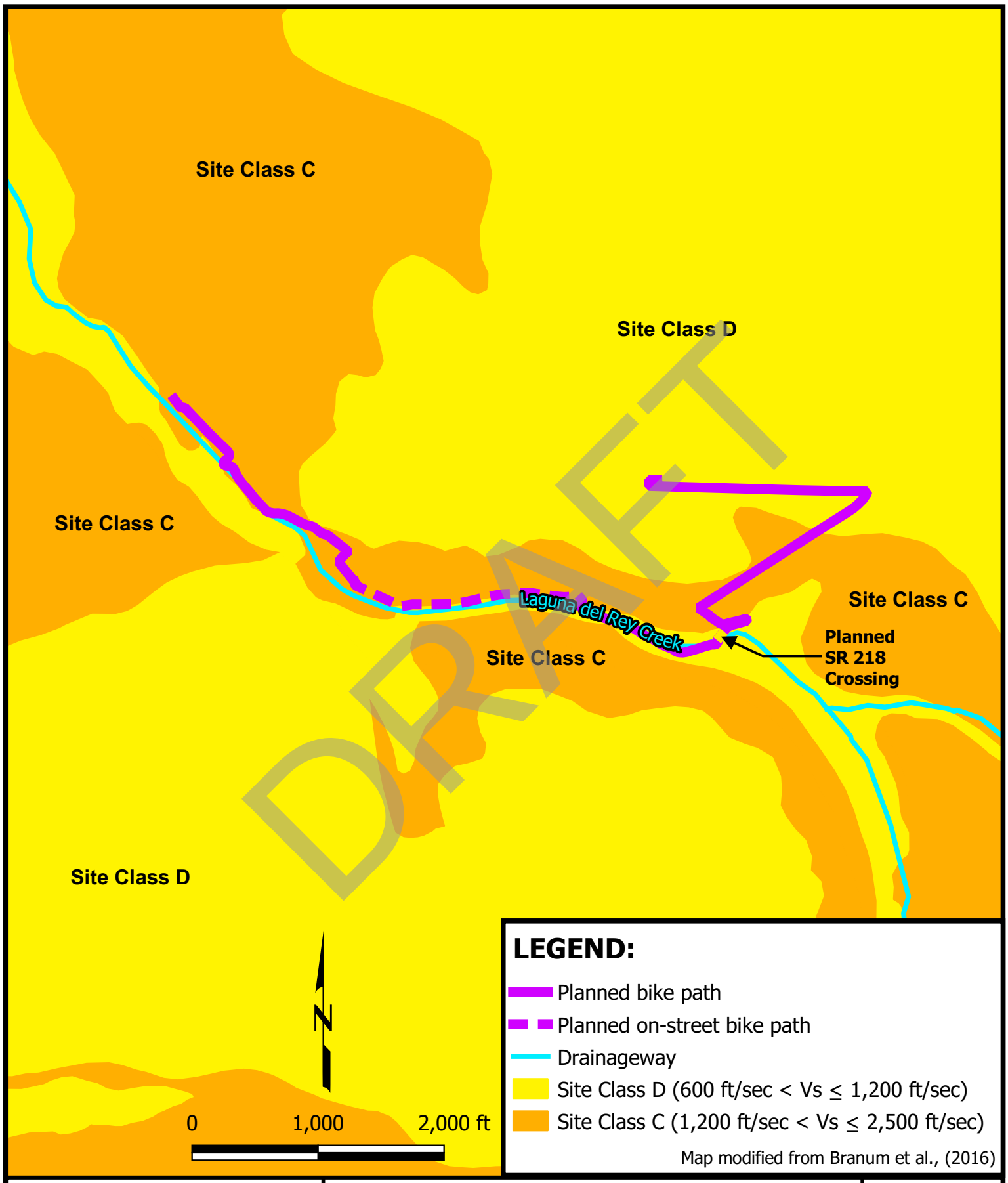
FORTAG - Canyon Del Rey/SR218 Segment
Monterey, California

Geologic Map

Figure
5.2



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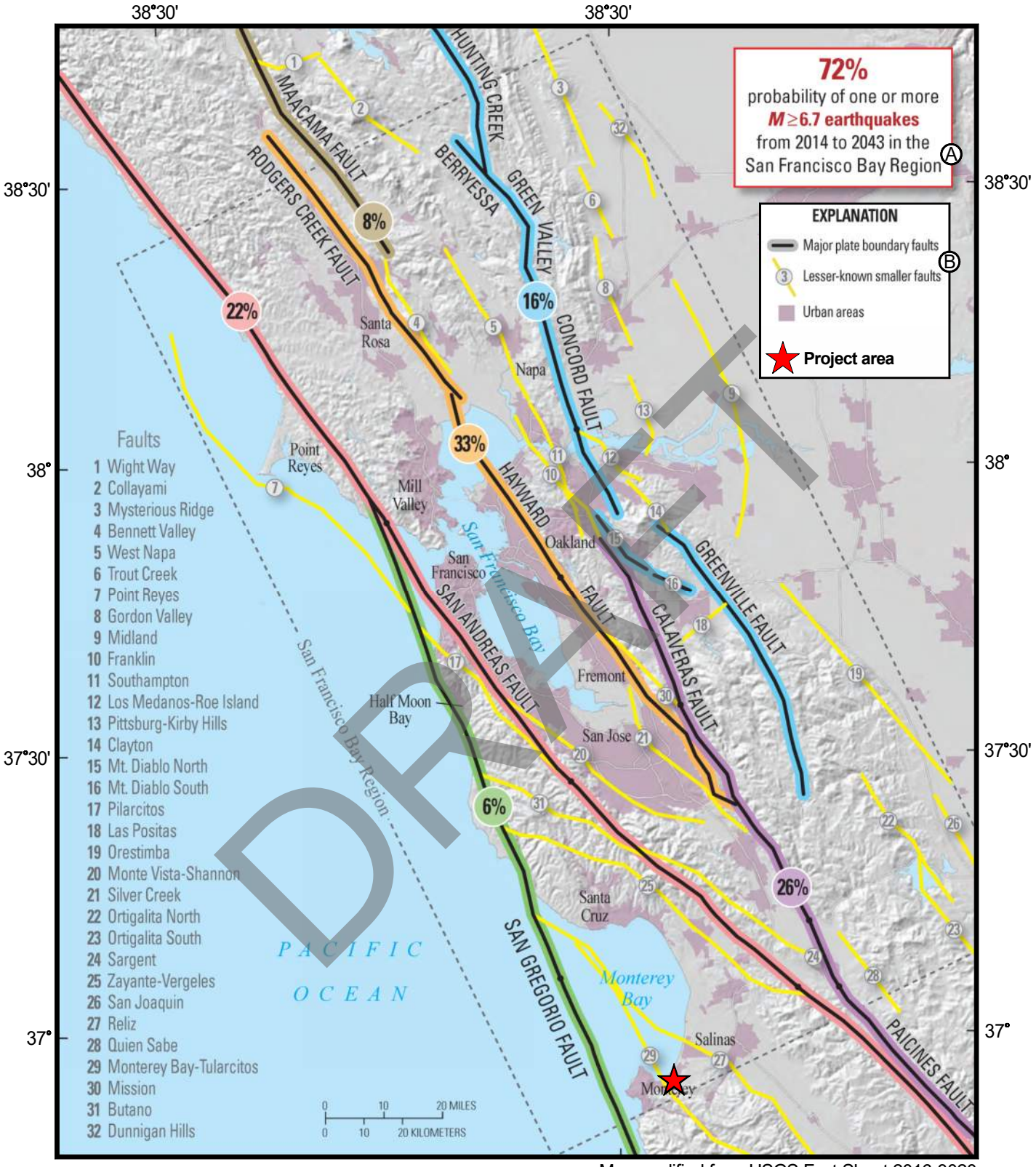
FORTAG - Phase 1 - Canyon Del Rey/SR218 Segment
Monterey, California

Vs30 Map

Figure

6



Map modified from USGS Fact Sheet 2016-3020

Ⓐ On major plate boundary faults, lesser-known faults, and unknown faults.
Ⓑ The probability that a M > 6.7 earthquake will involve one of the lesser known faults is 13%.

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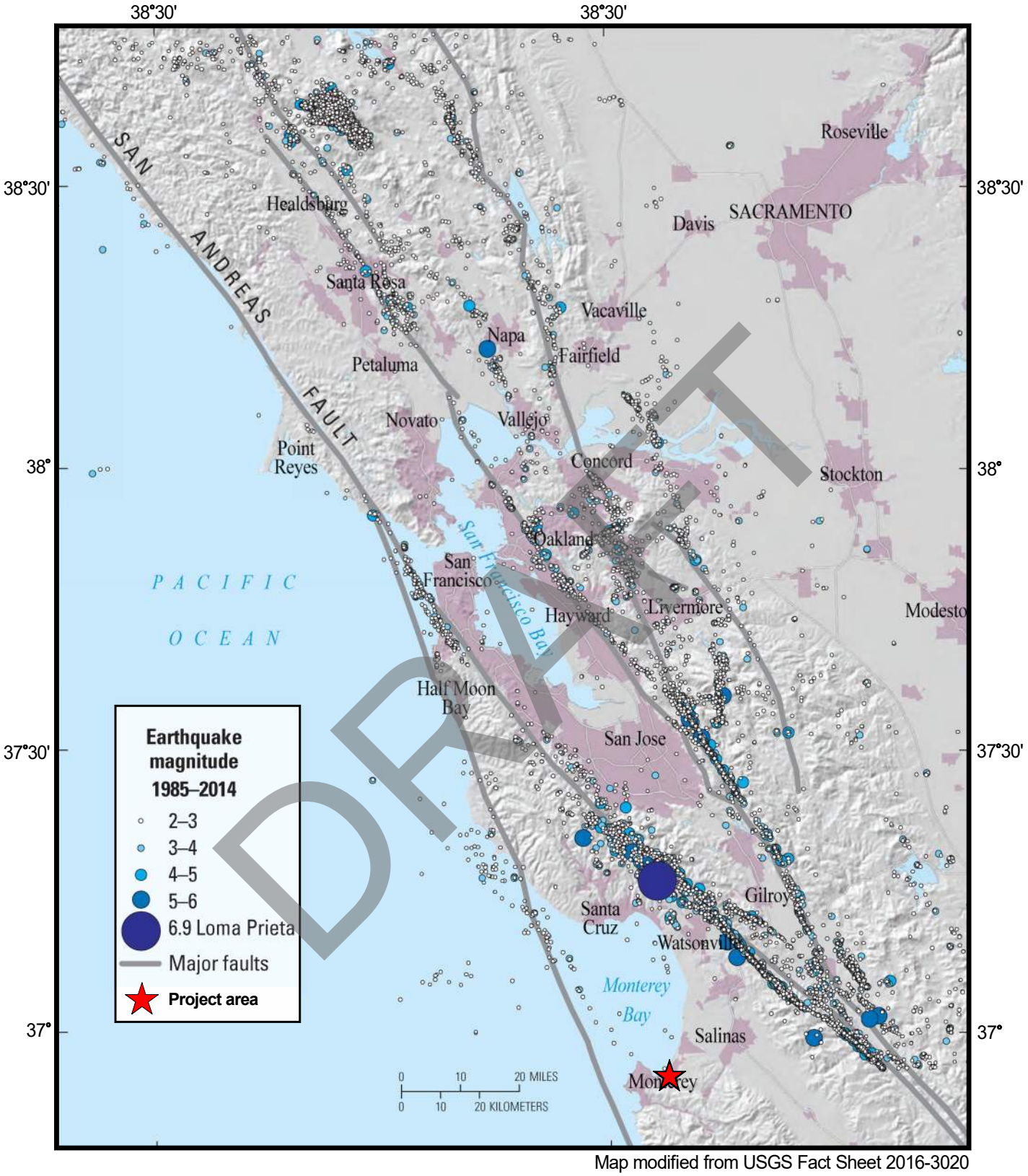
FORTAG - Canyon Del Rey/SR218 Segment
Del Rey Oaks, California

Fault Map

Figure 7



Map modified from USGS Fact Sheet 2016-3020

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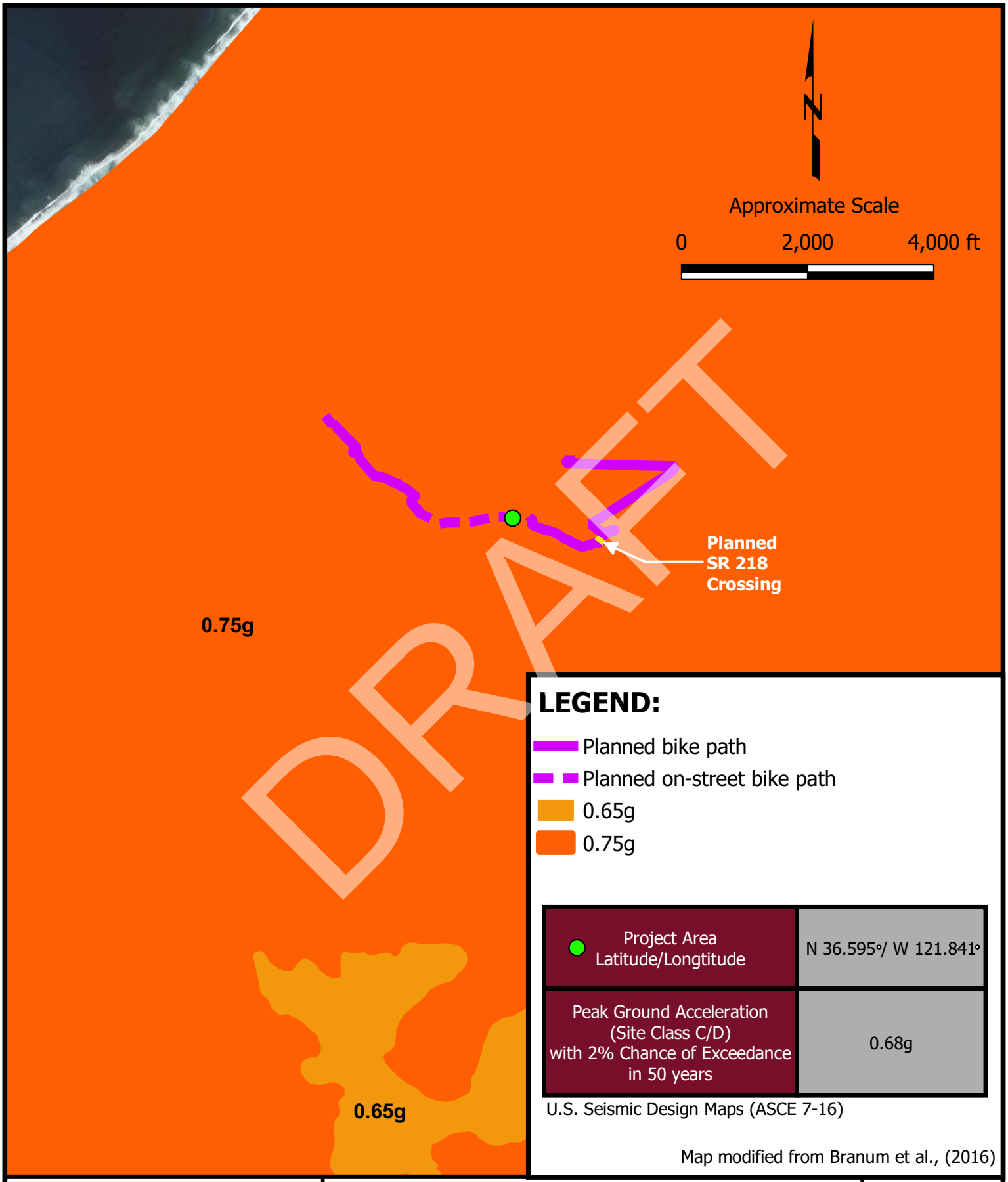
FORTAG - Canyon Del Rey/SR218 Segment
Del Rey Oaks, California

Earthquake Map

Figure 8



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FORTAG - Canyon Del Rey/SR218 Segment
Monterey, California

Seismic Shaking Map

Figure

9

AVERAGE PEAK VELOCITY (cm/s)	MODIFIED MERCALLI INTENSITY VALUE AND DESCRIPTION	AVERAGE PEAK ACCELERATION (gravity 9.80 m/s^2)
	I. Not felt except by a very few under especially favorable circumstances.	
	II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.	
	III. Felt quite noticeable indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing vehicles may rock slightly. Vibration like passing of a truck. Duration estimated.	
1 - 2	**IV.** During the day felt indoors by many, outdoors by few. At night some awakened. Rattling of dishes, windows, and doors; walls make creaking sounds. Hanging objects swing. Sensation like a heavy truck passing. Standing vehicles rocked noticeably.	**0.015 - 0.02g**
2 - 5	**V.** Felt by nearly everyone, many awakened. Some dishes, windows and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles and other tall objects sometimes noticeable. Pendulum clocks may stop. Buildings trembled throughout.	**0.03 - 0.04g**
5 - 8	**VI.** Felt by all, many frightened and run outdoors. Some moderately heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Trees, bushes, shaken slightly to moderately. Damage slight in poorly constructed buildings. Broken dishes, glassware and some windows. Moved furnishings and overturned furniture.	**0.06 - 0.07g**
8 - 12	**VII.** Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; chimneys cracked to considerable extent. Noticed by persons driving vehicles. Waves on ponds, lakes, running water. Broke numerous windows, heavy furniture overturned. Dislodged bricks and stones.	**0.10 - 0.15g**
20 - 30	**VIII.** Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving vehicles disturbed.	**0.25 - 0.30g**
45 - 55	**IX.** Damage considerable in specially designed structures; well-designed frame structures thrown out-of-plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. Reservoirs threatened.	**0.50 - 0.55g**
> 60	**X.** Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Railroad rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks. Reservoirs greatly damaged. Open cracks in cement pavements and asphalt road surfaces.	**> 0.60g**
	XI. Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly. Dams, dikes, embankments severly damaged. Destroyed large well-built bridges.	
	XII. Damage total. Practically all works of construction damaged greatly or destroyed. Landslides, falls of rock, slumping of river banks extensive. Fault slips in firm rock, with notable horizontal vertical off-set displacements. Water channels, surface and underground disturbed and modified greatly. Waves seen on ground surfaces.	

REFERENCE: "Earthquakes & Volcanoes," Volume 21, Number 1, 1989
"Earthquakes A Primer," Bruce A. Bolt, W.H. Freeman and Company, San Francisco, Copyright 1993.

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Del Rey Oaks, California

Modified Mercalli Intensity Scale

Figure 10

Ground settlement

Vb

H-VH

Vb

Vb

H

M-L

M-L

VL

H

Planned
SR 218
Crossing

Laguna del Rey

Fremont
Gr. High Sch

Del Rey Woods
Sch

NOCHE BUENA

Del Rey Oaks

100

200

DRAFT

LEGEND

- Planned bike path
- Planned on-street bike path
- SR218 crossing
- Site of reported historical liquefaction effect

LIQUEFACTION SUSCEPTIBILITY

VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
Vb - Variable

0 600 1,200 ft

Map modified from Dupre (1990)

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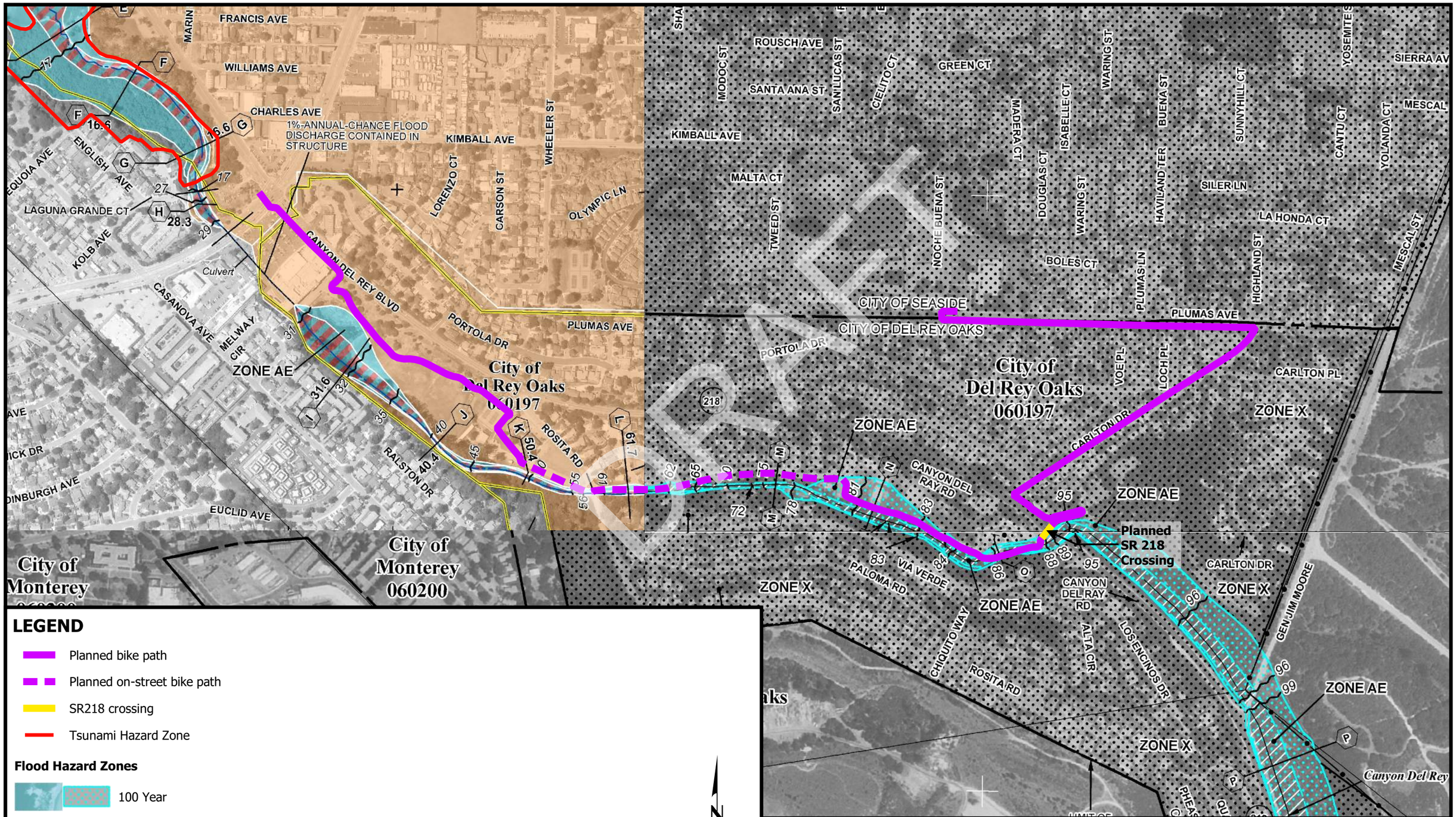
Del Rey Oaks, California

Liquefaction Susceptibility Map

Figure
11



LEGEND

- Planned bike path
- Planned on-street bike path
- SR218 crossing
- Tsunami Hazard Zone

Flood Hazard Zones

- 100 Year
- Regulatory Floodway Areas
- 500 Year
- 513 Base Flood Elevation Line (BFE), in feet

0 500 1,000 ft

Map modified from FEMA (2016 and 2009)

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Del Rey Oaks, California

Inundation Map

Figure 12.1

LEGEND:

- Planned bike path
- Planned on-street bike path
- Landward Limit of Predicted Erosion High Hazard Zone in 2100
- Current Coastal Base Flood (approximate 100-year flood extent)
- Sea Level Rise Scenario by Year 2100 Coastal Base Flood +1.4 meters (55 inches)

0 1,500 3,000 ft

N

Map modified from Pacific Institute (2009)

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FORTAG - Canyon Del Rey/SR218 Segment
Del Rey Oaks, California

Sea Level Rise

Figure

12.2

Appendix A

LEGEND FOR BORING LOGS IN APPENDIX B

- Grab sample
- 2.5" I.D./3" O.D. Modified California Sampler (ASTM D3550) with steel liners (MCS)
- 2" I.D./2.5" O.D. Split spoon sampler (SSS) (ASTM D1586)
- 1.4" I.D./2" O.D. Standard Penetration Test (ASTM D1586) sampler (SPT)
- Depth of free groundwater seepage first noted into boring during drilling
- Depth of free groundwater level measured in boring after drilling

RELATIVE DENSITY		CONSISTENCY		
SANDS AND GRAVELS	SPT, N	SILTS AND CLAYS	SPT, N	UNCONFINED COMPRESSIVE STRENGTH, tsf
VERY LOOSE	0-4	VERY SOFT	0-2	0-0.25
LOOSE	4-10	SOFT	2-4	0.25-0.50
MEDIUM DENSE	10-30	MEDIUM STIFF	4-8	0.50-1.00
DENSE	30-50	STIFF	8-15	1.00-2.00
VERY DENSE	50+	VERY STIFF	15-30	2.00-4.00
		HARD	30+	>4.00

Reference: Terzaghi, K. and Peck, R., SOIL MECHANICS IN ENGINEERING PRACTICE, 2nd ed., John Wiley and Sons, New York, 1967. Page 341 Table 45.1 and pp. 347 Table 45.2.

CONSTITUENT DESCRIPTIONS

DESCRIPTION	CRITERIA
TRACE	less than 5%
FEW	5% to 10%
LITTLE	15% to 25%
SOME	30% to 45%
MOSTLY	50% to 100%

Reference: ASTM D2488, Note 15

MOISTURE CONDITION

DESCRIPTION	CRITERIA
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

Reference: ASTM D2488, Table 3 - Criteria for Describing Moisture Condition

GROUND BEHAVIOR	CLASSIFICATION
Ground that can be excavated without initial support to shallow depths (typically less than 10 feet) and where shoring can be installed before the ground starts to move. For example, unfissured hard clay when not highly overstressed.	Firm
Ground of which chunks or flakes begin to fall off excavation walls. If raveling starts within a few minutes of excavation then it is "fast" raveling; otherwise, it is "slow" raveling. Silts and sands with clay binder may be fast raveling. Stiff fissured clays may be slow or fast raveling depending upon the degree of overstress.	Raveling
Ground that squeezes or plastically extrudes into excavations without visible fracturing. Can occur at shallow to medium depth in very soft to medium stiff clay, and can occur in stiff to hard clay under high overstress.	Squeezing
Ground consisting of clean dry granular material (e.g., sand and gravel) that moves by gravity to its angle of repose.	Running
Ground in a fluid-like condition (e.g., a disturbed mixture of predominantly silt, sand and/or gravel with water), that flows across pressure gradients.	Flowing
Ground that expands in volume due to the absorption of water (e.g., clays).	Swelling

Reference: Modified from Heuer, R.E., 1974, Important ground parameters in soft ground tunneling, Subsurface exploration for underground excavation and heavy construction, New England College, Henniker, New Hampshire, American Society of Civil Engineers, New York, P. 41-55.

NOTES:

1. Project borings were made with either (a) a Mobile B-24 drill rig using 5-inch diameter continuous flight solid stem augers, (b) hydraulic portable drill using 3-inch diameter continuous flight solid stem augers, or (c) a SIMCO 2400 SK-1 Longstroke drill rig uisng 7-inch diameter continuous hollow stem augers as indicated on the respective log. Lines separating strata in the logs represent approximate boundaries and are dashed where strata change depth is less certain. Strata change may be gradual across the boundary lines logged. Logged groundwater depths are subject to limitations described in the text of the report.
2. Penetration Resistance (blows/ft.) are the last 12 inches of an 18-inch drive using either a 140-pound cathead sampling hammer falling 30 inches per blow unless noted otherwise. The Penetration Resistance values noted on the logs are actual blows per foot of penetration for the respective sampler type (e.g., MCS sampler penetration resistance blow counts have not been reduced to SPT sampler "N" values).

LEGEND FOR BORING LOGS IN APPENDIX B (Cont'd)

CRITERIA FOR ASSIGNING GROUP SYMBOLS AND GROUP NAMES [A]				GROUP SYMBOL	GROUP NAME [B]
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve	**GRAVELS** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels** < 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]	**GW**	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]	**GP**	Poorly graded gravel [F]
		Gravels with Fines > 12% fines [C]	Fines classify as ML or MH	**GM**	Silty gravel [F,G,H]
			Fines classify as CL or CH	**GC**	Clayey gravel [F,G,H]
	SANDS 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands** < 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]	**SW**	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]	**SP**	Poorly graded sand [I]
		Sands with Fines > 12% fines [D]	Fines classify as ML or MH	**SM**	Silty sand [G,H,I]
			Fines classify as CL or CH	**SC**	Clayey sand [G,H,I]
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve	**SILTS AND CLAYS** Liquid limit < 50	**Inorganic**	PI > 7 plots on or above "A" line [J]	**CL**	Lean clay [K,L,M]
			PI < 4 plots below "A" line [J]	**ML**	Silt [K,L,M]
		Organic	Liquid limit-oven dried / Liquid limit-not dried < 0.75	**OL**	Organic Clay [K,L,M,N] / Organic Silt [K,L,M,O]
	SILTS AND CLAYS Liquid limit > 50	**Inorganic**	PI plots on or above "A" line	**CH**	Fat clay [K,L,M]
			PI plots below "A" line	**MH**	Elastic silt [K,L,M]
		Organic	Liquid limit-oven dried / Liquid limit-not dried < 0.75	**OH**	Organic Clay [K,L,M,P] / Organic Silt [K,L,M,Q]
HIGHLY ORGANIC SOILS		**Primarily organic matter, dark color and organic odor**		**PT**	Peat

NOTES:

A Based on the material passing the 3-inch (75mm) sieve.

B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.*

C Gravels with 5% to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

D Sands with 5% to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

E $Cu = \frac{D_{60}}{D_{10}}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

F If soil contains ≥ 15% sand, add "with sand" to group name.

G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

H If fines are organic, add "with organic fines" to group name.

I If soil contains ≥ 15% gravel, add "with gravel" to group name.

J If Atterberg limits plot in hatched area, soil is a CL-ML (silty clay).

K If soil contains 15% to 29% plus No. 200,add "with sand" or "with gravel", whichever is predominant.

L If soil contains ≥ 30% plus No.200, predominantly sand, add "sandy" to group name.

M If soil contains ≥ 30% plus No.200, predominantly gravel, add "gravelly" to group name.

N PI ≥ 4 and plots on or above "A" line.

O PI < 4 or plots below "A" line.

P PI plots on or above "A" line.

Q PI plots below "A" line.

PLASTICITY

Term	PI	Dry Strength	Field Test
Nonplastic	0-3	Very low	Falls apart easily
Slightly plastic	3-15	Slight	Easily crushed with fingers
Medium plastic	15-30	Medium	Difficult to crush
Highly plastic	30 or more	High	Impossible to crush with fingers

Reference: Sowers, George F., Introductory Soil Mechanics and Foundations: Geotechnical Engineering, 4th ed., Macmillan Publishing Co., Inc., New York. 1979, Page 83 Table 2:10.

GRAIN SIZE

Group	Texture	Sieve	Dimension, mm
Boulder	-	> 12"	> 305
Cobble	-	3"	75
Gravel	Coarse	3/4"	19
	Fine	No. 4	4.75
Sand	Coarse	No. 10	2.00
	Medium	No. 40	0.425
	Fine	No. 200	0.075
Fines	Silt	< No. 200	0.002
	Clay		< 0.002

Reference: modified from ASTM D2487

**The largest particle that could have been retrieved from a boring is a function of the diameter of the boring, drill bit, and sampler. Intact cobble- and boulder-size particles, if any, are too large to retrieve from small diameter borings performed for the project. Therefore, there may have been larger particles (e.g., cobble- and boulder-size) in the borings than were retrieved in samples, observed in drill cuttings and consequently logged in borings.*

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Monterey, California

Boring Log Legend

Figure A-1 (2 of 2)

WEATHERING CRITERIA

FRESH - Rock fresh, crystals bright, few joints show slight staining. Rock rings under hammer if crystalline.

VERY SLIGHT - Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.

SLIGHT - Rock generally fresh, joints stained, and discoloration extends into rock up to 1 inch. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.

MODERATE - Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.

MODERATELY SEVERE - All rocks except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. Rock goes "clunk" when struck.

SEVERE - All rocks except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.

VERY SEVERE - All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.

COMPLETE - Rock reduced to "soil". Rock "fabric" not discernible or discernable only in small scattered locations. Quartz may be present as dikes or stringers.

HARDNESS

VERY HARD - Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.

HARD - Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.

MODERATELY HARD - Can be scratched with knife or pick. Gouges or grooves to ¼ inch deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.

MEDIUM - Can be grooved or gouged 1/16 inch deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-inch maximum size by hard blows of the point of a geologist's pick.

SOFT - Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.

VERY SOFT - Can be carved with a knife. Can be excavated readily with point of pick. Pieces 1-inch or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Reference: Subsurface Investigation for Design and Construction of Foundations of Buildings, ASCE-Manuals and Reports on Engineering Practice-No. 56, 1976, by American Society of Civil Engineers.

STRENGTH

PLASTIC - moldable

FRIABLE - crumbles easily by rubbing with fingers

WEAK - an unfractured specimen of such material will crumble under light hammer blows

MODERATELY STRONG - specimen will withstand a few heavy hammer blows before breaking

STRONG - specimen will withstand a few heavy ringing hammer blows but will yield larger fragments with difficulty

VERY STRONG - specimen will resist heavy ringing hammer blows and will yield only dust and small flying fragments with difficulty

ANGLE FROM HORIZONTAL	DESCRIPTION
0-5°	horizontal
5-35°	shallow
35-55°	moderate
55-85°	steep
85-90°	vertical

DISCONTINUITIES

SPACING	FRACTURING	BEDDING
Less then ½ inch	crushed	laminated
½ inch to 2 inches	very close	very thin
2 inches to 1 foot	close	thin
1 foot to 3 feet	moderately close	medium
3 feet to 10 feet	wide	thick
More than 10 feet	very wide	very thick

APERTURE

STRUCTURE	DESCRIPTION
tight	no visible separation
open	amount of separation, staining or coatings on fracture surfaces, and fracture surface moisture conditions may be noted
healed	degree of healing, (i.e., partial or complete), thickness and mineralogy/hardness may be noted
filled	degree of filling, (i.e. partial or complete), thickness and type of filling may be noted

ROUGHNESS

SURFACE	DESCRIPTION
stepped	near normal steps and ridges occur on fracture surface
rough	large, angular asperities can be seen
moderately rough	asperities are clearly visible and fracture surface feels abrasive
slightly rough	small asperities on the fracture surface visible and can be felt
smooth	no asperities, smooth to touch
polished	extreamly smooth and shiny

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FORTAG - Canyon Del Rey/SR218 Segment
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Bedrock Descriptors

Figure

A-2

Appendix B

LOG OF BORING B-1 ①

LOCATION: see Figure 1

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	③GROUNDWATER	DESCRIPTION ②	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR: Cohesion p.s.f.	DIRECT SHEAR: Internal Friction Angle
					SILTY SAND (SM) - FILL - black - few roots and gravel - trace clay - nonplastic - loose and medium dense - dry										
	1		18			21	89								
	2		6												
5					**POORLY GRADED SAND (SP)** - dark gray - trace gravel, silt, and clay - nonplastic - very loose and medium dense - wet										
	3		24			23	98								
	4		3							1	96	3		520	35°
10					**BOTTOM OF BORING AT 10 FEET**										
15															
20															
25															

FINES: 1% Silt, 2% Clay

NOTES
① Drilled 08/25/2021 using a Mobile B-24, 5" solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer. See notes in Figure A-1, Appendix A.
② See report text and figures in Appendices A and C for additional definitions, boring information, lab test results, and ground descriptions.
③ Groundwater seepage was encountered during drilling at a depth of 6.5' and a groundwater level was measured at 5' prior to boring backfilling on 08/25/2021.

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Transportation Agency for Monterey County
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Log of Boring B-1

Figure B-1

LOG OF BORING B-2 ①

LOCATION: see Figure 1

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	③ GROUNDWATER	DESCRIPTION ②	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR: Cohesion p.s.f.	DIRECT SHEAR: Internal Friction Angle
0					**POORLY GRADED SAND WITH SILT AND CLAY (SP-SM/SP-SC)** - very pale brown to light brown and light yellowish brown - medium dense to dense - dry to moist - trace gravel - nonplastic										
	1		37			2	93								
5	2		49							<1	89	11			
	3														
10	4		72		- mica sand grains visible in samples 4 and 5	8	90						0.1		
	5		40												
15	6				**BEDROCK - MONTEREY FORMATION (?)** - chert - porcelaneous shale										
	7		50/6"												
	8		50/3"												
					BORING REFUSAL AT 17.5 FEET										
20															
25															

FINES: 4% Silt, 7% Clay

NOTES
① Drilled 08/25/2021 using a portable minuteman, 3" solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer. See notes in Figure A-1, Appendix A
② See report text and figures in Appendices A and C for additional definitions, boring information, lab test results, and ground descriptions.
③ Groundwater seepage was not encountered during drilling nor prior to boring backfilling on 08/25/2021.

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Transportation Agency for Monterey County
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Del Rey Oaks, California

Log of Boring B-2

Figure B-2

LOG OF BORING B-3 ①

LOCATION: see Figure 1

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	③ GROUNDWATER	DESCRIPTION ②	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (>#4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
	1				**SILTY SAND (SM) - FILL** - dark brown - few gravel and clay - nonplastic - dry										
	2		10		**SILTY SAND (SM)** - light gray and light brown - few clay - nonplastic - medium dense - dry to moist	14	99								
5	3				**FAT CLAY WITH SAND (CH)** - dark gray to black - few silt and organics - highly plastic - soft to medium stiff - moist			61	33						
	4		4			40	79						1.1		
	5		5												
10					**BOTTOM OF BORING AT 10 FEET**										
15															
20															
25															

NOTES
① Drilled 08/25/2021 using a Mobile B-24, 5" solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer. See notes in Figure A-1, Appendix A.
② See report text and figures in Appendices A and C for additional definitions, boring information, lab test results, and ground descriptions.
③ Groundwater seepage was not encountered during drilling nor prior to boring backfilling on 08/25/2021.

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Log of Boring B-3

Figure

B-3

LOG OF BORING B-4 ①

LOCATION: see Figure 1

DEPTH (feet)	SAMPLE NO.	TYPE	PENETRATION RESISTANCE (blows/ft.)	③GROUNDWATER	DESCRIPTION ②	MOISTURE (%)	DRY DENSITY (lbs./ft.³)	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH (kips/ft.²)	DIRECT SHEAR: Cohesion (p.s.f.)	DIRECT SHEAR: Internal Friction Angle
	1				**SILTY CLAYEY SAND (SM/SC) - FILL** - dark to very dark brown - few gravel - nonplastic - concrete at 2' to 3' - loose - dry to moist					6	80	14			
	2		9			8	103								
5	3		7												
	4		6		**SILTY CLAYEY SAND (SM/SC)** - dark gray to black - trace gravel - slightly to medium plastic - loose - moist to wet **CORROSION TEST** Sample B-4-5 See Appendix C					<1	50	50			
10	5		5												
	6		15		**SILT WITH SAND (ML)** - dark gray - trace gravel - few clay - slightly plastic - soft to medium stiff - wet	43	74							270	21°
15	7		4					46	12						
	8		26		**SILTY CLAYEY SAND (SM/SC)** - dark gray - slightly plastic - loose to medium dense - wet	26	98								
20	9		9		**LEAN TO FAT CLAY (CL/CH)** - dark gray - trace to little sand - medium to highly plastic - stiff - wet						67	33			
25					**POORLY GRADED SAND WITH SILT (SP-SM)** - dark gray - trace clay and gravel - nonplastic - medium dense to dense - wet										
					LOG CONTINUED AT 27 FEET ON FIGURE B-4 (2 of 2)										

FINES: 7% Silt, 7% Clay

FINES: 31% Silt, 19% Clay

FINES: 25% Silt, 8% Clay

NOTES

① Drilled 08/26/2021 using a SIMCO 2400 SK-1 Longstroke, 7" hollow stem augers, and a 30" drop by 140 lb. cathead sampling hammer. See notes in Figure A-1, Appendix A.

② See report text and figures in Appendices A and C for additional definitions, boring information, lab test results, and ground descriptions.

③ Groundwater seepage was encountered in samples or during drilling at a depth of 10' and 16.5' and a groundwater level was measured at 31' prior to boring backfilling on 08/26/2021.

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Log of Boring B-4

Figure B-4 (1 of 2)

LOG OF BORING B-4 (continued)①

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	DESCRIPTION	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR: Cohesion p.s.f.	DIRECT SHEAR: Internal Friction Angle
					LOG CONTINUED FROM 27 FEET ON FIGURE B-4 (1 of 2)										
30	10		52		**POORLY GRADED SAND WITH SILT (SP-SM)** - dark gray - medium dense to dense - trace clay and gravel - wet - nonplastic	22	100			4	88	8			
	11		12												
	12		20												
35					**ELASTIC SILT (MH)** - white - highly plastic - diatomaceous and/or tuffaceous - medium stiff (bentonitic volcanic ash ?) - wet										
					ELASTIC SILT (MH) and PEAT (PT) - black - medium stiff - highly plastic - wet			112	42						
40	13		4		**BOTTOM OF BORING AT 40 FEET**										
45															
50															

FINES
5% Silt
3% Clay

NOTES
① See notes on Figure B-4 (1 of 2).

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Log of Boring B-4

Figure
B-4
(2 of 2)

LOG OF BORING B-5a ①

LOCATION: see Figure 1

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	③GROUNDWATER	DESCRIPTION ②	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (>#4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					POORLY GRADED SAND (SP) - FILL - light brown - dry - trace clay and gravel - nonplastic										
					BORING B-5a REFUSAL AT 2 FEET ON APPARENT CONCRETE AND METAL, MOVED 10 FEET TO THE SOUTHWEST AND DRILLED BORING B-5b										
5															
10															
15															
20															
25															

NOTES

① Drilled 08/26/2021 using a SIMCO 2400 SK-1 Longstroke, 7" hollow stem augers, and a 30" drop by 140 lb. cathead sampling hammer. See notes in Figure A-1, Appendix A.
② See report text and figures in Appendices A and C for additional definitions, boring information, lab test results, and ground descriptions.
③ Groundwater seepage was not encountered during drilling nor prior to boring backfilling on 08/26/2021.

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Log of Boring B-5a

Figure

B-5a

LOG OF BORING B-5b[1]

LOCATION: see Figure 1

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER[3]	DESCRIPTION[2]	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (>#4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
	1		17		**SILTY SAND (SM) - FILL** - light brown - medium dense - nonplastic - dry	2	101						FINES 5% Silt 4% Clay		
5	2		4		**POORLY GRADED SAND WITH SILT AND CLAY (SP-SM/SP-SC) - FILL** - yellowish brown and brown to light brown with some reddish brown - nonplastic - loose - dry to moist - trace gravel					3	88	9			
	3		4		- light brown with some reddish brown										
10	4a				- sample 4a bouncing on apparent concrete at 10.5' - drilled through concrete between 10.5' and 12'	4	95								
	4b		3		**SILTY CLAYEY SAND (SM/SC)** - very dark gray - very loose to loose - tuffaceous layers (?) - moist to wet - trace gravel - medium to highly plastic fines										
15	5		4	▽		78	52						FINES 16% Silt 9% Clay	620	26°
20	6		4							<1	75	25			
	7		6		**SILTY CLAYEY SAND (SM/SC)** - dark brown - loose - trace gravel - moist to wet - medium plastic fines										
25	8		4	▽						4	52	44	FINES 23% Silt 21% Clay		
					LOG CONTINUED AT 27 FEET ON FIGURE B-5b (2 of 2)										

NOTES

① Drilled 08/26/2021 using a SIMCO 2400 SK-1 Longstroke, 7" hollow stem augers, and a 30" drop by 140 lb. cathead sampling hammer. See notes in Figures A-1 and A-2, Appendix A.

② See report text and figures in Appendices A and C for additional definitions, boring information, lab test results, and ground descriptions.

③ Groundwater seepage was encountered in samples or during drilling at a depth of 18' and 29', and groundwater level was measured at 26' prior to boring backfilling on 08/26/2021.

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Del Rey Oaks, California

Log of Boring B-5b

Figure B-5b (1 of 2)

LOG OF BORING B-5b (continued) ①

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	DESCRIPTION	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (>#4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					LOG CONTINUED FROM 27 FEET ON FIGURE B-5b (1 of 2)										
					SILTY CLAYEY SAND (SM/SC) - dark brown - trace gravel - medium plastic fines - loose - wet										
30	9		5	▽											
					ELASTIC SILT WITH SAND (MH) and CLAYSTONE/SILTSTONE - MONTEREY FORMATION (?) - gray - few clay - medium plastic and highly plastic - cemented soil, to very severely weathered bedrock - very stiff soil, and soft rock hardness - wet										
	10		34			15	104						0.4		
35	11		26												
	12		27					87	25						
40					**BOTTOM OF BORING AT 40 FEET**										
45															
50															

NOTES

① See notes on Figure B-5b (1 of 2).

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Log of Boring B-5b

Figure B-5b (2 of 2)

LOG OF BORING B-6 ①

LOCATION: see Figure 1

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	③GROUNDWATER	DESCRIPTION ②	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (>#4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
	1		7		**SILTY SAND (SM)** - olive yellow - nonplastic - loose to medium dense - dry	3	91								
5	2		14		**POORLY GRADED SAND WITH SILT AND CLAY (SP-SM/SP-SC)** - olive yellow - nonplastic - medium dense - dry						91	9			
	3				**SILTY SAND (SM)** - light gray and pale yellow to light gray - nonplastic - dense to very dense - dry										
10	4		47			5	98								
	5		51												
15	6														
	7		75			8	95								
	8		43												
20					**BOTTOM OF BORING AT 20 FEET**										
25															

FINES
6% Silt
3% Clay

NOTES
① Drilled 08/25/2021 using a portable minuteman, 3" solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer. See notes in Figure A-1, Appendix A
② See report text and figures in Appendices A and C for additional definitions, boring information, lab test results, and ground descriptions.
③ Groundwater seepage was not encountered during drilling nor prior to boring backfilling on 08/25/2021.

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Del Rey Oaks, California

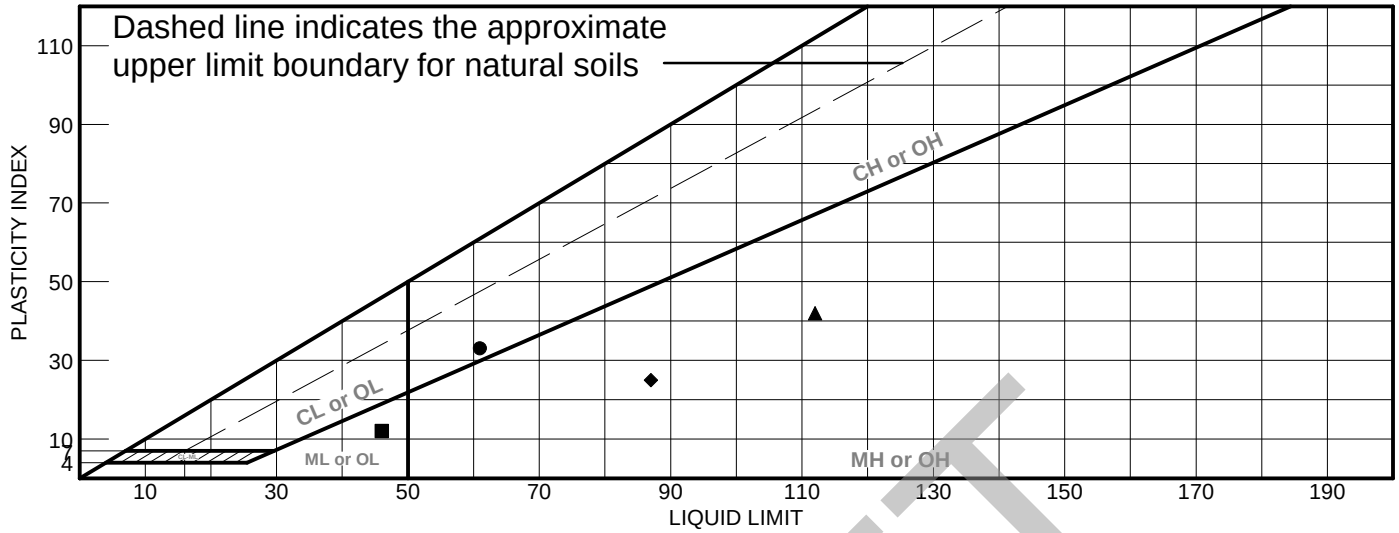
Log of Boring B-6

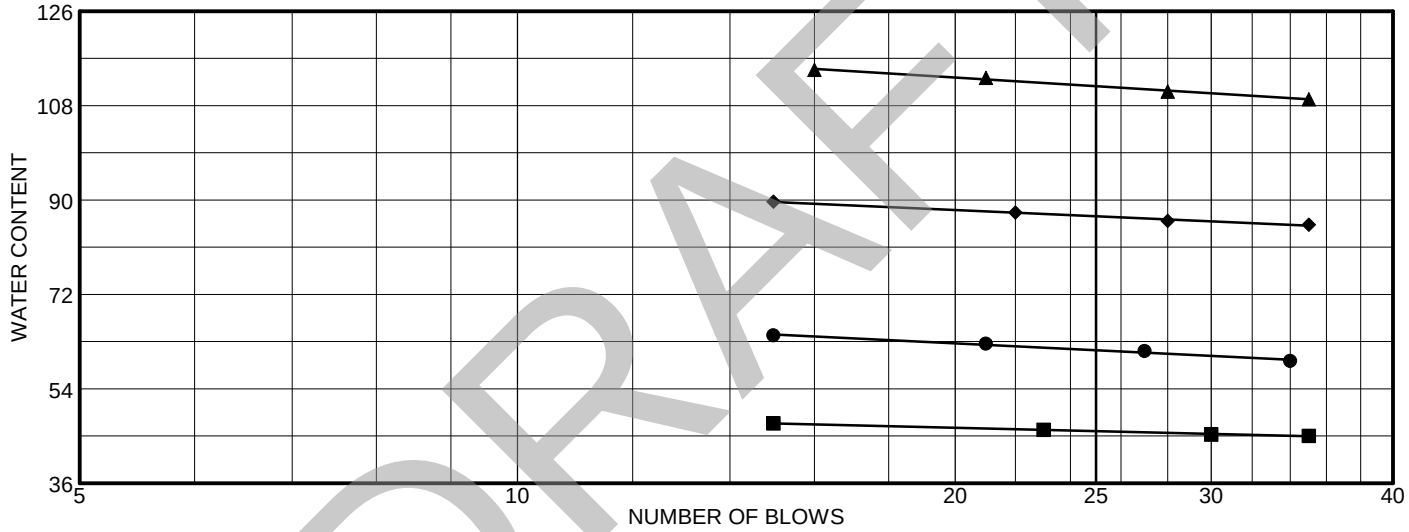
Figure

B-6

Appendix C

LIQUID AND PLASTIC LIMITS TEST REPORT (ASTM D4318)





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Very Dark Olive Gray Fat CLAY	61	28	33			
■	Very Dark Bluish Gray SILT w/ Sand	46	34	12			
▲	Very Dark Olive Brown Elastic SILT	112	70	42			
◆	Dark Olive Brown Elastic SILT	87	62	25			

Project No. 1022-034 **Client:** McMillen Jacobs Associates

Project: 6231

● **Source:** B-3-3 **Elev./Depth:** 5'
■ **Source:** B-4-7 **Elev./Depth:** 16.5'
▲ **Source:** B-4-13 **Elev./Depth:** 38.5'
◆ **Source:** B-5-12 **Elev./Depth:** 38.5'

Remarks:

● Sample was prepared using the wet prep method.
■ Sample was prepared using the wet prep method.
▲ Sample was prepared using the wet prep method.
◆ Sample was prepared using the wet prep method.

LIQUID AND PLASTIC LIMITS TEST REPORT (ASTM D4318)

COOPER TESTING LABORATORY

Figure

Particle Size Distribution Report

% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.6	96.7	0.8	1.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	99.7		
#4	99.4		
#10	98.3		
#30	93.1		
#40	88.0		
#50	71.3		
#100	9.8		
#200	2.7		
#270	2.1		
0.0353 mm.	3.2		
0.0223 mm.	3.2		
0.0129 mm.	3.1		
0.0092 mm.	2.9		
0.0065 mm.	2.6		
0.0046 mm.	2.1		
0.0032 mm.	2.1		
0.0023 mm.	1.9		
0.0012 mm.	1.9		

* (no specification provided)

Soil Description

Olive Gray Poorly Graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.386 D_{60}= 0.262 D_{50}= 0.237
D_{30}= 0.194 D_{15}= 0.163 D_{10}= 0.151
C_u= 1.74 C_c= 0.95

Classification

USCS= AASHTO=

Remarks

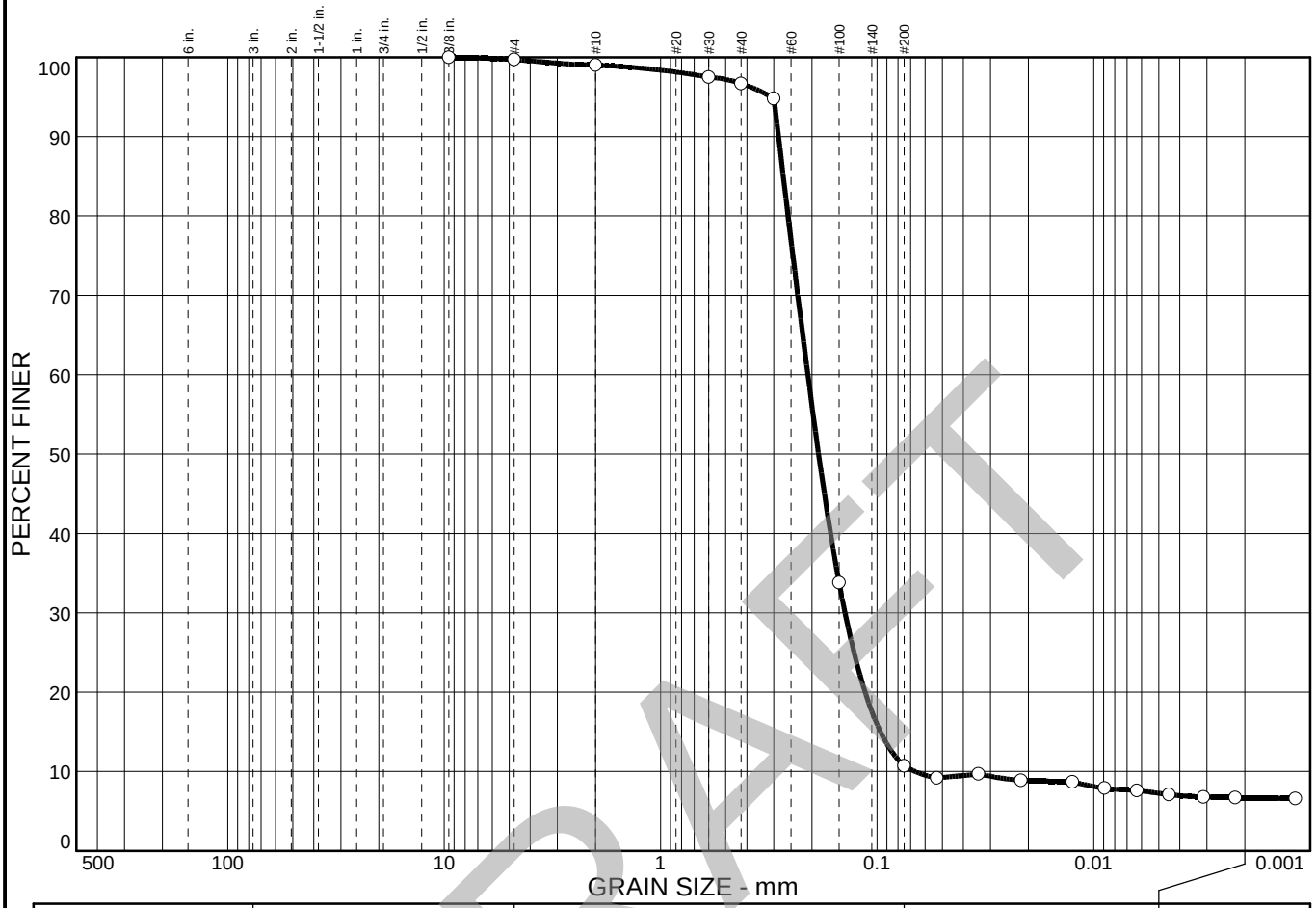
Sample No.: **Source of Sample:** B-1-4 **Date:** 9/14/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231

Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.3	89.0	4.0	6.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.7		
#10	99.0		
#30	97.5		
#40	96.7		
#50	94.8		
#100	33.8		
#200	10.7		
#270	9.2		
0.0340 mm.	9.7		
0.0216 mm.	8.9		
0.0125 mm.	8.7		
0.0089 mm.	7.9		
0.0063 mm.	7.6		
0.0045 mm.	7.1		
0.0031 mm.	6.8		
0.0022 mm.	6.7		
0.0012 mm.	6.6		

* (no specification provided)

Soil Description

Yellowish Brown Poorly Graded SAND w/ Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.272 D_{60}= 0.209 D_{50}= 0.187
D_{30}= 0.141 D_{15}= 0.0966 D_{10}= 0.0666
C_u= 3.14 C_c= 1.42

Classification

USCS= AASHTO=

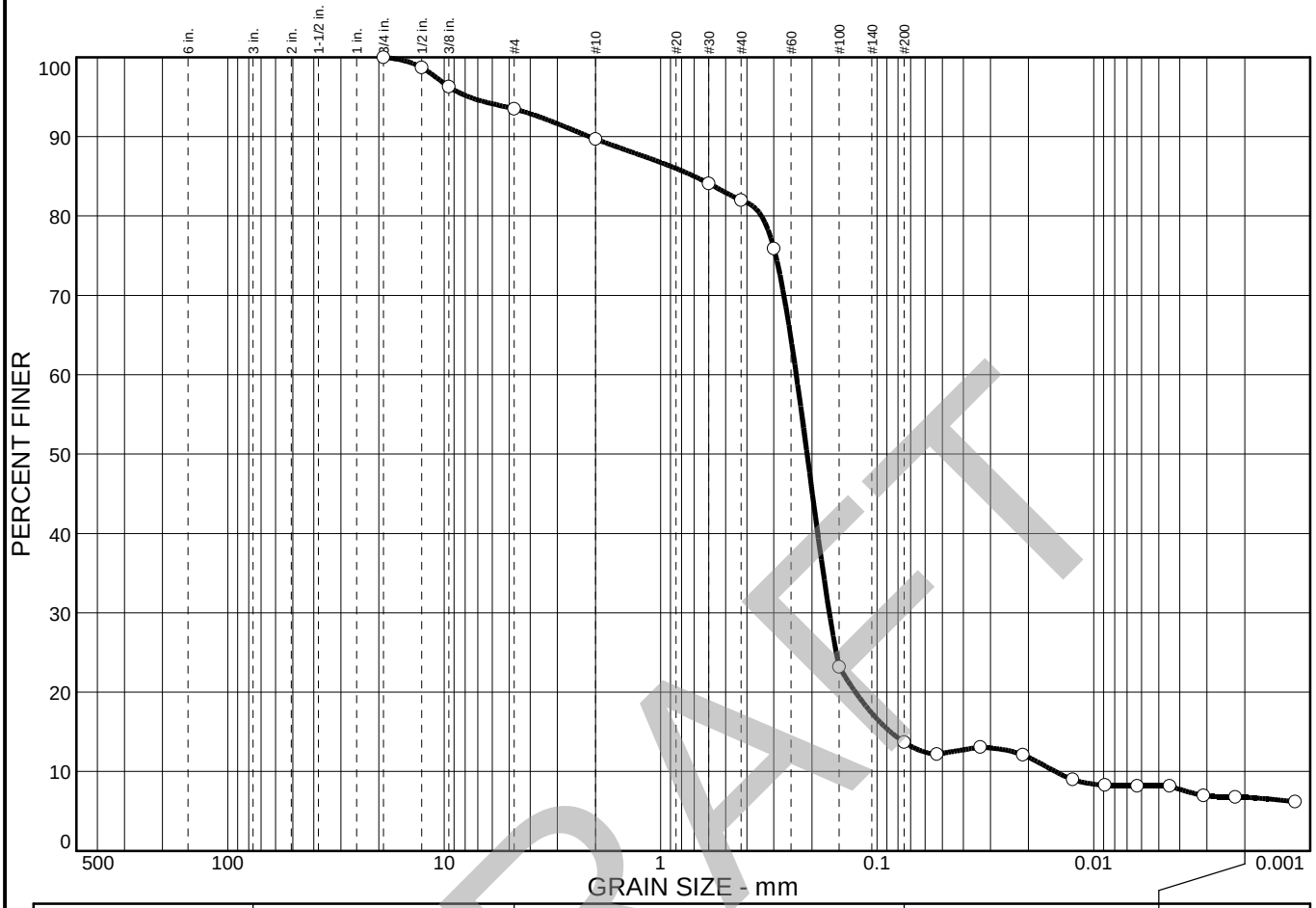
Remarks

Sample No.: **Source of Sample:** B-2-2 **Date:** 9/14/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	6.5	79.8	6.9	6.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
1/2 in.	98.7		
3/8 in.	96.3		
#4	93.5		
#10	89.7		
#30	84.1		
#40	82.0		
#50	75.9		
#100	23.2		
#200	13.7		
#270	12.2		
0.0334 mm.	13.1		
0.0212 mm.	12.1		
0.0125 mm.	9.0		
0.0089 mm.	8.3		
0.0063 mm.	8.2		
0.0045 mm.	8.2		
0.0031 mm.	7.0		
0.0022 mm.	6.8		
0.0012 mm.	6.2		

* (no specification provided)

Soil Description

Dark Reddish Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.700 D_{60}= 0.237 D_{50}= 0.211
D_{30}= 0.166 D_{15}= 0.0870 D_{10}= 0.0150
C_u= 15.73 C_c= 7.78

Classification

USCS= AASHTO=

Remarks

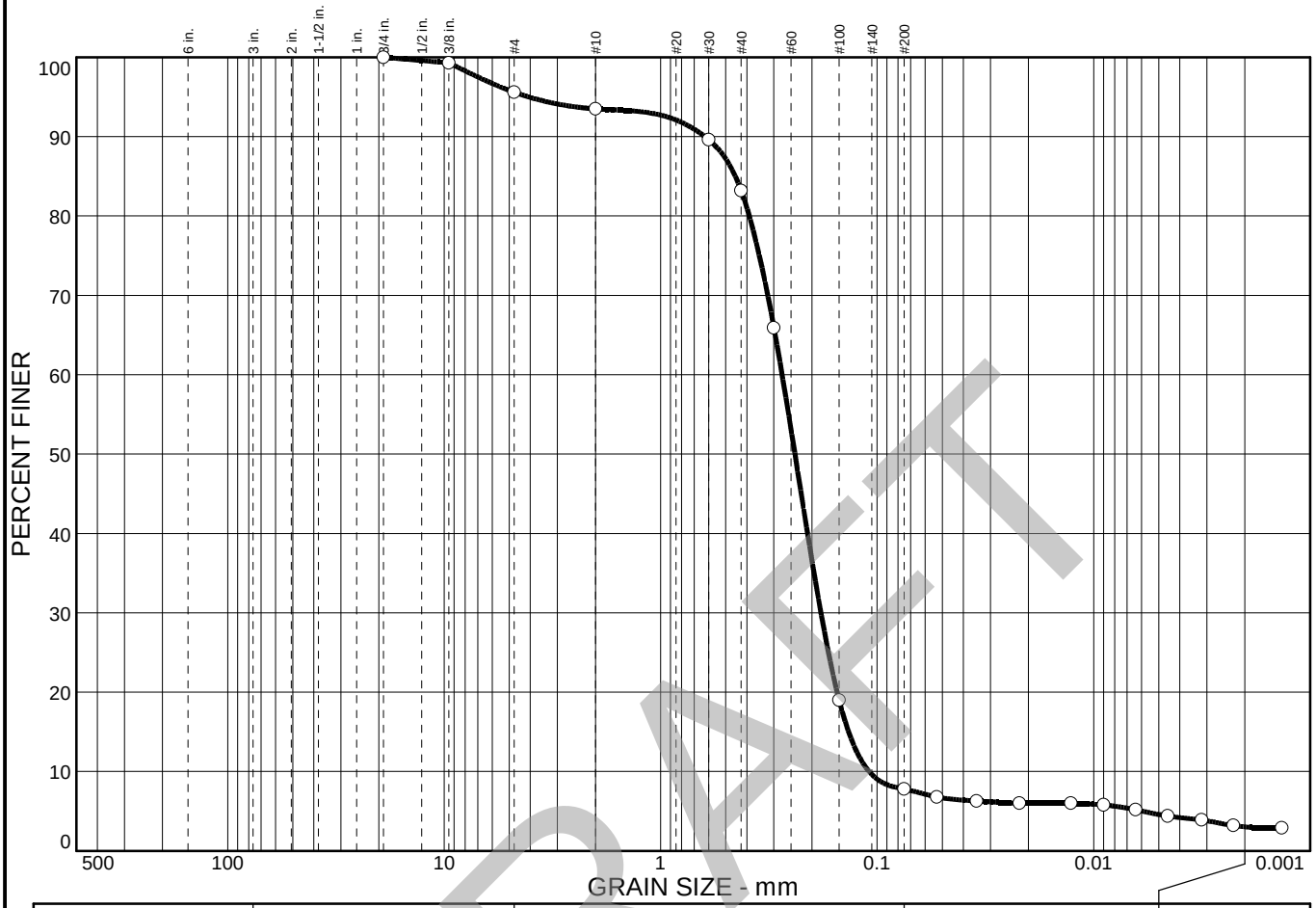
Sample No.: **Source of Sample:** B-4-1 **Date:** 9/14/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231

Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	4.4	87.8	4.8	3.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	99.3		
#4	95.6		
#10	93.5		
#30	89.6		
#40	83.2		
#50	65.9		
#100	19.0		
#200	7.8		
#270	6.8		
0.0347 mm.	6.3		
0.0220 mm.	6.0		
0.0127 mm.	6.0		
0.0090 mm.	5.8		
0.0064 mm.	5.2		
0.0046 mm.	4.4		
0.0032 mm.	3.9		
0.0023 mm.	3.2		
0.0014 mm.	2.9		

* (no specification provided)

Soil Description

Gray Poorly Graded SAND w/ Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.452 D_{60}= 0.275 D_{50}= 0.240
D_{30}= 0.182 D_{15}= 0.136 D_{10}= 0.109
C_u= 2.52 C_c= 1.10

Classification

USCS= AASHTO=

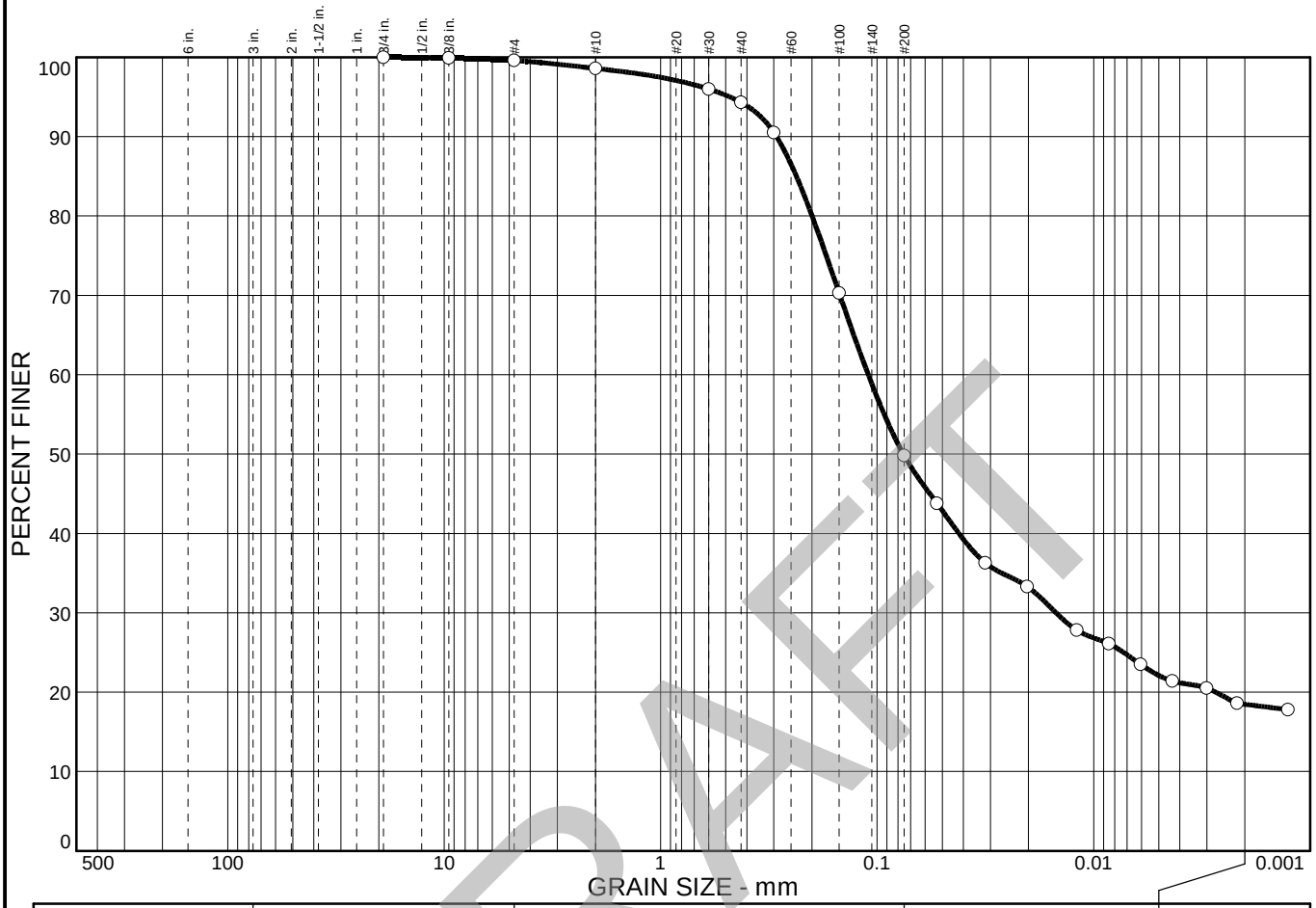
Remarks

Sample No.: **Source of Sample:** B-4-10 **Date:** 9/16/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.4	49.8	31.3	18.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	99.9		
#4	99.6		
#10	98.6		
#30	96.0		
#40	94.3		
#50	90.5		
#100	70.3		
#200	49.8		
#270	43.8		
0.0317 mm.	36.3		
0.0203 mm.	33.3		
0.0120 mm.	27.8		
0.0085 mm.	26.1		
0.0061 mm.	23.5		
0.0043 mm.	21.4		
0.0030 mm.	20.5		
0.0022 mm.	18.6		
0.0013 mm.	17.8		

* (no specification provided)

Soil Description

Black Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.236 D_{60}= 0.110 D_{50}= 0.0757
D_{30}= 0.0149 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

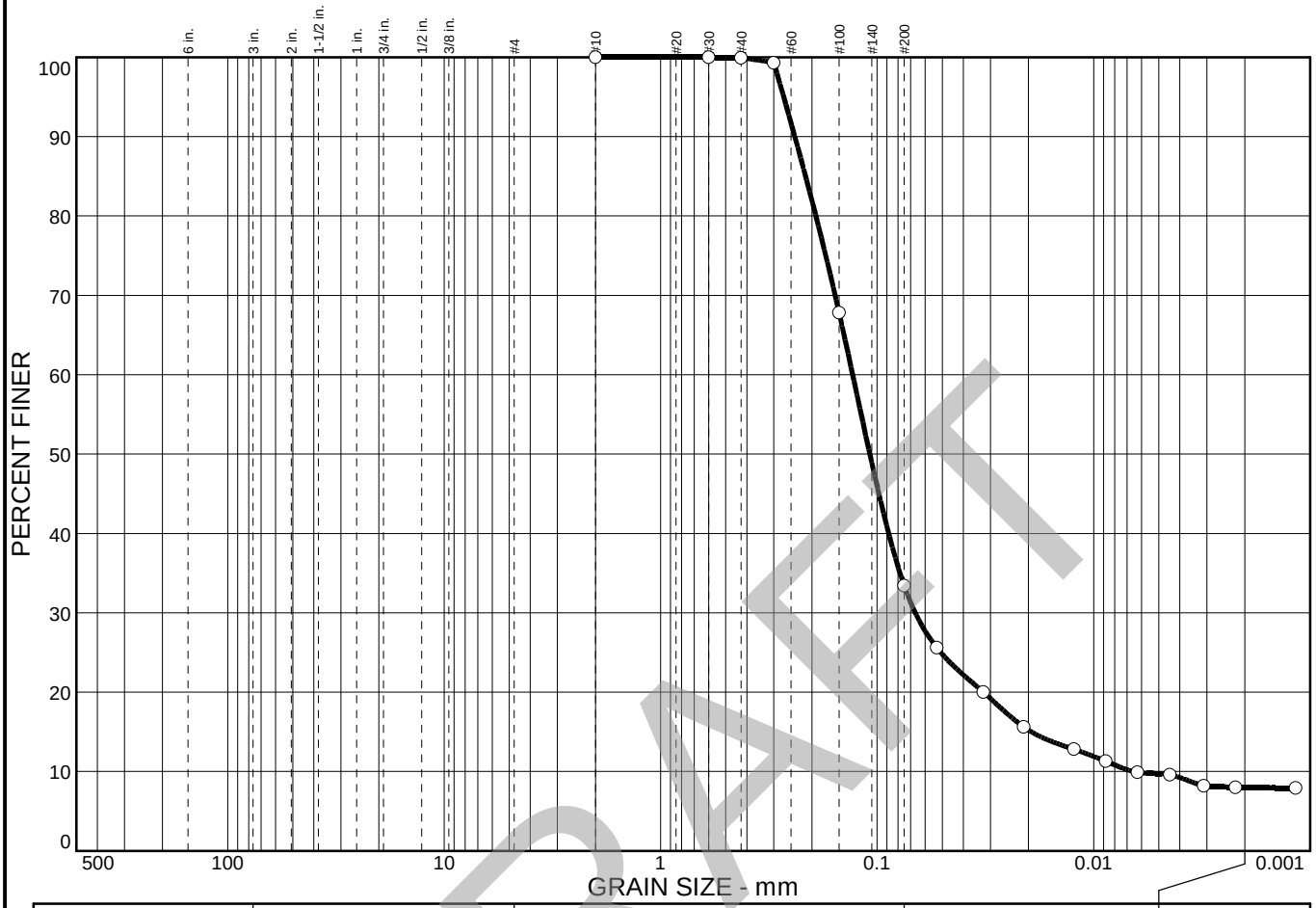
Remarks

Sample No.: **Source of Sample:** B-4-5 **Date:** 9/17/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	66.6	25.4	8.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	99.9		
#50	99.3		
#100	67.8		
#200	33.4		
#270	25.6		
0.0323 mm.	20.0		
0.0210 mm.	15.6		
0.0123 mm.	12.8		
0.0088 mm.	11.3		
0.0063 mm.	9.9		
0.0044 mm.	9.6		
0.0031 mm.	8.2		
0.0022 mm.	8.0		
0.0012 mm.	7.9		

* (no specification provided)

Soil Description

Olive Gray Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.214 D_{60}= 0.130 D_{50}= 0.108
D_{30}= 0.0667 D_{15}= 0.0194 D_{10}= 0.0065
C_u= 19.87 C_c= 5.25

Classification

USCS= AASHTO=

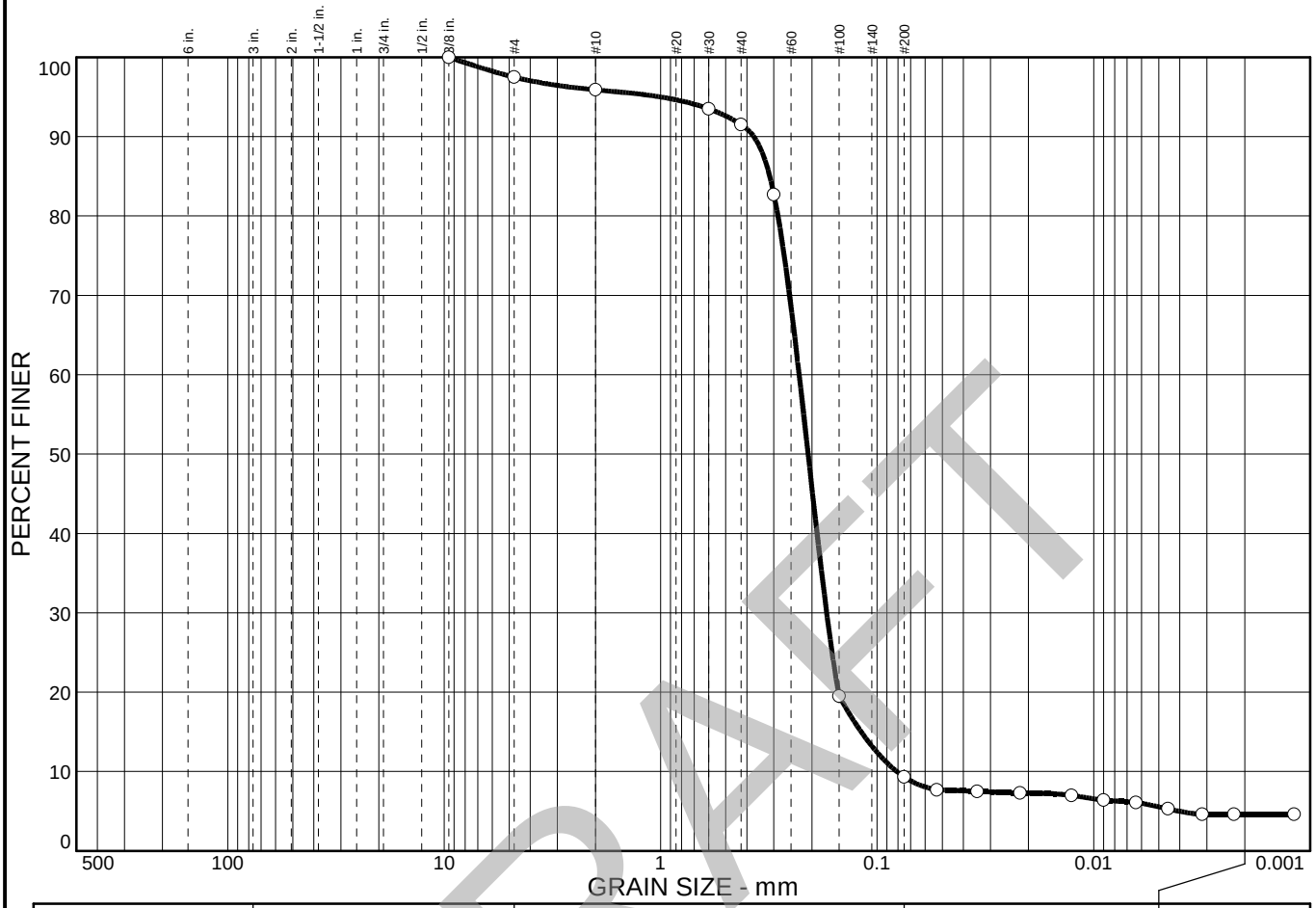
Remarks

Sample No.: **Source of Sample:** B-4-9 **Date:** 9/14/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	2.5	88.2	4.7	4.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	97.5		
#10	95.9		
#30	93.5		
#40	91.5		
#50	82.7		
#100	19.5		
#200	9.3		
#270	7.7		
0.0345 mm.	7.5		
0.0219 mm.	7.3		
0.0127 mm.	7.0		
0.0090 mm.	6.4		
0.0064 mm.	6.1		
0.0045 mm.	5.3		
0.0032 mm.	4.6		
0.0022 mm.	4.6		
0.0012 mm.	4.6		

* (no specification provided)

Soil Description

Reddish Brown Poorly Graded SAND w/ Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.314 D_{60}= 0.229 D_{50}= 0.209
D_{30}= 0.171 D_{15}= 0.119 D_{10}= 0.0812
C_u= 2.82 C_c= 1.57

Classification

USCS= AASHTO=

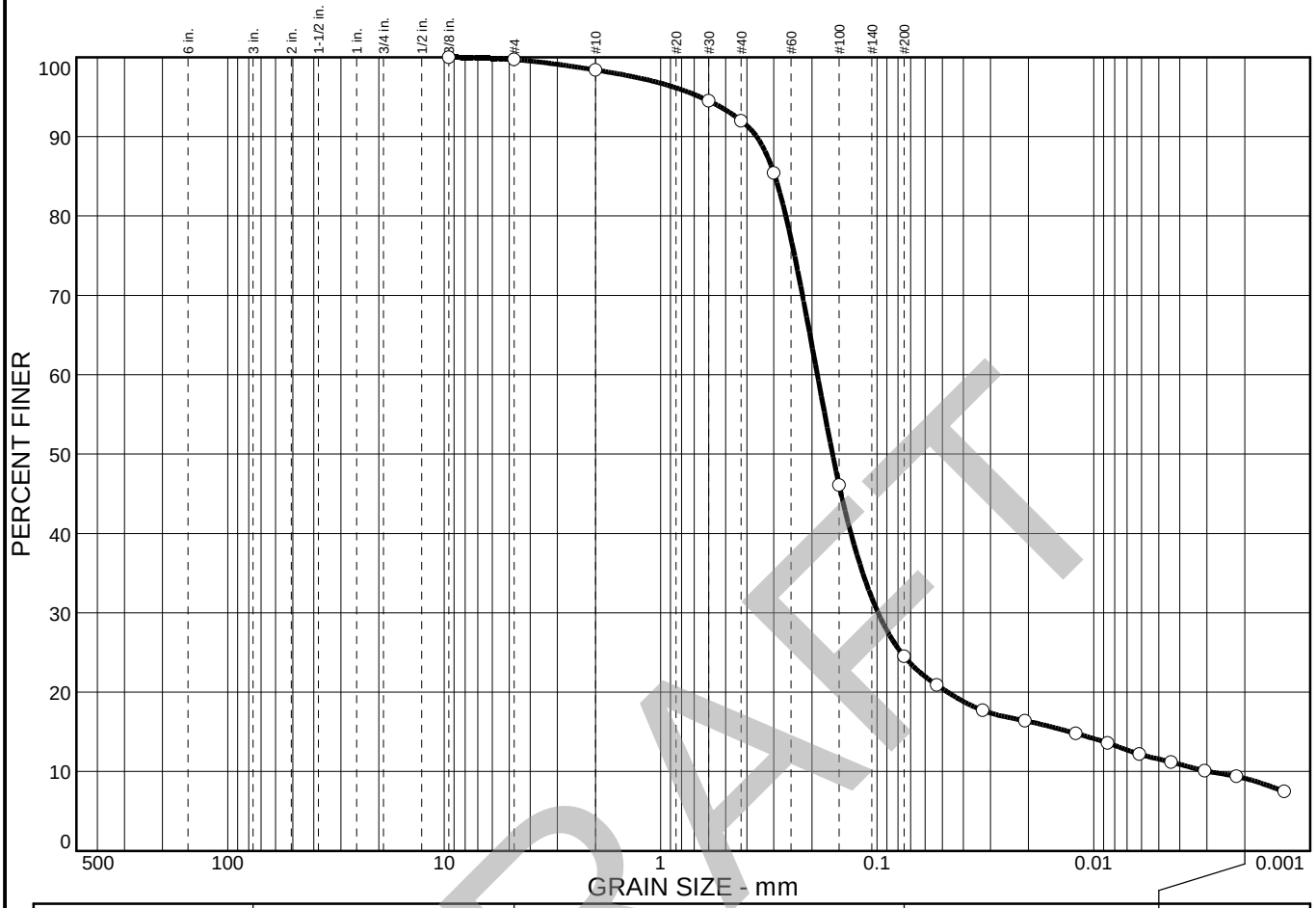
Remarks

Sample No.: **Source of Sample:** B-5-2 **Date:** 9/14/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.3	75.2	15.4	9.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.7		
#10	98.4		
#30	94.5		
#40	92.0		
#50	85.4		
#100	46.1		
#200	24.5		
#270	20.9		
0.0325 mm.	17.7		
0.0207 mm.	16.4		
0.0121 mm.	14.8		
0.0086 mm.	13.6		
0.0062 mm.	12.2		
0.0044 mm.	11.2		
0.0031 mm.	10.1		
0.0022 mm.	9.4		
0.0013 mm.	7.5		

* (no specification provided)

Soil Description

Dark Yellowish Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.297 D_{60}= 0.189 D_{50}= 0.161
D_{30}= 0.0991 D_{15}= 0.0129 D_{10}= 0.0029
C_u= 64.44 C_c= 17.68

Classification

USCS= AASHTO=

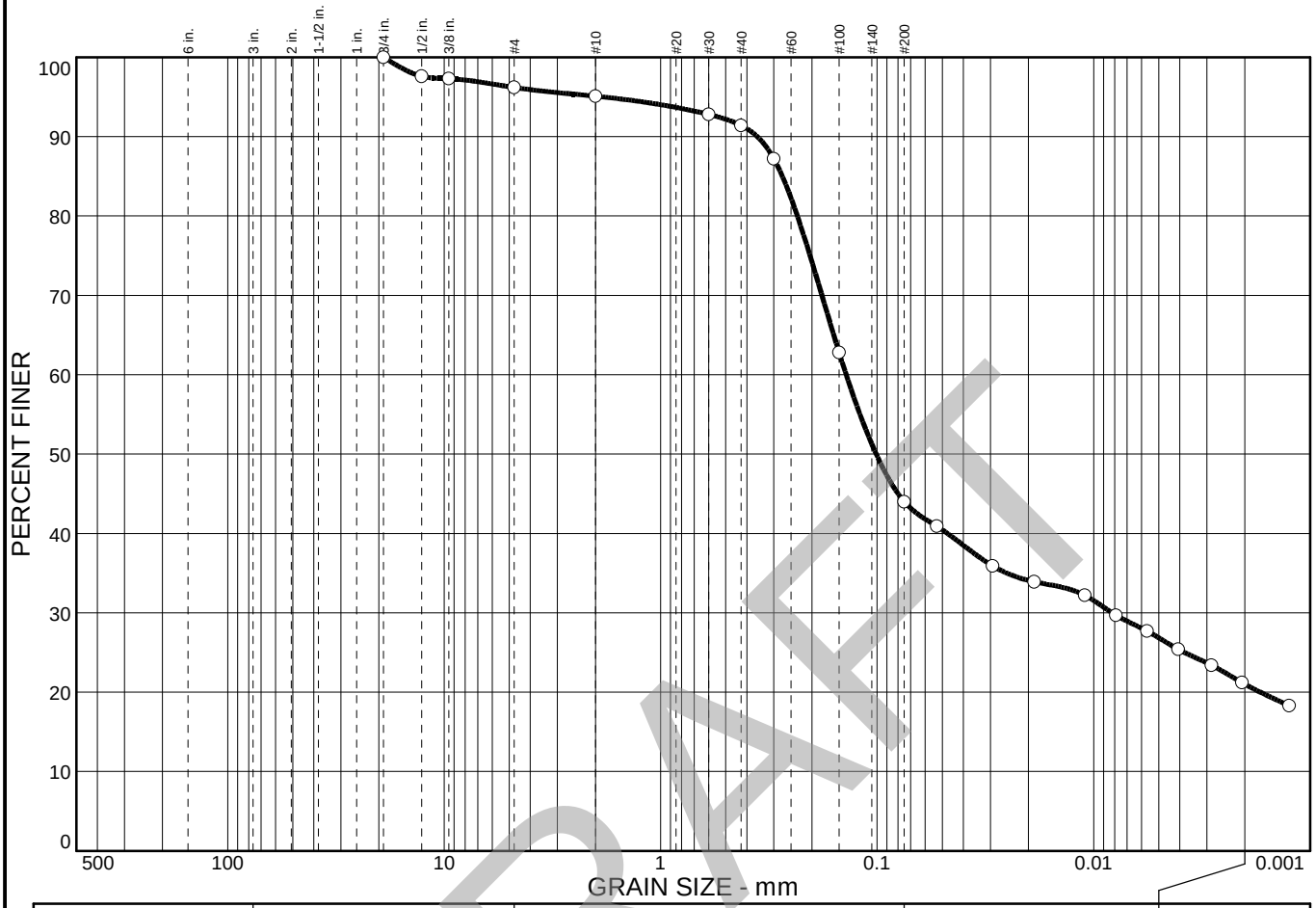
Remarks

Sample No.: **Source of Sample:** B-5-6 **Date:** 9/16/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	3.8	52.2	23.0	21.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
1/2 in.	97.6		
3/8 in.	97.3		
#4	96.2		
#10	95.1		
#30	92.8		
#40	91.4		
#50	87.2		
#100	62.8		
#200	44.0		
#270	40.9		
0.0293 mm.	35.9		
0.0188 mm.	33.9		
0.0110 mm.	32.2		
0.0079 mm.	29.7		
0.0057 mm.	27.7		
0.0041 mm.	25.4		
0.0029 mm.	23.4		
0.0021 mm.	21.2		
0.0012 mm.	18.3		

* (no specification provided)

Soil Description

Dark Grayish Brown Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.274 D_{60}= 0.139 D_{50}= 0.101
D_{30}= 0.0082 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

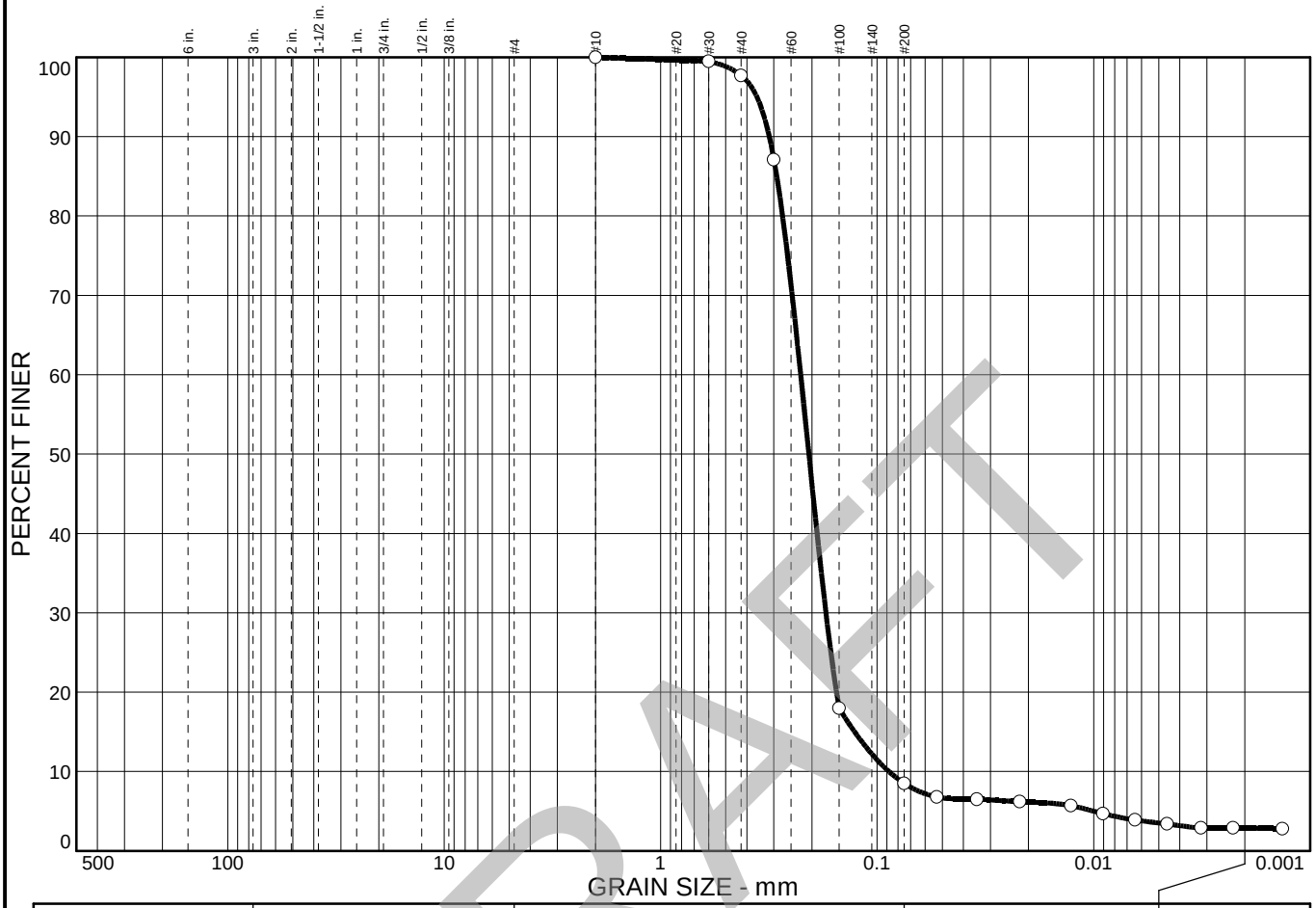
Remarks

Sample No.: **Source of Sample:** B-5-8 **Date:** 9/16/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	91.5	5.6	2.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.5		
#40	97.7		
#50	87.1		
#100	18.0		
#200	8.5		
#270	6.8		
0.0346 mm.	6.5		
0.0220 mm.	6.2		
0.0127 mm.	5.7		
0.0091 mm.	4.7		
0.0064 mm.	3.9		
0.0046 mm.	3.4		
0.0032 mm.	2.9		
0.0023 mm.	2.9		
0.0013 mm.	2.8		

* (no specification provided)

Soil Description

Yellowish Brown Poorly Graded SAND w/ Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.291 D_{60}= 0.226 D_{50}= 0.207
D_{30}= 0.173 D_{15}= 0.127 D_{10}= 0.0883
C_u= 2.56 C_c= 1.49

Classification

USCS= AASHTO=

Remarks

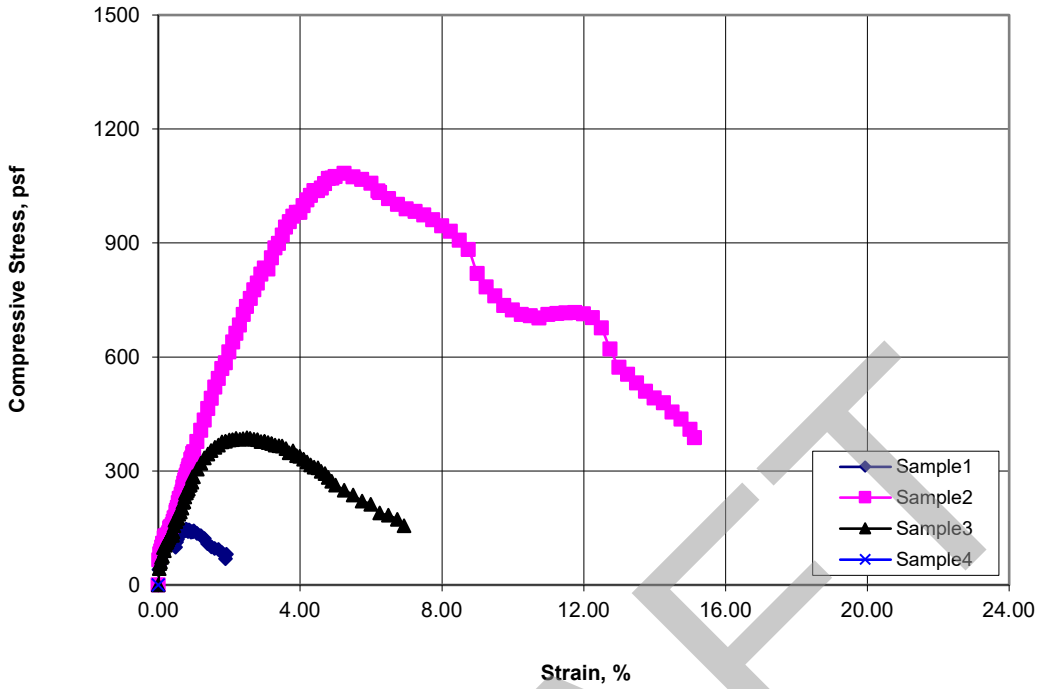
Sample No.: **Source of Sample:** B-6-2 **Date:** 9/16/21
Location: **Elev./Depth:**

COOPER TESTING LABORATORY

Client: McMillen Jacobs Associates
Project: 6231
Project No: 1022-034 **Figure**

Unconfined Compressive Strength

ASTM D2166



Sample No.:	1	2	3	4	
Unconfined Compressive Strength, psf	146	1083	388		
Unconfined Compressive Strength, psi	1.0	7.5	2.7		
Undrained Shear Strength, psf	73	541	194		
Failure Strain, %	0.8	5.2	2.5		
Strain Rate, % per minute	1.0	1.0	1.0		
Strain Rate, inches/minute	0.05	0.05	0.05		
Moisture Content, %	7.9	40.3	14.9		
Dry Density, pcf	90.4	79.2	103.6		
Saturation, %	24.5	96.4	64.3		
Void Ratio	0.864	1.129	0.627		
Specimen Diameter, inches	2.409	2.390	2.390		
Specimen Height, inches	5.00	4.98	5.00		
Height to Diameter Ratio	2.1	2.1	2.1		
Assumed Specific Gravity	2.70	2.70	2.70		

Sample Location

	Boring	Sample	Depth, ft.	Soil Description
1	B-2-4b		11-11.5	Yellowish Brown Silty SAND
2	B-3-4b		8-8.5	Black Sandy CLAY
3	B-5-10		34-34.5	Dark Yellowish Brown Silty SAND
4				

Job No.:	1022-034	**Type of Sample**	Undisturbed
Client:	McMillen Jacobs Associates		
Project:	6231		
Date:	9/9/2021 **By:** MD/RU		

Remarks:

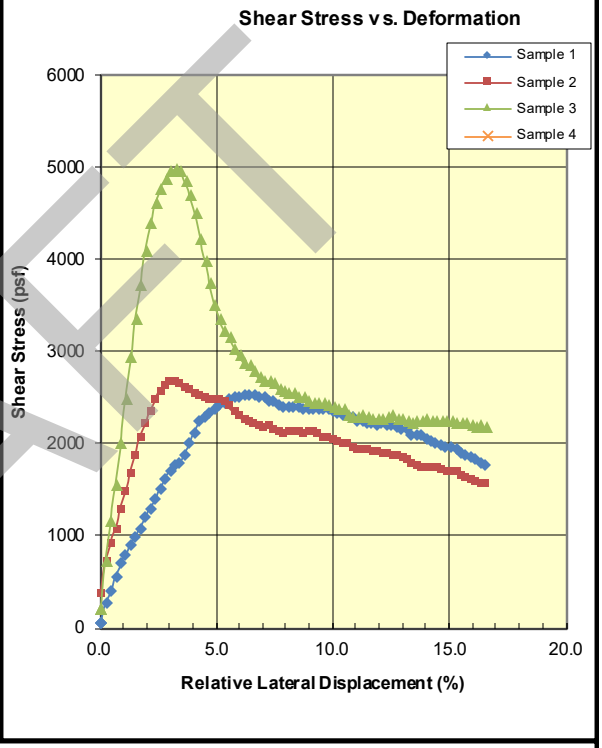
COOPER TESTING LABORATORY

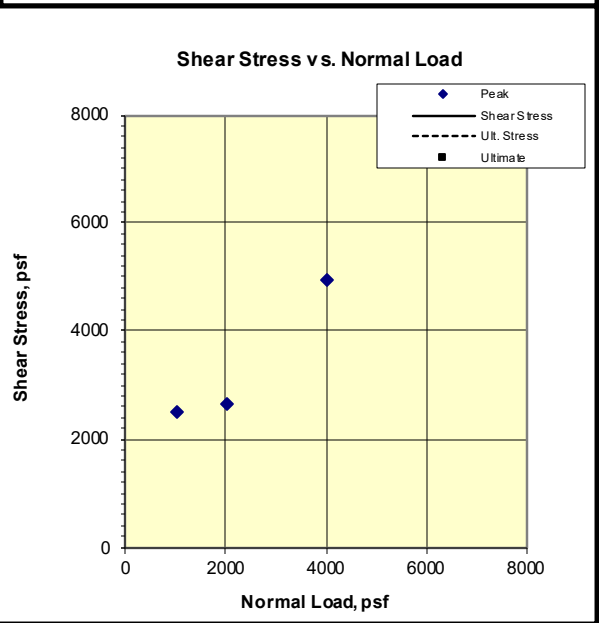
Consolidated Undrained Direct Shear (ASTM D3080M)

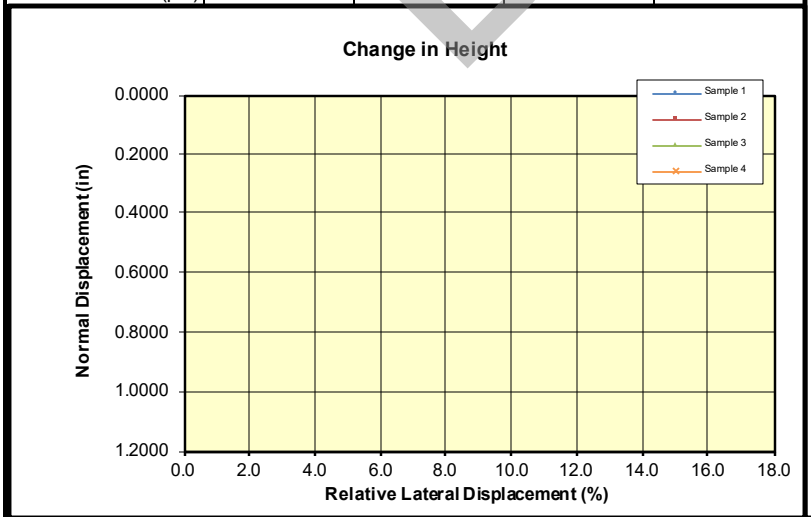
CTL Job #:	1022-034	Project #:	6231	By:	MD
Client:	McMillen Jacobs Associates	Date:	9/9/2021	Checked:	PJ
Project Name:		Remolding Info:			

Specimen Data				
	1	2	3	4
Boring:	B-1-3b	B-1-3b	B-1-3b	
Sample:				
Depth (ft):				
Visual Description:	Gray Silty SAND	Gray Silty SAND	Gray Silty SAND	
Normal Load (psf)	1000	2000	4000	
Dry Mass of Specimen (g)	117.3	119.5	118.7	
Initial Height (in)	1.00	1.01	1.00	
Initial Diameter (in)	2.42	2.42	2.42	
Initial Void Ratio	0.735	0.716	0.713	
Initial Moisture (%)	23.8	23.4	23.4	
Initial Wet Density (pcf)	120.3	121.2	121.4	
Initial Dry Density (pcf)	97.1	98.2	98.4	
Initial Saturation (%)	87.6	88.2	88.4	
ΔHeight Consol (in)	0.0125	0.0149	0.0183	
At Test Void Ratio	0.713	0.691	0.682	
At Test Moisture (%)	24.3	23.6	23.2	
At Test Wet Density (pcf)	122.3	123.2	123.5	
At Test Dry Density (pcf)	98.4	99.7	100.2	
At Test Saturation (%)	92.0	92.1	91.9	
Strain Rate (%/min)	1.1	1.0	1.1	
Strengths Picked at	Peak	Peak	Peak	
Shear Stress (psf)	2530	2680	4975	
ΔHeight (in) at Peak				
Ultimate Stress (psf)				

Phi (deg)		Ult. Phi (deg)	
Cohesion (psf)		Ult. Cohesion (psf)	







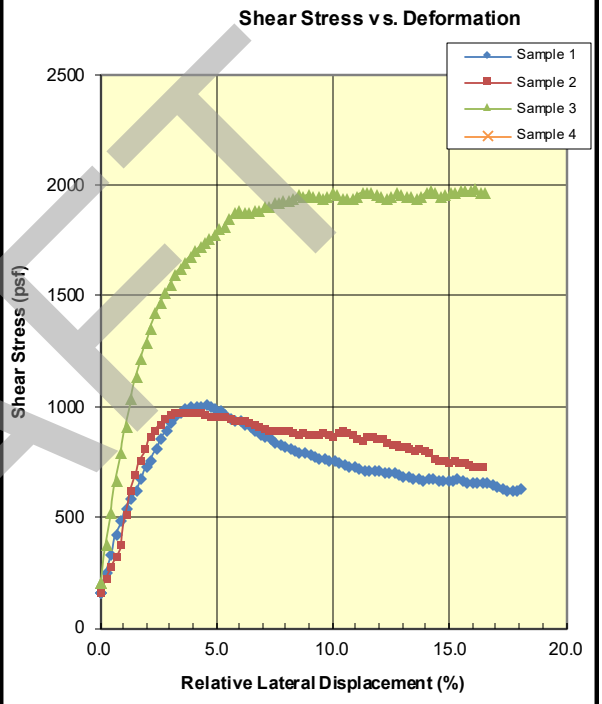
Remarks: *DS-CU* A fully undrained condition may not be attained in this test. ΔH is not measured during undrained direct shear tests. Engineering judgement is required to determine phi and cohesion, no phi or cohesion is reported. To add phi and cohesion to the report go to the "phi" tab and in cells G30, G31, H30, and H31 enter end points for a line through the 3 data points. The points plotted can be changed on the "Eng Values" tab using cells L6, A2, C2, and E2.

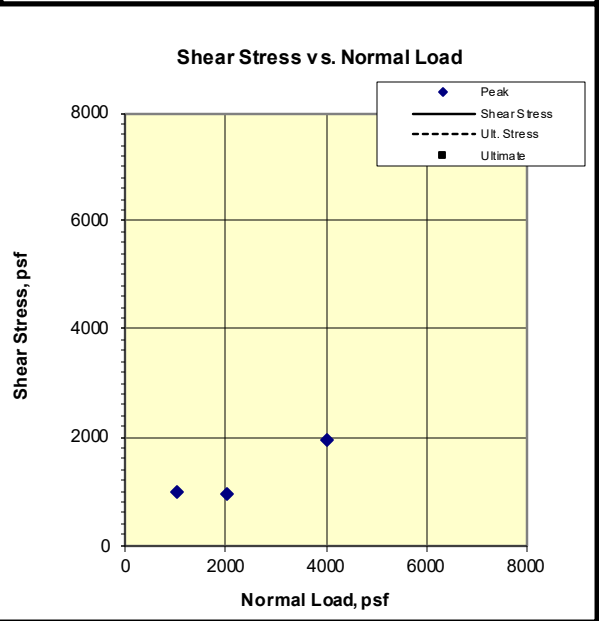
Consolidated Undrained Direct Shear (ASTM D3080M)

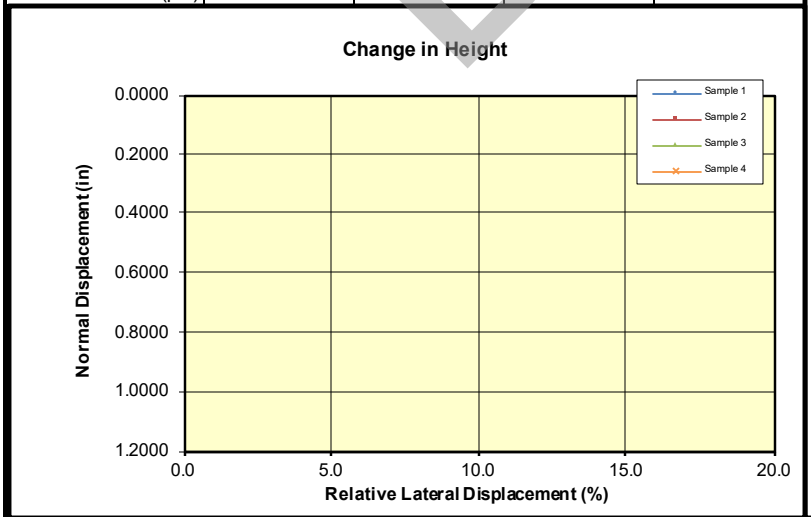
CTL Job #:	1022-034	Project #:	6231	By:	MD
Client:	McMillen Jacbos Associates	Date:	9/9/2021	Checked:	PJ
Project Name:		Remolding Info:			

Specimen Data				
	1	2	3	4
Boring:	B-4-6a	B-4-6a	B-4-6a	
Sample:				
Depth (ft):				
Visual Description:	Gray Sandy CLAY	Gray Sandy CLAY	Gray Sandy CLAY	
Normal Load (psf)	1000	2000	4000	
Dry Mass of Specimen (g)	85.9	88.5	94.6	
Initial Height (in)	1.01	1.01	1.00	
Initial Diameter (in)	2.42	2.42	2.42	
Initial Void Ratio	1.383	1.326	1.149	
Initial Moisture (%)	46.3	44.6	36.9	
Initial Wet Density (pcf)	103.5	104.8	107.4	
Initial Dry Density (pcf)	70.7	72.5	78.4	
Initial Saturation (%)	90.4	90.8	86.7	
ΔHeight Consol (in)	0.0198	0.0411	0.0786	
At Test Void Ratio	1.336	1.231	0.980	
At Test Moisture (%)	46.7	44.1	34.8	
At Test Wet Density (pcf)	105.9	108.9	114.7	
At Test Dry Density (pcf)	72.2	75.5	85.1	
At Test Saturation (%)	94.4	96.8	95.8	
Strain Rate (%/min)	1.2	1.0	1.1	
Strengths Picked at	Peak	Peak	Peak	
Shear Stress (psf)	1008	974	1979	
ΔHeight (in) at Peak				
Ultimate Stress (psf)				

Phi (deg)		Ult. Phi (deg)	
Cohesion (psf)		Ult. Cohesion (psf)	







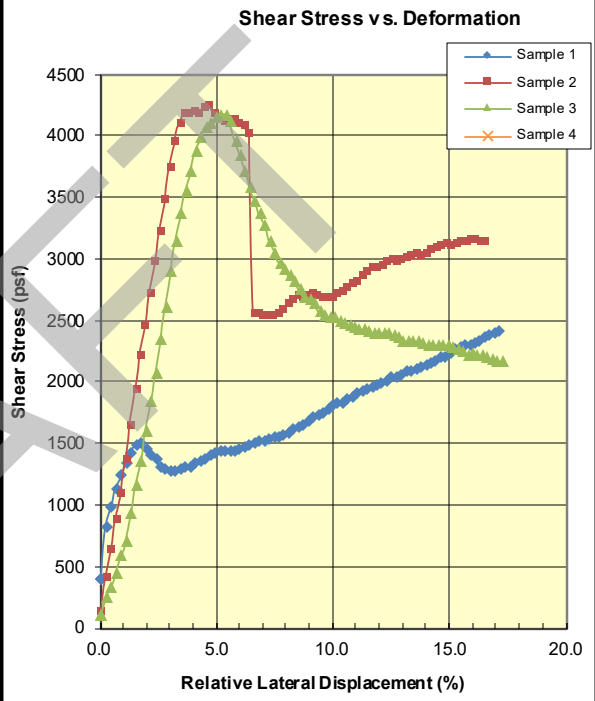
Remarks: *DS-CU* A fully undrained condition may not be attained in this test. ΔH is not measured during undrained direct shear tests. Engineering judgement is required to determine phi and cohesion, no phi or cohesion is reported. To add phi and cohesion to the report go to the "phi" tab and in cells G30, G31, H30, and H31 enter end points for a line through the 3 data points. The points plotted can be changed on the "Eng Values" tab using cells L6, A2, C2, and E2.

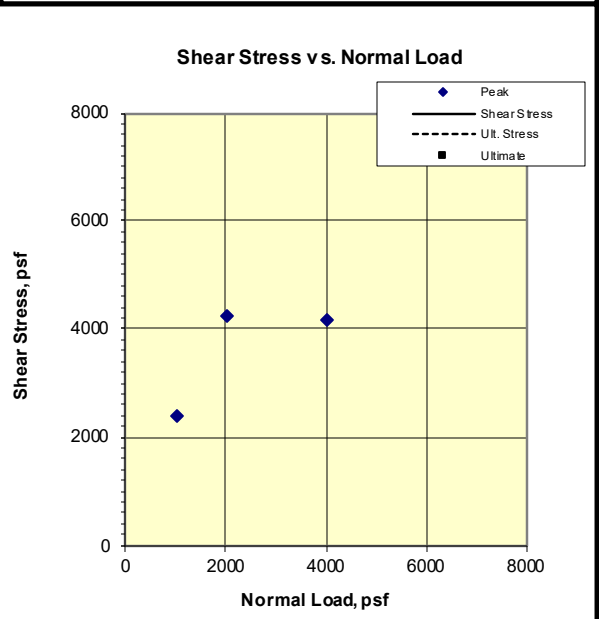
Consolidated Undrained Direct Shear (ASTM D3080M)

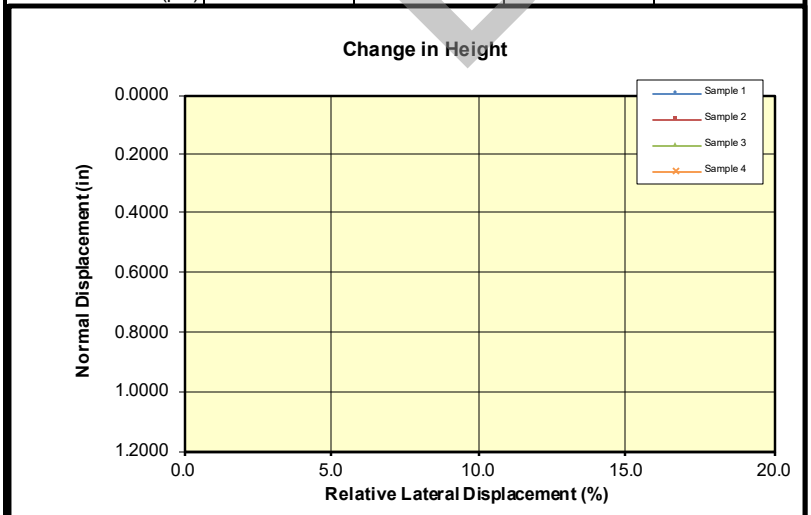
CTL Job #:	1022-034	Project #:	6231	By:	MD
Client:	McMillen Jacobs Associates	Date:	9/10/2021	Checked:	PJ
Project Name:		Remolding Info:			

Phi (deg)		Ult. Phi (deg)	
Cohesion (psf)		Ult. Cohesion (psf)	

Specimen Data				
	1	2	3	4
Boring:	B-5-5b	B-5-5b	B-5-5b	
Sample:				
Depth (ft):				
Visual Description:	Olive Gray Sandy SILT	Olive Gray Sandy SILT	Olive Gray Sandy SILT	
Normal Load (psf)	1000	2000	4000	
Dry Mass of Specimen (g)	61.1	62.7	65.2	
Initial Height (in)	1.00	1.00	1.02	
Initial Diameter (in)	2.42	2.42	2.42	
Initial Void Ratio	2.338	2.251	2.185	
Initial Moisture (%)	79.3	78.2	75.6	
Initial Wet Density (pcf)	90.6	92.4	92.9	
Initial Dry Density (pcf)	50.5	51.9	52.9	
Initial Saturation (%)	91.6	93.8	93.4	
ΔHeight Consol (in)	0.0069	0.0097	0.0233	
At Test Void Ratio	2.315	2.219	2.112	
At Test Moisture (%)	81.7	79.3	77.3	
At Test Wet Density (pcf)	92.4	93.9	96.0	
At Test Dry Density (pcf)	50.9	52.4	54.2	
At Test Saturation (%)	95.3	96.5	98.8	
Strain Rate (%/min)	1.0	1.0	1.1	
Strengths Picked at	Peak	Peak	Peak	
Shear Stress (psf)	2414	4255	4176	
ΔHeight (in) at Peak				
Ultimate Stress (psf)				







Remarks: *DS-CU* A fully undrained condition may not be attained in this test. ΔH is not measured during undrained direct shear tests. Engineering judgement is required to determine phi and cohesion, no phi or cohesion is reported. To add phi and cohesion to the report go to the "phi" tab and in cells G30, G31, H30, and H31 enter end points for a line through the 3 data points. The points plotted can be changed on the "Eng Values" tab using cells L6, A2, C2, and E2.

Corrosivity Test Summary

CTL # 1022-034 **Date:** 9/16/2021 **Tested By:** PJ **Checked:** PJ

Client: McMillen Jacobs Associates **Project:** **Proj. No:** 6231

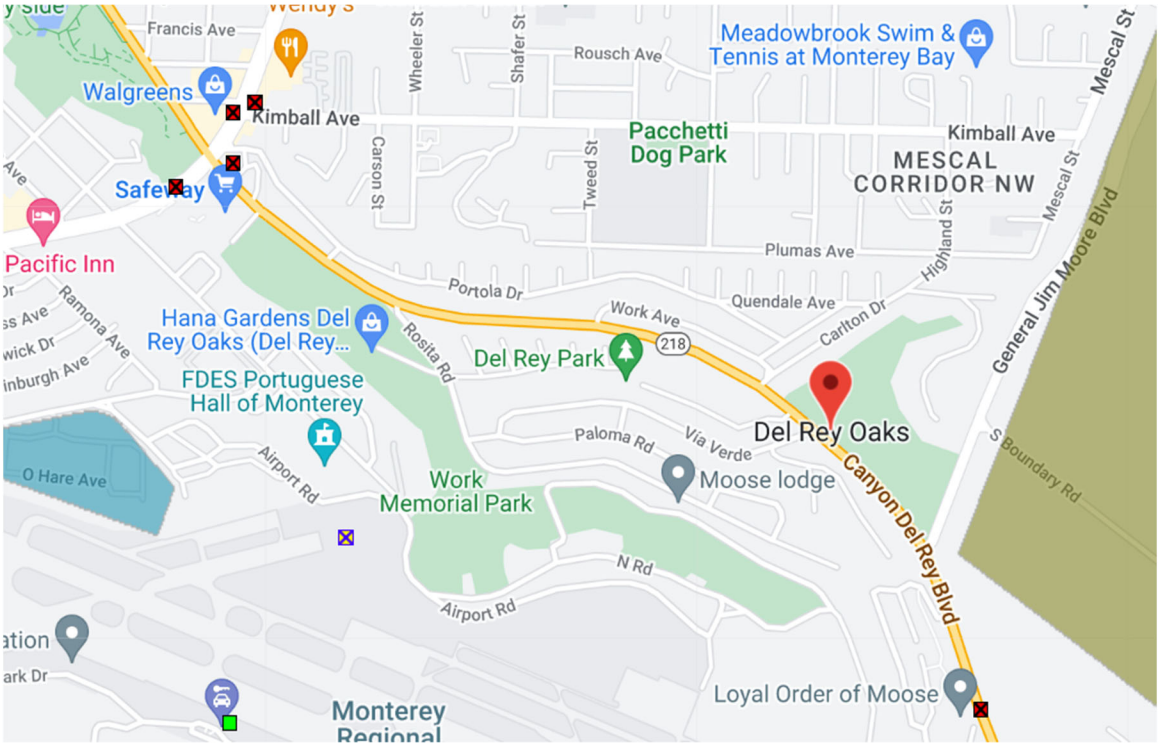
Remarks:

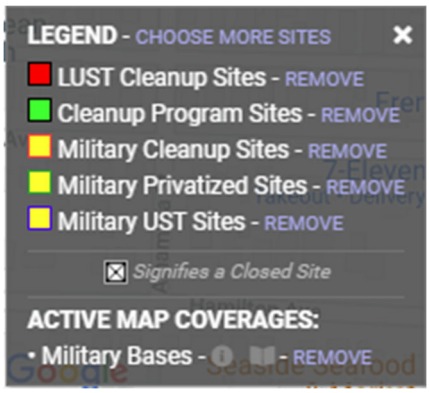
Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg	mg/kg	%		(Redox)	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		mv	%	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
B-4-5	-	-	-	1908	-	29	417	0.0417	7.1	-	2.8	Black Silty SAND

Attachment D

Underground Hazards

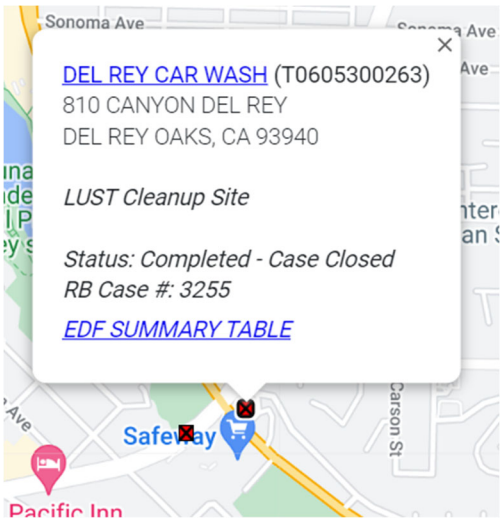
Map of Nearby USTs, Hazardous Waste Sites, and Cleanup Sites

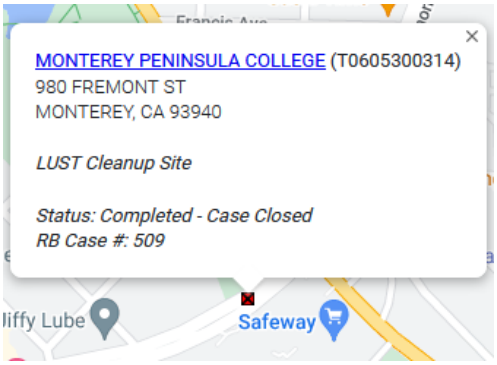




There are no identified USTs, or hazardous waste sites within 200' of the proposed Stormwater Control Measures.

The following cleanup sites are located within 200' of the work area:





Source: https://geotracker.waterboards.ca.gov/

Accessed: 6/28/22

National Flood Hazard Layer FIRMette

FEMA

121°50'29"W 36°35'52"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

121°49'52"W 36°35'23"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

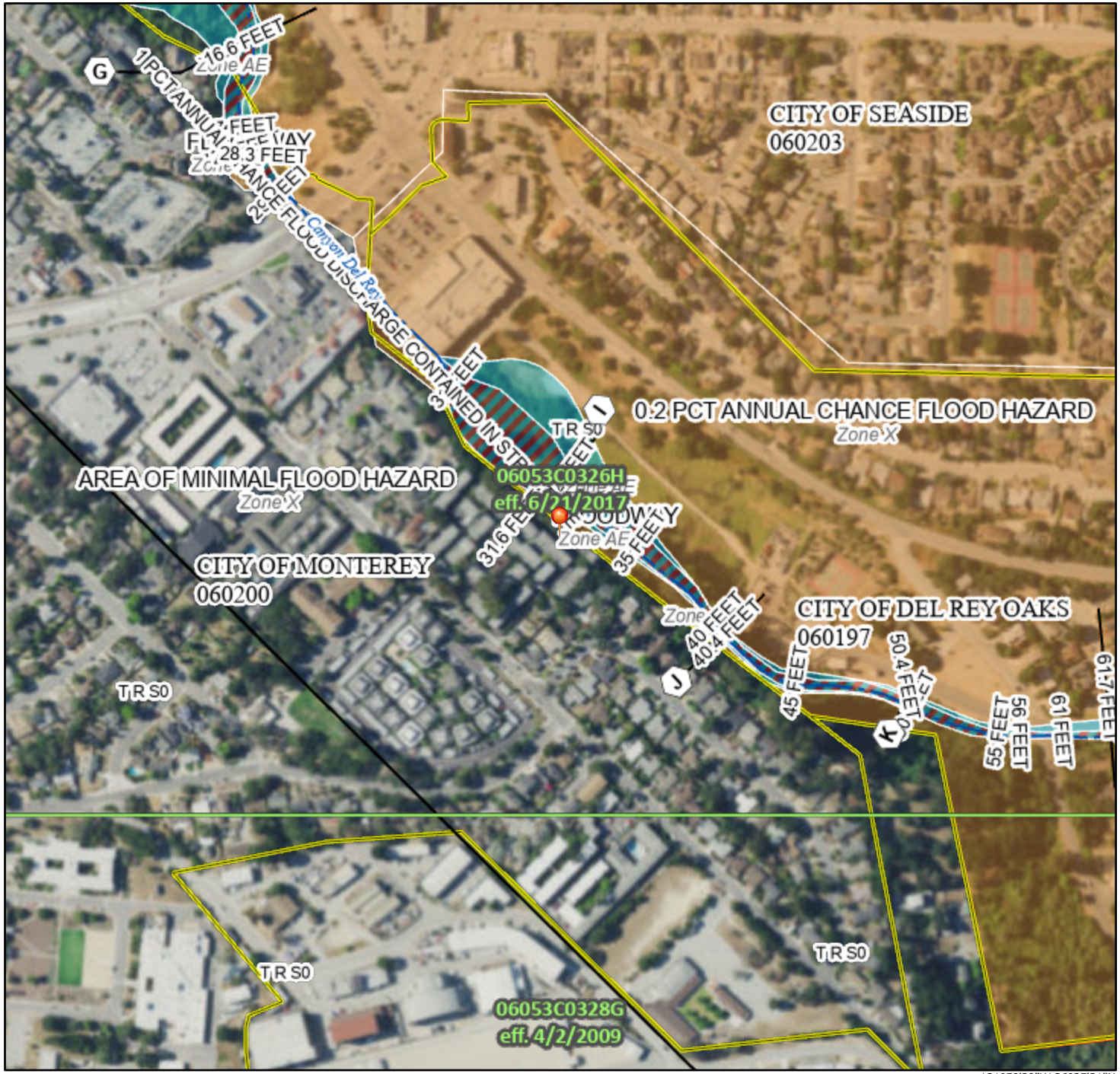
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/14/2022 at 11:40 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette

FEMA

121°51'16"W 36°35'59"N



121°50'39"W 36°35'31"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

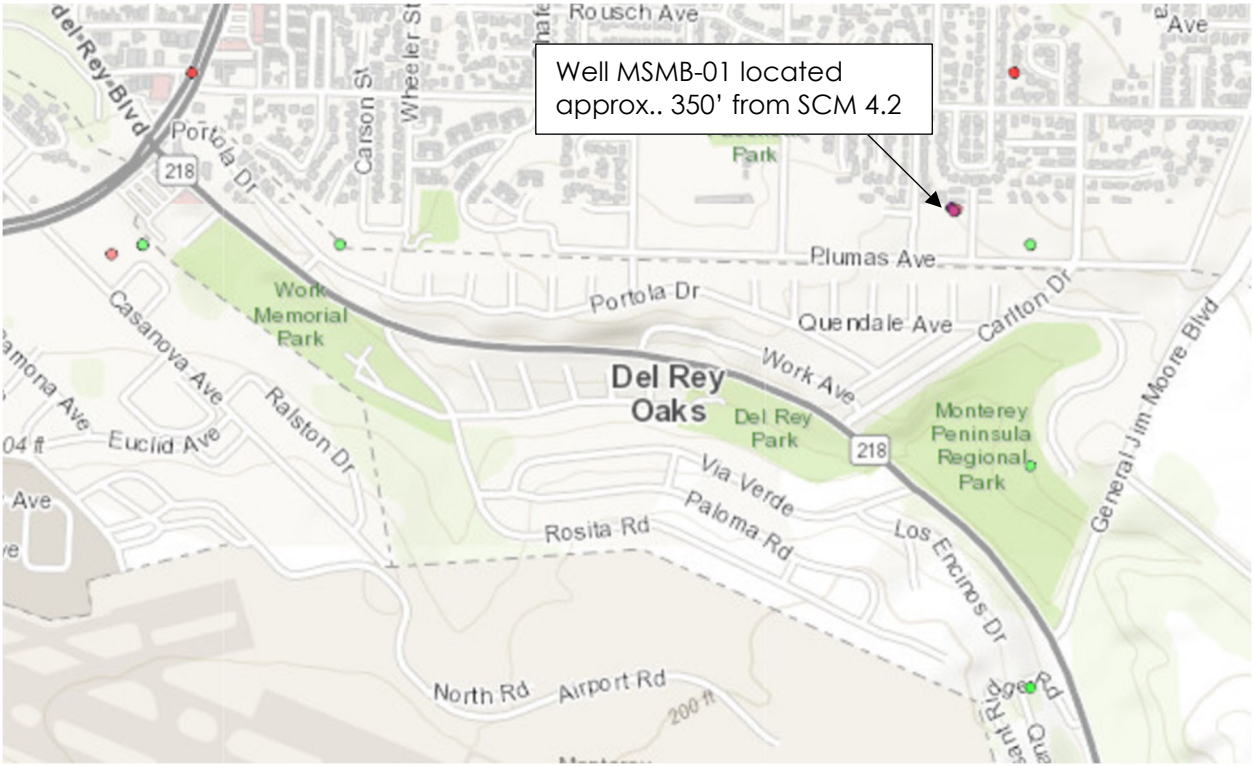
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/9/2022 at 1:18 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Map of Nearby Domestic Water Wells

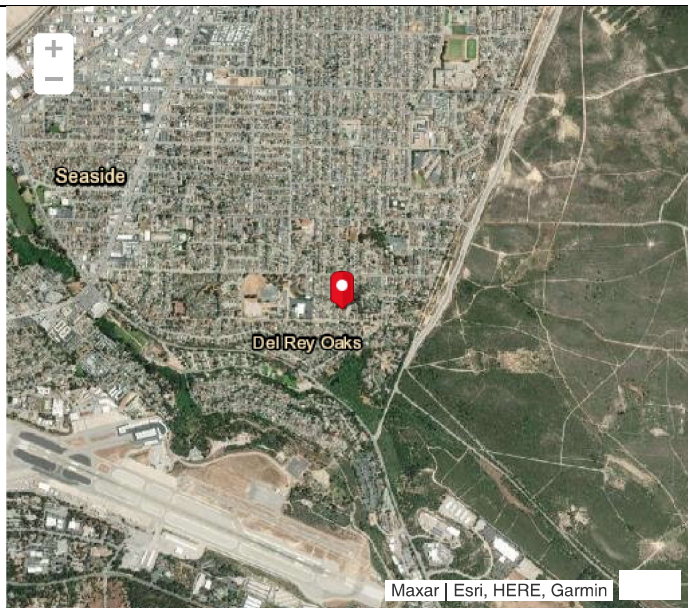


No water wells are located within 200' of the proposed stormwater control measures.

Source: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer
Accessed: 6/28/2022

GAMA Well: MSMB-01

Well ID: MSMB-01
Latitude: 36.59775
Longitude: -121.834556
Well Category: MUNICIPAL
Dataset Name: GAMA_USGS
County: MONTEREY
DWR Basin: SALINAS VALLEY - SEASIDE (3-004.08)
Regional Board: CENTRAL COAST
Senate District: 17
HVA:
GAMA Study Area: MONTEREY/SALINAS
Assembly District: 29
Underlying GSA:
Hydrologic Region: Central Coast



GAMA Well Data

View GAMA Opendata Table

No Data has been found for this well.

Note: this is a public domestic well owned by California-American Water Co., located approximately 250' north of the north right-of-way of Plumas Ave. and approximately 350' from SCM 4.2.

Attachment E

DMA Exhibit and Table

Drainage Management Areas (sq. ft.)

DMA No. -->	PM0.005A	PM0.005B	PM0.005C	PM0.020	PM0.118	PM0.273	PM0.927	PM0.916	PM0.932	PM0.941	1500	5700	6000
Project Area (New + Replaced Areas)	**2,800**	**300**	**400**	**13,600**	**1,000**	**-**	**8,400**	**9,100**	**15,400**	**8,700**	**1,800**	**13,600**	**1,600**
New Impervious Area	1,400			2,300	100		1,500	1,300	1,500	4,500	400		
Replaced Impervious Area	1,400	300	400	9,600	100		6,900	4,200	11,000		1,400		
New Pervious Area									2,900				
Replaced Pervious Area				1,700				3,600		4,200		13,600	1,600
SCM Area (New Pervious Area)													
SCM Area (Replaced Pervious Area)					800								
Existing Areas to Remain (Outside Project Area)	**-**	**-**	**-**	**-**	**15,600**	**516,900**	**129,200**	**-**	**19,100**	**22,500**	**5,200**	**78,500**	**46,700**
Impervious Area to Remain	-	-	-	-	12,600	251,700	75,200		4,100	20,000	5,000	4,700	4,700
Pervious Area to Remain	-	-	-	-	3,000	265,200	54,000		15,000	2,500	200	73,800	42,000
Totals - Pre-Project	**2,800**	**300**	**400**	**13,600**	**16,600**	**516,900**	**137,600**	**9,100**	**34,500**	**31,200**	**7,000**	**92,100**	**48,300**
Total Impervious Area	**1,400**	**300**	**400**	**9,600**	**12,700**	**251,700**	**82,100**	**4,200**	**18,000**	**20,000**	**6,400**	**4,700**	**4,700**
Total Pervious Area	**1,400**	**-**	**-**	**4,000**	**3,900**	**265,200**	**55,500**	**4,900**	**16,500**	**11,200**	**500**	**87,400**	**43,600**
Pre-Project Imperviousness (Project Area Only)	**50%**	**100%**	**100%**	**71%**	**10%**		**82%**	**46%**	**90%**	**0%**	**78%**	**0%**	**0%**
Totals - Post-Project	**2,800**	**300**	**400**	**13,600**	**16,600**	**516,900**	**137,600**	**9,100**	**34,500**	**31,200**	**7,000**	**92,100**	**48,300**
Total New + Replaced Impervious Area	**2,800**	**300**	**400**	**11,900**	**200**	**-**	**8,400**	**5,500**	**12,500**	**4,500**	**1,800**	**-**	**-**
Total Impervious Area	**2,800**	**300**	**400**	**11,900**	**12,800**	**251,700**	**83,600**	**5,500**	**16,600**	**24,500**	**6,800**	**4,700**	**4,700**
Total Pervious Area (including SCM Area)	**-**	**-**	**-**	**1,700**	**3,800**	**265,200**	**54,000**	**3,600**	**17,900**	**6,700**	**200**	**87,400**	**43,600**
Pre-Project Imperviousness (Project Area Only)	**100%**	**100%**	**100%**	**88%**	**20%**		**100%**	**60%**	**81%**	**52%**	**100%**	**0%**	**0%**
Total Impervious + SCM Area *	**2,800**	**300**	**400**	**11,900**	**13,600**	**251,700**	**83,600**	**5,500**	**16,600**	**24,500**	**6,800**	**4,700**	**4,700**
Total Pervious Area - SCM Area *	**-**	**-**	**-**	**1,700**	**3,000**	**265,200**	**54,000**	**3,600**	**17,900**	**6,700**	**200**	**87,400**	**43,600**

*SCM surface area is treated as if it were impervious for Tier 4 calculations

= Self Treating Area

Summary and Calculations (sq. ft.)

DMA No. -->	PM0.005A	PM0.005B	PM0.005C	PM0.020	PM0.118	PM0.273	PM0.927	PM0.916	PM0.932	PM0.941	1500	5700	6000
Total New + Replaced Impervious Area (ft^2)	2,800	300	400	11,900	200	0	8,400	5,500	12,500	4,500	1,800	0	0
Exempt New + Replaced Impervious Area (ft^2)				2,100	100		2,100		6,200		1,400		
Exemption				B.1.b.ii.	B.1.b.i.		B.1.b.i.		B.1.b.i.		B.1.b.i.		
PCR 2: New + Replaced Impervious Area Subject to PCRs (ft^2)	2,800	300	400	9,800	100		6,300	5,500	6,300	4,500	400		
PCR 3: New + 50% of Replaced Impervious Area Subject to PCRs (ft^2)	2,100	150	200	5,000	50		2,850	3,400	800	4,500	1,100		
PCR 2 Mitigated Impervious Area (ft2)					**12,800**							**4,700**	
PCR 3 Mitigated Impervious Area (ft2)					**12,800**							**4,700**	
Drains to SCM:					#2d							#2d	

Exemption			
B.1.b.i.	Road and parking lot maintenance	98	CN, impervious areas
B.1.b.ii.	Sidewalk and bicycle path or lane projects	45	CN, landscape areas
		76	CN, gravel areas

Areas in Sq. Mi., for input into HEC-HMS

DMA No. -->	PM0.005A	PM0.005B	PM0.005C	PM0.020	PM0.118	PM0.273	PM0.927	PM0.916	PM0.932	PM0.941	1500	5700	6000
Totals for Tier 4 Analysis - Pre-Project	**0.000100**			**0.000488**	**0.000595**		**0.004936**	**0.000326**	**0.001238**	**0.001119**	**0.000251**	**0.003304**	
Total Impervious Area	**0.000050**			**0.000344**	**0.000456**		**0.002945**	**0.000151**	**0.000646**	**0.000717**	**0.000230**	**0.000169**	
Total Pervious Area	**0.000050**			**0.000143**	**0.000140**		**0.001991**	**0.000176**	**0.000592**	**0.000402**	**0.000018**	**0.003135**	
Totals for Tier 4 Analysis - Post-Project	**0.000100**			**0.000488**	**0.000595**		**0.004936**	**0.000326**	**0.001238**	**0.001119**	**0.000251**	**0.003304**	
Total Impervious + SCM Area *	**0.000100**			**0.000427**	**0.000488**		**0.002999**	**0.000197**	**0.000595**	**0.000879**	**0.000244**	**0.000169**	
Total Pervious Area - SCM Area *	**-**			**0.000061**	**0.000108**		**0.001937**	**0.000129**	**0.000642**	**0.000240**	**0.000007**	**0.003135**	

*SCM surface area is treated as if it were impervious for Tier 4 calculations.

GREEN =DMAs combined in HEC-HMS model for simplicity.

27,878,400 s.f. per sq. mile

Drainage Management Areas (sq. ft.)

DMA No. -->	6400	24340	24400	24430	24450	25230	25250	25340	30000	30050	30150	30500	30900
Project Area (New + Replaced Areas)	**14,200**	**-**	**800**	**-**	**14,500**	**1,400**	**-**	**10,400**	**5,200**	**3,900**	**500**	**2,500**	**300**
New Impervious Area	1,200				3,100	200		1,100	1,100	3,900		2,500	
Replaced Impervious Area	11,900		800		11,400	1,200		9,300	3,300		500		300
New Pervious Area													
Replaced Pervious Area	1,100												
SCM Area (New Pervious Area)													
SCM Area (Replaced Pervious Area)													
Existing Areas to Remain (Outside Project Area)	**-**	**33,300**	**239,200**	**120,200**	**65,600**	**64,800**	**362,300**	**801,000**	**800**	**6,800**	**-**	**3,500**	**-**
Impervious Area to Remain		27,400	163,600	74,700	33,400	41,300	152,700	450,000	800				
Pervious Area to Remain		5,900	75,600	45,500	32,200	23,500	209,600	351,000		6,800		3,500	
Totals - Pre-Project	**14,200**	**33,300**	**240,000**	**120,200**	**80,100**	**66,200**	**362,300**	**811,400**	**6,000**	**10,700**	**500**	**6,000**	**300**
Total Impervious Area	**11,900**	**27,400**	**164,400**	**74,700**	**44,800**	**42,500**	**152,700**	**459,300**	**4,100**	**-**	**500**	**-**	**300**
Total Pervious Area	**2,300**	**5,900**	**75,600**	**45,500**	**35,300**	**23,700**	**209,600**	**352,100**	**1,900**	**10,700**	**-**	**6,000**	**-**
Pre-Project Imperviousness (Project Area Only)	**84%**		**100%**		**79%**	**86%**		**89%**	**63%**	**0%**	**100%**	**0%**	**100%**
Totals - Post-Project	**14,200**	**33,300**	**240,000**	**120,200**	**80,100**	**66,200**	**362,300**	**811,400**	**6,000**	**10,700**	**500**	**6,000**	**300**
Total New + Replaced Impervious Area	**13,100**	**-**	**800**	**-**	**14,500**	**1,400**	**-**	**10,400**	**4,400**	**3,900**	**500**	**2,500**	**300**
Total Impervious Area	**13,100**	**27,400**	**164,400**	**74,700**	**47,900**	**42,700**	**152,700**	**460,400**	**5,200**	**3,900**	**500**	**2,500**	**300**
Total Pervious Area (including SCM Area)	**1,100**	**5,900**	**75,600**	**45,500**	**32,200**	**23,500**	**209,600**	**351,000**	**800**	**6,800**	**-**	**3,500**	**-**
Pre-Project Imperviousness (Project Area Only)	**92%**		**100%**		**100%**	**100%**		**100%**	**85%**	**100%**	**100%**	**100%**	**100%**
Total Impervious + SCM Area *	**13,100**	**27,400**	**164,400**	**74,700**	**47,900**	**42,700**	**152,700**	**460,400**	**5,200**	**3,900**	**500**	**2,500**	**300**
Total Pervious Area - SCM Area *	**1,100**	**5,900**	**75,600**	**45,500**	**32,200**	**23,500**	**209,600**	**351,000**	**800**	**6,800**	**-**	**3,500**	**-**

*SCM surface area is treated as if it were impervious for Tier 4 calculation

Summary and Calculations (sq. ft.)

DMA No. -->	6400	24340	24400	24430	24450	25230	25250	25340	30000	30050	30150	30500	30900
Total New + Replaced Impervious Area (ft^2)	13,100	0	800	0	14,500	1,400	0	10,400	4,400	3,900	500	2,500	300
Exempt New + Replaced Impervious Area (ft^2)	11,900				3,300	500		1,900	4,400	1,400	500	2,500	300
Exemption	B.1.b.i.				B.1.b.i.	B.1.b.i.		B.1.b.i.	B.1.b.i.	B.1.b.ii.	B.1.b.i.	B.1.b.ii.	B.1.b.i.
PCR 2: New + Replaced Impervious Area Subject to PCRs (ft^2)	1,200		800		11,200	900		8,500					
PCR 3: New + 50% of Replaced Impervious Area Subject to PCRs (ft^2)	1,200		400		7,150	550		4,800					
PCR 2 Mitigated Impervious Area (ft2)						**42,700**							
PCR 3 Mitigated Impervious Area (ft2)													
Drains to SCM:						#10a							

Areas in Sq. Mi., for input into HEC-HMS

DMA No. -->	6400	24340	24400	24430	24450	25230	25250	25340	30000	30050	30150	30500	30900
Totals for Tier 4 Analysis - Pre-Project	**0.000509**				**0.002873**	**0.002375**		**0.029105**		**0.000384**		**0.000215**	
Total Impervious Area	**0.000427**				**0.001607**	**0.001524**		**0.016475**		**-**		**-**	
Total Pervious Area	**0.000083**				**0.001266**	**0.000850**		**0.012630**		**0.000384**		**0.000215**	
Totals for Tier 4 Analysis - Post-Project	**0.000509**				**0.002873**	**0.002375**		**0.029105**		**0.000384**		**0.000215**	
Total Impervious + SCM Area *	**0.000470**				**0.001718**	**0.001532**		**0.016515**		**0.000140**		**0.000090**	
Total Pervious Area - SCM Area *	**0.000039**				**0.001155**	**0.000843**		**0.012590**		**0.000244**		**0.000126**	

*SCM surface area is treated as if it were impervious for Tier 4 calculation

Note: Blank columns are DMAs with no change in impervious coverage. These DMAs are not included in the Tier 4 analysis.

Drainage Management Areas (sq. ft.)

DMA No. -->	30970	C1	C2	C3	Total
Project Area (New + Replaced Areas)	**18,500**	**52,900**	**15,400**	**1,200**	**218,400**
New Impervious Area	4,500	27,500	14,800		**72,900**
Replaced Impervious Area	14,000	3,500		1,200	**92,700**
New Pervious Area		3,900			**6,800**
Replaced Pervious Area		18,000	600		**44,400**
SCM Area (New Pervious Area)					**-**
SCM Area (Replaced Pervious Area)					**800**
Existing Areas to Remain (Outside Project Area)	**6,400**	**-**	**-**	**39,500**	**2,577,100**
Impervious Area to Remain	6,400			39,500	**1,367,800**
Pervious Area to Remain					**1,209,300**
Totals - Pre-Project	**24,900**	**52,900**	**15,400**	**40,700**	**2,795,500**
Total Impervious Area	**20,400**	**7,400**	**-**	**40,700**	**1,467,300**
Total Pervious Area	**4,500**	**45,500**	**15,400**	**-**	**1,328,100**
Pre-Project Imperviousness (Project Area Only)	**76%**	**14%**	**0%**	**100%**	**46%**
Totals - Post-Project	**24,900**	**52,900**	**15,400**	**40,700**	**2,795,500**
Total New + Replaced Impervious Area	**18,500**	**31,000**	**14,800**	**1,200**	**165,600**
Total Impervious Area	**24,900**	**31,000**	**14,800**	**40,700**	**1,533,400**
Total Pervious Area (including SCM Area)	**-**	**21,900**	**600**	**-**	**1,262,100**
Pre-Project Imperviousness (Project Area Only)	**100%**	**59%**	**96%**	**100%**	**76%**
Total Impervious + SCM Area *	**24,900**	**31,000**	**14,800**	**40,700**	**1,534,200**
Total Pervious Area - SCM Area *	**-**	**21,900**	**600**	**-**	**1,261,300**

*SCM surface area is treated as if it were impervious for Tier 4 calculation

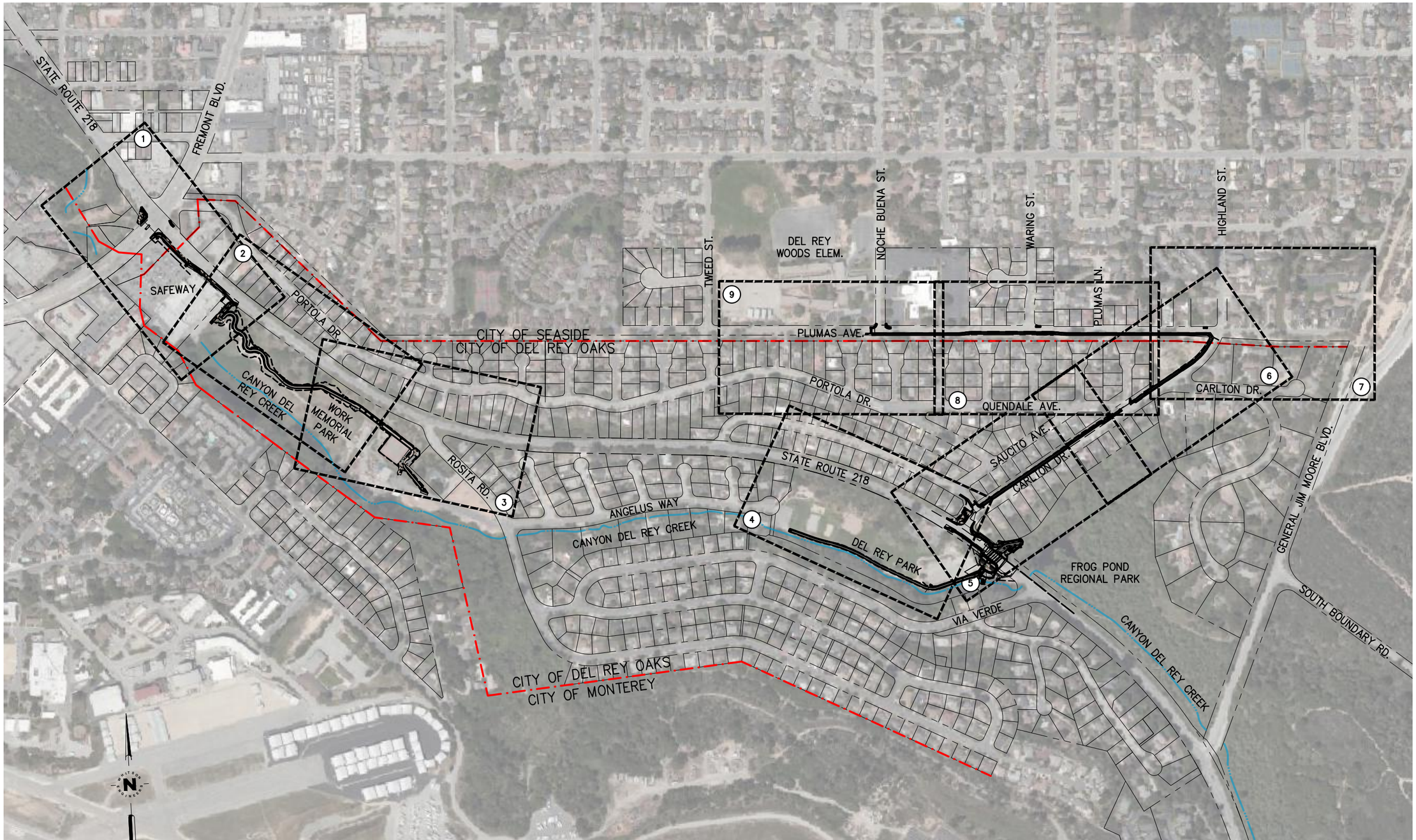
Summary and Calculations (sq. ft.)

DMA No. -->	30970	C1	C2	C3	Total
Total New + Replaced Impervious Area (ft^2)	18,500	31,000	14,800	1,200	**165,600**
Exempt New + Replaced Impervious Area (ft^2)	2,800	31,000	14,800		**87,200**
Exemption	B.1.b.i.	B.1.b.ii.	B.1.b.ii.		
PCR 2: New + Replaced Impervious Area Subject to PCRs (ft^2)	15,700			1,200	**75,900**
PCR 3: New + 50% of Replaced Impervious Area Subject to PCRs (ft^2)	15,700			600	**50,550**
PCR 2 Mitigated Impervious Area (ft2)	**24,900**			**40,700**	**125,800**
PCR 3 Mitigated Impervious Area (ft2)	**24,900**			**-**	**42,400**
Drains to SCM:	#11c, 11d			#12a	

Areas in Sq. Mi., for input into HEC-HMS

DMA No. -->	30970	C1	C2	C3	Total
Totals for Tier 4 Analysis - Pre-Project	**0.000893**	**0.001898**	**0.000552**		**0.051161**
Total Impervious Area	**0.000732**	**0.000265**	**-**		**0.026738**
Total Pervious Area	**0.000161**	**0.001632**	**0.000552**		**0.024420**
Totals for Tier 4 Analysis - Post-Project	**0.000893**	**0.001898**	**0.000552**		**0.051161**
Total Impervious + SCM Area *	**0.000893**	**0.001112**	**0.000531**		**0.029098**
Total Pervious Area - SCM Area *	**-**	**0.000786**	**0.000022**		**0.022064**

*SCM surface area is treated as if it were impervious for Tier 4 calculation 67%



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FORT ORD REC TRAIL AND GREENWAY (FORTAG)
Del Rey Oaks, California

STORM WATER CONTROL PLAN EXHIBIT

SCALE:	1" = 250'
DRAWN:	NM/EJM
JOB No.:	4065.01

SHEET
INDEX
OF

NOT FOR CONSTRUCTION

PM: 0.118 — DRAINAGE MANAGEMENT AREA

NEW IMPERVIOUS AREA

NEW PERVIOUS AREA

REPLACED IMPERVIOUS AREA

REPLACED PERVIOUS AREA

EXEMPT IMPERVIOUS AREA

EX. IMPERVIOUS AREA TO REMAIN

EX. PERVIOUS AREA TO REMAIN

18"SD — EXISTING STORM DRAIN

NUMBER — DRAINAGE SYSTEM I.D.

— DRAINAGE UNIT I.D.

18"SD — PROPOSED INLET AND STORM DRAIN

PROPOSED BIORETENTION AREA

DRAINAGE FLOW DIRECTION

DMA PM: .005A

DMA PM: .005B

DMA PM: .005C

DMA PM: 0.020

DMA PM: 0.118

DMA: 5700

DMA: 1500

DMA C1

Exist DI

Exist DI

DI 1a
TYPE G3

CB 1521

STATE ROUTE 218

SAFEWAY

FREMONT BLVD.

CANYON DEL REY CREEK

BOX CULVERT

CITY OF SEASIDE

CITY OF DEL REY OAKS

CITY OF MONTEREY

CITY OF DEL REY OAKS

CITY OF MONTEREY

40 0 40 80 120 Feet

SCALE: 1" = 40'

0 1 2 INCHES 3

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JOB No.:	4065.01

SHEET 1 OF

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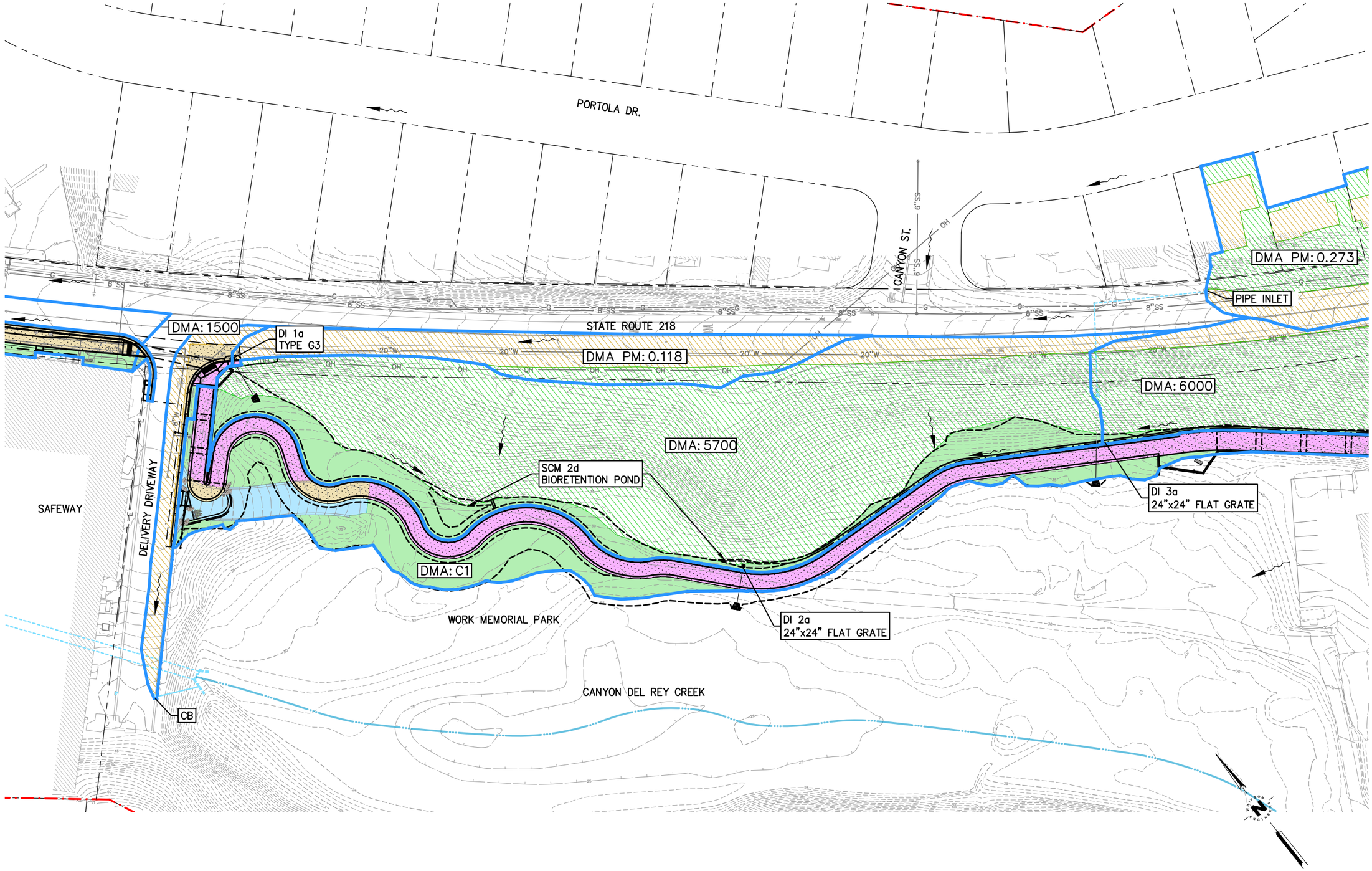

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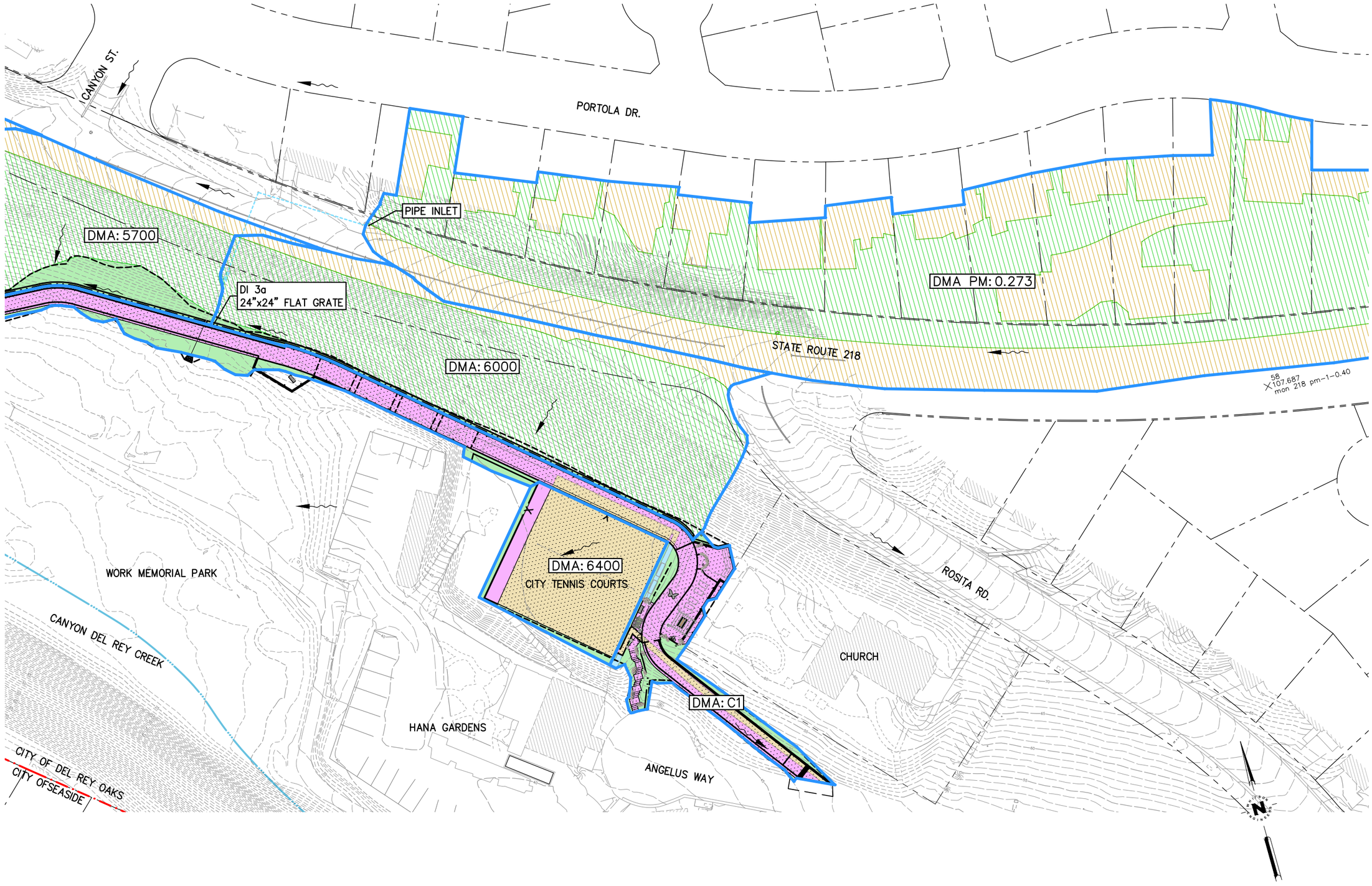

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DRAWN:	NM/EJM
JOB No.:	4065.01

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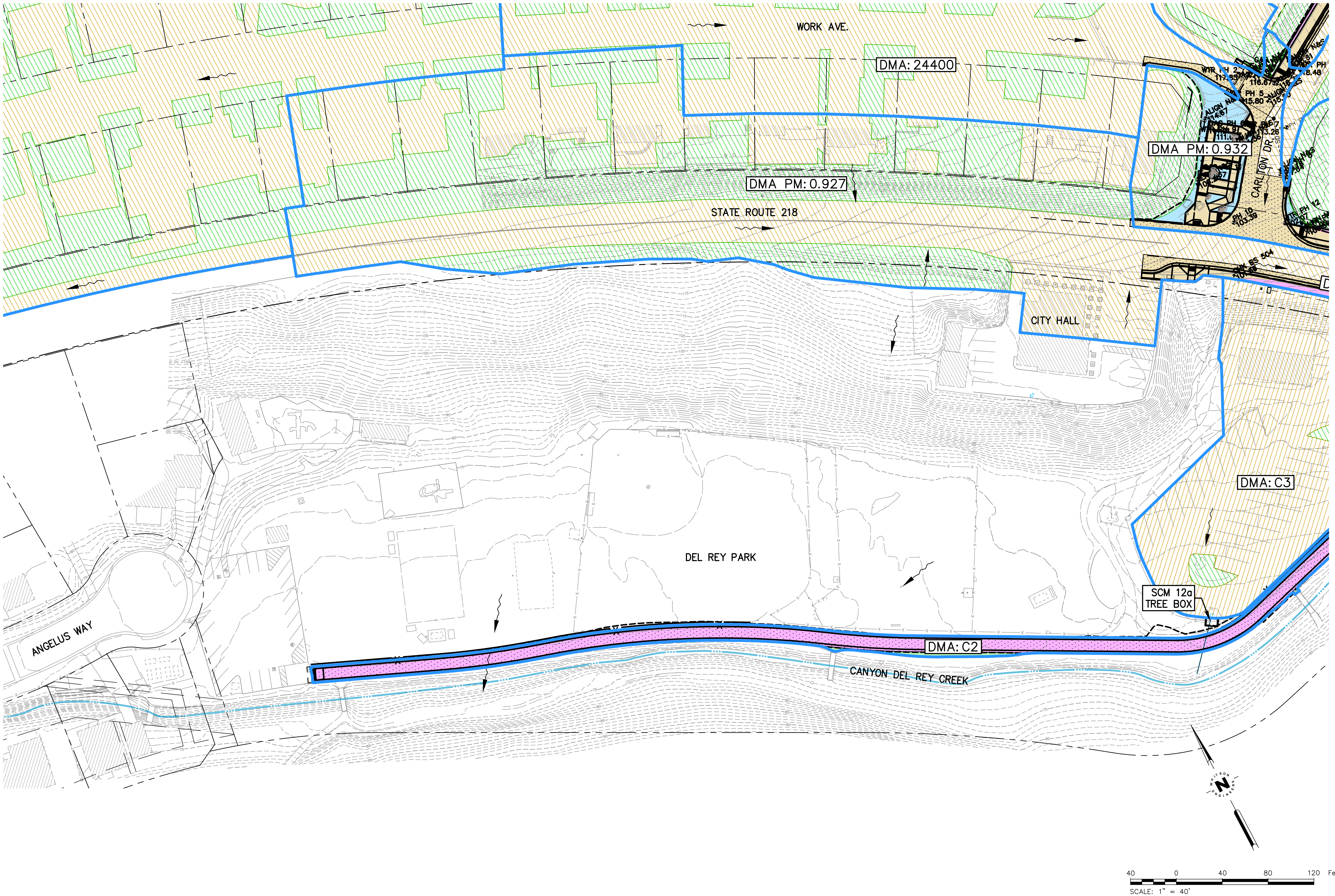

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JOB No.:	4065.01

SHEET 4 OF

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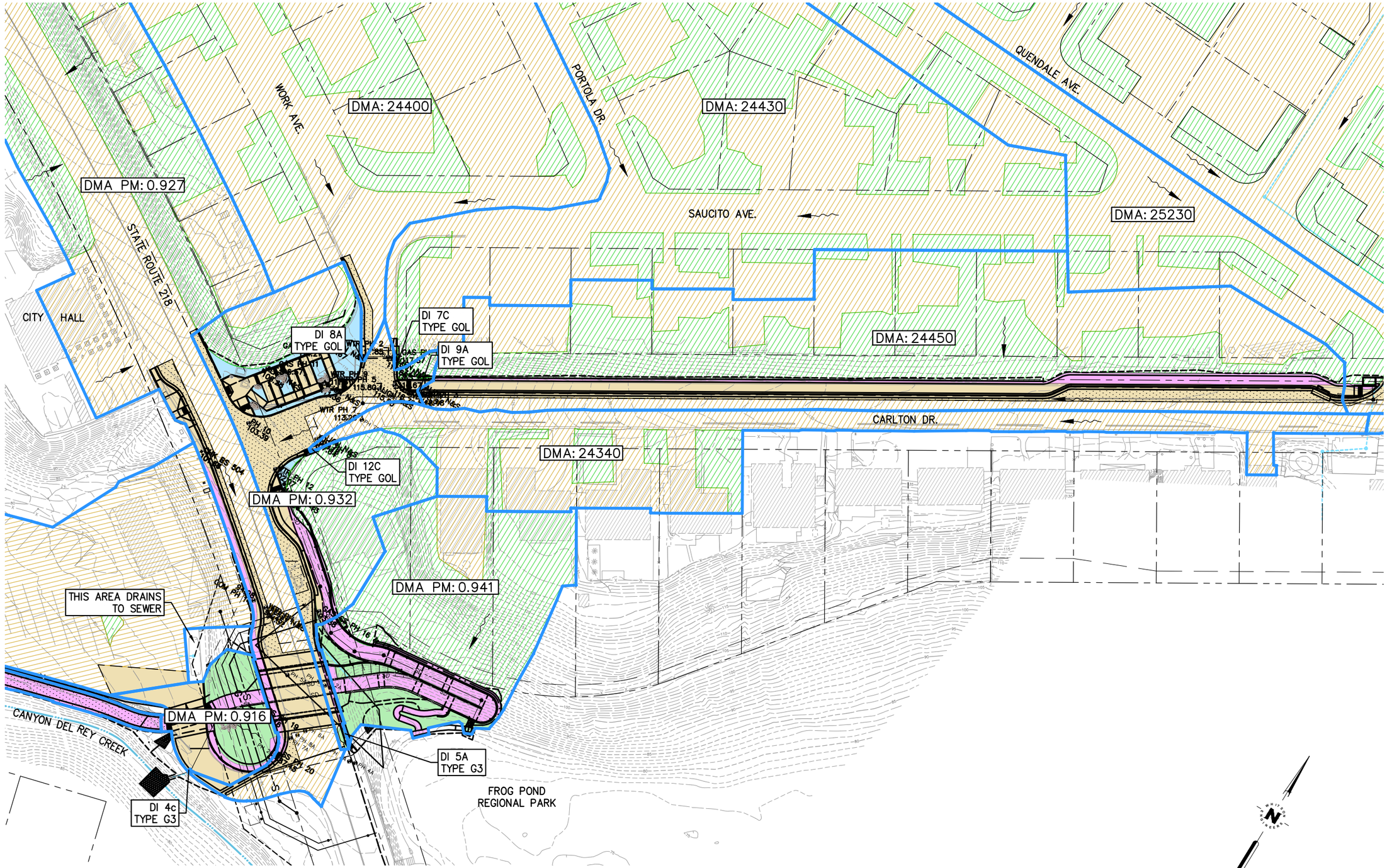

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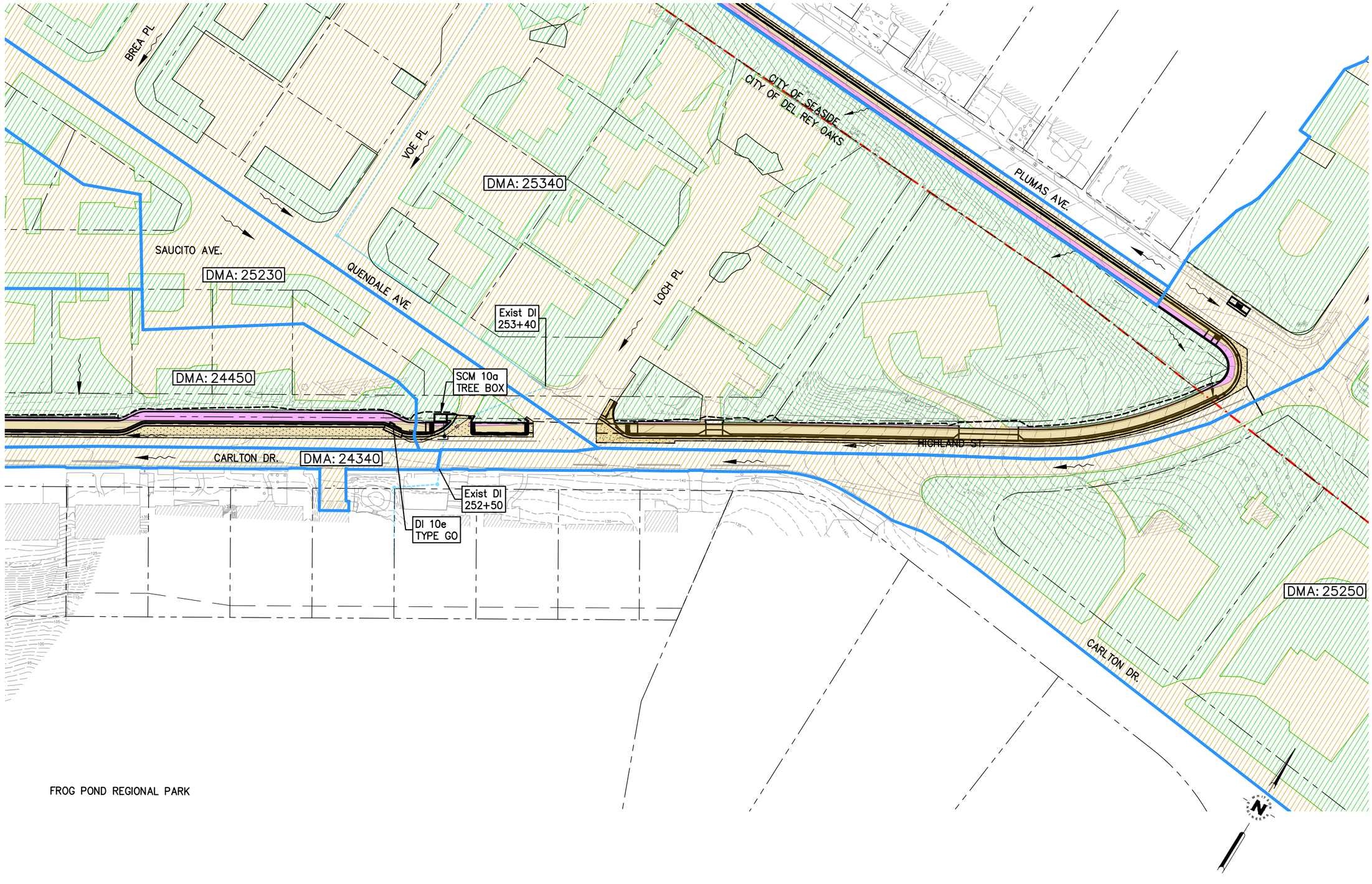

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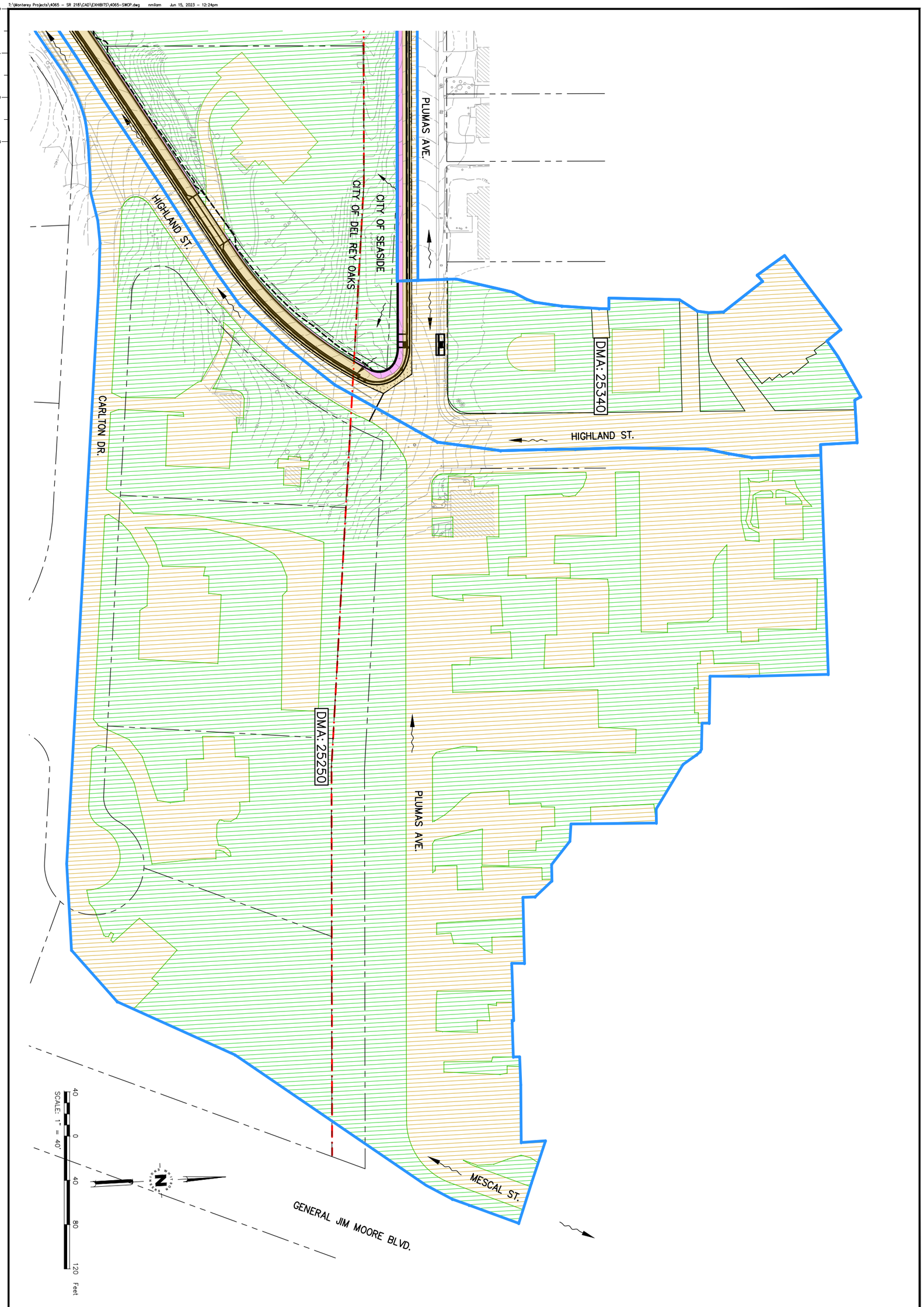

SHEET 7 OF

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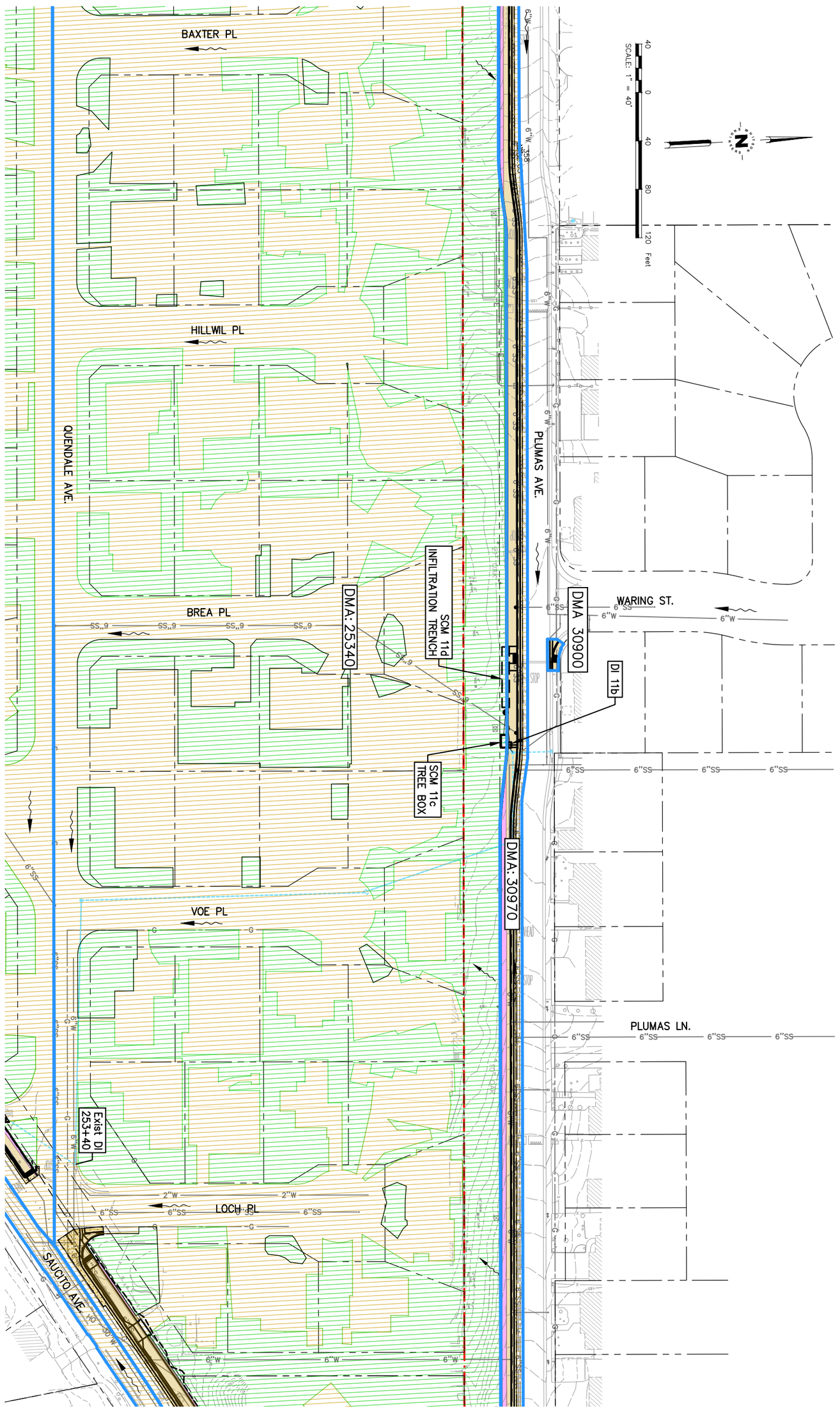

SHEET 8 OF	JOB NO.: 4065.01	DRAWN: NM/EM	SCALE: 1" = 40'

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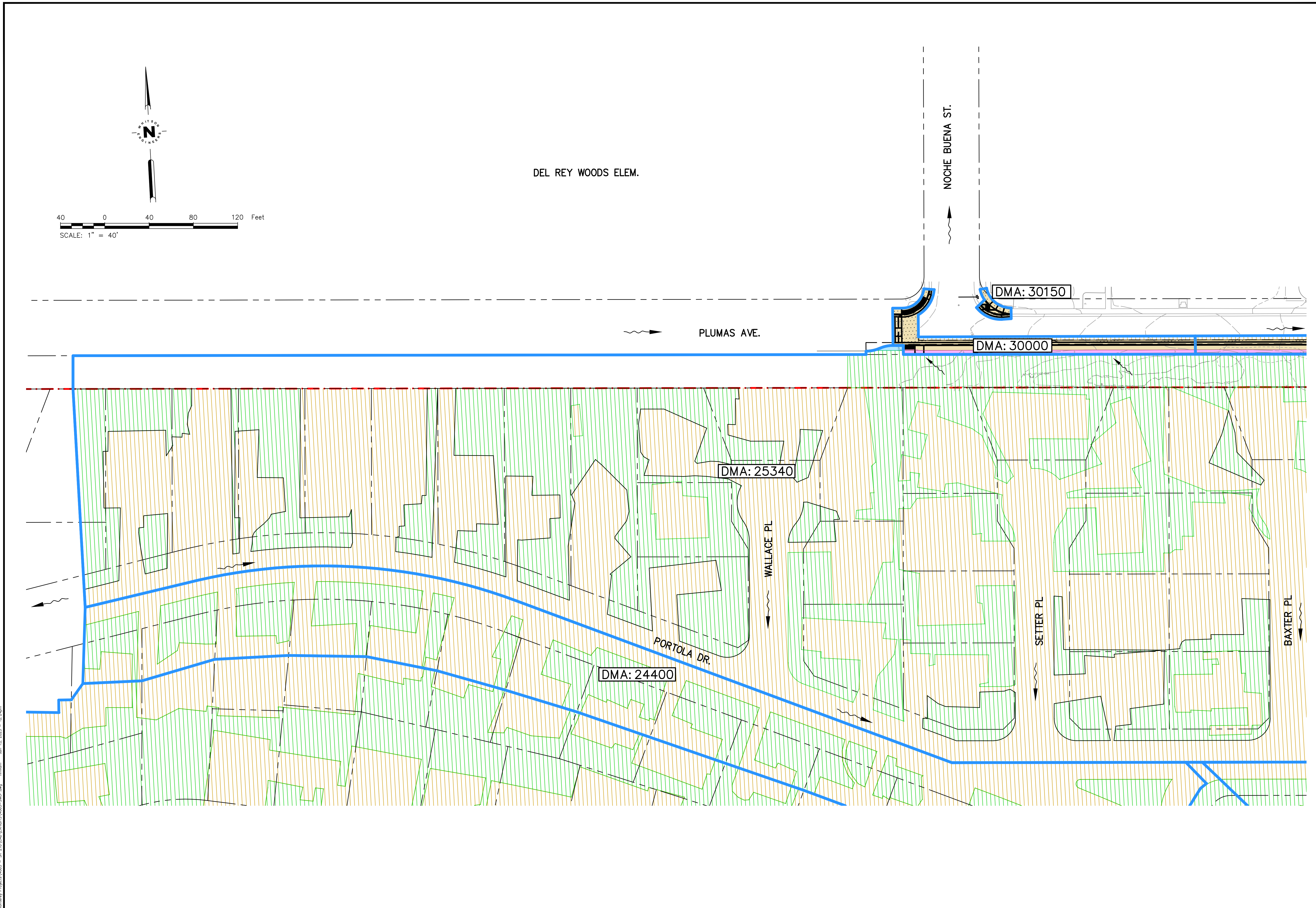

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DRAWN:	NM/EJM
JOB No.:	4065.01

SHEET 9 OF

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Attachment F

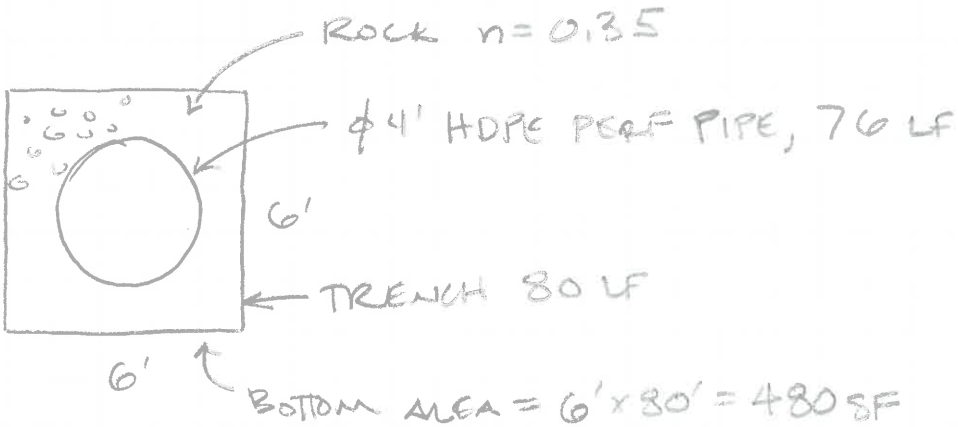
SCM Stage-Storage Tables

Whitson ENGINEERS

Project FORTAG
Job # 4065
Prepared by NM

Sheet # 1
Date 6/15/22

INFILTRATION TRENCH



$$VOL = 6' \times 6' \times 80' \times 0.35 + \frac{\pi}{4}(4')^2 \times 76' \times 0.65 = 1628\ CF$$

ROCK = 1008 CF PIPE = 620 CF

Attachment G

Central Coast SCM Calculator
(PCR 3 Calculations)

Central Coast Region
Stormwater Control Measure
Sizing Calculator

Version: 7/2/2018

1. Project Information

Project name:	FORTAG Phase 1
Project location:	Del Rey Oaks
Tier 2/Tier 3:	Tier 3 - Retention
Design rainfall depth (in):	1.3
Total project area (ft2):	
Total DMA area (ft2):	0
Total new impervious area (ft2):	
Total replaced impervious within a USA (ft2):	
Total replaced impervious not in a USA (ft2):	
Total pervious/landscape area (ft2):	
Total SCM area (ft2):	

2. DMA Characterization

Name	DMA Type	Area (ft2)	Surface Type	New, Replaced?	Connection
PM 0.118 NIA	Drains to SCM	100	Concrete or asphalt	New	SCM 2
PM 0.118 RIA	Drains to SCM	100	Concrete or asphalt	New	SCM 2
PM 0.118 IA to Remain	Drains to SCM	12600	Concrete or asphalt	New	SCM 2
5700 IA to Remain	Drains to SCM	4700	Concrete or asphalt	New	SCM 2
30970 NIA	Drains to SCM	4500	Concrete or asphalt	New	SCM 11d
30970 RIA	Drains to SCM	14000	Concrete or asphalt	New	SCM 11d
30970 IA to Remain	Drains to SCM	6400	Concrete or asphalt	New	SCM 11d

DMA Summary Area	
Total assigned DMA area (ft2):	42400
New impervious area (ft2):	42400
Replaced impervious within a USA (ft2):	0
Replaced impervious not in a USA (ft2):	0
Total pervious/landscape area (ft2):	0

Check DMA table areas against plan sheet areas

3. SCM Characterization

						Flow Control	Reservoir
Name	SCM Type	Safety Factor	SCM Soil Type	Infilt. Rate (in/hr)	Area (ft2)	Orifice?	Depth (in)
SCM 2	Bioretention	1	Site-Specific	1	800	No	
SCM 11d	Direct Infiltration	2	Site-Specific	2	**480**		

4. Run SBUH Model

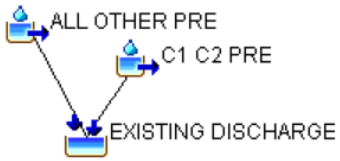
5. SCM Minimum Sizing Requirements

SCM Name	Min. Required Storage Vol. (ft3)	Depth Below Underdrain (ft)	Drain Time (hours)	Orifice Diameter (in)
SCM 2	648	2.31	6.5	

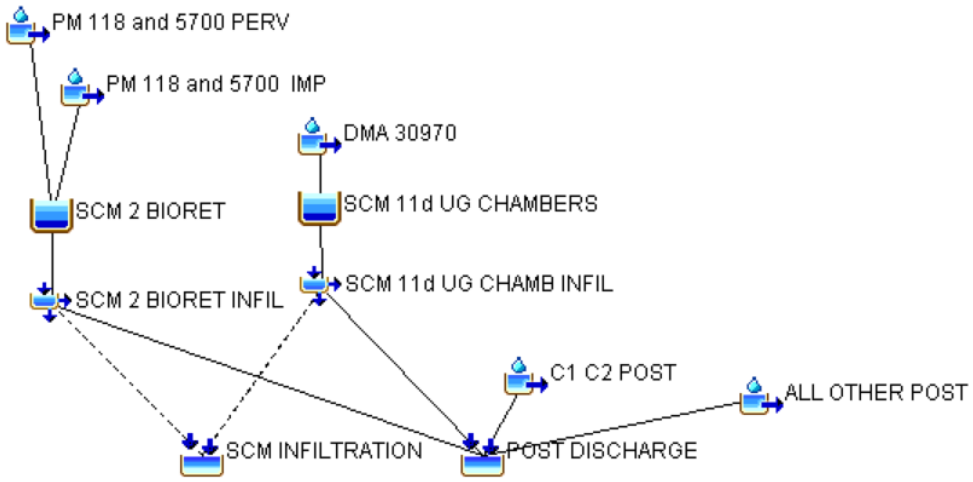
Attachment H

HEC-HMS Model, Inputs and Results

Existing Model



Proposed Model



Subbasin	Initial A... (IN)	Curve N...	Impervious (%)
ALL OTHER POST		45	59
ALL OTHER PRE		45	58
C1 C2 POST		76	67
C1 C2 PRE		76	0.0
DMA 30970		98	0.0
PM 118 and 5700 PERV		45	0.0
PM 118 and 5700 IMP		98	0.0

Model Notes:

1. Watersheds with no change in imperviuos coverage and which do not drain to SCMs (DMAs PM0.005B, PM0.005C, PM0.273, 6000, 24340, 24400, 24430, 25250, 30000, 30150, 30900, and C3) are not included in the model.
2. Existing Watersheds C1 and C2 (existing gravel road) use CN=76. All other existing pervious areas use CN=45. All impervious areas use CN=98.
3. Due to their small size, a Lag Time of 10 minutes is used for all watersheds, as a practical minimum.

2-year Analysis Results

Project: FORTAG Simulation Run: 002 year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 09Jun2023, 16:56:34

Basin Model: Site
Meteorologic Model: 002 year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
ALL OTHER POST	0.043919	18.29448	01Jan2000, 10:03	2.64578
ALL OTHER PRE	0.048712	19.94709	01Jan2000, 10:03	2.88479
C1 C2 POST	0.002450	1.22273	01Jan2000, 10:03	0.18359
C1 C2 PRE	0.002450	0.20663	01Jan2000, 10:06	0.04843
DMA 30970	0.000893	0.60299	01Jan2000, 10:03	0.08047
EXISTING DISCHARGE	0.051162	20.14045	01Jan2000, 10:03	2.93321
PM 118 and 5700 PERV	0.003243	0.00000	01Jan2000, 00:00	0.00000
PM 118 and 5700 IMP	0.000656	0.44296	01Jan2000, 10:03	0.05911
POST DISCHARGE	0.051161	19.59921	01Jan2000, 10:03	2.87485
SCM INFILTRATION	0.000000	0.09700	01Jan2000, 09:45	0.05819
SCM 11d UG CHAMBERS	0.000893	0.16087	01Jan2000, 10:36	0.04467
SCM 11d UG CHAMB INFIL	0.000893	0.15687	01Jan2000, 10:36	0.03755
SCM 2 BIORET	0.003899	0.18500	01Jan2000, 10:06	0.05900
SCM 2 BIORET INFIL	0.003899	0.09200	01Jan2000, 10:06	0.00793

10-year Analysis Results

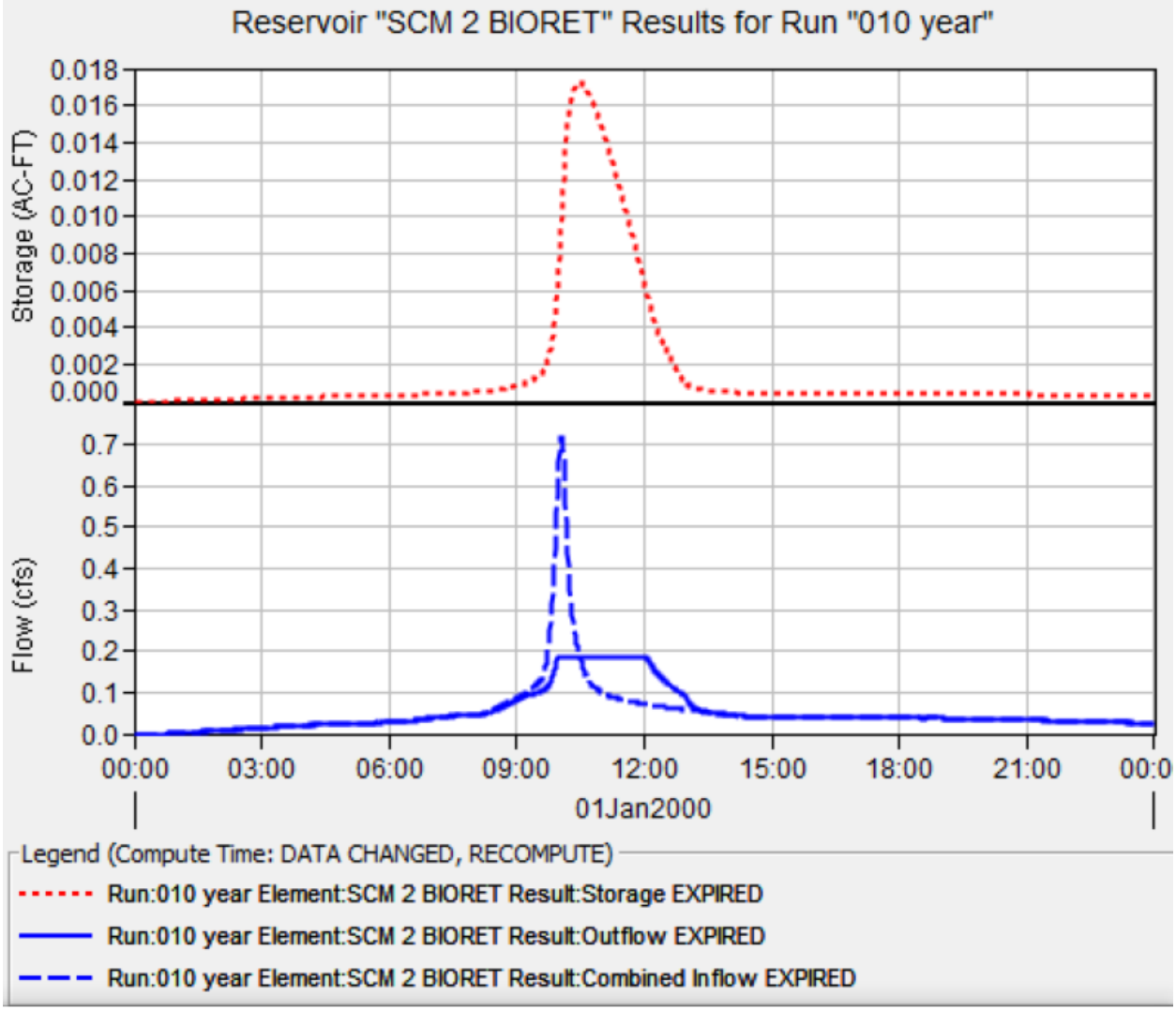
Project: FORTAG Simulation Run: 010 year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Site
Meteorologic Model: 010 year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
ALL OTHER POST	0.043919	28.96627	01Jan2000, 10:03	4.21498
ALL OTHER PRE	0.048712	31.58290	01Jan2000, 10:03	4.59692
C1 C2 POST	0.002450	2.12375	01Jan2000, 10:03	0.31006
C1 C2 PRE	0.002450	0.88199	01Jan2000, 10:04	0.13539
DMA 30970	0.000893	0.97850	01Jan2000, 10:03	0.13333
EXISTING DISCHARGE	0.051162	32.45799	01Jan2000, 10:03	4.73231
PM 118 and 5700 PERV	0.003243	0.00855	01Jan2000, 21:54	0.00465
PM 118 and 5700 IMP	0.000656	0.71881	01Jan2000, 10:03	0.09794
POST DISCHARGE	0.051161	32.19916	01Jan2000, 10:03	4.63502
SCM INFILTRATION	0.000000	0.09700	01Jan2000, 09:15	0.08985
SCM 11d UG CHAMBERS	0.000893	1.23373	01Jan2000, 09:57	0.09752
SCM 11d UG CHAMB INFIL	0.000893	1.22973	01Jan2000, 09:57	0.09012
SCM 2 BIORET	0.003899	0.18500	01Jan2000, 09:58	0.10232
SCM 2 BIORET INFIL	0.003899	0.09200	01Jan2000, 09:58	0.01987



Summary Results for Reservoir "SCM 2 BIORET"

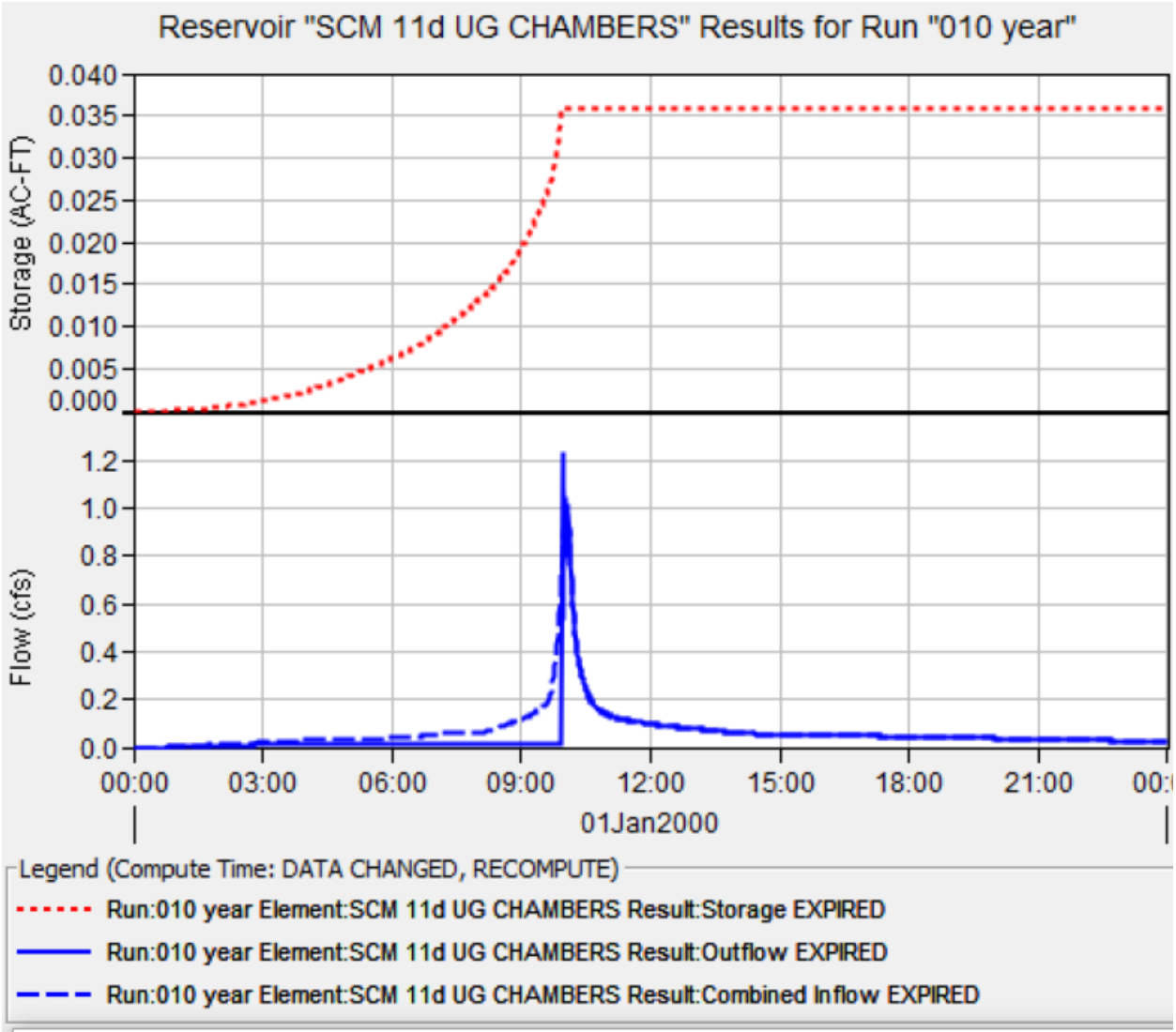
Project: FORTAG Simulation Run: 010 year
Reservoir: SCM 2 BIORET

Start of Run:	01Jan2000, 00:00	Basin Model:	Site
End of Run:	02Jan2000, 00:00	Meteorologic Model:	010 year
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	Control 1

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	0.71881 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 10:04
Peak Discharge:	0.18500 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 09:58
Inflow Volume:	0.10259 (ACRE-FT)	Peak Storage:	0.01719 (ACRE-FT)
Discharge Volume:	0.10232 (ACRE-FT)		



Summary Results for Reservoir "SCM 11d UG CHAMBERS"

Project: FORTAG Simulation Run: 010 year
Reservoir: SCM 11d UG CHAMBERS

Start of Run:	01Jan2000, 00:00	Basin Model:	Site
End of Run:	02Jan2000, 00:00	Meteorologic Model:	010 year
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	Control 1

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	0.97850 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 10:04
Peak Discharge:	1.23373 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 09:57
Inflow Volume:	0.13333 (ACRE-FT)	Peak Storage:	0.03596 (ACRE-FT)
Discharge Volume:	0.09752 (ACRE-FT)		

Existing CN for DMAs C1 and C2

CN for all impervious areas

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

pre- and post-project CN for undeveloped areas

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.