APPENDIX H2

Low Impact Development Plan

Low Impact Development Plan
Brookside Project

April 7, 2023

Prepared For:

Spring Meadows Homes LLC/ Meadow Pass Estates LLC
18517 Gale Avenue, Suite A
City of Industry, CA 91748

Submittal To:

City of Walnut
21201 La Puente Road
Walnut, CA 91789

Prepared By:

Pacific Advanced Civil Engineering, Inc.
17520 Newhope Street, Suite 200
Fountain Valley, CA 92708
(714) 481-7300





Contact Person:
Mark Krebs, P.E.
Cherise Thompson, EIT
Ron Rovansek, Ph.D., P.E., LEED AP

PACE JN B852

Table of Contents

Executive Summary **1**

1 Introduction **1-1**

2 Project Location and Description **2-1**
2.1 Location 2-1
2.2 Land Use Designations / Proposed Use 2-1
2.3 Access 2-1
2.4 Open Space 2-1
2.5 Stormwater / Lemon Creek 2-1
2.6 Project LID Regulations 2-2
2.7 Existing Site Characteristics 2-3
2.8 Proposed Site Characteristics 2-9
2.8.2 Significant Ecological Areas (SEAs) 2-11
2.8.3 Hydromodification Analysis 2-11
2.9 Property Ownership / Management 2-11

3 Geotechnical Conditions **3-1**
3.1 Topography 3-1
3.2 Groundwater 3-1
3.3 Geotechnical Hazards 3-1
3.3.1 Liquefaction 3-1
3.3.2 Landslides 3-1
3.3.3 Erosion 3-2
3.3.4 Collapse / Expansion 3-2
3.4 Site Preparation and Grading 3-2
3.5 Setbacks 3-2
3.6 Feasibility of Infiltration 3-2

4 Source Control Measures **4-1**
4.1 Proposed Source Control Measures 4-1
4.1.1 Storm Drain Message and Signage (S-1) 4-1
4.1.2 Outdoor Material Storage Area (S-2) 4-2
4.1.3 Landscaping Irrigation Practices (S-8) 4-3
4.1.4 Building Materials (S-9) 4-3

5 Stormwater Quality Design Volume **5-1**
5.1 Stormwater Quality Design Volume Calculation 5-1

6 Stormwater Quality Control Measures **6-1**
6.1 Proposed Stormwater Quality Control Measures 6-1

7 Hydromodification **7-1**
7.1 Hydromodification Calculations 7-1
7.2 Hydromodification Controls 7-2

8 Site Design Principles **8-1**
8.1 Site Planning 8-1
8.2 Protect / Restore Natural Areas 8-2
8.3 Minimize Land Disturbance 8-3
8.4 Minimize Impervious Area 8-4

9 Maintenance Plan **9-6**
9.1 Description of the Facilities 9-6
9.2 Maintenance / Inspection Access 9-8
9.3 General Maintenance Activities 9-8
9.3.1 Routine Maintenance Activities 9-8
9.3.2 Major Maintenance Activities 9-9

9.4 Inspection and Maintenance Checklist 9-10

10 Conclusion 10-1

11 Bibliography 11-1

Tables

Table 2-1: Designated Project Characteristics for Brookside 2-2
Table 2-2: Existing Conditions Site Attributes 2-4
Table 2-3: Proposed Conditions Site Attributes 2-9
Table 3-1: Infiltration Test Results 3-3
Table 4-1: Structural Source Control Measures Required for Brookside 4-1
Table 4-2: Classification of Materials for Potential Pollutant Risk 4-2
Table 5-1: HydroCalc Results – Proposed Conditions 5-1
Table 6-1: Stormwater Basin Design Volumes Summary 6-1
Table 6-2: Stormwater Basin Design Details 6-2
Table 7-1: Existing Conditions Hydromodification Analysis Results 7-1
Table 7-2: Proposed Conditions Hydromodification Analysis Results 7-2
Table 9-1: Schedule of Inspections 9-8
Table 9-2: Inspection & Maintenance Checklist 9-10

Figures

Figure 1-1: Vicinity Map 1-2
Figure 1-2: Existing Project Site Map 1-3
Figure 1-3: Proposed Site Development Plan 1-4
Figure 2-1: Existing Conditions Hydrologic Workmap 2-5
Figure 2-2: Downstream Face of 'Culvert A' 2-6
Figure 2-3: Downstream Face of 'Culvert B' 2-6
Figure 2-4: Upstream Face of 'Culvert C' 2-7
Figure 2-5: Downstream Face of 'Culvert D' (to be removed) 2-7
Figure 2-6: Dense Vegetation Within Lemon Creek 2-8
Figure 2-7: La Puente Culvert at Downstream End of Property 2-8
Figure 2-8: Proposed Conditions Hydrologic Workmap 2-10
Figure 2-9: SEA Map for the City of Walnut 2-11
Figure 2-10: Tentative Tract Map 2-13
Figure 8-1: Conceptual Landscape Plan (Placeholder) 8-5
Figure 9-1: Site Map – Stormwater Features O&M 9-7

Attachments:

Attachment A: Calculations

Attachment B: Geotechnical Report

Attachment C: Project Owner Certification

Attachment D: Master Covenant Agreement

Attachment E: Engineer Certification

Executive Summary

This Low Impact Development Plan ("LID Report") has been prepared for the 25.8-acre Brookside Project, located at 800 Meadow Pass Rd. in the City of Walnut, in order to comply with the Los Angeles County *2014 LID Standards Manual*. The *LID Standards Manual* provides guidance for the implementation of stormwater quality control measures in new and redevelopment projects, with the intention of improving water quality and mitigating potential water quality impacts for stormwater and non-stormwater discharges. The goal of the LID Plan is to reduce adverse impacts of stormwater runoff from developed areas on natural drainage systems, minimizing pollutant loadings from impervious surfaces, and minimizing erosion and other hydrologic impacts on natural drainage systems. This LID plan demonstrates that the Brookside project complies with all relevant requirements laid out in the *LID Standards Manual*.

The proposed project would develop approximately 13.6 acres of the property over 27 lots, leaving 12.2 acres as permanent open space, some of which would be privately owned or residentially zoned property. Lemon Creek is a natural drainage feature that flows through the middle of the site, and would remain largely untouched. Potential impacts to streambed, protected vegetation, and/or protected wildlife due to the proposed improvements would be mitigated by the project per CEQA / CDFW requirements.

The Brookside Project, which is categorized as a Designated Project in the *LID Manual*, has been designed with the following functions in mind:

- Apply site-specific control measures
- Apply site design principles
- Detain and treat the stormwater quality design volume
- Detain the hydromodification volume
- Maintenance of the proposed stormwater / LID compliance features

Site-specific control measures are designed to prevent pollutants from contacting stormwater runoff or prevent discharge of contaminated stormwater runoff to the storm drain system and/or receiving water. The site-specific control measures that would be implemented at the Brookside Project include (1) storm drain messaging and signage, (2) landscape irrigation practices, (3) building material considerations, and (4) outdoor material storage area considerations (**Table 4-1**).

Site design principles are intended to protect sensitive environmental features and reduce stormwater runoff peak flows and volumes and other impacts associated with land development. The site design principles applied to the Brookside Project meet the requirements listed in the *LID Standards Manual* and include (1) site planning, (2) protection and restoration of natural areas, (3) minimization of land disturbance, and (4) minimization of impervious cover.

The stormwater quality design volume (SWQDv) is normally defined as the 85th percentile storm runoff volume from developed areas of the site. In cases where infiltration rates are below 0.3 inches per hour, as in the case of the Brookside Project, the SWQDv cannot be reliably retained on-site through infiltration; therefore, the SWQDv becomes 1.5 x the 85th percentile storm runoff volume. Runoff from the developed portions of the site would be designed to flow to one of two basins for treatment before discharging to Lemon Creek. Stormwater Basin No.1, located in the north of the site, would collect runoff from an area 11.84 acres in size, with an 85th percentile runoff volume of 0.44 acres, resulting in a SWQDv of 0.65 ac-ft. Stormwater Basin No.2, located in the south of the site, would collect runoff from an area 5.78 acres in size, with an 85th percentile runoff volume of 0.21 ac-ft, resulting in a SWQDv of 0.31 ac-ft. Stormwater Basin No.1 would be designed to store 100% of the SWQDv within the voids of porous material that would be placed at the bottom of the basin, resulting in no ponding above the invert. Stormwater Basin No.2 would be designed to store some of the SWQDv within the voids of the porous material at the bottom of the basin, while the rest would pond to a depth no greater than 18-inches. Stormwater Basin No.2 would have minimum freeboard of 2.5 ft. from the ponded water surface to nearby pad elevations.

Due to increased impervious area associated with the proposed project, post-project conditions would result in greater peak flow rates and runoff volumes entering Lemon Creek from the site without the mitigation

proposed by the project. The project is required to mitigate the increases up to the 50-yr storm event; however, the project has been designed to mitigate above and beyond the requirement, up to the 100-yr storm event, in order to provide further protection to the Creek and proposed development. Multiple storm events were analyzed, including the 85th percentile, 2-yr, 10-yr, 50-yr, and 100-yr storms. Pre- versus post-project condition local hydrology was modeled with HydroCalc, which showed that the project would result in increases to peak runoff flow rates for the 85th percentile and 2-yr storms only. All storm events analyzed show increases to runoff volumes from the site to Lemon Creek in the proposed condition, if none of the proposed mitigation were to be implemented. The maximum increase in runoff volume would occur at the 100-yr storm event, equal to 2.67 ac-ft. This 100-yr 'hydromodification volume' would be mitigated for through capture in Stormwater Basin No.1. From there, runoff would be slowly released into Lemon Creek, without impacting the storm hydrograph. The captured hydromodification volume would pond above the invert of the basin, with minimum freeboard of 1.0 ft. provided between the ponded water surface and nearby pad elevations.

The two proposed Stormwater Basins would be owned and maintained by either a public agency or the Homeowners Association (HOA), and would be subject to deed restrictions prohibiting use of the restricted open space for planting vegetation, installing fencing, or otherwise developing or using the restricted natural open space areas. A maintenance plan for the basins is included herein.

1 Introduction

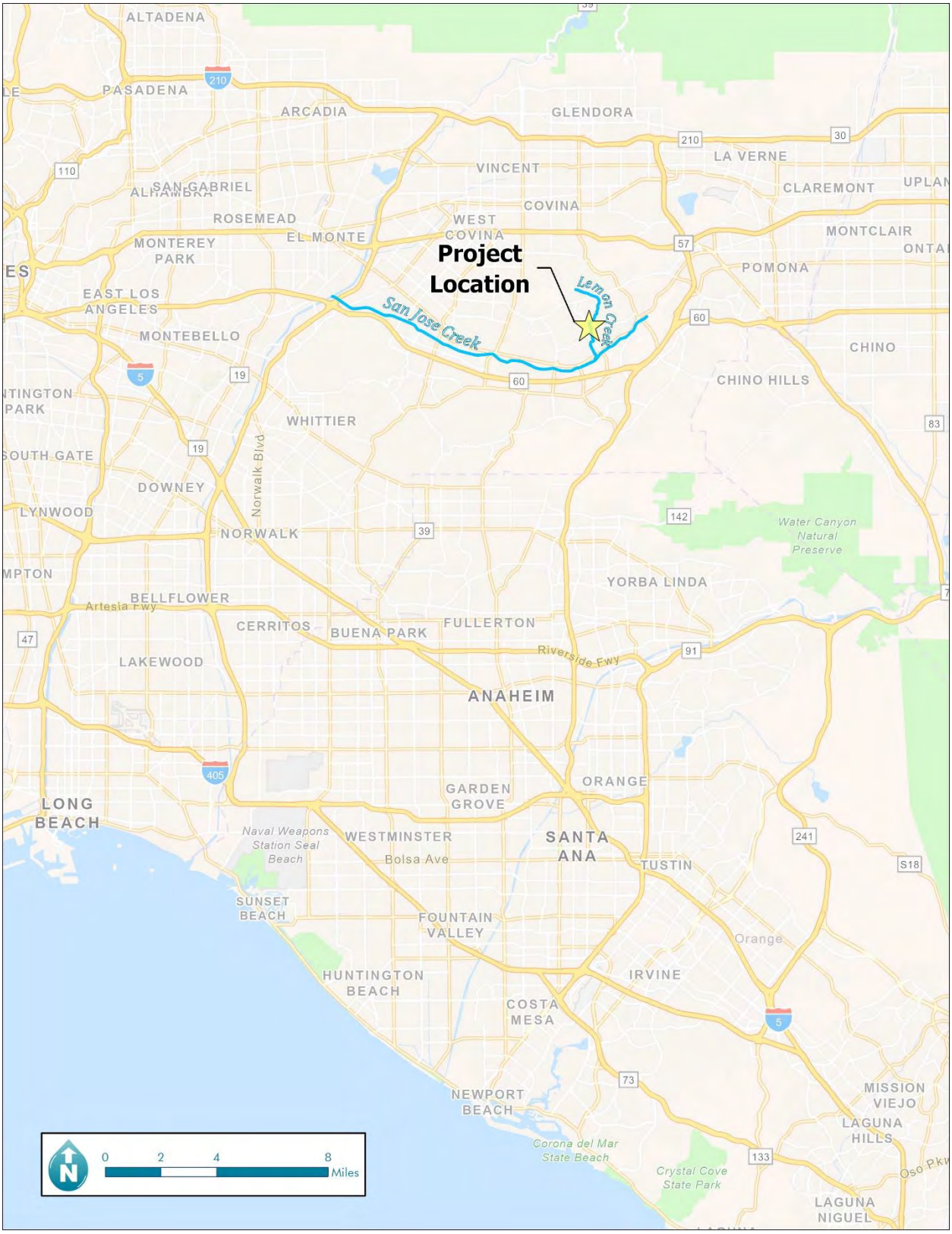
Pacific Advanced Civil Engineering, Inc. (PACE) has been retained by Spring Meadows Homes LLC/ Meadow Pass Estates LLC to prepare a Low Impact Development (LID) Plan for the proposed Brookside development project, located at 800 Meadow Pass Road, in the City of Walnut, California (APN 8709-093-001, -002, and -003). The property is accessible through North Lemon Avenue, East La Puente Road, South Meadow Pass Road, and West Broken Lance Road. A vicinity of the project site is shown on **Figure 1-1**.

The proposed project is situated on a 25.8-acre site that was formerly used as the Brookside Equestrian Center, which closed in 2014. The site is undeveloped, but contains various equestrian-related structures. **Figure 1-2** shows notable features of the existing site and the boundary of the project. Lemon Creek is a natural drainage feature that runs through the site. Four existing culverts are situated within the creek, referred to herein as Culvert A, Culvert B, Culvert C, and Culvert D, where Culvert A is toward the upstream end of the project reach and Culvert D is toward the downstream end. There is some existing storm drain infrastructure on-site, including three storm drain outlets which convey off-site flow from Meadow Pass Road and from the west of Lemon Ave. to Lemon Creek. Immediately downstream of the property boundary, Lemon Creek enters an existing double 10 ft.(w) x 5 ft.(h) box culvert beneath La Puente Road, which is maintained by the City of Walnut.

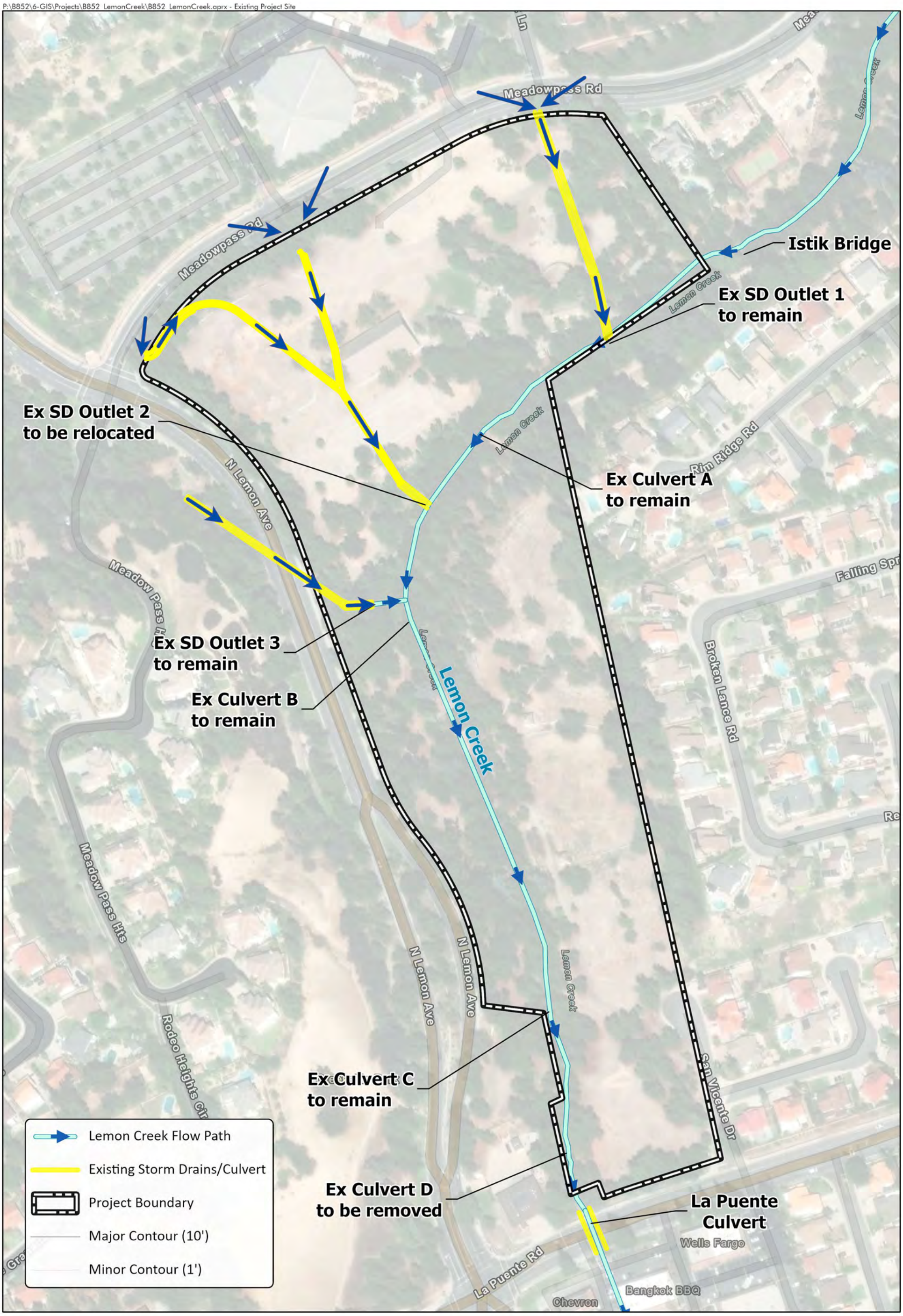
The proposed development at Brookside includes the removal of the equestrian-related structures and the construction of 27 residential housing lots with a minimum area of 28,500 square feet each. The development will also incorporate public streets, walkways adjacent to public streets, wet and dry utilities, two Stormwater Basins, vegetated planting spaces, and the removal of Culvert D. **Figure 1-3** shows notable features of the proposed project.

This LID plan has been prepared in order to comply with the Los Angeles County *2014 LID Standards Manual*. The *LID Standards Manual* was prepared by the County to comply with the requirements of the National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit for stormwater and non-stormwater discharges from the MS4 within the coastal watersheds of Los Angeles County (CAS004001, Order No. R4-2012-0175). The *LID Standards Manual* provides guidance for the implementation of stormwater quality control measures in new and redevelopment projects, with the intention of improving water quality and mitigating potential water quality impacts for stormwater and non-stormwater discharges. Projects are required to submit LID Plans with the goal of reducing adverse impacts of stormwater runoff from developed areas on natural drainage systems, minimizing pollutant loadings from impervious surfaces, and minimizing erosion and other hydrologic impacts on natural drainage systems. This LID plan will demonstrate that the Brookside project complies with all relevant requirements of the *LID Standards Manual*.

Figure 1-1: Vicinity Map



P:\B852\6-GIS\Projects\B852_LemonCreek\B852_LemonCreek.aprx - Existing Project Site



BROOKSIDE DEVELOPMENT

EXISTING PROJECT SITE

PACE Advanced Water Engineering

0 87.5 175 350 Feet

Date: 3/30/2023

Job Number: B852

Figure 1-2

P:\B852\6-GIS\Projects\B852_LemonCreek\B852_LemonCreek.aprx - Proposed Site Development Plan

Meadowpass Rd

Istik Bridge

Ex SD Outlet 1
to remain

Ex SD Outlet 2
to be relocated

Ex Culvert A
to remain

Pr Stormwater
Basin No. 1

Pr Bridge

Pr SD Outlet 4

Ex SD Outlet 3
to remain

Ex Culvert B
to remain

Lemon Creek

Ex Culvert C
to remain

Ex Culvert D,
to be removed

Pr Stormwater
Basin No. 2

Pr SD Outlet 5

Pr Trash Rack

La Puente Culvert

Lemon Creek Flow Path
Existing Storm Drains/Culvert
Proposed Strom Drains
Project Boundary
Major Contour (10')
Minor Contour (1')

BROOKSIDE DEVELOPMENT

PROPOSED SITE DEVELOPMENT PLAN

PACE Advanced Water Engineering

0 87.5 175 350 Feet

Date: 3/30/2023

Job Number: B852

Figure 1-3

2 Project Location and Description

2.1 Location

The project site consists of 25.8 acres located at 800 Meadow Pass Road. It is comprised of Assessor's Parcel Nos. 8709-093-001, -002, and -003 and is bordered by La Puente Road to the south, North Lemon Avenue to the west, Meadow Pass Road to the north, and homes to the east. It is in the southeast portion of the City of Walnut (City), approximately 2.3 miles northwest of the confluence of State Route 60 and State Route 57 (Figure 1). It is depicted on Township 02S, Range 09W, Section 6 of the United States Geological Survey, San Dimas California 7.5-minute quadrangle (Figure 2). The approximate center of the project site is located at latitude 34.024363 °N and longitude -117.866254°W.

2.2 Land Use Designations / Proposed Use

The project site has a General Plan designation of Very Low Density and is zoned Residential Planned Development Zone (RPD) with a designation of RPD–28,500–1.3. Pursuant to Section 6.24.030 A2 of the Walnut Municipal Code, the project proposes the development of 27 detached single-family homes under R-1 standards with a minimum lot size of 28,500 square feet. The project requires approval of a Tentative Tract Map and Site Plan/Architectural Review.

2.3 Access

All project streets will be public. The northerly 25 homes will take access from Meadow Pass Road and the two most southerly homes will take access from San Vicente Drive, with each street ending in a cul-de-sac to preclude cut-through traffic. A bridge will provide access over Lemon Creek to those homes south of Lemon Creek that will be accessed from Meadow Pass Road.

2.4 Open Space

The entirety of Lemon Creek will be preserved and included within 12.2 acres of privately owned and residentially zoned property - over 47% of the site – that will serve as permanent open space. Currently, the site contains approximately 1,876 trees. Through preservation and new plantings, the project will increase the number of trees onsite to approximately 1,936, also increasing the ratio of native to non-native/invasive trees. The developer will improve to City trail standards a public trail that will run through the open space area, passing across the project's primary road. An easement will then be granted to the City for the long-term operation and maintenance of the public trail.

As is common with existing development throughout the City's Residential Planned Development Zone, 9.5 acres of the open space area will be within privately owned residential lots. Those portions of open space, Lemon Creek, and the public trail within private lots will be subject to recorded deed restrictions prohibiting use of the restricted open space by the owners of the private lots, including planting vegetation, installing fencing, or otherwise developing or using the restricted natural open space areas. The restrictions will be enforceable by the City. The remaining 2.7 acres of the open space area will consist of internal slope areas and water quality basins that will be owned by a public agency or the Homeowners Association (HOA) and subject to similar deed restrictions.

The open space will be maintained by a combination of a Lighting and Open Space Maintenance District (LOSMD) through a new zone funded entirely by the project's homeowners (as to the natural open space only), the City (as to the trail only), the flood control district or another public or quasi-public agency (as to stormwater retention basins only), and the project's HOA.

2.5 Stormwater / Lemon Creek

Three public storm drain inlets along Meadow Pass Road at the northerly boundary of the project site currently direct offsite stormwater into and through existing public storm drain lines within the project site. That offsite stormwater then enters Lemon Creek through two existing outlets. These public storm drains, which do not capture onsite stormwater now and will not do so when the project is complete, will be

realigned under the project streets. One of the existing outlets into Lemon Creek will remain in its current location, while the second will be relocated to a point below the proposed project bridge.

While onsite stormwater historically flows directly into the creek, two water quality basins have been designed to detain any increase in on-site stormwater runoff resulting from the proposed project, up to a 100-year storm event. These basins will treat on-site runoff up to the 85th percentile storm event, consistent with Los Angeles County regulations. One water quality basin will be in the northern portion of the site and will hold and gradually release project stormwater into an existing public storm drain connection which enters the property from Lemon Avenue. The second water quality basin will be in the southern portion of the site and will hold and gradually release project stormwater into a proposed outlet to Lemon Creek. These water quality basins are designed to assure that project stormwater will enter Lemon Creek onsite at a volume and flow rate no greater than presently occurs. Runoff entering Lemon Creek will then pass offsite into existing public drainage facilities located on public property adjacent to the project site at La Puente Road.

In addition, one of the four existing onsite culverts ("Culvert D," located approximately 100 linear feet upstream of La Puente Road) will be removed, restoring the native creek in this location.

2.6 Project LID Regulations

Lemon Creek, a natural conveyance feature that ultimately drains to the San Jose Creek Diversion Channel, flows through the property, conveying both on- and off-site flows. The project plans to develop approximately 13.6 acres of the property, which will add more than 10,000 square feet of impervious area. The entirety of Lemon Creek will be preserved and included within 12.2 acres of privately owned and residentially zoned property – over 47% of the site – that will serve as permanent open space.

Table 2-1 below describes the types of projects that the *LID Manual* categorizes as 'designated projects'. Based on the planned disturbed area and increase in impervious area, the Brookside project can be categorized as a 'designated' project and will therefore will be subject to a specific set of requirements presented in the LID Manual.

Table 2-1: Designated Project Characteristics for Brookside

Category	Yes	No
1. Development of a new project equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet of impervious area	X	
2. Development of a new industrial park with 10,000 square feet or more of surface area		X
3. Development of a new commercial mall with 10,000 square feet or more surface area		X
4. Development of a new retail gasoline outlet with 5,000 square feet or more of surface area		X
5. Development of a new restaurant (SIC 5812) with 5,000 square feet or more of surface area		X
6. Development of a new parking lot with either 5,000 ft^2 or more of impervious area or with 25 or more parking spaces		X
7. Development of a new automotive service facility (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7538) with 5,000 square feet or more of surface area		X
8. Projects located in or directly adjacent to, or discharging directly to a Significant Ecological Area (SEA), where the development will:		X
a. Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and		X
b. Create 2,500 square feet or more of impervious area		X
9. Redevelopment of 5,000 square feet or more in one of the categories listed above		X
10. Redevelopment of 10,000 square feet or more to a Single Family Home, without a change in landuse		X

As a 'designated project', the Brookside Project must:

- Conduct site assessment and identify design considerations, including determining the feasibility of on-site infiltration
- Apply site-specific source control measures
- Apply site design principles
- Calculate stormwater quality design volume
- Implement stormwater quality control measures
- Implement alternative compliance measures, if necessary
- Implement hydromodification requirements, if necessary
- Develop a maintenance plan, if necessary

The following sections demonstrate how the proposed Brookside project meets these requirements.

2.7 Existing Site Characteristics

The current 25.8- acre site (1.1M sq. ft.) is mostly undeveloped, with on- and off-site flows draining to Lemon Creek, which measures approximately 2,340 feet in length through the center of the property. Off-site flows enter three existing storm drain inlets located along Meadow Pass Road and are conveyed in two storm drain pipes before outletting to two different locations in Lemon Creek. On-site flows pass overland as surface flow before eventually entering Lemon Creek. The project reach of Lemon Creek begins north of Meadow Pass Road and ends at the La Puente Culvert on the downstream side. The Lemon Creek watershed is about 1,541 acres in size at the confluence point of the La Puente Culvert. The project site constitutes approximately 1.6% of this area. A regional hydrology analysis performed by PACE, which is described in *Brookside Development Project – Lemon Creek Hydrology & Hydraulics Report,* goes into further details of the entire Lemon Creek watershed. Through this analysis, it was determined that the overall Lemon Creek watershed is approximately 77% developed.

Nearly all of the main channel area in the project reach of Lemon Creek is vegetated. Some of the older trees were observed to be 15 years in age or older. The stream has a natural, trapezoidal shape with a low flow incisement generated by a near constant flow of water. There are multiple constructed sections of the stream, mostly at each of the four existing culvert locations. Additionally, these culverts provide creek crossing points for the adjacent trail network. A field investigation was performed by PACE on August 30th, 2021, during which a photo survey was performed to document the current conditions in the creek. Representative photos are presented in **Figures 2-2** through **2-7**.

In accordance with the guidelines laid out in the Los Angeles County Department of Public Works *Hydrology Manual*, the HydroCalc 0.2.0 program was used to simulate the existing on-site hydrology, using the Modified Rational Method. The 85th percentile, 2-yr, 10-yr, 50-yr, and 100-yr storms were each assessed in order to determine peak runoff flow rates and volumes.

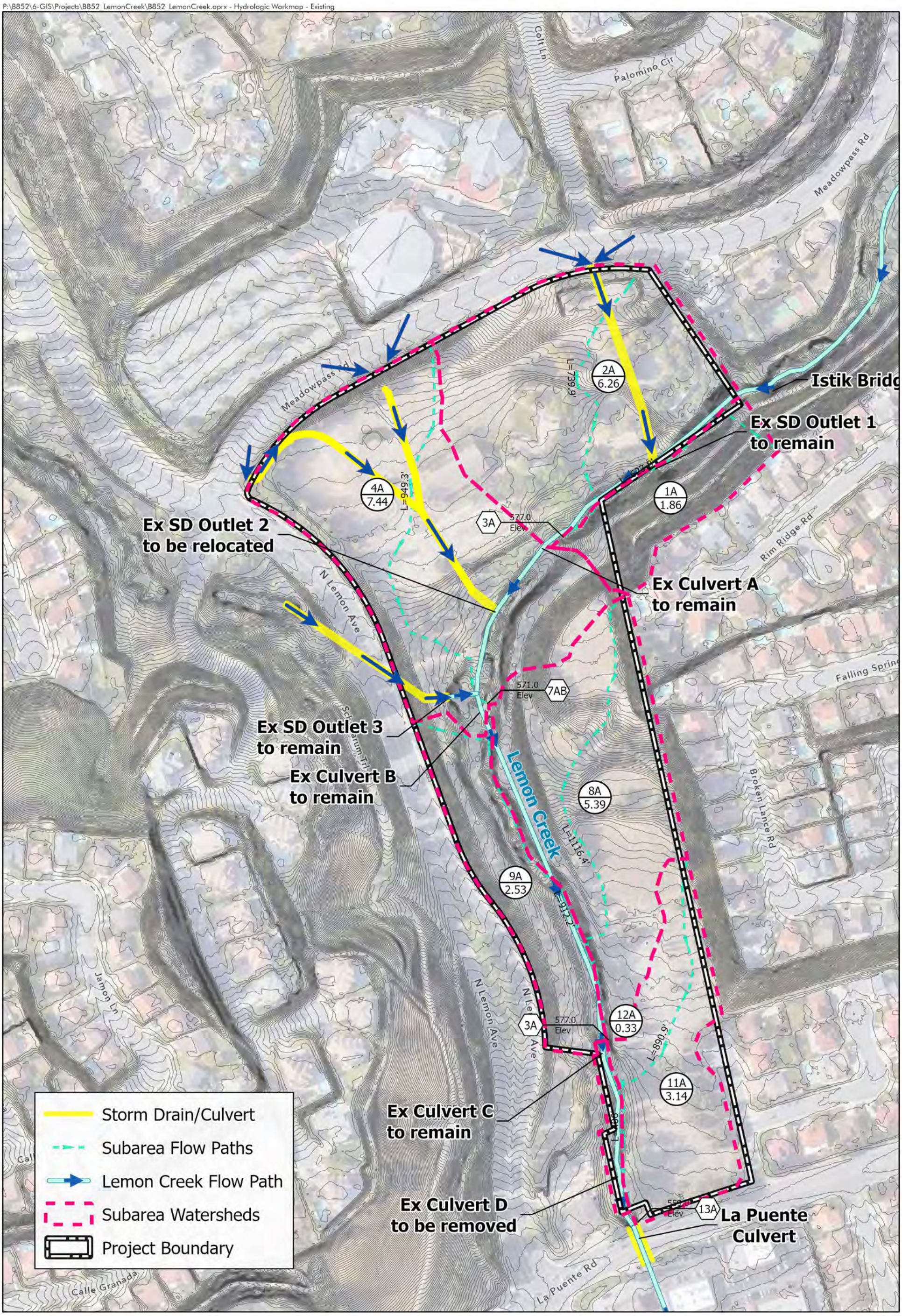
Seven sub-watersheds were delineated for the existing site using 1-foot contour topographic data obtained by Michael Baker International in 2019. The sub-watersheds range in size from 0.33 acres to 7.44 acres and are mixed land use, predominantly categorized as open space and recreation. A hydrologic workmap for existing conditions is shown in **Figure 2-1**. Land use data was obtained from LACDPW Water Resources Publications website, and analyzed using GIS software ArcMap. The site has a relatively small amount of impervious land cover, consisting of approximately 6% of the total area (1.6 ac). Additionally, the LACDPW Water Resources Publications website showed that the site contains soil types 2 and 17. **Table 2-2** summarizes the existing site characteristics, which were used in the on-site hydrology analysis. It should be noted that the sum total of watershed areas listed in **Table 2-2** is equal to 26.9 acres, which exceeds the total site area (25.8 acres). This is due to the fact that small off-site areas drain through the property, which were included in the on-site hydrology analysis for both existing and proposed conditions.

Site survey revealed existing utilities, which include storm drain, water, and sewer lines. Most of these exist in the northern portion of the site, but there are existing sewer and water lines on the south end of the site as well.

Table 2-2: Existing Conditions Site Attributes

WS Name	Acres	L	Slope	Land Use	Percent Impervious	Soil Group	Soil Type
1A	1.86	623.8	0.11061	Mixed / Majority Road	65.6%	C	2
2A	6.26	739.9	0.06623	Mixed / Majority Open Space & Recreation	2.1%	C	17
4A	7.44	949.3	0.05794	Mixed / Majority Open Space & Recreation	0.0%	C	17
8A	5.39	1116.4	0.08151	Mixed / Majority Open Space & Recreation	1.6%	C	2
9A	2.53	912.2	0.05591	Mixed / Majority Open Space & Recreation	0.7%	C	2
11A	3.14	890.9	0.02469	Mixed / Majority Open Space & Recreation	2.8%	C	2
12A	0.33	406.0	0.01970	Mixed / Majority Open Space & Recreation	31.4%	C	2
Total Area =	**26.9**	**ac**					

P:\B852\6-GIS\Projects\B852_LemonCreek\B852_LemonCreek.aprx - Hydrologic Workmap - Existing



BROOKSIDE DEVELOPMENT

ON-SITE WATERSHEDS WORKMAP EXISTING

PACE Advanced Water Engineering

0 100 200 400 Feet

Date: 3/30/2023

Job Number: B852

Figure 2-1

Figure 2-2: Downstream Face of 'Culvert A'



Figure 2-3: Downstream Face of 'Culvert B'



Figure 2-4: Upstream Face of 'Culvert C'



Figure 2-5: Downstream Face of 'Culvert D' (to be removed)



Figure 2-6: Dense Vegetation Within Lemon Creek



Figure 2-7: La Puente Culvert at Downstream End of Property



2.8 Proposed Site Characteristics

The proposed project will develop approximately 13.6 acres of the 25.8-acre site, including 27 residential housing lots with a minimum area of 28,500 square feet each, public streets, walkways, wet and dry utilities, two Stormwater Basins, vegetated planting spaces, and the removal of Culvert D. Lemon Creek, which includes both CDFW and ACOE jurisdictional areas, will remain largely untouched by the development, with the exception of the added 'Street B' bridge crossing over the creek and the removal of Culvert D. The proposed development will increase the impervious area on-site by approximately 5.9 acres, as compared to existing conditions.

In accordance with the guidelines laid out in the LA County Hydrology Manual, the HydroCalc 2.0 program was used to simulate the proposed on-site hydrology, using the Modified Rational Method. The 85th percentile, 2-yr, 10-yr, and 50-yr, storms were each assessed in order to determine peak runoff flow rates and volumes, and to compare them to existing conditions. Although not required, the 100-yr storm was also analyzed, in order to provide additional protection to Lemon Creek and the proposed development.

Ten sub-watersheds were delineated for the proposed site, using both existing 1-foot topographic contour data obtained by Michael Baker International in 2019, as well as the proposed site development plan, as shown on the January 2023 tentative tract map (**Figure 2-10**). A hydrologic workmap for the proposed conditions site is shown on **Figure 2-8**. The sub-watersheds range in size from 0.97 acres to 4.31 acres and are mixed land use, predominantly categorized as Open Space & Recreation (18.8 acres). The impervious land cover in proposed conditions is approximately 28% of the total area (7.5 ac). **Table 2-3** below summarizes the proposed site characteristics, which were used in the on-site hydrology analysis.

Table 2-3: Proposed Conditions Site Attributes

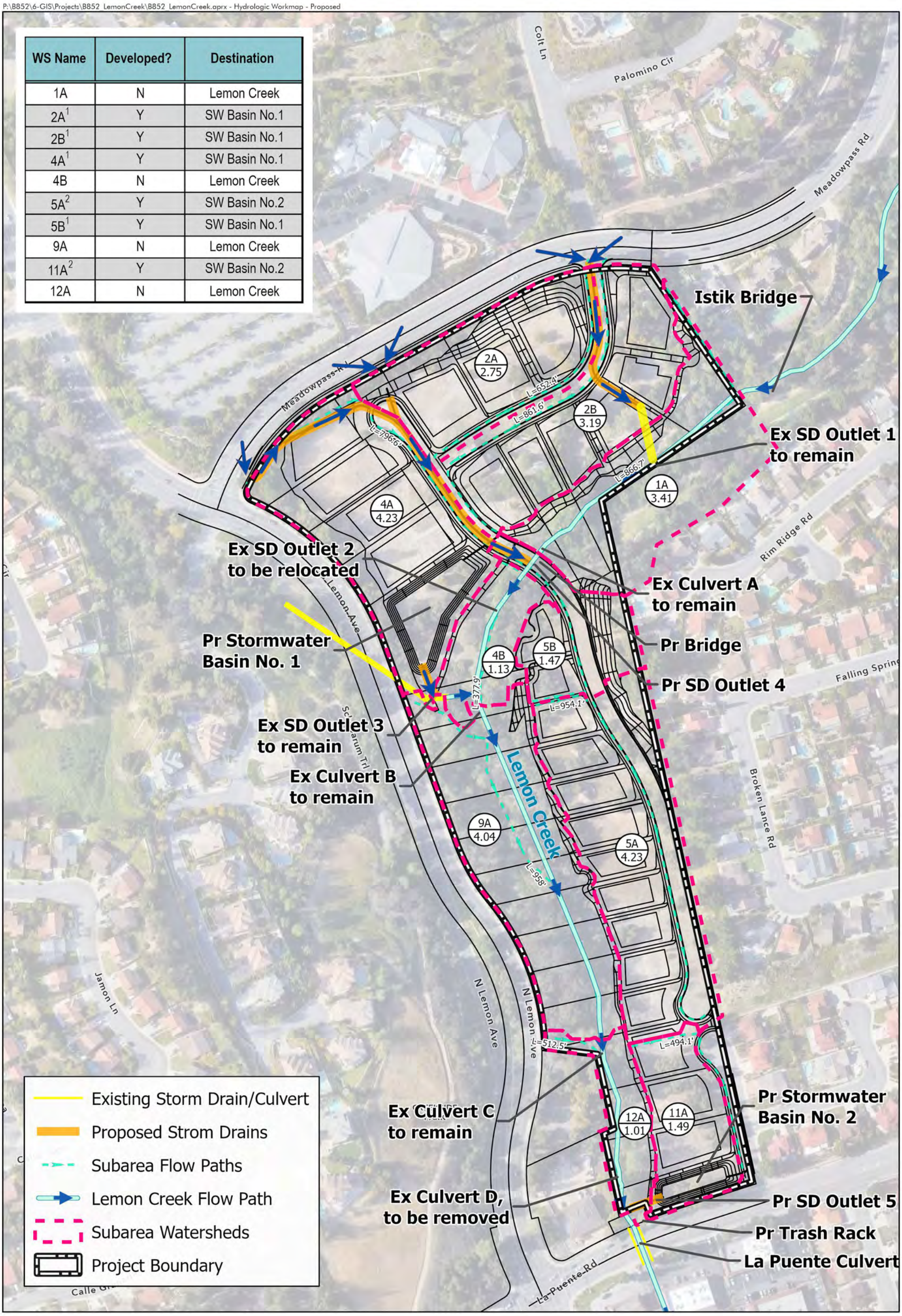
WS Name	Acres	L	Slope	Land Use	Percent Impervious	Soil Group	Soil Type
1A	3.28	866.7	0.04038	Mixed / Majority Open Space & Recreation	37.0%	C	2
2A[1]	2.75	652.4	0.04599	Residential	74.5%	C	17
2B[1]	3.32	861.6	0.03714	Residential	42.9%	C	2
4A[1]	4.31	796.6	0.01130	Residential	19.6%	C	17
4B	1.05	377.9	0.02646	Mixed / Majority Open Space & Recreation	0.1%	C	2
5A[2]	4.24	954.1	0.03354	Residential	45.3%	C	2
5B[1]	1.47	542.7	0.01290	Residential	46.0%	C	2
9A	4.02	958.0	0.05323	Mixed / Majority Open Space & Recreation	0.3%	C	2
11A[2]	1.53	494.1	0.00607	Residential	26.3%	C	17
12A	0.97	512.5	0.07414	Mixed / Majority Open Space & Recreation	13.3%	C	2
Total Area =	**26.9**	**ac**					

Notes:
- *Gray cells indicate sub-watershed is developed in proposed conditions*
- *Superscript 1 indicates sub-watershed drains to Stormwater Basin No.1*
- *Superscript 2 indicates sub-watershed drains to Stormwater Basin No.2*

Much of the existing sewer and storm drain easements on the project site will be quitclaimed and a new sewer and storm drain system will be constructed to meet the needs of the Brookside development. The existing water utilities will be untouched, with the exception of tying in the proposed domestic water system at key locations. Existing and proposed storm drain alignments are shown on **Figure 2-8**.

P:\B852\6-GIS\Projects\B852_LemonCreek\B852_LemonCreek.aprx - Hydrologic Workmap - Proposed

WS Name	Developed?	Destination
1A	N	Lemon Creek
2A[1]	Y	SW Basin No.1
2B[1]	Y	SW Basin No.1
4A[1]	Y	SW Basin No.1
4B	N	Lemon Creek
5A[2]	Y	SW Basin No.2
5B[1]	Y	SW Basin No.1
9A	N	Lemon Creek
11A[2]	Y	SW Basin No.2
12A	N	Lemon Creek



BROOKSIDE DEVELOPMENT

ON-SITE WATERSHEDS WORKMAP PROPOSED

PACE Advanced Water Engineering

0 100 200 400 Feet

Date: 3/30/2023

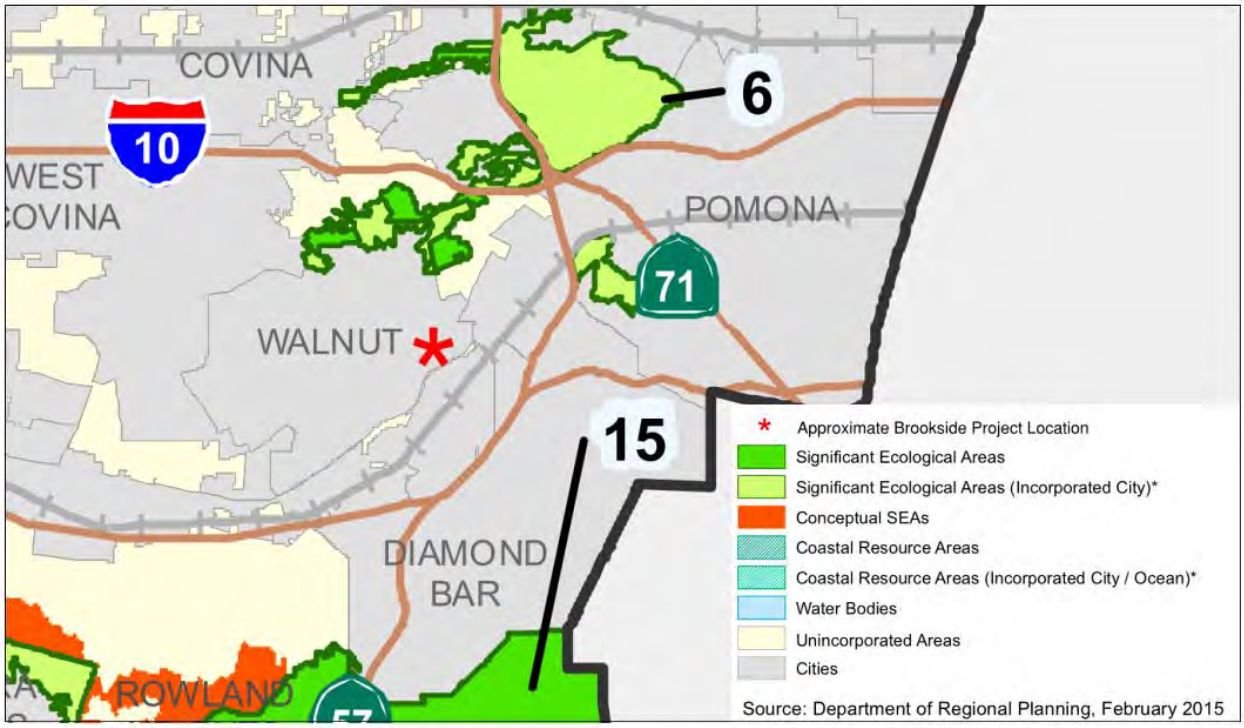
Job Number: B852

Figure 2-8

2.8.2 *Significant Ecological Areas (SEAs)*

A review of the current Significant Ecological Areas and Coastal Resources Areas (SEA) Policy Map for the County of Los Angeles revealed that the project is not located in or directly adjacent to or directly discharging to an SEA. **Figure 2-9** shows a portion of the SEA map which includes the City of Walnut.

Figure 2-9: SEA Map for the City of Walnut



2.8.3 *Hydromodification Analysis*

According to the definitions laid out in the LA County *LID Standards Manual*, the Brookside project is a designated project that is tributary to a natural drainage system (Lemon Creek) and is required to implement hydromodification controls. The Brookside project is required to analyze for hydromodification impact during the 85th percentile, 2-yr, 10-yr, and 50-yr storm events, per the LACDPW Hydraulic and Hydrology manuals and regulate stormwater discharges from the site to mitigate any hydromodification impacts indicated by the analyses. In addition, the 100-yr storm event was also analyzed, in order to provide further protection to the Creek and proposed development. The hydromodification analysis performed for the Brookside project is discussed in further detail in **Section 7**.

According to the *LID Manual,* the Brookside project is not required to perform a sediment transport analysis as part of the hydromodification analysis, because the capital flood flow rate is less than 5,000 cfs. A hydrology information request submitted to LA County's Flood Control District in April of 2014 indicated that the capital flood flow rate at the La Puente culvert was 3,255 cfs.

2.9 Property Ownership / Management

The existing project site has a General Plan designation of Very Low Density and is zoned Residential Planned Development Zone (RPD) with a designation of RPD–28,500–1.3. Pursuant to Section 6.24.030 A2 of the Walnut Municipal Code, the project proposes the development of 27 detached single-family homes under R-1 standards with a minimum lot size of 28,500 square feet. The site is owned by Spring Meadows Homes LLC / Meadow Pass Estates LLC.

All project streets will be public. The northerly 25 homes will take access from Meadow Pass Road and the two most southerly homes will take access from San Vicente Drive, with each street ending in a cul-de-sac

to preclude cut-through traffic. A bridge will provide access over Lemon Creek to those homes south of Lemon Creek that will be accessed from Meadow Pass Road.

The existing trail on the site, although private property, is utilized by many local residents. In order to permanently preserve public access to this valued asset, the trail will be improved to City standards and an easement will then be granted to the City for the long-term operation and maintenance of the public trail. The trail will cross Lemon Creek at Culvert A only, as occurs in existing conditions.

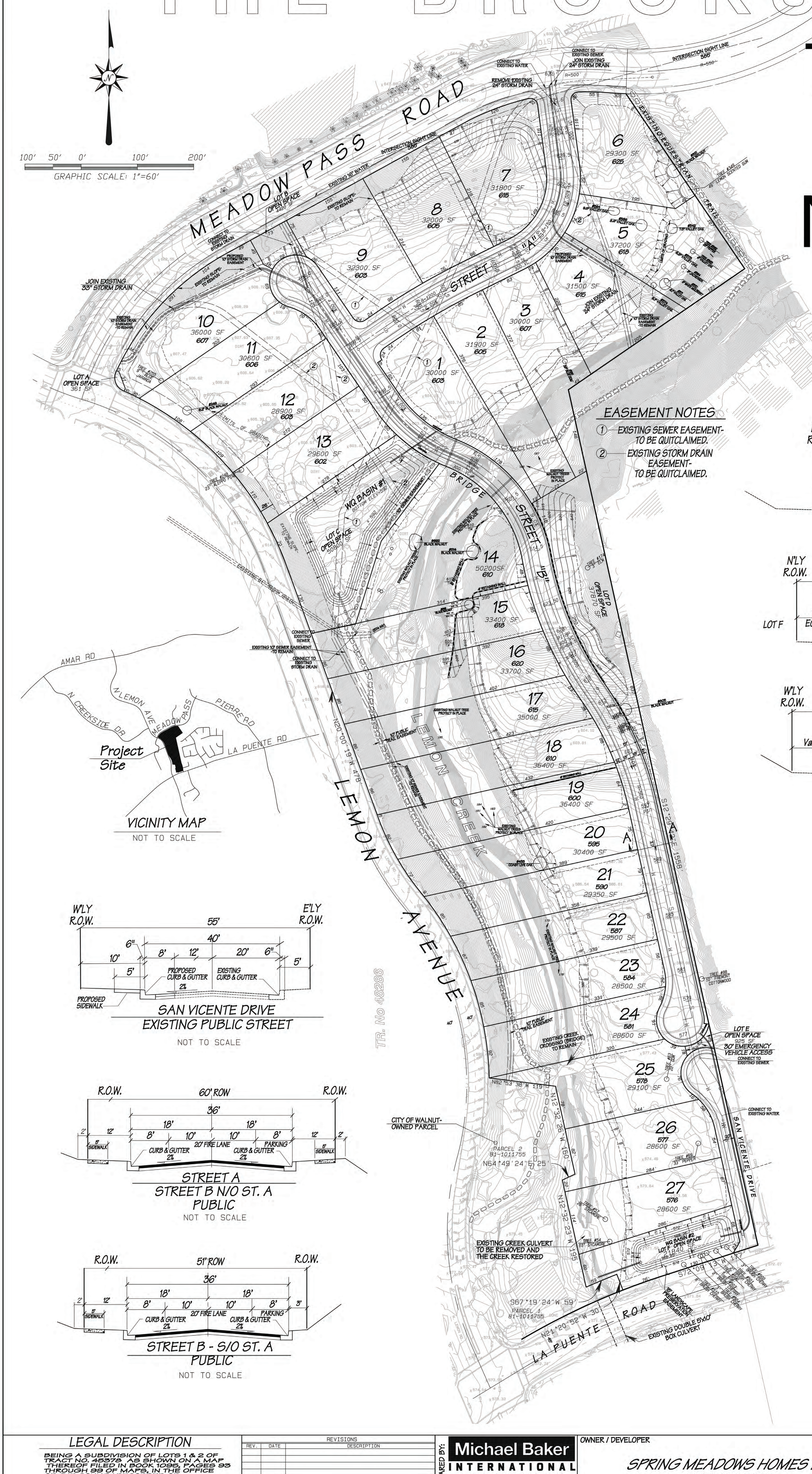
As is common with existing development throughout the City's Residential Planned Development Zone, 9.5 acres of the open space area will be within privately owned residential lots. Those portions of open space, Lemon Creek, and the public trail within private lots will be subject to recorded deed restrictions prohibiting use of the restricted open space by the owners of the private lots, including planting vegetation, installing fencing, or otherwise developing or using the restricted natural open space areas. The restrictions will be enforceable by the City. The remaining 2.7 acres of the open space area will consist of internal slope areas and water quality basins that will be owned by a public agency or the Homeowners Association (HOA) and subject to similar deed restrictions.

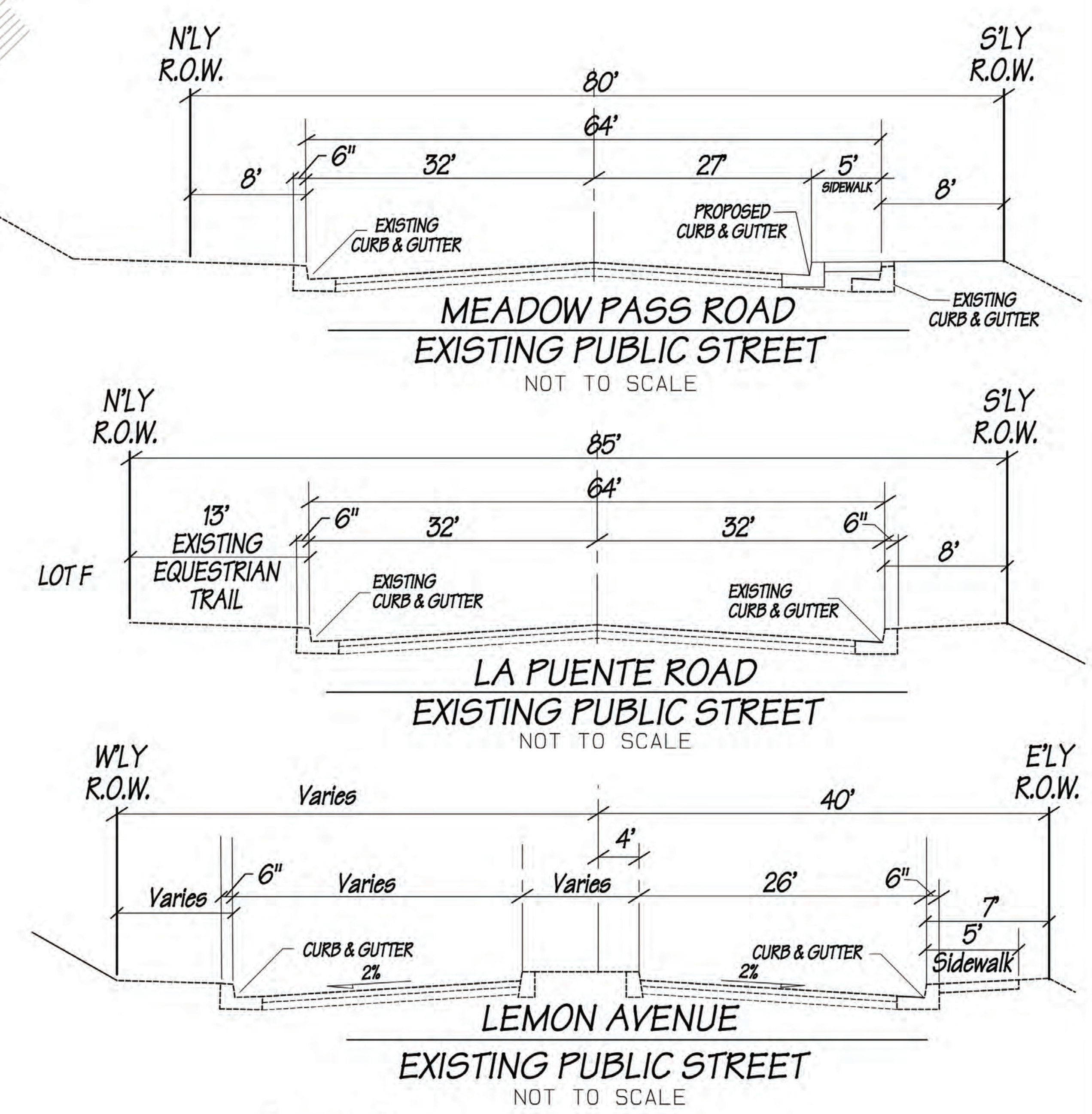
The open space will be maintained by a combination of a Lighting and Open Space Maintenance District (LOSMD) through a new zone funded entirely by the project's homeowners (as to the natural open space only), the City (as to the trail only), the flood control district or another public or quasi-public agency (as to stormwater basins only), and the project's HOA.

THE BROOKSIDE

TENTATIVE TRACT NO. 72798

City of Walnut, County of Los Angeles State of California





Legend

- Proposed Property Line Shown Thus:
- Proposed Centerline Shown Thus:
- Proposed Contour Shown Thus: 100
- Existing Contour Shown Thus: 100
- Proposed Storm Drain Shown Thus:
- Proposed Sewer Line Shown Thus: S
- Proposed Water Line Shown Thus: W
- Lot Numbers Shown Thus: 28
- Proposed Street Elevation Shown Thus: 1475.5
- Proposed Street Grade Shown Thus: 0.50%
- Proposed Access/Public Utility Easement Shown Thus:
- Cut/Fill Line Shown Thus C F
- Manufactured Slopes Shown Thus
- Proposed Retaining Wall Shown Thus:
- Proposed/Existing Hiking/Equestrian Trails Shown Thus:
- Existing Tree (within graded area) to remain — TREE #63 22" GUM (TREE NUMBER PER ARBORIST REPORT; SIZE AND TYPE OF TREE)

General Information

1. EXISTING LAND USE: VACANT, EQUESTRIAN FACILITY (CLOSED)
2. PROPOSED LAND USE: SINGLE FAMILY RESIDENTIAL, OPEN SPACE
3. SURROUNDING LAND USE- N: Church, Residential
   W: Residential, Fire Station
   E: Residential
   S: Commercial
4. MINIMUM LOT SIZE: 28,500 SF
5. CURRENT ZONING: R.P.D. 28,500 - 1.3 DU
6. PROPOSED ZONING: R-1 28,500SF
7. DENSITY: 0.92 UNITS/ACRE
8. UTILITY COMPANIES:
   GAS: SOUTHERN CALIFORNIA GAS CO. (800) 427-2200
   ELECTRICITY: SOUTHERN CALIFORNIA EDISON (800) 655-4555
   WATER: WALNUT VALLEY WATER DISTRICT (909) 595-7554
   SEWER: CONSOLIDATED SEWER MAINTENANCE DISTRICT
   REFUSE: VALLEY VISTA SERVICES (800) 442-6454
9. THOMAS GUIDE - LOS ANGELES COUNTY 2006 EDITION: PAGE 639, GRID 6E
10. ALL SLOPES SHALL BE CONSTRUCTED AT A RATIO OF 2:1 UNLESS OTHERWISE INDICATED.
11. ALL STREETS WILL BE PUBLIC.
12. ASSESSOR'S PARCEL NUMBERS: 8709-093-001, 002, & 003
13. APPROXIMATE EARTHWORK: CUT: 60,000 CY
    *FILL: 60,000 CY *ALLOWANCE INCLUDED FOR SHRINKAGE.
14. GEOLOGIST: GROUP DELTA CONSULTANTS, INC.
    370 AMAPOLA AVENUE, SUITE 212
    TORRANCE, CA 90501
    (310) 320-5100
15. MAXIMUM STREET GRADE IS 12%.

27 RESIDENTIAL (LOTS 1-27) 19.75 AC
6 OPEN SPACE LOTS-2.67 AC
33 TOTAL NUMBER OF LOTS

Tentative Tract No. 72798

3 PUBLIC STREETS
SAN VICENTE DR., STREET A, STREET B -3.22 AC
PROJECT AREA ACREAGE: 25.84 ACRES GROSS
CONTOUR INTERVAL: 1 FOOT

Sheet Index

1. TENTATIVE TRACT MAP
2. OPEN SPACE EASEMENT EXHIBIT

JANUARY 6, 2023

LEGAL DESCRIPTION

BEING A SUBDIVISION OF LOTS 1 & 2 OF TRACT NO. 45378 AS SHOWN ON A MAP THEREOF FILED IN BOOK 1095, PAGES 93 THROUGH 99 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, CALIFORNIA

REVISIONS		
REV.	DATE	DESCRIPTION

PREPARED BY: Michael Baker INTERNATIONAL
5 HUTTON CENTRE DR. SUITE 500
SANTA ANA, CALIF 92707
949-472-3505
JN: 137644

OWNER / DEVELOPER
SPRING MEADOWS HOMES LLC
18217 GALE AVE., SUITE A
CITY OF INDUSTRY, CA 91748
ATTN.: MR. JACK SU (626) 817-6989

THE BROOKSIDE
TENTATIVE TRACT
NO. 72798
City of Walnut, County of Los Angeles

Figure 2-10

PLOT DATE: 1/6/2023

H: \pdata\137644\TERRA\TTM update_1-03-23.pro

3 Geotechnical Conditions

A draft geotechnical analysis and report were prepared by Group Delta in March 2023, which concluded that the proposed Brookside Project is feasible from a geotechnical standpoint. Their analysis was useful in determining topographic characteristics of the site, the type of soil and geologic formations present, location of groundwater, geotechnical hazards, required setbacks, and infiltration rates. The percolation test was especially useful in determining the infiltration potential at the site, which was utilized in the selection and design of Brookside's water quality control measures (**Section 7**) and hydromodification controls (**Section 8**).

3.1 Topography

The current site grade varies approximately from an elevation of 640 feet on the north boundary adjacent to Meadow Pass Road down to elevation 572 feet on the southern boundary adjacent to La Puente Road. The southern portion of the site is free of any structures and mostly developed by prior agricultural and equestrian use. The northern portion of the site has improvements related to the development of Meadow Pass Road and an abandoned equestrian facility. In review of the USGS historical topographic map from 1926, it appears that significant cuts and fills have been placed to develop the current landscape at the site.

The soil conditions beneath the site were explored by drilling four (4) borings (B-18 to B-21) to depths of 26 to 46 feet below the existing grade using hollow stem auger drilling equipment. In addition, five tests pits were excavated to depths of about 7 to 10 feet below the existing grade.

3.2 Groundwater

Current groundwater was encountered at depths of about 18 feet in boring B-14 to 34.5 feet in Boring B-3. There is surface water flowing within the unconfined channel of Lemon Creek. The historical highest groundwater contours and borehole log data (San Dimas Quadrangle, CGS, 1998) does not have adequate coverage at the project site. The adjacent data indicates that the historical highest groundwater at this area is deeper than 20 feet below ground surface.

Since shallowest groundwater encountered in the borings is 18 feet below existing grade, the design groundwater level was assumed to be at a depth of 18 feet.

3.3 Geotechnical Hazards

3.3.1 Liquefaction

The northern portion of the site and southern end of the site are located in a mapped liquefaction hazard zone on the California Seismic Hazard Zone Map for San Dimas 7.5-minute Quadrangle (CGS, 1999). Liquefaction triggering analyses were performed per the County of Los Angeles Administrative Manual (GS 045.0, Rev. 10/1/14). The results of the liquefaction triggering analyses indicate that the potential for liquefaction is high in the southern portion of the site near Lemon Creek and decreases to the eastern portion of the site where building pads are planned. The potential for liquefaction is low in the northern portion of the site. The limits of high liquefaction potential zones will be determined during design-level geotechnical investigations. Mitigation measures to reduce liquefaction-induced settlements, ground displacements, and loss of bearing capacity may include ground improvement and/or mat foundations for the proposed structures. Mitigation measures to reduce potential lateral spreading / offsets may be mitigated through mat foundation design.

3.3.2 Landslides

The site is not within a known landslide zone, however, the proposed development includes cuts and fills near existing slopes; therefore, slope stability analyses were performed at key locations. The results of the stability analyses indicated that global stability would not be an issue if properly addressed by engineered mitigations; therefore, the development will be setback from adjacent slopes in accordance with Section 1808.7 of the 2022 California Building Code. No other special structural setback is required.

3.3.3 Erosion

Substantial soil erosion can occur along slopes and gentle gradients where loose and weakly vegetated soils are present and exposed to surface water flow and / or wind; therefore, slopes steeper than 1 Horizontal : 1 Vertical are subject to higher probability and rate of erosion as well. However, there are several ways to address erosion, including but not limited to establishing deep-rooted vegetation, or fortifying susceptible areas with rock or concrete.

3.3.4 Collapse / Expansion

Soft clays and organic rich soils encountered near Lots 2 through Lot 6 pose the risk of collapsing or settlement under weight of proposed new fills. Mitigation measure would consist of supporting the proposed structure on mat foundations established on ground improvement, or deep foundations.

The onsite soils consist predominantly of clayey alluvium underlain by bedrock. The clayey alluvium and bedrock are not subject to hydroconsolidation. Therefore, potential for hydroconsolidation is considered low.

The site is not mapped in an active subsidence area, as defined by the USGS, online map of Areas of Land Subsidence in California. Nor is it within an active oil field as defined by the CalGEM GIS Well-Finder. The potential for subsidence hazard at the project site is considered low.

The clayey soils onsite have a high potential for expansion and can significantly impact building slab support, hardscape, pavement and flat works. Mitigation of expansive soils for building slabs, hardscape, pavement and flat works would consist of excavation and replacing the upper expansive clay with non-expansive import soils and/or reinforced pavements.

3.4 Site Preparation and Grading

Where excavations are deeper than about 4 feet, the sides of the excavations should be sloped back at 1:1 (horizontal to vertical) or shored for safety. Unshored excavations should not extend below a plane drawn at 1½:1 (horizontal to vertical) extending downward from adjacent existing footings.

Structural fill or backfill should be compacted to at least 95 percent of the maximum dry density. Fill placed in non-structural areas should be compacted to at least 90 percent of the maximum dry density. The moisture content of the on-site soils at the time of compaction should vary no more than 2% below or above optimum moisture content. The moisture content of the on-site clayey soils at the time of compaction should be between 2% and 4% above optimum moisture content.

3.5 Setbacks

Based on the results of the stability analysis, global stability will not be an issue if proper engineering mitigation is developed. The proposed structures may be setback from adjacent slopes in accordance with Section 1808.7 of the 2022 California Building Code. No other special structural setback is required.

3.6 Feasibility of Infiltration

Infiltration tests were performed at three boring locations. Following saturation, falling head permeability tests were conducted in each test well in accordance with Los Angeles County Administrative Manual (GS200.1, 2021). The calculated infiltration rate for each of the borings is shown in **Table 3-1**.

Table 3-1: Infiltration Test Results

Test ID (Boring)	Soil Type	Test Interval Depth (feet)	Calculated Infiltration Rate (in/hr)
I-1	ML/CL	2-5	0.2
I-2	ML/CL	0-5	0.2
I-3	ML/CL	0-5	0.1

Based on the most recent GMED Policy GS 200.1, the required minimum design infiltration rate is 0.3 inches per hour for infiltration facilities. The maximum infiltration rate measured during the percolation test was 0.2 in/hr; therefore, stormwater infiltration is not considered a feasible option at the site. Any requirements to retain or infiltrate water on-site need to be met without the aid of infiltration.

Because of the low hydraulic conductivity associated with the fine-grained soils on the site, any proposed detention / water quality basins have a risk of saturating the adjacent slopes and causing slope instability. Because of this, it is recommended that the proposed Stormwater Basins be lined with an impermeable liner.

4 Source Control Measures

Source control measures are designed to prevent pollutants from contacting stormwater runoff or prevent discharge of contaminated stormwater runoff to the storm drain system and/or receiving water. Source control measures can be either structural or non-structural. Non-structural source control measures include good housekeeping and employee training to optimize pollution prevention. Non-structural measures are discussed in the *California Stormwater Best Management Practices Handbooks* (California Stormwater Quality Association, 2003). The proposed Brookside project plans to meet all standard non-structural source control measures.

The structural source control measures that the Brookside project is required to utilize are shown in **Table 4-1** below. These source control measures are laid out in the *LID Standards Manual* for the project category that Brookside falls into.

Table 4-1: Structural Source Control Measures Required for Brookside

Designated Projects – New Development Development ≥1 acre and ≥10,000 ft² new impervious area		
Source Control Measure	**Yes**	**No**
Storm Drain Messaging and Signage (S-1)	X	
Outdoor Material Storage Area (S-2)	X	
Outdoor Trash Storage / Waste Handling Area (S-3)		X
Outdoor Loading/Unloading Dock Area (S-4)		X
Outdoor Vehicle Equipment Repair / Maintenance Area (S-5)		X
Outdoor Vehicle Equipment / Accessory Wash Area (S-6)		X
Fuel & Maintenance Area (S-7)		X
Landscape Irrigation Practices (S-8)	X	
Building Materials (S-9)	X	
Animal Care & Handling Facilities (S-10)		X
Outdoor Horticulture Areas (S-11)		X

4.1 Proposed Source Control Measures

The Brookside project will utilize the required structural source control measures laid out in **Table 4-1**, in order to prevent pollutants generated on-site from discharging to Lemon Creek. Each of the source control measures are described in the following sections.

4.1.1 Storm Drain Message and Signage (S-1)

Storm drain messages are useful in alerting and reminding the public about the effects of and prohibitions against waste disposal into the storm drain system. These signs are typically stenciled or affixed near the storm drain inlet or catch basin. The message informs the public that dumping of waste into storm drain inlets is prohibited and/or ultimately discharges to receiving waters.

Signs will be posted at designated public access points along Lemon Creek. Storm drain message markers (e.g. “No Dumping – Drains to Ocean”) will also be affixed to all storm drain inlets and catch basins within the project area to discourage illegal or inadvertent dumping.

The Brookside Project will either enter into a maintenance agreement with a public agency or will record a deed restriction upon the property title to maintain the legibility of the placards and signs.

4.1.2 Outdoor Material Storage Area (S-2)

The storage of materials in a designated outdoor area including raw materials, by-products, finished products, and waste products can become a source of pollutants in stormwater runoff if not handled or stored properly. Contamination of stormwater runoff may be prevented by eliminating the possibility of stormwater runoff contact with the material storage areas either through diversion, cover, or capture of the stormwater runoff. The Brookside Project will contain temporary outdoor material storage / staging areas during construction on a lot-by-lot basis. No outdoor material storage areas will be part of the permanent site design.

Materials are classified into three categories based on the potential risk of pollutant release associated with stormwater runoff contact:

Table 4-2: Classification of Materials for Potential Pollutant Risk

1 - High Risk	• Recycled materials with discharge potential • Corrosives • Food items • Chalk/gypsum products • Scrap or salvage goods • Feedstock/grain • Fertilizers • Pesticides • Compost • Asphalt • Lime/lye/soda ash • Animal/human wastes • Rubber and plastic pellets or other small pieces • Uncured concrete/cement • Lead and copper, and any metals with oil/grease coating
2 - Medium Risk	• Clean recycled materials without discharge potential • Metal (excluding lead and copper, and any metals with oil/grease coating) • Sawdust/bark chips • Sand/soil • Unwashed gravel/rock
3 - Low Risk	• Washed gravel/rock • Finished lumber (non-pressure treated) • Rubber or plastic products (excluding small pieces) • Clean, precast concrete products • Glass products (new) • Inert products • Gaseous products • Products in containers that prevent contact with stormwater (fertilizers and pesticides excluded)

The Brookside Project will prevent pollutants from temporary storage areas during construction from reaching stormwater runoff through either diversion, cover, or capture of the stormwater runoff. In addition, if any materials are used in the construction process that are listed in **Table 4-2** above, appropriate handling of the material will be exercised as specified in Table D-2 of the *LID Standards Manual*.

Accumulated water within the construction areas will be disposed of in accordance with applicable laws and regulations and will not be discharged directly to the storm drain or sanitary sewer system without appropriate permitting.

Outdoor material storage areas will be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on.

4.1.3 Landscaping Irrigation Practices (S-8)

Excess irrigation runoff can provide a pathway for pollutants (i.e., nutrients, bacteria, organics, sediment) to enter Lemon Creek. By effectively irrigating, less runoff is produced, resulting in less potential for pollutants to enter the storm drain system. The Brookside project will employ the following landscaping irrigation practices:

- Not allow irrigation runoff from landscaped areas to drain directly in to the storm drain system or Lemon Creek.
- Minimize the use of fertilizer, pesticides, and herbicides on landscaped areas.
- Plan sites with sufficient landscaped area and dispersal capacity (e.g., ability to receive irrigation water without generating runoff).
- Consult a landscape professional regarding appropriate plants, fertilizer, mulching applications, and irrigation requirements (if any) to ensure healthy vegetation growth.
- Choose plants that minimize the need for fertilizer and pesticides.
- Use mulch to minimize evaporation and erosion.
- Include vegetative boundary around sites to act as a filter.
- Install an approved subsurface drop, pop-up, or other irrigation system. The irrigation system will employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.
- Install rain sensors to shut off the irrigation system during and after storm events.
- Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.
- If hydraulic conductivity in the soil is not sufficient for the necessary water application rate, soil amendments will be implemented to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).
- For areas on or within 50 feet of a steep slope (15% or greater), landscape will not be irrigated within 3 days of a storm event to avoid potential geotechnical instability.
- Implement Integrated Pest Management practices.

The irrigation areas will be maintained to remove trash, debris, and loose vegetation. Bare soil will be rehabilitated. Rain or pressure sensors and irrigation components will be checked periodically to ensure proper function. Equipment will be cleaned as necessary to prevent algae growth and vector breeding. Landscape maintenance activities will be handled by the homeowner's association (HOA).

4.1.4 Building Materials (S-9)

Some building materials, such as metal siding, roofing, and fencing, may be significant sources of metals in stormwater runoff, especially due to acidic precipitation. Where applicable, the Brookside Project will utilize alternative building materials to reduce pollutant sources in stormwater runoff and to reduce the need to perform maintenance activities (i.e., painting). For example, pressure treated wood may be replaced with cement-fiber or vinyl and galvanized chain-link fences may be replaced with vinyl-coated fencing.

The use of pesticides around foundations will also be reduced through the use of alternative barriers, such as sand or metal shields, as they can also prevent termites from tunneling into the wood.

5 Stormwater Quality Design Volume

Current water quality requirements are based on treating a specific volume of stormwater runoff from the project site, also known as the stormwater quality design volume (SWQDv). Treating the SWQDv reduces or eliminates pollutant loads from reaching receiving waters, as it targets the runoff from the earlier part of a storm, which typically contains higher pollutant loads. The design storm for which SWQDv is calculated is defined as the greater of (1) the 0.75-inch, 24-hr rain event or (2) the 85th percentile, 24-hour rain event as determined from the Los Angeles County 85th percentile precipitation isohyetal map. The 85th percentile precipitation was found to be 1.0 inch for the project area; therefore, the 0.75-inch event was not analyzed.

To convert precipitation to a runoff volume, the modified rational method (MODRAT) is utilized (according to LA County *Hydrology Manual*). MODRAT produces a runoff hydrograph, from which both total runoff volume and peak flow rate can be determined. LACDPW has developed HydroCalc 2.0, which is a computer program that uses specified inputs to generate a hydrograph, using MODRAT. Because HydroCalc does not have reach routing capabilities, it is limited to watersheds and project areas up to 40 acres. Because the Brookside project is 25.8 acres, it was determined that HydroCalc would be appropriate to use for the present analysis.

5.1 Stormwater Quality Design Volume Calculation

The Brookside project proposes to capture and infiltrate the 85th percentile runoff volume from the developed areas of the project site by diverting runoff from those areas into two Stormwater Basins. All runoff from developed areas will be collected in the proposed storm drain conveyance system and will be routed to the two basins.

The two basins were sized by calculating the SWQDv (1.5 x 85th percentile runoff volume) for the sub-watersheds that will be developed. **Figure 2-8** shows the ten sub-watersheds that were delineated for proposed conditions, six of which will be developed (2A, 2B, 4A, 5A, 5B, and 11A). All other sub-watersheds will remain unchanged and will drain to Lemon Creek as occurs in existing conditions. **Table 2-3** shows a summary of hydrologic characteristics for the proposed condition, which were used in the HydroCalc analysis. **Table 7-1** summarizes the output from the HydroCalc program for existing conditions for multiple storm events; **Table 7-2** summarizes the output for the proposed condition for the same storm events. Detailed output for each sub-watershed is included in **Attachment A**.

As can be seen from **Table 5-1**, the total 85th percentile runoff volume from the developed sub-watersheds is equal to 0.64 ac-ft, which must be treated prior to entering Lemon Creek. Details related to the stormwater quality control measures utilized for the Brookside project are discussed in detail in **Section 6**.

Table 5-1: HydroCalc Results – Proposed Conditions

WS Name	Acres	85th Percentile Runoff Volume (ac-ft)
1A	3.28	0.11
2A[1]	2.75	0.16
2B[1]	3.32	0.13
4A[1]	4.31	0.09
4B	1.05	0.01
5A[2]	4.24	0.17
5B[1]	1.47	0.06
9A	4.02	0.04
11A[2]	1.53	0.04
12A	0.97	0.02
Total =	**26.95**	**0.83**
Total (Developed) =	**17.62**	**0.64**

Notes: *- Gray cells indicate sub-watershed is developed in proposed conditions*
- "Developed" indicates hydrologic sub-watershed areas which contain development. This number should not be used to quantify the actual area on-site that is proposed to be developed.
- Superscript 1 indicates sub-watershed drains to Stormwater Basin No.1
- Superscript 2 indicates sub-watershed drains to Stormwater Basin No.2

6 Stormwater Quality Control Measures

Stormwater quality control measures are required to reduce the volume of stormwater runoff from project areas and reduce the potential pollution loads associated with stormwater runoff to the maximum extent practicable. According to the *LID Manual,* Projects with suitable infiltration rates (>0.3 in/hr) are required to accommodate the 85th percentile runoff volume through retention-based methods; however, if the project is unable to reliably retain all of the 85th percentile runoff volume on-site due to poor infiltration rates, as is the case with the Brookside Project, then bio-filtration may be implemented, as long as it bio-filtrates 150% the 85th percentile storm that is not reliably retained on-site. Because infiltration rates at the Brookside project site are not adequate for retention-based stormwater quality control measures (<0.3 in/hr), the project will utilize bio-filtration-based design. The analysis assumes that no volume of runoff can be reliably retained on-site. The 85th percentile runoff volume is multiplied by 1.5 to determine the design volume (SWQDv) of the bio-filtration features. The SWQDv for each Stormwater Basin is shown in **Table 7-1**.

Table 6-1: Stormwater Basin Design Volumes Summary

Stormwater Basin ID	85th Percentile Runoff Volume (ft^3)	Stormwater Quality Design Volume (SWQDv, ft^3)
1	18,962	28,443
2	9,030	13,545

6.1 Proposed Stormwater Quality Control Measures

The stormwater quality control measures utilized by the Brookside project are identified as bio-filtration areas (BIO-1) in the LID Manual, which receive and treat stormwater runoff from developed areas. A shallow ponding zone is provided above the vegetated surface for temporary storage (detention) of stormwater runoff. During storm events, runoff would accumulate in the ponding zone and gradually infiltrate below the surface, filtering through the biofiltration soil media before being collected by an underdrain system outletting to Lemon Creek. Stormwater runoff treatment would occur through a variety of natural mechanisms as stormwater runoff would filter through the vegetation root zone. Microbes and organic material in the biofiltration soil media would help promote the adsorption of pollutants into the soil matrix. Plants would utilize the soil moisture and promote the drying of the soil through transpiration. The biofiltration areas will be planted with native, drought-tolerant plant species that do not require fertilization and can withstand wet soils for at least 96 hours. The basins are designed to drain completely between storm events over a 96-hour period.

The SWQDv will be captured in both Stormwater Basins No. 1 and No. 2. Stormwater Basin No. 1 is located just south of Lot No. 13, and is capable of storing up to 2.67 ac-ft of water, with a surface area of 32,480 square feet (at top of slope). This basin will intercept flows from proposed sub-watersheds 2A, 2B, 4A, and 5B before discharging to Lemon Creek. The bio-filtration design volume is 0.65 ac-ft, occupying approximately 24% of the capacity of Stormwater Basin No.1. The water quality design volume is proposed to be stored fully in the porous media voids at the facility invert, with no portion being ponded above the invert. The remainder of the basin is designed to detain the 100-yr hydromodification volume, as described in further detail in **Section 7**.

Stormwater Basin No.2 is located just south of Lot No. 27, and is capable of storing up to 0.67 ac-ft of water, with a surface area of 11,380 square feet (at top of slope). This basin will intercept flows from proposed sub-watersheds 5A and 11A before discharging to Lemon Creek. The bio-filtration design volume of Stormwater Basin No.2 is 0.31 ac-ft. The water quality design volume is proposed to be stored partially in the porous media voids at the facility invert and partially ponded above the invert. The design ponded depth will not exceed 18-inches, in accordance with the *LID Standards Manual*.

Pretreatment is typically considered for stormwater quality control measures whose function may be adversely affected by sediment or other pollutants. The proposed Stormwater Basins at the Brookside project are not anticipated to need pretreatment, since the collected runoff will originate from developed areas with a low potential for generating sediment and debris. Additionally, the Stormwater Basins will be owned / maintained by a public agency or the Homeowners Association (HOA), which will include frequent inspection and removal of any accumulated sediment, as necessary, in order to ensure the proper functioning of the stormwater infrastructure.

The Stormwater Basins will also be sited with appropriate setbacks from slopes and building foundations according to the most recent GMED Policy GS 200.1. Additionally, the basins will be designed at 4:1 side slopes and will include an impermeable liner around the sides and bottom of the basin, in order to prevent saturation of adjacent soils.

Table 6-2 summarizes the design details associated with both of the proposed Stormwater Basins.

Table 6-2: Stormwater Basin Design Details

Stormwater Basin ID	Area (sf)	Area (ac)	Stormwater Quality Design Volume (SWQDv, ac-ft)	Stormwater Quality Design Flowrate (SWQDQ, cfs)	BMP Type	BMP Size Provided (ac-ft)	GPS Coordinates
1	10,780	0.25	0.65	1.4	Biofiltration Area	2.67	Lat: 34^0 1'27.43"N Long: 117^{0}52'0.61"W
2	7,425	0.17	0.31	0.7	Biofiltration Area	0.67	Lat: 34^0 1'15.58"N Long: 117^{0}51'53.13"W

7 Hydromodification

All designated projects draining to a natural drainage system are required to implement hydromodification controls. The Brookside project must fully mitigate off-site drainage impacts caused by hydromodification and changes in water quality, flow velocity, flow volume, and depth/width of flow. The hydromodification analysis was performed for the 85th percentile, 2-yr, 10-yr, and 50-yr storm events, per the LACDPW Hydraulic and Hydrology manuals. The 100-yr storm was also analyzed, in order to provide further protection to the Creek and proposed development. The frequency analyses are used to demonstrate compliance with hydromodification requirements and identify potential drainage impacts to off-site property.

7.1 Hydromodification Calculations

Similar to the SWQDv analysis, HydroCalc 2.0 was utilized to calculate the on-site runoff volume and peak flow rates for existing and proposed conditions, for each of the required storm events. For existing conditions, the hydrologic parameters listed in **Table 2-2** were used as inputs, and, for proposed conditions, the parameters listed in **Table 2-3** were used as inputs. The sub-watershed delineations shown in **Figures 2-1** and **2-8** were used for existing and proposed conditions, respectively. **Table 8-1** below lists the results for each of the analyzed storm events in existing conditions. **Table 8-2** lists the results for each of the analyzed storm events in proposed conditions. It should be noted that the acreage totals listed in **Tables 7-1** and **7-2** equal 26.95 ac, while the total project site is 25.8 acres. This is due to the fact that small areas off-site drain through the site to Lemon Creek, as shown in **Figures 2-1** and **2-8** and have been incorporated into the local hydrology analysis.

Table 7-1: Existing Conditions Hydromodification Analysis Results

WS Name	Acres	85th Percentile Peak Runoff Flow Rate (cfs)	2-yr Peak Runoff Flow Rate (cfs)	10-yr Peak Runoff Flow Rate (cfs)	50-yr Peak Runoff Flow Rate (cfs)	100-yr Peak Runoff Flow Rate (cfs)
1A	1.86	0.5	1.7	4	6	7
2A	6.26	0.1	3.9	12	20	25
4A	7.44	0.1	4.1	13	22	25
8A	5.39	0.4	3.2	9	16	18
9A	2.53	0.2	1.5	4	7	9
11A	3.14	0.2	1.8	5	9	10
12A	0.33	0.1	0.3	1	1	1
Total =	**26.95**	**1.5**	**16.5**	**49**	**82**	**96**
WS Name	**Acres**	**85th Percentile Runoff Volume (ac-ft)**	**2-yr Runoff Volume (ac-ft)**	**10-yr Runoff Volume (ac-ft)**	**50-yr Runoff Volume (ac-ft)**	**100-yr Runoff Volume (ac-ft)**
1A	1.86	0.10	0.26	0.5	0.7	0.8
2A	6.26	0.06	0.23	0.6	1.0	1.2
4A	7.44	0.07	0.25	0.6	1.1	1.4
8A	5.39	0.07	0.25	0.7	1.3	1.5
9A	2.53	0.03	0.12	0.3	0.6	0.7
11A	3.14	0.04	0.15	0.4	0.8	0.9
12A	0.33	0.01	0.03	0.1	0.1	0.1
Total =	**26.95**	**0.38**	**1.29**	**3.2**	**5.5**	**6.7**

Table 7-2: Proposed Conditions Hydromodification Analysis Results

WS Name	Acres	85th Percentile Peak Runoff Flow Rate (cfs)	2-yr Peak Runoff Flow Rate (cfs)	10-yr Peak Runoff Flow Rate (cfs)	50-yr Peak Runoff Flow Rate (cfs)	100-yr Peak Runoff Flow Rate (cfs)
1A	3.28	0.5	2.3	6	10	11
2A[1]	2.75	0.2	2.0	5	9	11
2B[1]	3.32	0.5	2.3	6	10	11
4A[1]	4.31	0.2	2.3	7	11	14
4B	1.05	0.1	0.8	2	4	4
5A[2]	4.24	0.6	2.8	7	12	14
5B[1]	1.47	0.3	1.1	3	4	5
9A	4.02	0.3	2.4	7	12	13
11A[2]	1.53	0.1	1.0	3	5	5
12A	0.97	0.1	0.8	2	3	4
Total =	**26.95**	**3.0**	**17.8**	**48**	**79**	**93**
Delta (PR - EX) =		*1.5*	*1.2*	*0*	*-3*	*-3*
WS Name	**Acres**	**85th Percentile Peak Runoff Volume (ac-ft)**	**2-yr Peak Runoff Volume (ac-ft)**	**10-yr Peak Runoff Volume (ac-ft)**	**50-yr Peak Runoff Volume (ac-ft)**	**100-yr Peak Runoff Volume (ac-ft)**
1A	3.28	0.11	0.32	0.7	1.1	1.2
2A[1]	2.75	0.16	0.41	0.8	1.1	1.2
2B[1]	3.32	0.13	0.35	0.7	1.1	1.3
4A[1]	4.31	0.09	0.27	0.6	0.9	1.1
4B	1.05	0.01	0.05	0.1	0.2	0.3
5A[2]	4.24	0.17	0.46	1.0	1.5	1.7
5B[1]	1.47	0.06	0.16	0.3	0.5	0.6
9A	4.02	0.04	0.18	0.5	0.9	1.1
11A[2]	1.53	0.04	0.11	0.2	0.4	0.4
12A	0.97	0.02	0.06	0.2	0.3	0.3
Total =	**26.95**	**0.83**	**2.38**	**5.1**	**8.0**	**9.3**
Delta (PR - EX) =		*0.45*	*1.09*	*1.9*	*2.5*	*2.7*

Notes:

- *Gray cells indicate sub-watershed is developed in proposed conditions*
- *Superscript 1 indicates sub-watershed drains to Stormwater Basin No.1*
- *Superscript 2 indicates sub-watershed drains to Stormwater Basin No.2*

The results indicate that the peak runoff flow rate from the project site will increase in proposed conditions for the 85th percentile and 2-yr storm events. However, the peak runoff flow rate will be unchanged / reduced for the 10-, 50-, and 100-yr storm events. The unchanged / reduced peak runoff flow rates for the 10-, 50-, and 100-yr storm events in proposed conditions is a result of longer flow paths introduced by the proposed streets and pipes.

The results also indicate that the runoff volume from the site will increase in proposed conditions for all storm events analyzed, if no hydromodification mitigation were to be implemented. This is consistent with more impervious area in a developed condition.

7.2 Hydromodification Controls

Mitigation of hydromodification impacts will take place in Stormwater Basin No.1, which will temporarily store stormwater runoff during a storm event before discharging slowly into Lemon Creek, after the peak of the storm has passed. This ensures that any increase in runoff volume, flow rate, etc. due to the proposed development does not reduce the capacity of downstream reaches. The design volume of Stormwater Basin No.1 described in the previous sections will mitigate the increase in runoff volume associated with the

development up to the 100-yr storm. The design volume of Basin 1 is equal to 2.67 ac-ft, which eliminates the increase in runoff volume from the development in proposed conditions, as shown in **Table 7-2**. The detained runoff is designed to pond at a depth of 3.8 ft. Freeboard equal to a minimum of 1.0 ft. will be provided between the ponded water surface and adjacent lot pad elevations.

8 Site Design Principles

The Brookside Project will comply with all relevant Site Design Principles as listed in the *LID Standards Manual.* Site Design Principles are intended to protect sensitive environmental features such as riparian areas, wetlands, and steep slopes, as well as help to reduce stormwater runoff peak flows and volumes and other impacts associated with land development. Site Design Principles include the following:

- Site Planning
- Protection and restoration of natural areas
- Minimization of land disturbance
- Minimize impervious cover

The following sections describe how the Brookside Project will address each of these Site Design Principles.

8.1 Site Planning

Site Planning is a holistic approach to site design that, when implemented effectively, results in a more hydraulically-functional site, maximized effectiveness of on-site detention, and integrates stormwater management throughout the site. The Brookside Project has achieved this in multiple ways.

- *Multi-Disciplinary Approach* - The Brookside Project design team consists of engineers, planners, architects, biologists, environmental scientists, and landscapers. Each discipline provides a unique perspective to project design, with specific prioritization of protecting environmental resources. All consultants have been involved since early phases of the project, allowing time for early project site planning and identification of physical constraints.
- *Stormwater Spatial Planning* – Since early phases of the design, certain site areas have been reserved for low-impact flood control / flood impact mitigation features. These include the stormwater basins and proposed storm drain pipes. In-depth investigation has been performed to identify existing on-site storm drains, flood conveyance features, and runoff patterns, for which the stormwater design takes into account.
- *Stormwater Quality Control* – The proposed stormwater basins have been designed to mitigate the quality of stormwater leaving the Brookside Project. Due to constraints created by topographic features and the alignment of Lemon Creek, it was deemed necessary to provide one basin to treat on-site runoff from the northern areas of the site and another basin to treat on-site runoff from the southern areas of the site. These basins will ensure that the Brookside Project does not increase pollutant loading to Lemon Creek, up to the standard of all relevant regulations. Stormwater quality control was prioritized to the point that one lot which was initially proposed in the south of the site (Lot 28) was eliminated in order to carve out the required space for the stormwater basins.
- *Flood Control* – Flood control was also considered in the preliminary design phases of the Brookside Project. A combination of surface street and buried storm drain pipe systems will convey on-site runoff from developed areas to one of the two stormwater quality basins. The street and pipe flow will be designed to accommodate runoff from storms up to the 100-yr storm event. Before on-site runoff confluences with Lemon Creek, it will enter one of the two stormwater basins. If flows are large enough that the stormwater basin's detention capacity is 100% utilized, the excess water will flow from the basin to Lemon Creek via a secondary outlet or overflow device. Appropriate outlet structures will be designed for each stormwater basin, which will prevent erosion and property damage in / around Lemon Creek. Fencing and protective barriers will be provided as-needed.
- *Alternative Building Materials* – The Brookside Project will be designed with alternative materials in mind, which will have less of an impact on the environment as traditional materials. For example, certain metals that have the potential to leach into Lemon Creek / the environment will not be utilized in the construction of the project.

- *Los Angeles County Green Standards Building Code* – All relevant LACGSBC requirements will be implemented for the Brookside site planning stages.

8.2 Protect / Restore Natural Areas

Conservation of natural resources can help restore areas to pre-development hydrology and function. The Brookside site has poor infiltration rates; however, through detention of the 100-yr hydromodification volume, the project will maintain the existing hydrologic timing, runoff flow rates, and runoff volumes of the pre-development condition. Sensitive areas of the site, such as Lemon Creek and its buffers, floodplains, and slopes will be protected and restored. The Brookside project will protect / restore natural areas of the site in the following ways:

- *Preserve Undisturbed Areas* – The Brookside Project will restrict nearly all development from touching Lemon Creek and its jurisdictional boundaries (CDFW / ACOE), with exception to minor impacts at the location of the proposed bridge crossing of 'Street B' and the construction of an outlet structure at Stormwater Basin No.2. Other than these two locations, no grading, development, or construction activities will take place in the Creek. The entirety of Lemon Creek will be preserved and included within 12.2 acres of privately owned and residentially zoned property – over 47% of the site – that will serve as permanent open space. 9.5 acres of the open space area will be within privately owned residential lots. Those portions of open space, Lemon Creek, and a public trail within private lots will be subject to recorded deed restrictions prohibiting use of the restricted open space by the owners of the private lots, including planting vegetation, installing fencing, or otherwise developing or using the restricted natural open space areas. The restrictions will be enforceable by the City. The remaining 2.7 acres of the open space area will consist of internal slopes and the stormwater basins, which will be owned by a public agency or the Homeowners Association (HOA) and subject to similar deed restrictions.
- *Maintain Surface Flow Patterns* – The Brookside project proposes to develop 13.6 acres of the entire 25.8-acre site, leaving 12.2 acres as open space. The existing drainage patterns of the open space areas will not be altered and will run-off into Lemon Creek as occurs in existing conditions. The drainage patterns of the developed areas will be altered from the existing condition; however, due to longer flow paths and detention time introduced by the two stormwater basins, the peak runoff flow rates and runoff volumes will not be increased by the project, compared to the existing condition.
- *Preserve High Permeability Soils* – The Brookside Project site has poor in-situ infiltration rates and geotechnical investigations have not revealed areas of high permeability soils. As such, the project will not reduce areas of high permeability soils that could be otherwise used for retention-based stormwater quality control measures. The project's stormwater quality control measures will utilize detention within the stormwater basins to control the rate / volume of flow leaving the site, up to the 100-yr storm event. Impermeable liners will be placed below the sides and invert of the basins to prevent saturating adjacent slopes and causing slope instability.
- *Incorporate Existing Trees into Site Layout* - Lemon Creek contains extensive natural vegetation, which the project does not propose to remove or reduce. The site in its entirety contains approximately 1,876 trees. Through preservation and new plantings, the total number of trees on-site in post-project conditions will equal 1,936, also increasing the ratio of native to non-native / invasive trees.
- *Identify / Avoid Erosion-Susceptible Areas* - In October 2021, PACE prepared a technical memorandum titled *Lemon Creek Stream Stability Analysis at Proposed Brookside Development* (included in **Appendix C**). The analysis evaluated historical imagery, site photographs, and empirical equations for stable channel dimensions to determine Lemon Creek's potential to migrate vertically and horizontally over time. The analysis concluded that Lemon Creek is stable and that its stability can be credited to the protection provided by the dense existing vegetation and the existing culverts, which act as invert control points. In order to protect the proposed development, it was recommended that (1) minimal vegetation be removed from the creek during construction and (2) the proposed residential structure footprints be placed a minimum of 10 ft.

outside the limits of the calculated average stable channel widths. The current plan complies with both of these recommendations and will not change the stability of Lemon Creek. It should be noted that some of the project details have changed since the creation of the stream stability technical memo (i.e. 27 lots instead of 28; altered land use summary; shifted development layout; altered water quality basin size / layout). However, none of the project changes impact the analysis, conclusions, or recommendations presented in the technical memo; therefore, the technical memo still applies to the project as currently described.

- *Protect Slopes from Erosion* – As identified in the geotechnical study provided by Group Delta, substantial soil erosion can occur along slopes where loose and weakly vegetated soils are present. Specifically, slopes steeper than 1 Horizontal : 1 Vertical are subject to higher probability and rate of erosion. However, the Brookside Project will address / mitigate against erosion along slopes, through establishment of deep-rooted vegetation or fortifying susceptible areas with rock or concrete.
- *Limit Clearing / Grading of Native Vegetation* – The Brookside Project will preserve all protected California native trees on the site. Thirty (30) non-protected California native trees will be removed during construction, 28 of which are considered unhealthy by the project biologist. Of the non-native and invasive trees on the site, 430 will be removed, 273 of which were deemed unhealthy by the project biologist. No vegetation removal is proposed within Lemon Creek.
- *Maintain Existing Topography & Drainage Divides* – For the open space areas of the site (12.2 acres), drainage patterns will remain as they currently exist, discharging runoff into Lemon Creek at multiple locations or as sheet flow. For the proposed developed areas (13.6 acres), site runoff will be directed to one of two stormwater basins. Stormwater Basin No.1, in the north of the site, will discharge flows into Lemon Creek at one location, and Stormwater Basin No.2, in the south of the site, will discharge flows into Lemon Creek at a second location. An outlet structure will be provided at the discharge points of each stormwater basin, in order to prevent erosion and property damage in / around Lemon Creek.
- *Maximize Tree / Vegetation Plantings* – In addition to preserving 75% of existing on-site trees, the Brookside Project will plant 520 new trees, all of which will be California native species. The total number of trees on-site in existing conditions is equal to 1,876, compared to a proposed total of 1,936.
- *Promote Natural Vegetation* - In addition to trees, the project will also incorporate new vegetation in landscaped areas of the development. **Figure 8-1** shows the conceptual landscape plan of the Brookside Project.

8.3 Minimize Land Disturbance

The Brookside Project has incorporated the Minimize Land Disturbance site design principle by preserving 47% of the site as open space, preserving all vegetation within Lemon Creek, and preserving California native (protected and non-protected) trees throughout the site. Protection of Lemon Creek helps to preserve the natural hydrology and draingeways of the project site, thereby reducing the need for grading and disturbance of native vegetation / soils. The proposed buildings on-site will also be set back from steep slopes (per geotechnical recommendations) and draingeways, thereby reducing the project's hydrologic impact and the amount of grading and clearing necessary.

As mentioned previously, the Brookside project site contains soils with poor infiltration rates; therefore, clearing, grading, and heavy equipment activities during construction are not a concern in terms of their potential effect on native soil compaction / reduced soil infiltration capacity. For the same reason, soil compaction proposed to take place for foundation / structure stability will also not be of concern to the infiltration rates on the site.

It should also be reiterated that no construction activities will take place within Lemon Creek, with exception to work required to construct the 'Street B' bridge over the creek and to construct the Stormwater Basin No.2 outlet structure, near the southern border of the site.

8.4 Minimize Impervious Area

In general, when an undeveloped area of land is developed, there is an increase in pollutant loading from the site to downstream drainage systems. In order to mitigate water quality impacts, LA County has implemented requirements for projects, such as those discussed in **Sections 6** of this LID Plan. The purpose of the 'Minimize Impervious Area' site design principle, however, is not to mitigate the water quality effects of a project in their entirety, but to create numerous, smaller opportunities for reducing pollutant loading in stormwater runoff from the site. The Brookside Project has minimized proposed impervious areas as much as possible. In addition to preserving 12.2 acres of the site as open space (47% of the site), the Brookside project will create new lawns, landscaped areas, buffer zones, etc. within the 13.6 acres of development, which will allow incidental infiltration to occur, and trap / remove pollutants through natural processes.

MEADOW PASS ROAD

COLT LN

LEMON AVENUE

SAN VICENTE DRIVE

LA PUENTE ROAD

STREET "A"

STREET "B"

WQ BASIN #1

WQ BASIN #2

LOT G OPEN SPACE 50860 SF

LOT A OPEN SPACE

LOT E OPEN SPACE 925 SF

30' EMERGENCY VEHICLE ACCESS

CITY OF WALNUT-OWNED PARCEL

PARCEL 2 81-1011755

PARCEL 1 81-1011755

EXISTING CREEK CULVERT TO BE REMOVED AND THE CREEK RESTORED

EXISTING DOUBLE 5'X10' BOX CULVERT

LANDSCAPE DESIGNATION

	Parkway
	Front Yard
	Slopes
	Rear Yard

TREE SUMMARY - BEFORE AND AFTER

SUMMARY	TREE COUNT	CA NATIVE (PROTECTED)	CA NATIVE	NON-NATIVE & INVASIVE
Existing Total	1,876	MIXED		
Proposed Trees to be Removed & Replaced	460	0	30 (28 unhealthy)	430 (273 unhealthy)
Proposed New Trees	520	0	520	0
TOTAL TREES UPON COMPLETION	**1,936**	**Increase of 490 CA Native Trees**		**Removal & Replacement of 430 Non-Native & Invasive**

TREE TYPE LEGEND

TREE LOCATION	SYMBOL	SIZE	COUNT	TREE SPECIES	
Parkway		24" BOX	100	• White Alder • California Box Elder • Red Alder	• Madrone • California Sycamore • Big Leaf Maple
Side Yard		15 GAL	138	• Foothill Ash • Western Redbud • Holly Leaf Cherry	• Blue Elderberry • California Bay Laurel
Slopes / Rear Yard		15 GAL	262	• White Alder • Foothill Ash • Red Alder • Big Leaf Maple • Madrone • Coulter Pine • Holly Leaf Cherry	• California Sycamore • Western Redbud • California box Elder • Freemont Cottonwood • Blue Elderberry • California Bay Laurel • Toyon
Accent		15 GAL	20	• California Sycamore • Western Redbud	• Toyon • Madrone
PROPOSED NEW TREES			**520**		

Figure 8-1

Conceptual Landscape Plan

BROOKSIDE | WALNUT, CA

N

0 60 120 240

1"=60' Scale

February 28 , 2023

PLACEWORKS

9 Maintenance Plan

Inspection and maintenance are key components in extending the life of water quality control measures, and it is important that they are considered and incorporated into the design process. The two proposed Stormwater Basins will either be owned / maintained by a public agency or the Homeowners Association (HOA), which will be set up by the Brookside developers. Regardless of the entity that will own the infrastructure, the Maintenance Plan presented in this section will be implemented. The Maintenance Plan addresses the following items:

- Operation plan and schedule, including a site map
- Maintenance and cleaning activities and schedule
- Equipment and resource requirements necessary to operate and maintain stormwater quality control measures
- Responsible party for operation and maintenance

9.1 Description of the Facilities

The stormwater facilities to be maintained include two Stormwater Basins. The Stormwater Basins are designed to detain / treat runoff from the developed areas of the project site before it reaches Lemon Creek. Approximate locations for each of the facilities discussed are shown on **Figure 9-1**.

Stormwater Basin No.1 is located just south of Lot 13, occupying an area approximately 32,480 sq. ft. in size, with a depth of 5 ft. and side slopes of 4(H) : 1(V). The basin will intercept flows from sub-watershed areas 2A, 2B, 4A, and 5B, which includes Lot numbers 1 through 15. The basin will be configured as a biofiltration area, with vegetated slopes and bottoms, which will provide natural treatment processes for the captured runoff as it infiltrates into the underlying media. An underdrain system will be installed below the invert of the facility, which will transport the infiltrated water to an existing outlet point in Lemon Creek, where the Lemon Ave. storm drain outlets into Lemon Creek. A buried impermeable liner will be installed along the side slopes and invert of the basin (below the underdrain), in order to prevent saturated soils from creating unstable slopes in the vicinity of the basin, per recommendations from the geotechnical engineer (Group Delta). The Stormwater Basin will be designed to hold 2.67 ac-ft of runoff from the developed areas of the site, and will be completely drained within 96 hrs in order to avoid vector breeding. Flows in excess of the design volume of the Stormwater Basin will outlet over a spillway into Lemon Creek. The slopes at the spillway will be lined/armored in order to protect against erosion.

Stormwater Basin No.2 is located just south of Lot 27, occupying an area approximately 11,380 sq. ft. in size, with a depth of 4 ft. and side slopes of 4(H) : 1(V). The basin will intercept flows from sub-watershed areas 5A and 11A, which includes Lot numbers 16 through 27. The basin will be configured as a biofiltration area, similar to Basin No.1, with vegetation, an underdrain, and buried liners. Basin No.2 will be designed to hold 0.66 ac-ft of runoff from the developed areas of the site (0.31 ac-ft of which constitutes the SWQDv), completely draining within 96hrs. Flows in excess of the design volume will outlet over a spillway into Lemon Creek. The slopes at the spillway will be lined/armored to protect against erosion.

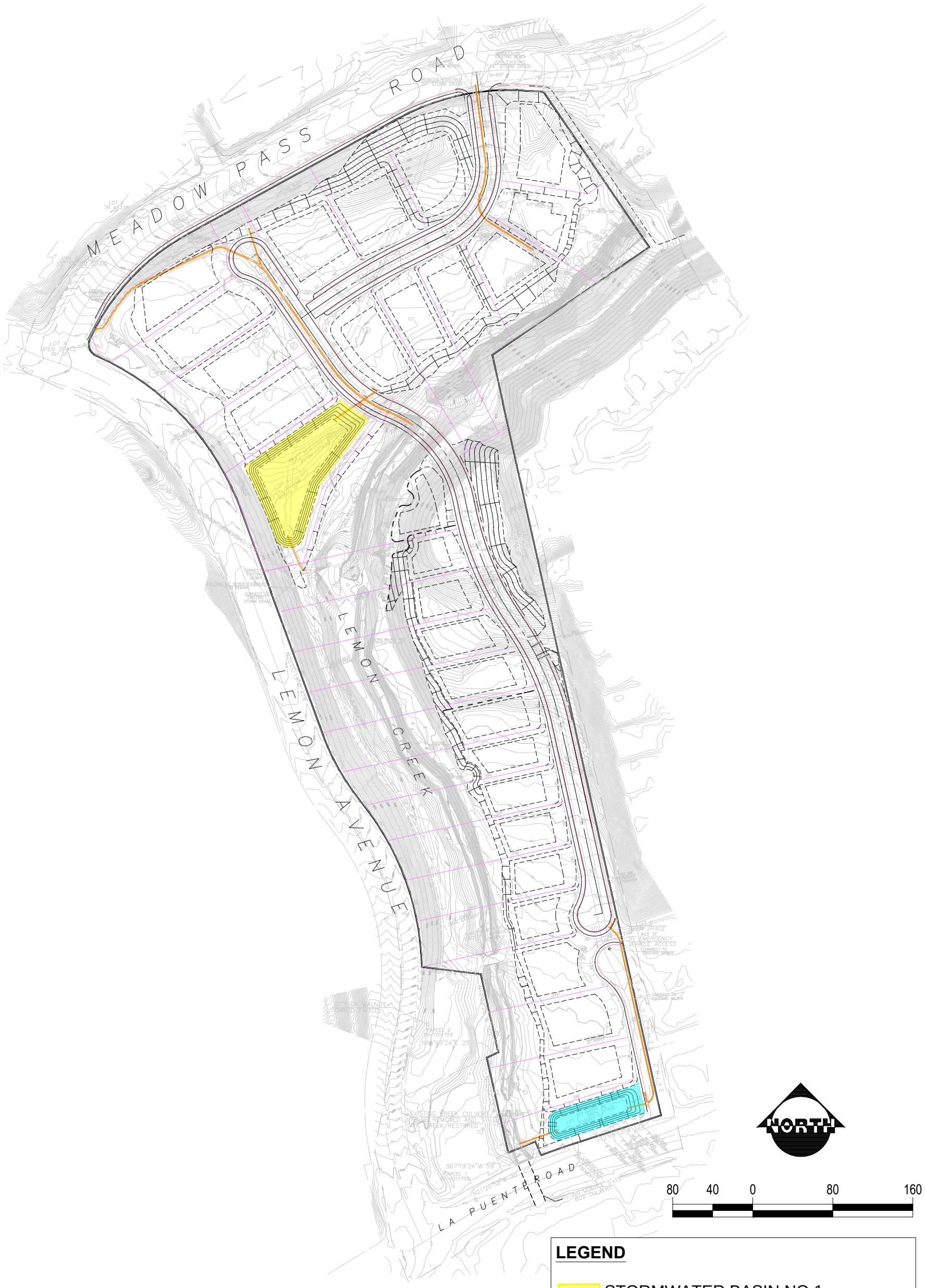


EXHIBIT 9-1	PACE Advanced Water Engineering 17520 Newhope Street, Suite 200 | Fountain Valley, CA 92708 P: (714) 481-7300 | www.pacewater.com	SCALE 1" = 200' DESIGNED MEK DRAWN CT CHECKED MEK DATE 02-03-2023 JOB NO. B852	JOB BROOKSIDE DEVELOPMENT PROJECT WALNUT CA	TITLE STORMWATER FEATURES OF LID PLAN

P:\B852\Engineering\GlobalExhibits\B852 Report Figures.dwg - Tab: 09-22 LID Rpt Fig 8-1 - SW O&M Map - by cthompson on 02/03/23 at 3:02:56 PM

9.2 Maintenance / Inspection Access

The Stormwater Basins can be accessed by vehicle through the use of the trail network on-site. The trail network that exists currently will be modified to ensure adequate widths for maintenance vehicle access. Stormwater Basin No.1 can be accessed by the trail that borders the west edge of the property. Stormwater Basin No.2 can be accessed by either of the two streets at the southeast corner of the property, namely, San Vicente Drive or La Puente Road.

The Stormwater Basins will need to be regularly inspected, in order to identify issues that should be addressed with maintenance. Those inspecting the facilities should keep a log of observations for each visit and schedule a time for any problems observed to be addressed. Different inspection activities will require different levels of frequency. During the first two years after construction, the results of the inspections will be the basis of a more appropriate frequency for maintenance activities to take place. **Table 8-1** is a guideline for how frequent the various inspection actives should take place. The associated maintenance required for these issues may be more or less frequent than the inspection frequency, and should only take place if an issue is observed.

Table 9-1: Schedule of Inspections

Inspect For	Frequency
Overgrown vegetation	1x per month
Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds	1x per month
Trash, plant litter, and dead leaves present	1x per month
Irrigation not functioning properly	1x per month
Inlet / outlet areas clogged with sediment and/or debris	Inspect quarterly; one inspection shall occur 30 days prior of October 1st. During the first two years, inspection should occur after every storm event.
Erosion/Sediment accumulation	Inspect quarterly; one inspection shall occur 30 days prior of October 1st. During the first two years, inspection should occur after every storm event.
Standing water	Inspect quarterly; one inspection shall occur 30 days prior of October 1st. During the first two years, inspection should occur after every storm event.
Any evidence of oil, gasoline, contaminants, or other pollutants	1x per year
Mulch layer thinning / absent	1x per year

9.3 General Maintenance Activities

9.3.1 Routine Maintenance Activities

The following maintenance activities will take place on a more regular basis and will require minimal effort to implement. These activities will, in general, occur once per month.

9.3.1.1 Facilities Inspection

Inspect the Stormwater Basins' flow entrances, ponding area, and surface overflow areas for signs that soil, plant material, and/or mulch layer needs to be replaced. Soil may need to be replaced/re-graded if the biofiltration area has standing water and/or if sediment accumulation is observed in the inlet/overflow areas. Plant material should be inspected for signs of overgrowth, death, or the presence of invasive, poisonous, nuisance, or noxious vegetation or weeds.

Inspect for sediment deposited in the Stormwater Basin areas, which could reduce the infiltration rate of the facility. If a buildup of sediment is observed, the source should be identified. Additionally, identify if the outlet pipe or weir spillway of the Stormwater Basins have obstructions or debris that might prevent them from draining. Underdrains should also be inspected for signs of clogging.

The Stormwater Basins should be inspected for signs of trash, plant litter, dead leaves, and any evidence of contaminants/pollution, such as oil and gasoline. If contaminants/pollution are observed, the source should be identified.

9.3.1.2 Trash & Debris Removal

Any accumulated trash or debris (i.e. plant litter, dead leaves) should be removed from the Stormwater Basins, in order to maintain the visual aesthetics of the facility and to ensure adequate infiltration, inflow, and outflow. If obstructions or debris are observed at the outlet pipe or weir spillway, it should be removed immediately. All collected trash/debris should be disposed of properly.

9.3.1.3 Minor Vegetation Upkeep

Irrigate plants as needed during prolonged dry periods. In general, the plants selected will be drought-tolerant and will not require irrigation after an establishment period of 2-3 years.

Prune and remove dead plant material as needed. Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and mulch is replaced on an annual basis. Do not apply nutrients and pesticides to the plants, as these may contribute pollutant loads to receiving waters.

Standing water should be immediately eliminated, in order to prevent vector breeding. Standing water in the stormwater basins should drain within 96 hours of a rain event. If the drain time is longer than 96 hours, this may indicate an issue with the outlets or clogging in the soil media / underdrain layer.

9.3.1.4 Minor Sediment operations

If a small amount of sediment is deposited in the facilities, remove excess surface deposits and stabilize the eroded areas as needed through regrading or addition of gravel.

9.3.2 Major Maintenance Activities

The following maintenance activities will take place on a less regular basis and will require greater effort to implement. These activities will, in general, occur once per year or less.

9.3.2.1 Major Vegetation Upkeep

Replace all dead plants, and if specific plants have a high mortality rate, asses the cause and, if necessary, replace with more appropriate species.

A two to three-inch mulch layer should be maintained, in the facilities. Thinning/removal of the mulch layer should be inspected for at least once per year and the mulch replaced/added to as necessary.

9.3.2.2 Major Sediment Removal

If large amounts of sediment are deposited in the facilities, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits. Eroded areas may be re-graded or repaired with gravel. The collected sediment should be properly disposed of.

9.3.2.3 Vector Control

Standing water should be immediately eliminated, in order to prevent vector breeding. Standing water in the stormwater basins should drain within 96 hours of a rain event. If the drain time is longer than 96 hours, this may indicate an issue with the outlets or clogging in the soil media / underdrain layer.

If burrowing of pests is observed in the facilities, traps or other rodent elimination methods should be implemented.

9.3.2.4 Spillway / Outlet Repair

If the inlet pipe, or weir spillway is damaged, it should be repaired upon discovery. If the underdrain shows signs of clogging, it should be replaced or the media should be cleaned as necessary.

9.4 Inspection and Maintenance Checklist

Oftentimes, inspection and maintenance will go hand in hand, and the inspection checklist can be reviewed during more frequent maintenance activities, such as monthly pruning and clearing of the facilities. However, inspection may take place without triggering some less frequent, major types of maintenance activities. **Table 8-2** lists the conditions that would be observed during an inspection that would trigger a maintenance activity, and also describes what the maintenance activities should entail.

Table 9-2: Inspection & Maintenance Checklist

Problem	Conditions When Maintenance is Needed	Maintenance Required
Vegetation	Overgrown vegetation	Mow and prune vegetation as appropriate
	Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds	Remove this vegetation and plant native species as needed
Mulch	Mulch is thin / removed throughout the facility surface	Replace / supplement mulch as needed to maintain a 2-3 inch layer depth
Trash & debris	Trash, plant litter, and dead leaves present	Remove and properly dispose of trash and debris
Irrigation	Not functioning properly	Check irrigation system for clogs or broken lines and repair as needed
Inlet / outlet	Inlet / underdrain areas clogged with sediment and/or debris	Remove material
	Overflow weir blocked or broken	Repair as needed
Erosion / sediment accumulation	Splash pads or spreader incorrectly placed Presence of erosion or sediment accumulation	Check inlet structure to ensure proper function. Repair, or replace if necessary, the inlet device. Repair eroded areas with gravel as needed. Re-grade the Stormwater Basin / biofiltration area as needed
Contaminants & pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove any evidence of visual contamination from floatables such as oil and grease
Standing water	Standing water is observed more than 96 hours after storm event	Inspect, and clean as needed, the underdrain to ensure proper function. Clear clogs as needed. Remove and replace planter media (sand, gravel, topsoil, mulch) and vegetation.

10 Conclusion

The Brookside development project, which is categorized as a Designated Project, will satisfy the requirements set forth by the LA County Low Impact Development Standards Manual, namely, implementing source control measures, site design principles, stormwater quality control measures, hydromodification requirements, and maintenance of the proposed facilities, in order to protect the natural drainage course known as Lemon Creek.

The Brookside project has poor in-situ infiltration rates, but will satisfy stormwater quality control requirements through detention of 1.5 x the 85th percentile runoff volume in two Stormwater Basins proposed on-site. These basins will intercept runoff from the proposed developed areas of the site, where it will infiltrate through the vegetative and soil media before traveling through an underdrain into Lemon Creek.

The hydromodification requirement will be met with Stormwater Basin No.1. The basin will be designed to detain up to the 100-yr hydromodification volume, thereby reducing the impact of increased runoff flow rates and volumes resulting from the development of the site.

The proposed Stormwater Basins will be owned / maintained by either a public agency or the HOA and will follow inspection and maintenance checklists that have been developed for the project, to ensure the facilities continue to function well over time.

The Brookside development project will be a desirable place to live, primarily because of its proximity to Lemon Creek; therefore, it is important that this natural resource be preserved and protected from the impacts of urbanization. The project proponents have developed this LID plan to ensure Lemon Creek will continue to be enjoyed by members of the community for many years to come.

11 Bibliography

California Building Code (CBC), 2019, published by International Code Council, Inc., Illinois, California.

California Geological Survey (CGS), 1998, State of California Seismic Hazard Zones Map, Anaheim Quadrangle, Orange County, California, March 25, 1999.

County of Los Angeles Department of Public Works (LADPW), 2021, "Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration, GS200.1", Revision on June 30, 2021.

County of Los Angeles Department of Public Works (LADPW), 2014, "Liquefaction/Lateral Spread, GS045.0", Revision on October 1, 2014.

California Stormwater Quality Association (CASQA), *California Stormwater Best Management Practices Handbooks*, 2003.

Group Delta, *Preliminary Geotechnical Investigation Report for Entitlement Proposed Residential Development Tentative Tract No. 72798*, March 17, 2023

Los Angeles County Flood Control District, *Los Angeles County Hydraulic Design Manual,* March 1982.

Los Angeles County Department of Public Works, *Los Angeles County Hydrology Manual*, January 2006.

Los Angeles County Department of Public Works, *Low Impact Development Standards Manual,* February 2014.

Los Angeles County Department of Public Works, Geotechnical and Materials Engineering Division, *Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration (GS200.1),* June 30, 2021.

Pacific Advanced Civil Engineering Inc. (PACE*), Brookside Development Project – Lemon Creek Hydrology & Hydraulics Report*, September 2022.

Attachment A - Calculations

Existing Conditions HydroCalc Results

Peak Flow Hydrologic Analysis

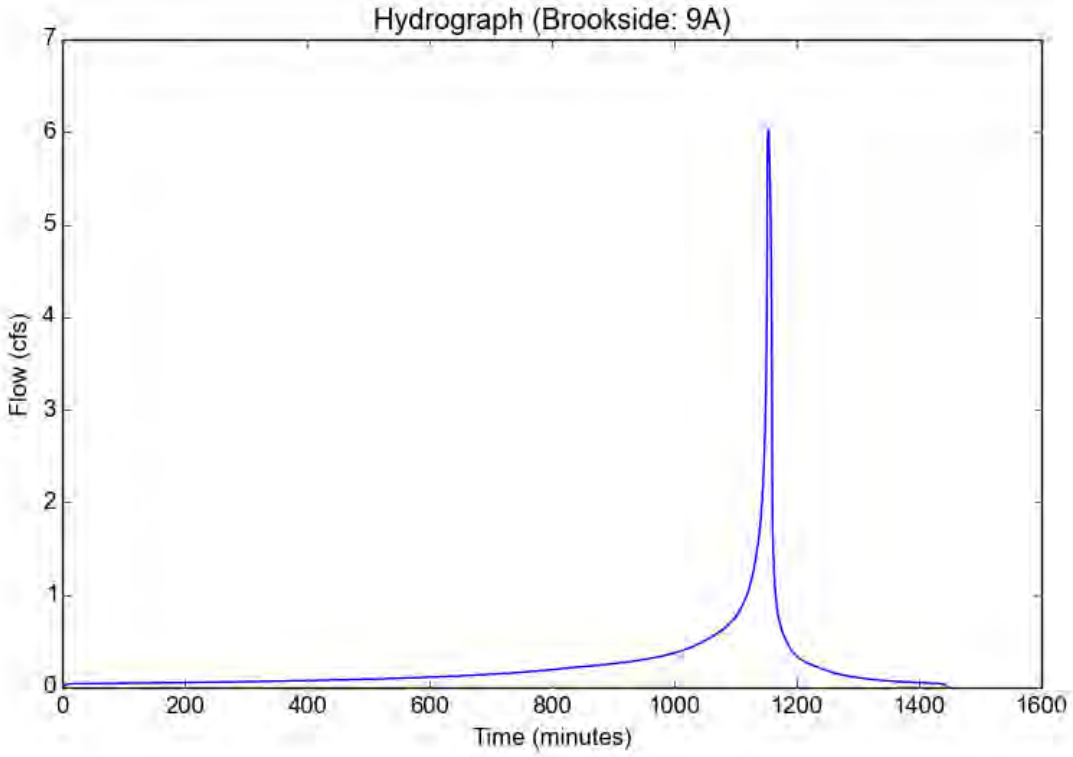
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/25-yr/Brookside Existing- 9A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	2.53
Flow Path Length (ft)	912.2
Flow Path Slope (vft/hft)	0.05591
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.7301
Undeveloped Runoff Coefficient (Cu)	0.8717
Developed Runoff Coefficient (Cd)	0.872
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	6.0231
Burned Peak Flow Rate (cfs)	6.0231
24-Hr Clear Runoff Volume (ac-ft)	0.4747
24-Hr Clear Runoff Volume (cu-ft)	20676.3093



Peak Flow Hydrologic Analysis

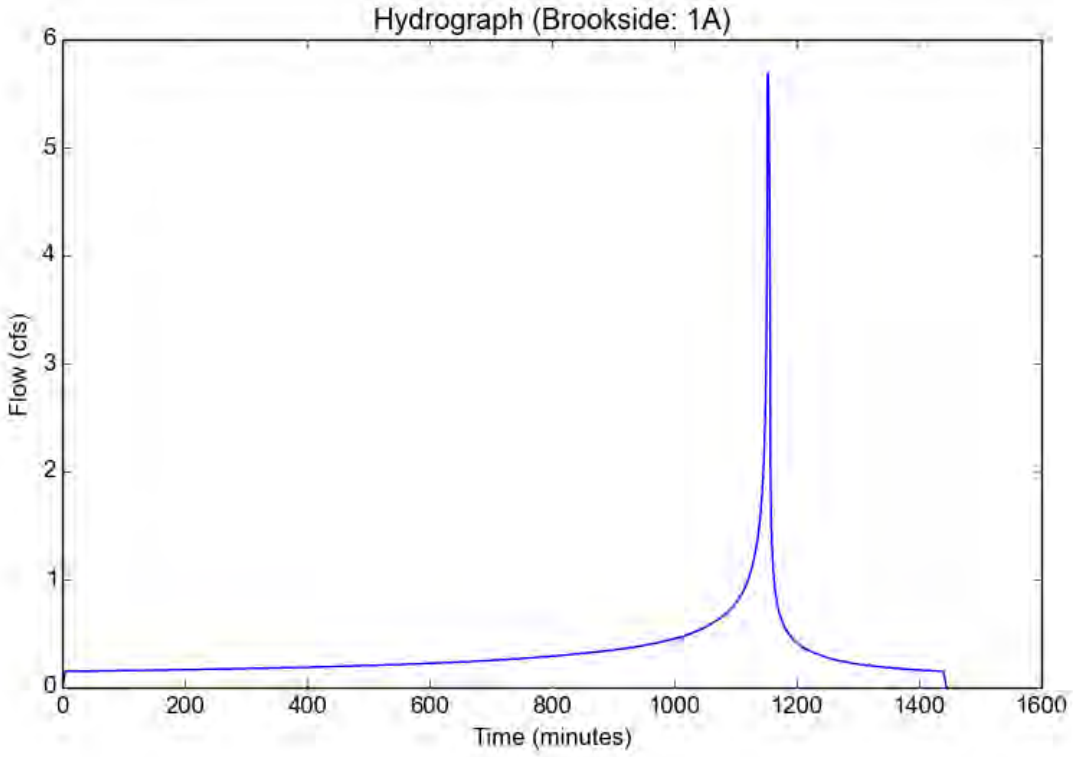
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/25-yr/Brookside Existing - 1A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	1.86
Flow Path Length (ft)	623.8
Flow Path Slope (vft/hft)	0.11061
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.656
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	3.405
Undeveloped Runoff Coefficient (Cu)	0.8934
Developed Runoff Coefficient (Cd)	0.8977
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	5.6856
Burned Peak Flow Rate (cfs)	5.6856
24-Hr Clear Runoff Volume (ac-ft)	0.6365
24-Hr Clear Runoff Volume (cu-ft)	27727.6148



Peak Flow Hydrologic Analysis

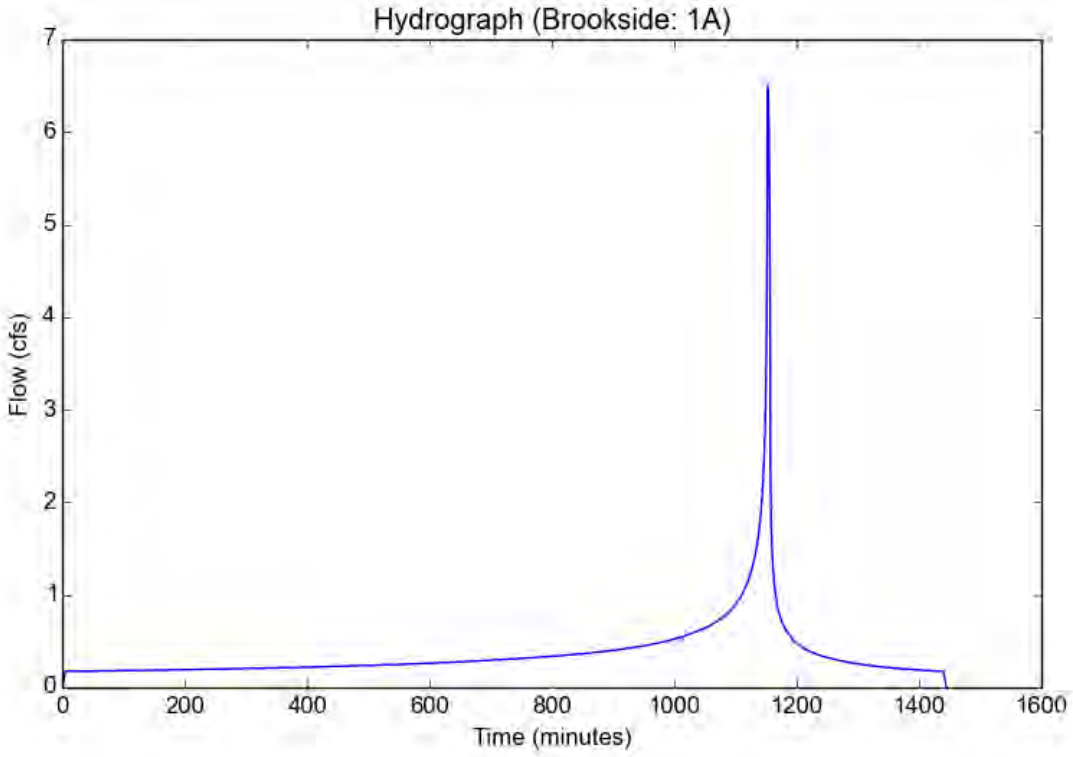
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/50-yr/Brookside Existing - 1A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	1.86
Flow Path Length (ft)	623.8
Flow Path Slope (vft/hft)	0.11061
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.656
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	6.4919
Burned Peak Flow Rate (cfs)	6.4919
24-Hr Clear Runoff Volume (ac-ft)	0.739
24-Hr Clear Runoff Volume (cu-ft)	32191.0964



Peak Flow Hydrologic Analysis

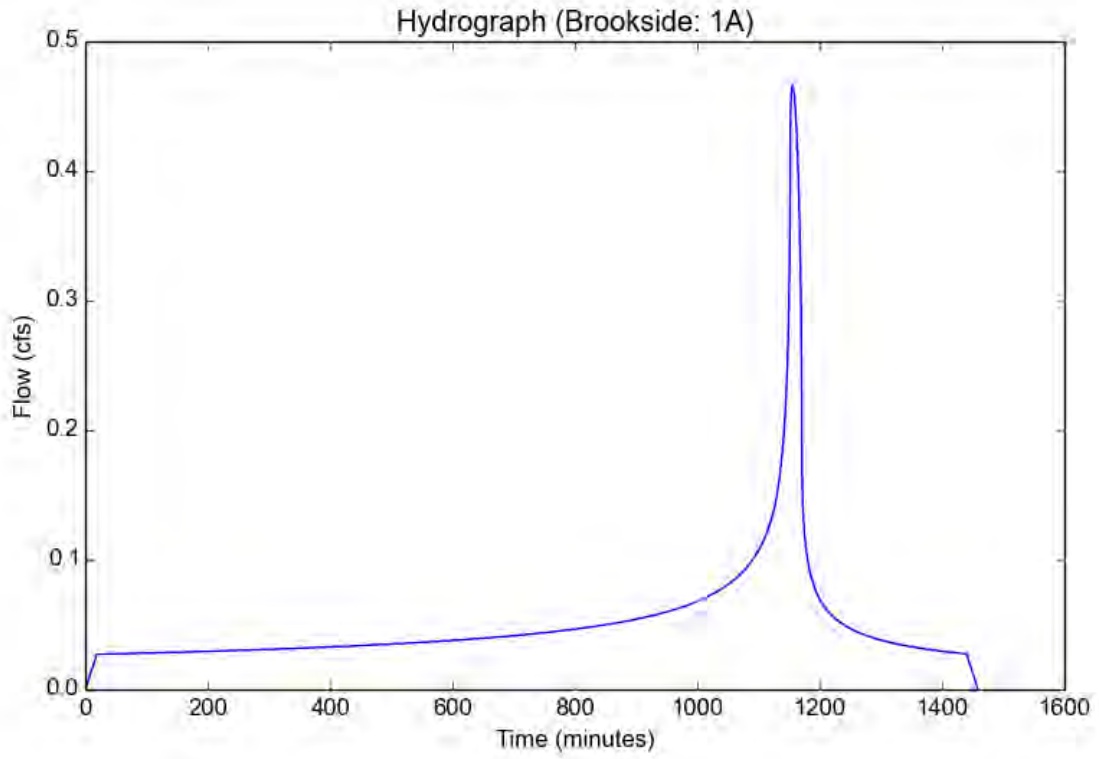
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/85th Percentile/Brookside Existing - 1A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	1.86
Flow Path Length (ft)	623.8
Flow Path Slope (vft/hft)	0.11061
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.656
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.3345
Undeveloped Runoff Coefficient (Cu)	0.463
Developed Runoff Coefficient (Cd)	0.7497
Time of Concentration (min)	19.0
Clear Peak Flow Rate (cfs)	0.4664
Burned Peak Flow Rate (cfs)	0.4664
24-Hr Clear Runoff Volume (ac-ft)	0.103
24-Hr Clear Runoff Volume (cu-ft)	4484.9849



Peak Flow Hydrologic Analysis

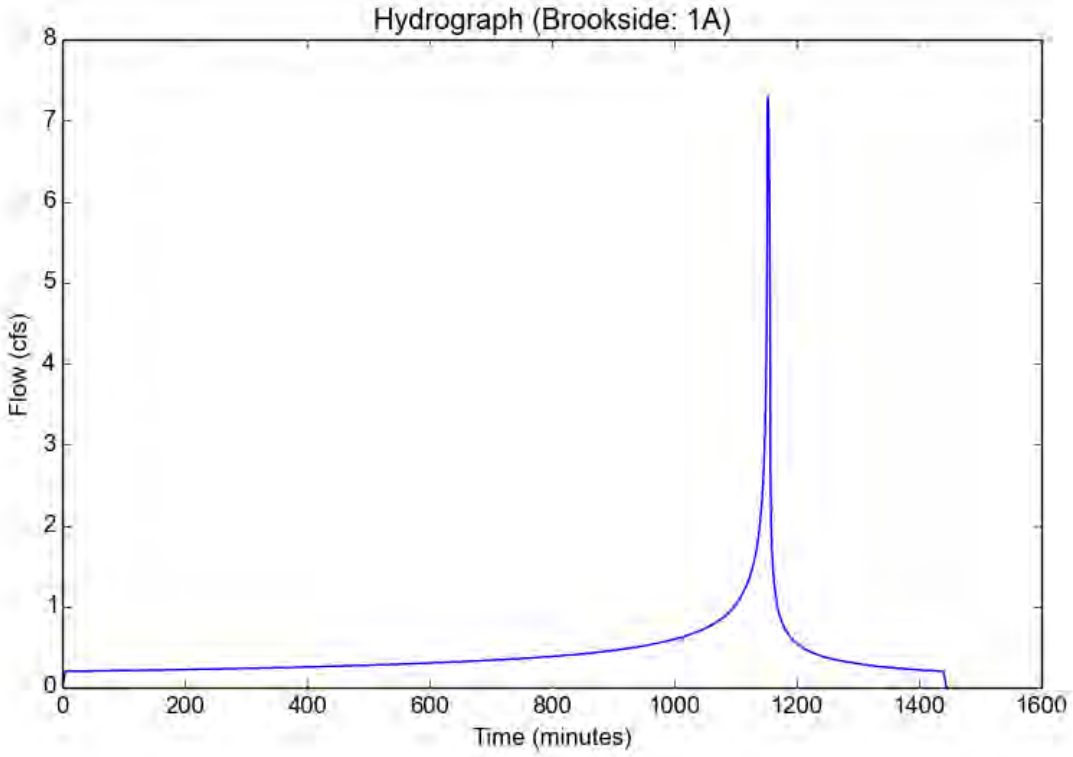
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/100yr/Brookside Existing - 1A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	1.86
Flow Path Length (ft)	623.8
Flow Path Slope (vft/hft)	0.11061
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.656
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	4.3512
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	7.2839
Burned Peak Flow Rate (cfs)	7.2839
24-Hr Clear Runoff Volume (ac-ft)	0.8428
24-Hr Clear Runoff Volume (cu-ft)	36712.1306



Peak Flow Hydrologic Analysis

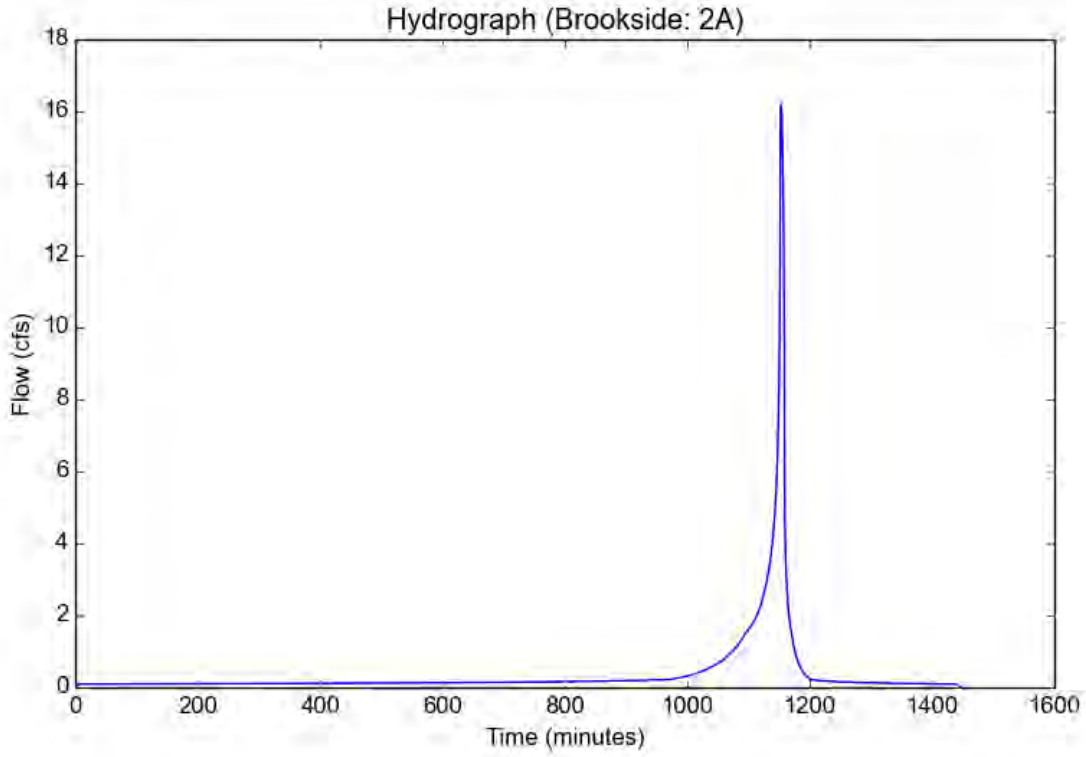
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/25-yr/Brookside Existing - 2A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	6.26
Flow Path Length (ft)	739.9
Flow Path Slope (vft/hft)	0.06623
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.021
Soil Type	17
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.9069
Undeveloped Runoff Coefficient (Cu)	0.889
Developed Runoff Coefficient (Cd)	0.8892
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	16.181
Burned Peak Flow Rate (cfs)	16.181
24-Hr Clear Runoff Volume (ac-ft)	0.7762
24-Hr Clear Runoff Volume (cu-ft)	33810.7964



Peak Flow Hydrologic Analysis

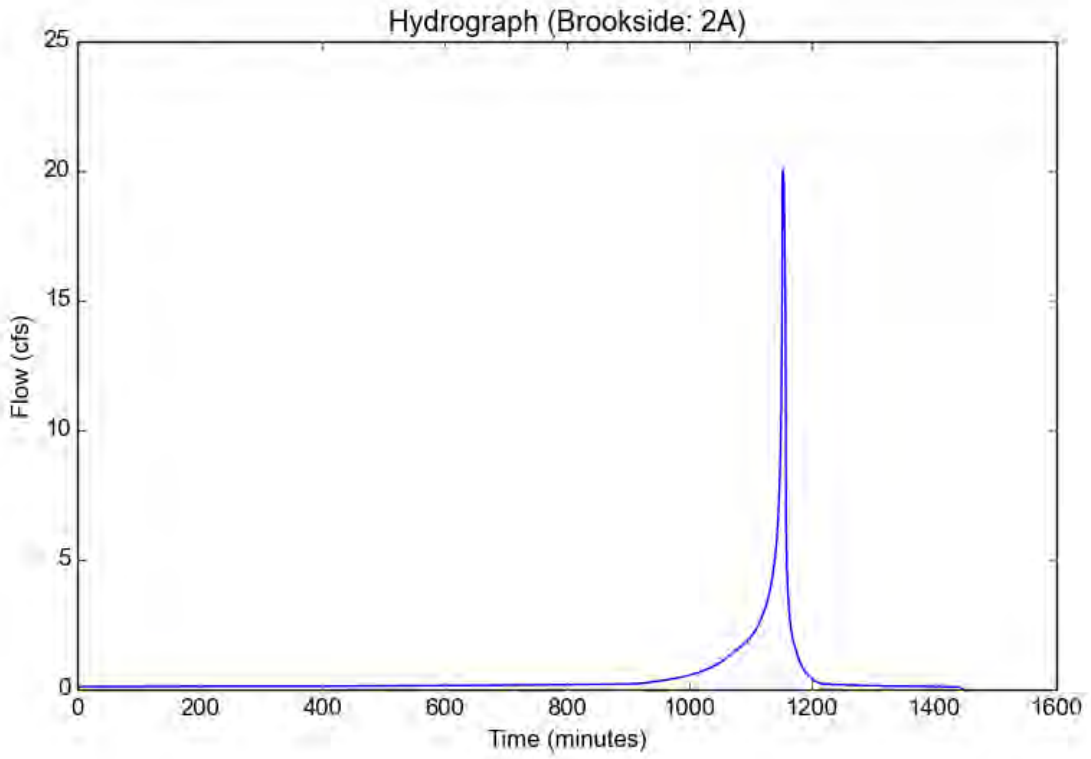
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/50-yr/Brookside Existing - 2A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	6.26
Flow Path Length (ft)	739.9
Flow Path Slope (vft/hft)	0.06623
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.021
Soil Type	17
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.5596
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	20.0548
Burned Peak Flow Rate (cfs)	20.0548
24-Hr Clear Runoff Volume (ac-ft)	0.9613
24-Hr Clear Runoff Volume (cu-ft)	41872.2766



Peak Flow Hydrologic Analysis

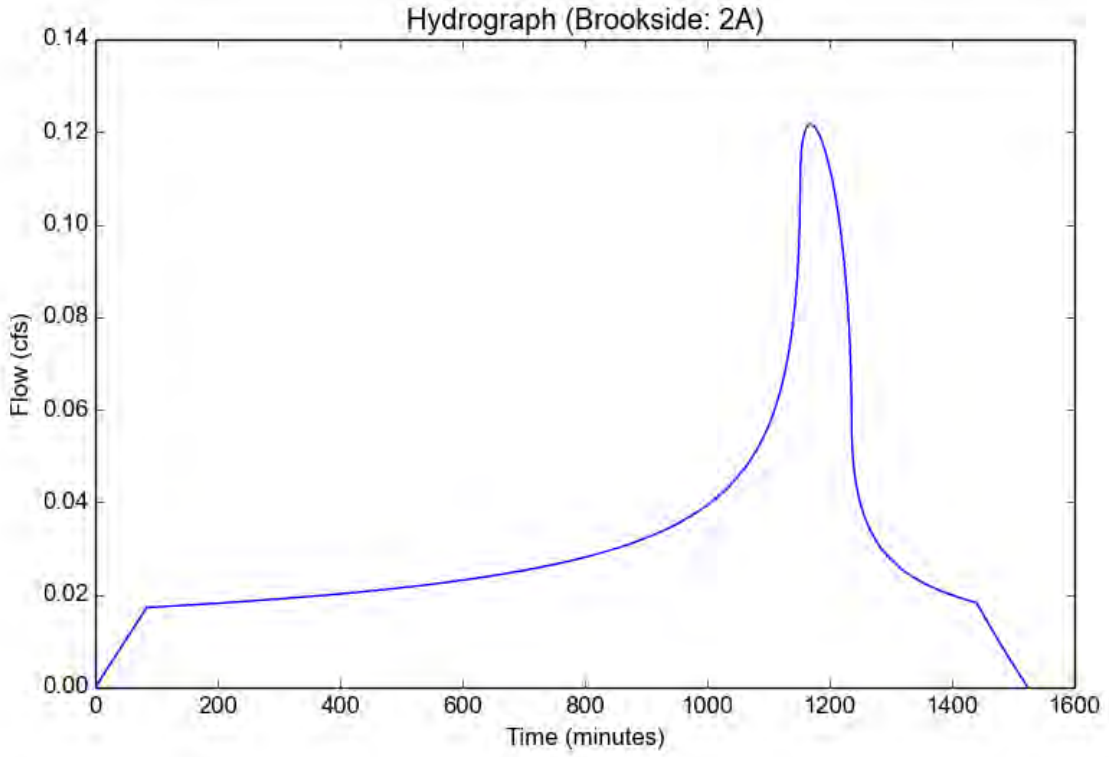
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/85th Percentile/Brookside Existing - 2A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	6.26
Flow Path Length (ft)	739.9
Flow Path Slope (vft/hft)	0.06623
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.021
Soil Type	17
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.1663
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.1168
Time of Concentration (min)	84.0
Clear Peak Flow Rate (cfs)	0.1216
Burned Peak Flow Rate (cfs)	0.1216
24-Hr Clear Runoff Volume (ac-ft)	0.0635
24-Hr Clear Runoff Volume (cu-ft)	2764.0729



Peak Flow Hydrologic Analysis

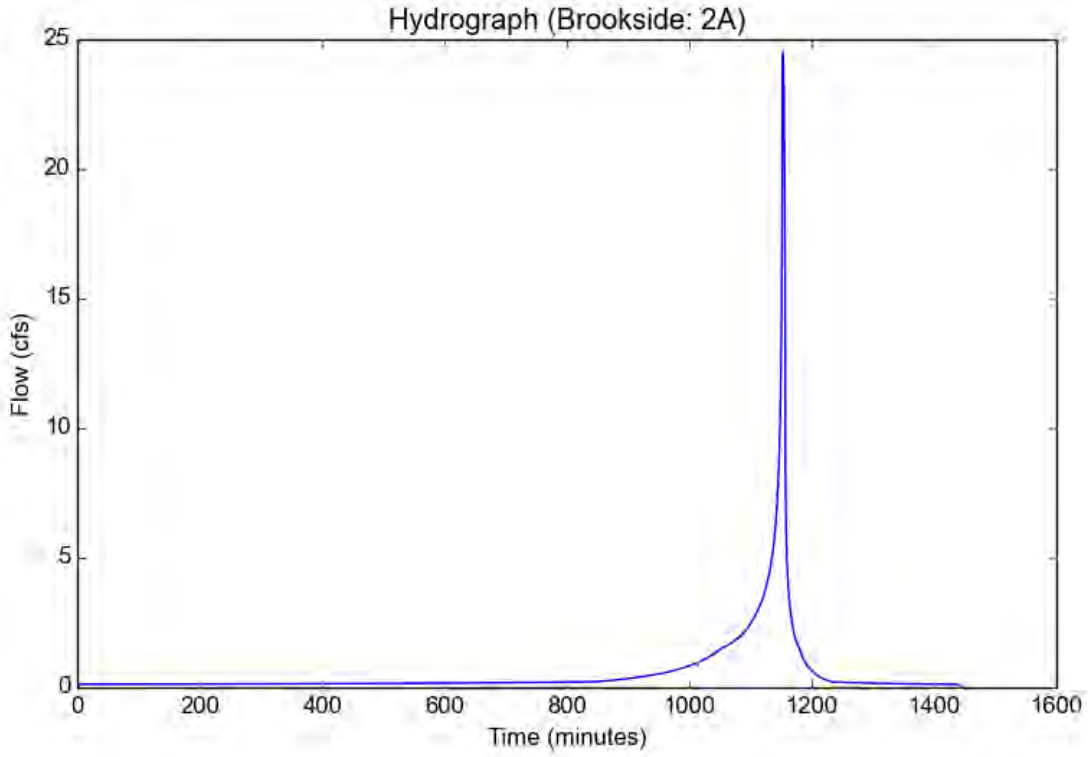
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/100yr/Brookside Existing - 2A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	6.26
Flow Path Length (ft)	739.9
Flow Path Slope (vft/hft)	0.06623
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.021
Soil Type	17
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	4.3512
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	24.5147
Burned Peak Flow Rate (cfs)	24.5147
24-Hr Clear Runoff Volume (ac-ft)	1.165
24-Hr Clear Runoff Volume (cu-ft)	50745.2465



Peak Flow Hydrologic Analysis

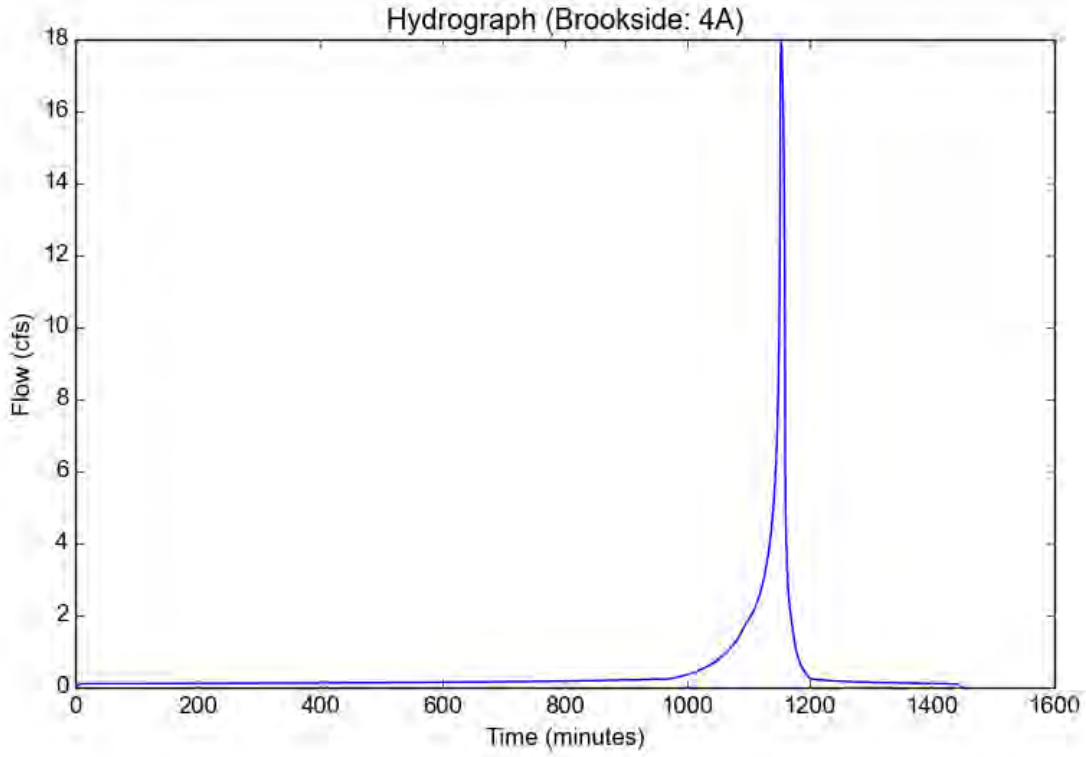
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/25-yr/Brookside Existing - 4A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	7.44
Flow Path Length (ft)	949.3
Flow Path Slope (vft/hft)	0.05794
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	17
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.7301
Undeveloped Runoff Coefficient (Cu)	0.8822
Developed Runoff Coefficient (Cd)	0.8824
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	17.9225
Burned Peak Flow Rate (cfs)	17.9225
24-Hr Clear Runoff Volume (ac-ft)	0.8973
24-Hr Clear Runoff Volume (cu-ft)	39087.0452



Peak Flow Hydrologic Analysis

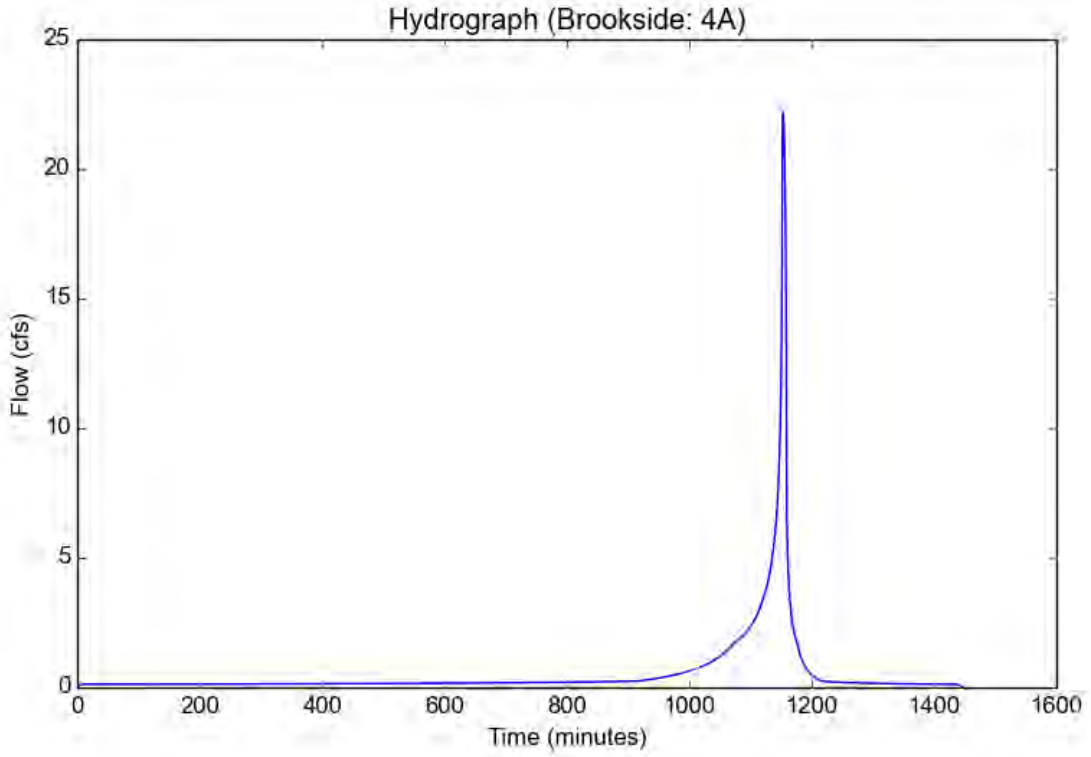
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/50-yr/Brookside Existing - 4A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	7.44
Flow Path Length (ft)	949.3
Flow Path Slope (vft/hft)	0.05794
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	17
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	22.1693
Burned Peak Flow Rate (cfs)	22.1693
24-Hr Clear Runoff Volume (ac-ft)	1.1155
24-Hr Clear Runoff Volume (cu-ft)	48591.857



Peak Flow Hydrologic Analysis

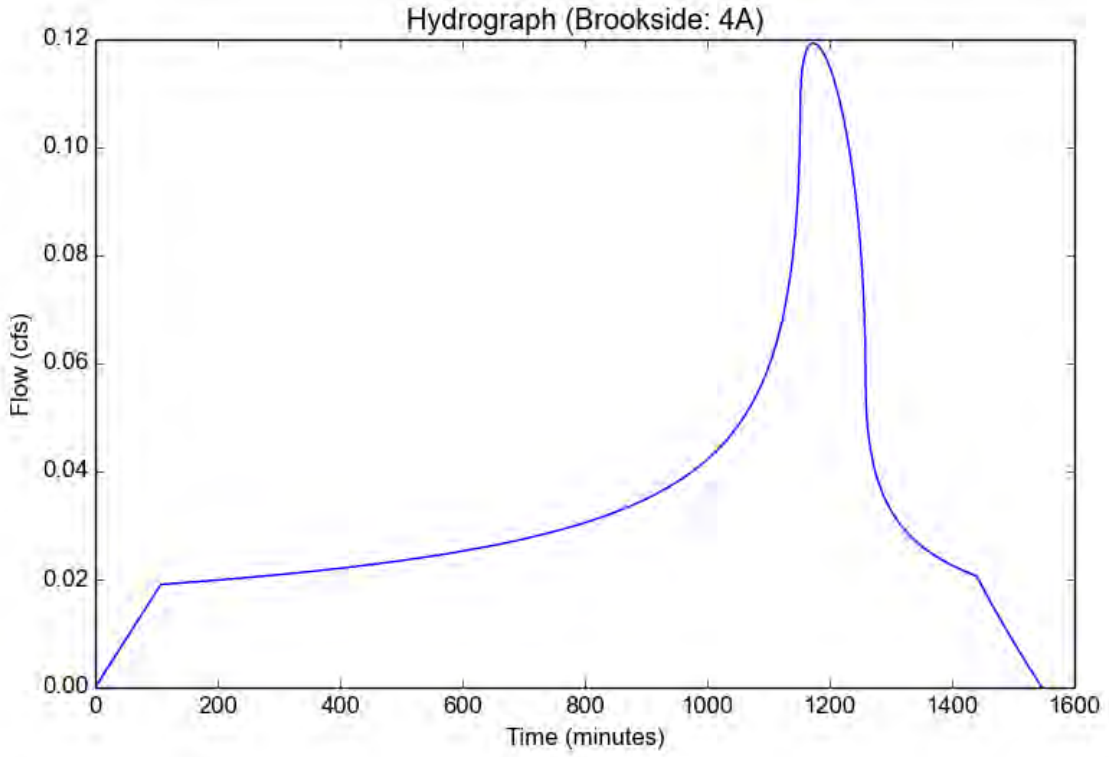
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/85th Percentile/Brookside Existing - 4A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	7.44
Flow Path Length (ft)	949.3
Flow Path Slope (vft/hft)	0.05794
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.01
Soil Type	17
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.1485
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.108
Time of Concentration (min)	107.0
Clear Peak Flow Rate (cfs)	0.1193
Burned Peak Flow Rate (cfs)	0.1193
24-Hr Clear Runoff Volume (ac-ft)	0.0697
24-Hr Clear Runoff Volume (cu-ft)	3037.7727



Peak Flow Hydrologic Analysis

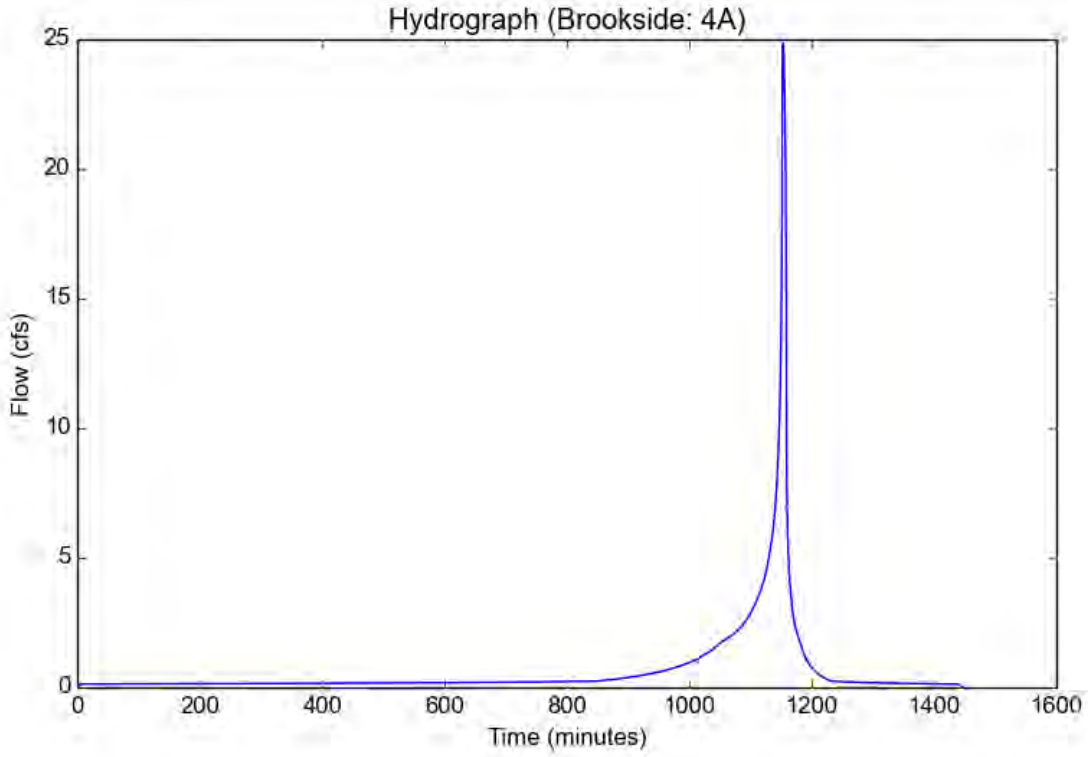
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/100yr/Brookside Existing - 4A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	7.44
Flow Path Length (ft)	949.3
Flow Path Slope (vft/hft)	0.05794
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	17
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.7147
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	24.8739
Burned Peak Flow Rate (cfs)	24.8739
24-Hr Clear Runoff Volume (ac-ft)	1.3566
24-Hr Clear Runoff Volume (cu-ft)	59092.8335



Peak Flow Hydrologic Analysis

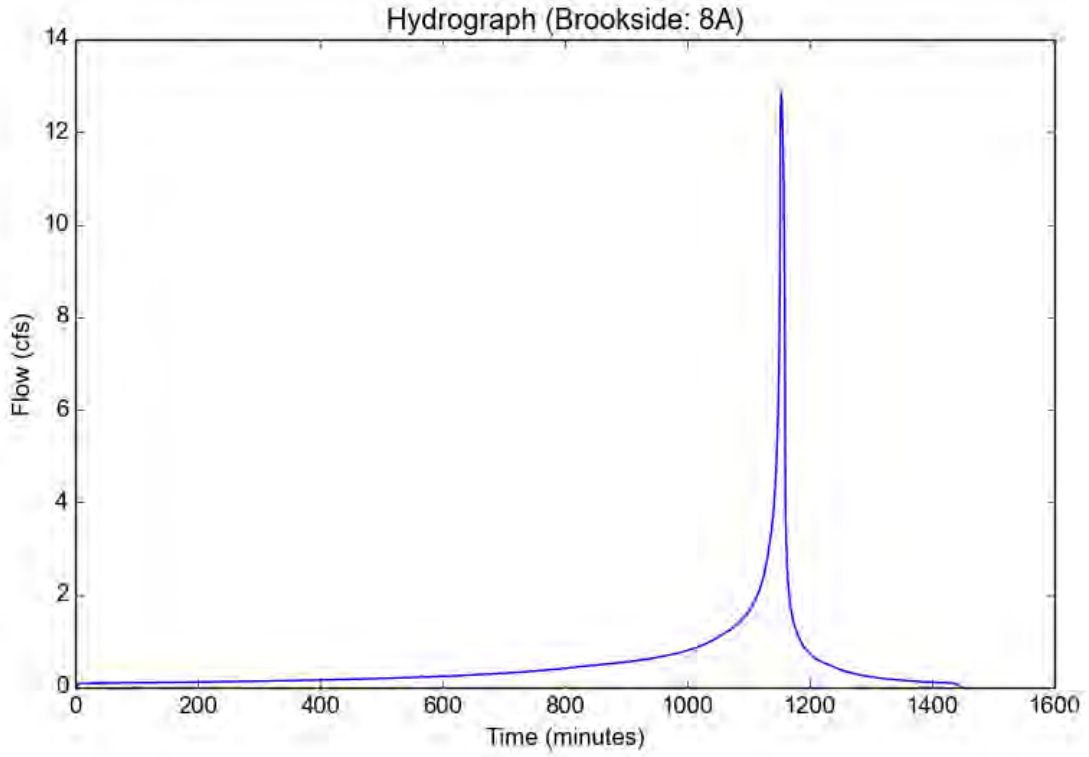
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/25-yr/Brookside Existing - 8A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	8A
Area (ac)	5.39
Flow Path Length (ft)	1116.4
Flow Path Slope (vft/hft)	0.08151
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.016
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.7301
Undeveloped Runoff Coefficient (Cu)	0.8717
Developed Runoff Coefficient (Cd)	0.8722
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	12.8343
Burned Peak Flow Rate (cfs)	12.8343
24-Hr Clear Runoff Volume (ac-ft)	1.019
24-Hr Clear Runoff Volume (cu-ft)	44386.5911



Peak Flow Hydrologic Analysis

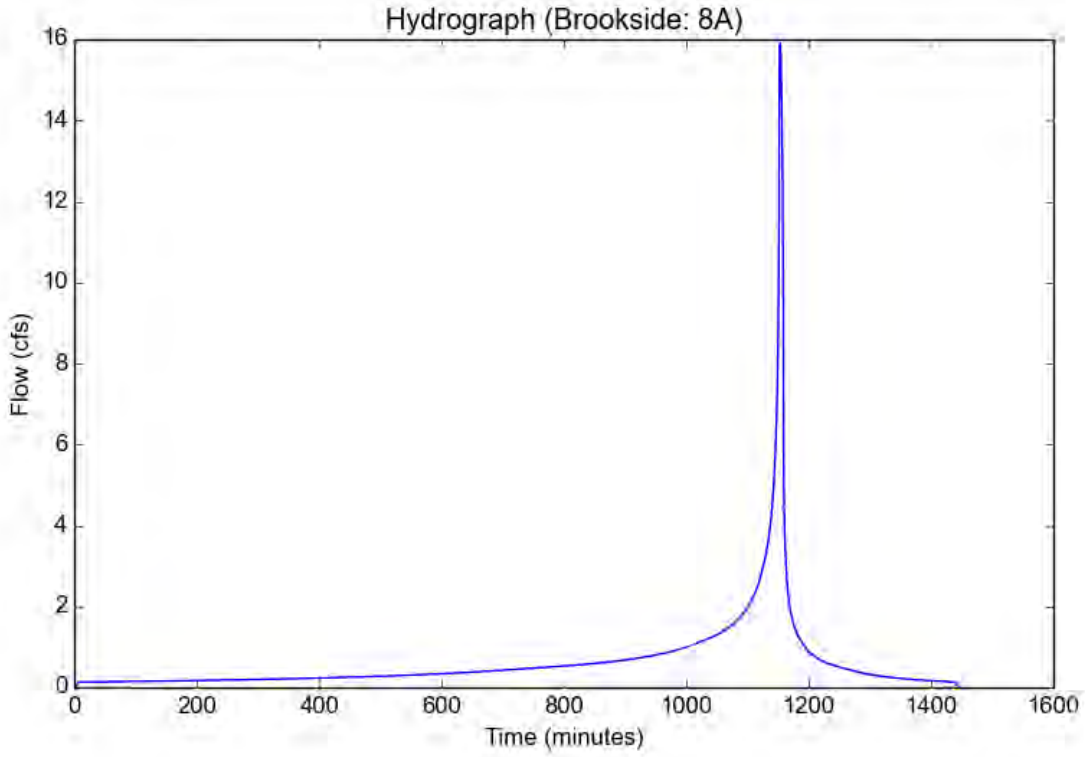
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/50-yr/Brookside Existing - 8A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	8A
Area (ac)	5.39
Flow Path Length (ft)	1116.4
Flow Path Slope (vft/hft)	0.08151
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.016
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.8912
Developed Runoff Coefficient (Cd)	0.8913
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	15.9059
Burned Peak Flow Rate (cfs)	15.9059
24-Hr Clear Runoff Volume (ac-ft)	1.2774
24-Hr Clear Runoff Volume (cu-ft)	55644.0839



Peak Flow Hydrologic Analysis

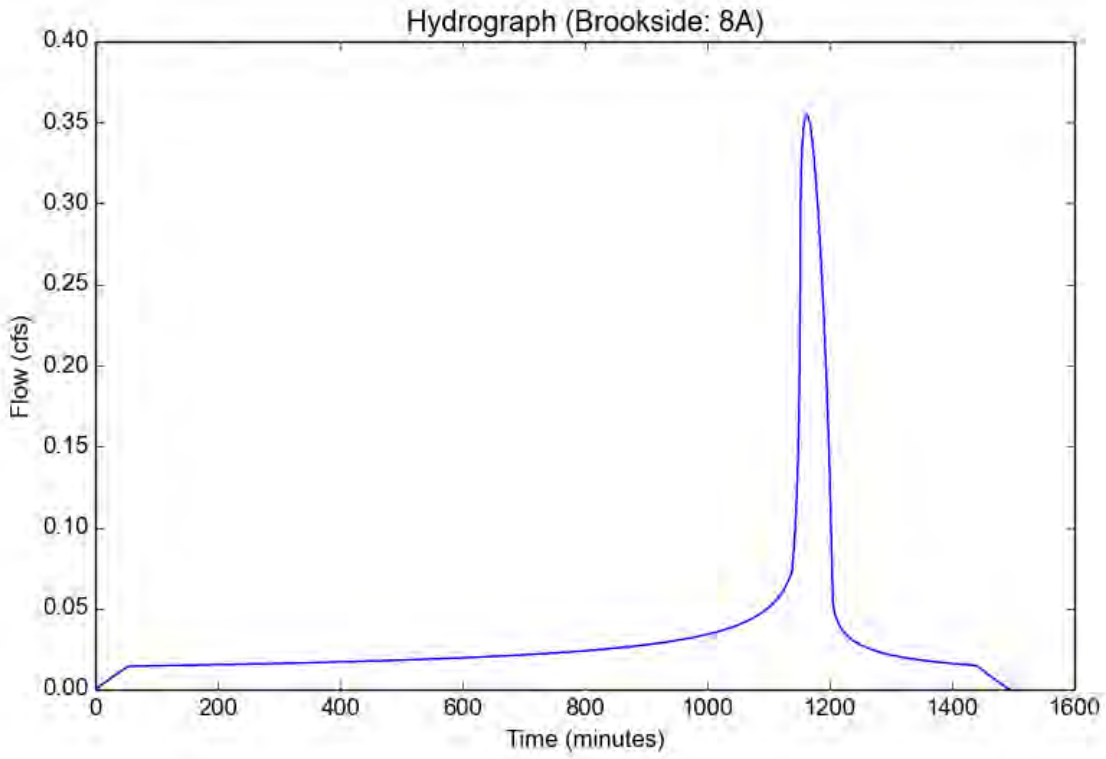
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/85th Percentile/Brookside Existing - 8A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	8A
Area (ac)	5.39
Flow Path Length (ft)	1116.4
Flow Path Slope (vft/hft)	0.08151
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.016
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2065
Undeveloped Runoff Coefficient (Cu)	0.3094
Developed Runoff Coefficient (Cd)	0.3189
Time of Concentration (min)	53.0
Clear Peak Flow Rate (cfs)	0.355
Burned Peak Flow Rate (cfs)	0.355
24-Hr Clear Runoff Volume (ac-ft)	0.0653
24-Hr Clear Runoff Volume (cu-ft)	2843.0823



Peak Flow Hydrologic Analysis

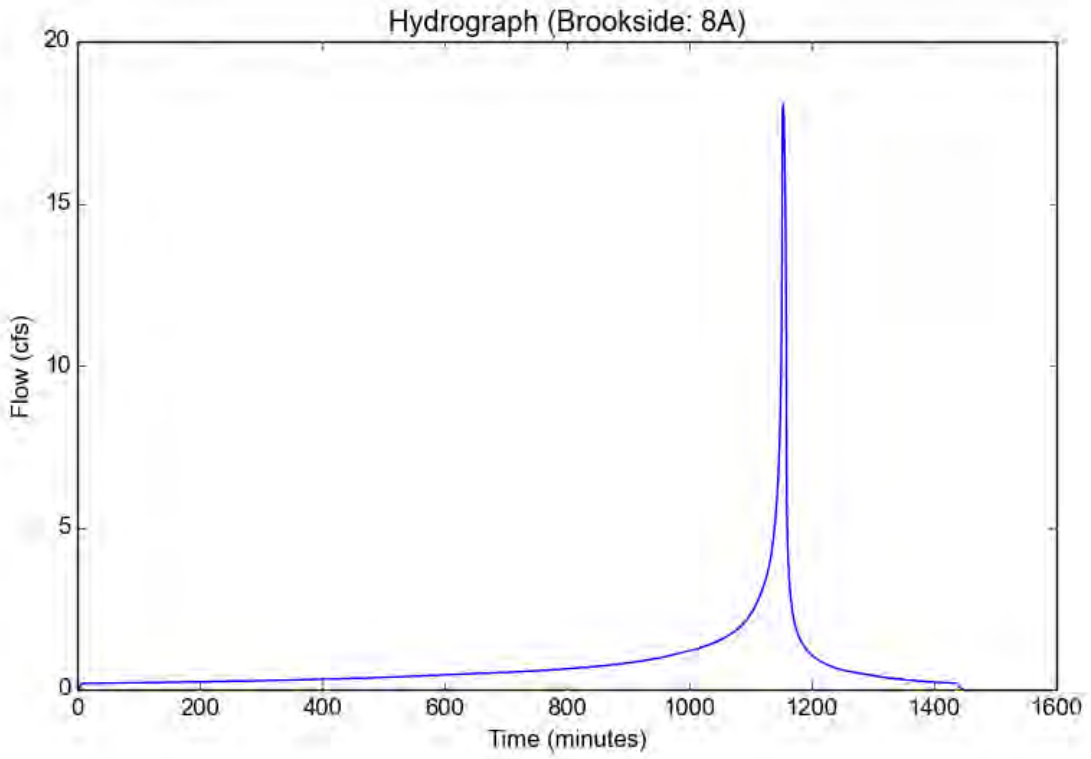
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/100yr/Brookside Existing - 8A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	8A
Area (ac)	5.39
Flow Path Length (ft)	1116.4
Flow Path Slope (vft/hft)	0.08151
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.016
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.7147
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	18.0202
Burned Peak Flow Rate (cfs)	18.0202
24-Hr Clear Runoff Volume (ac-ft)	1.547
24-Hr Clear Runoff Volume (cu-ft)	67388.9379



Peak Flow Hydrologic Analysis

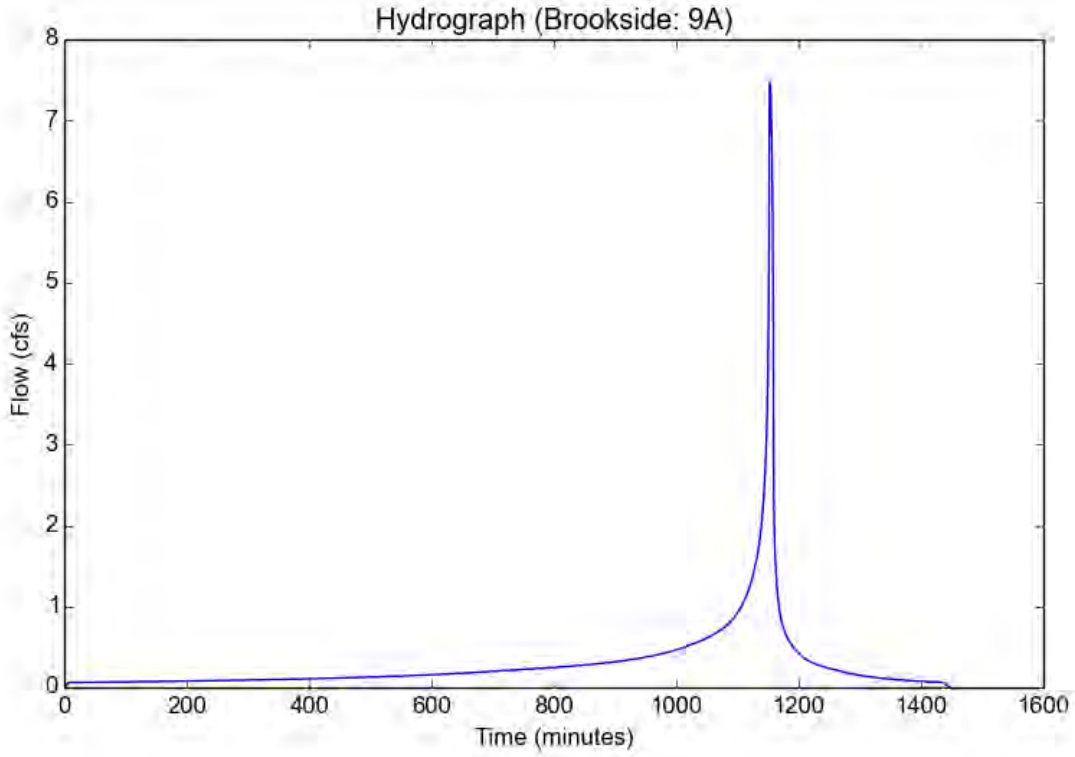
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/50-yr/Brookside Existing - 9A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	2.53
Flow Path Length (ft)	912.2
Flow Path Slope (vft/hft)	0.05591
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.8912
Developed Runoff Coefficient (Cd)	0.8913
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	7.4656
Burned Peak Flow Rate (cfs)	7.4656
24-Hr Clear Runoff Volume (ac-ft)	0.5958
24-Hr Clear Runoff Volume (cu-ft)	25953.0225



Peak Flow Hydrologic Analysis

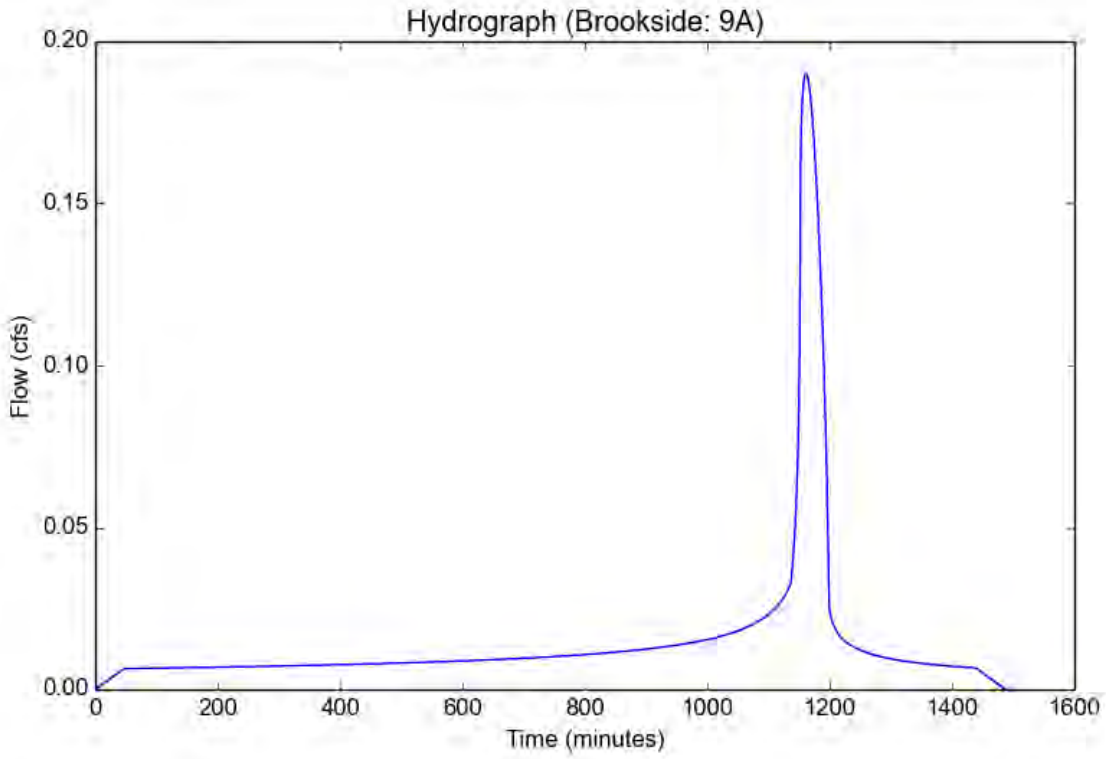
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/85th Percentile/Brookside Existing - 9A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	2.53
Flow Path Length (ft)	912.2
Flow Path Slope (vft/hft)	0.05591
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2185
Undeveloped Runoff Coefficient (Cu)	0.3385
Developed Runoff Coefficient (Cd)	0.3441
Time of Concentration (min)	47.0
Clear Peak Flow Rate (cfs)	0.1903
Burned Peak Flow Rate (cfs)	0.1903
24-Hr Clear Runoff Volume (ac-ft)	0.0302
24-Hr Clear Runoff Volume (cu-ft)	1316.3485



Peak Flow Hydrologic Analysis

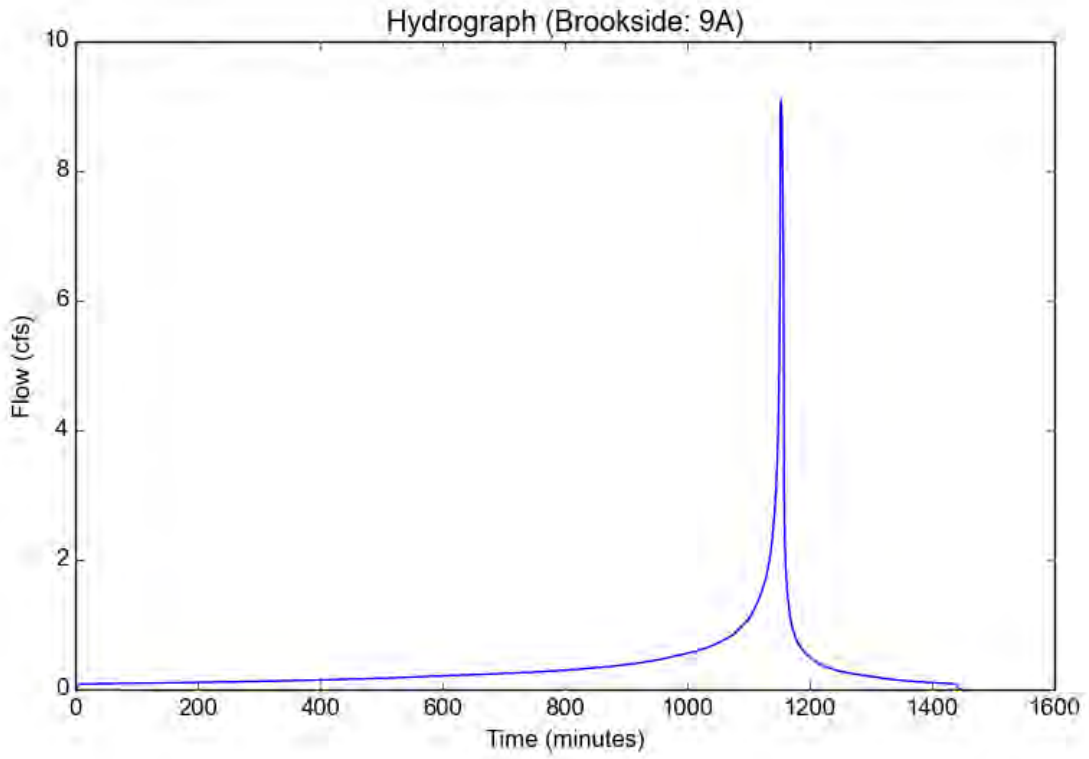
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/100yr/Brookside Existing - 9A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	2.53
Flow Path Length (ft)	912.2
Flow Path Slope (vft/hft)	0.05591
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.9939
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	9.094
Burned Peak Flow Rate (cfs)	9.094
24-Hr Clear Runoff Volume (ac-ft)	0.7221
24-Hr Clear Runoff Volume (cu-ft)	31455.4458



Peak Flow Hydrologic Analysis

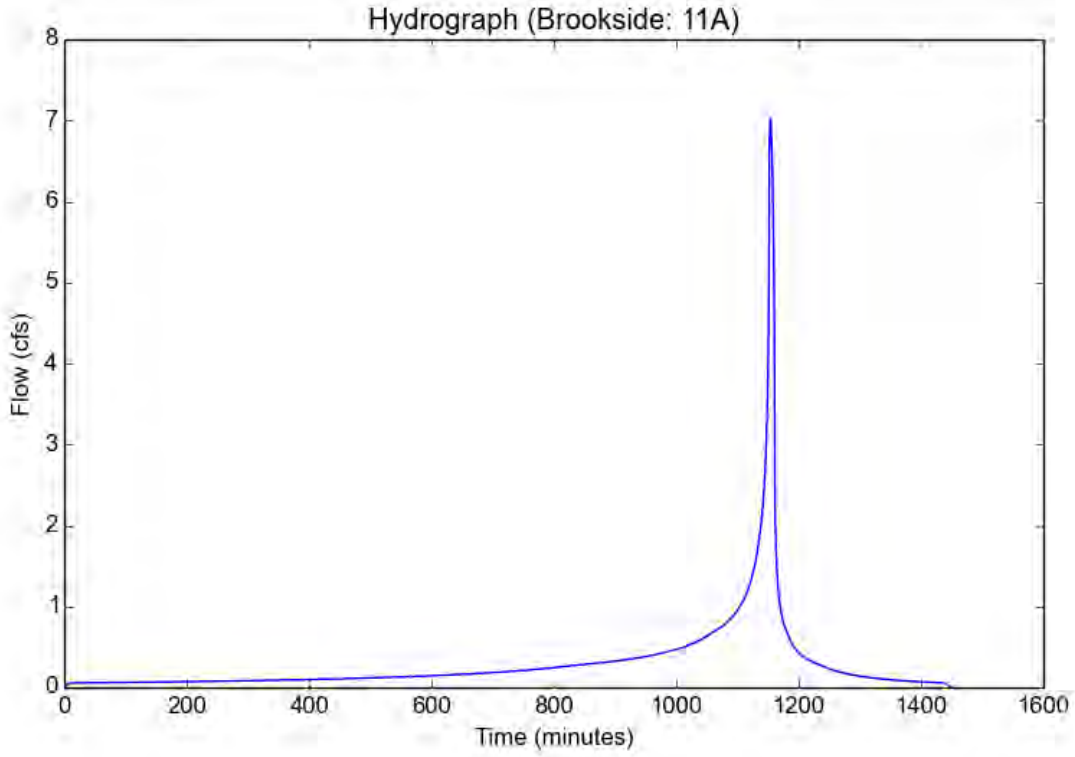
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/25-yr/Brookside Existing - 11A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	3.14
Flow Path Length (ft)	890.9
Flow Path Slope (vft/hft)	0.02469
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.028
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.5831
Undeveloped Runoff Coefficient (Cu)	0.8652
Developed Runoff Coefficient (Cd)	0.8662
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	7.0256
Burned Peak Flow Rate (cfs)	7.0256
24-Hr Clear Runoff Volume (ac-ft)	0.6025
24-Hr Clear Runoff Volume (cu-ft)	26245.0559



Peak Flow Hydrologic Analysis

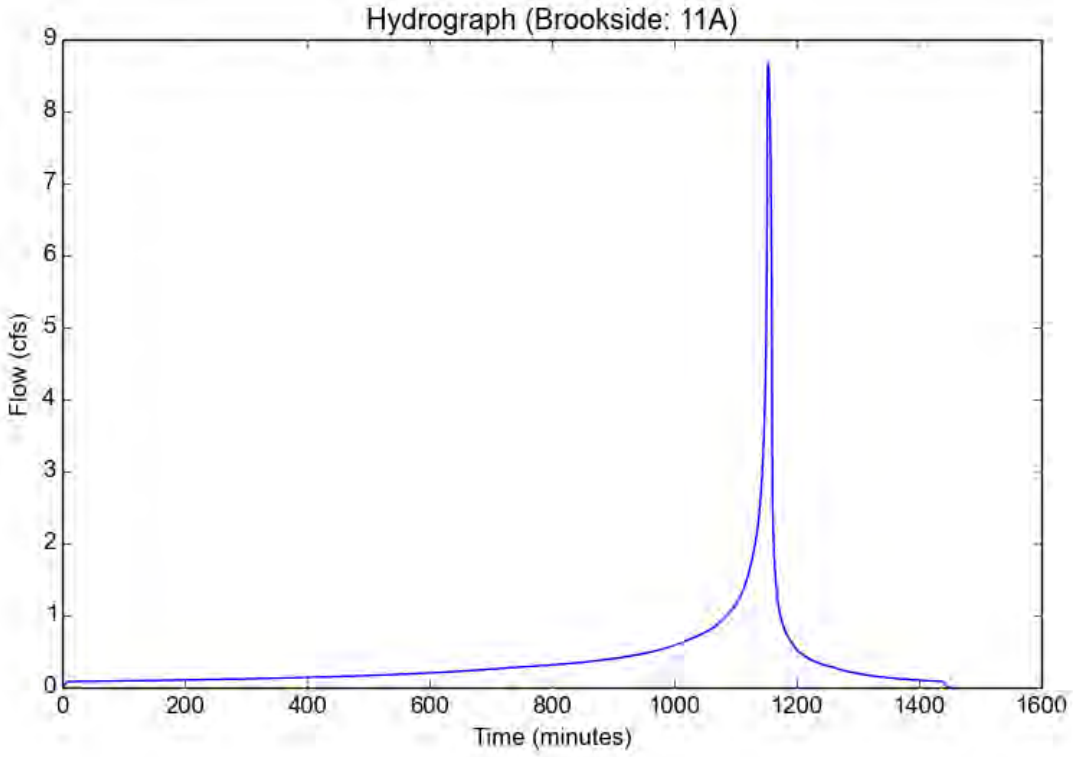
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/50-yr/Brookside Existing - 11A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	3.14
Flow Path Length (ft)	890.9
Flow Path Slope (vft/hft)	0.02469
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.028
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.1094
Undeveloped Runoff Coefficient (Cu)	0.8863
Developed Runoff Coefficient (Cd)	0.8867
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	8.6573
Burned Peak Flow Rate (cfs)	8.6573
24-Hr Clear Runoff Volume (ac-ft)	0.7535
24-Hr Clear Runoff Volume (cu-ft)	32823.0867



Peak Flow Hydrologic Analysis

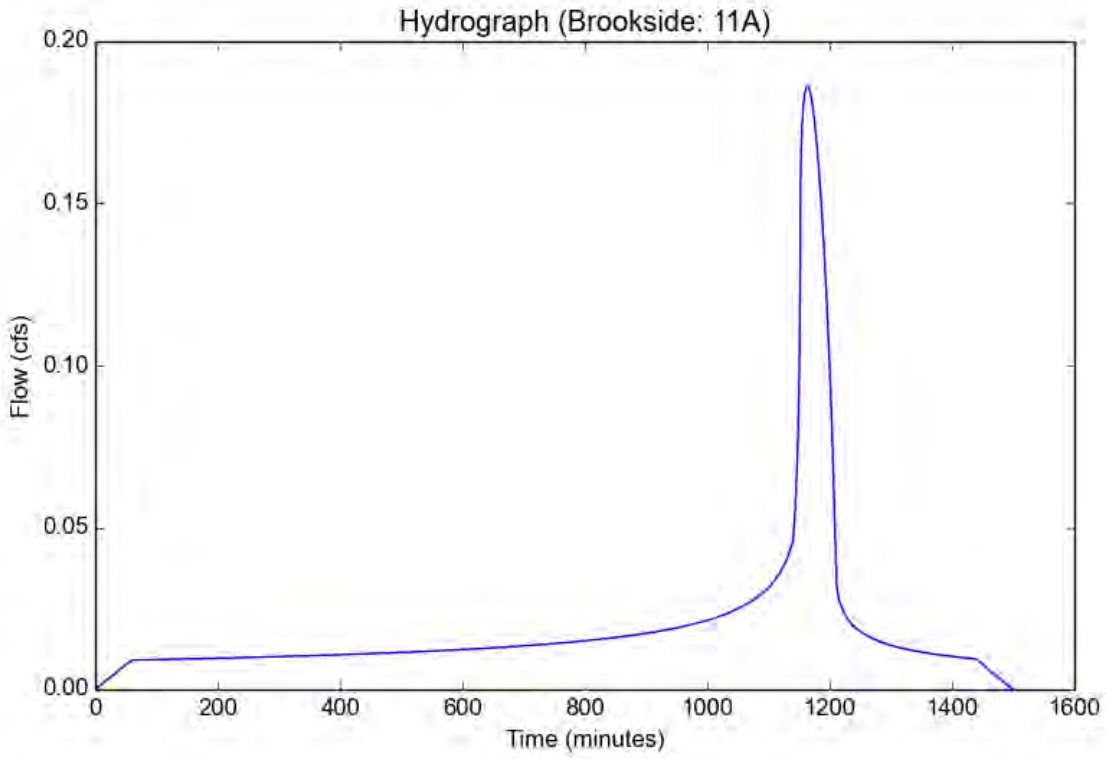
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/85th Percentile/Brookside Existing - 11A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	3.14
Flow Path Length (ft)	890.9
Flow Path Slope (vft/hft)	0.02469
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.028
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.1964
Undeveloped Runoff Coefficient (Cu)	0.2849
Developed Runoff Coefficient (Cd)	0.3021
Time of Concentration (min)	59.0
Clear Peak Flow Rate (cfs)	0.1863
Burned Peak Flow Rate (cfs)	0.1863
24-Hr Clear Runoff Volume (ac-ft)	0.0399
24-Hr Clear Runoff Volume (cu-ft)	1737.0985



Peak Flow Hydrologic Analysis

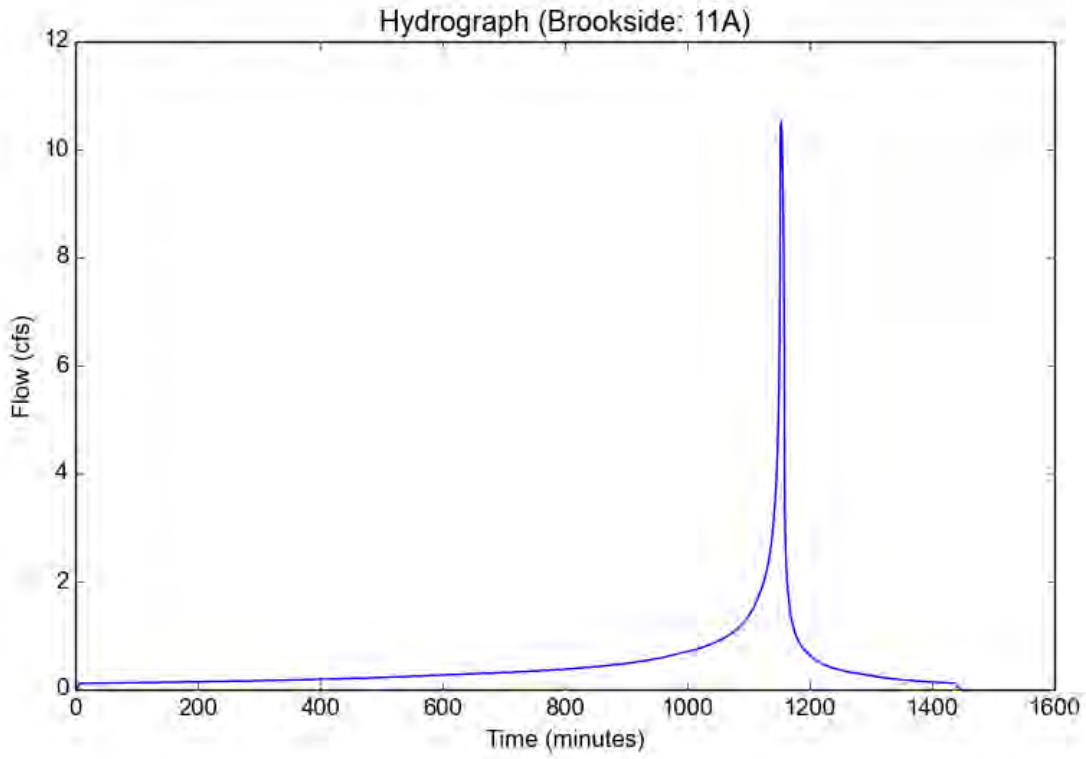
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/100yr/Brookside Existing - 11A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	3.14
Flow Path Length (ft)	890.9
Flow Path Slope (vft/hft)	0.02469
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.028
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.7147
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	10.4979
Burned Peak Flow Rate (cfs)	10.4979
24-Hr Clear Runoff Volume (ac-ft)	0.911
24-Hr Clear Runoff Volume (cu-ft)	39684.1927



Peak Flow Hydrologic Analysis

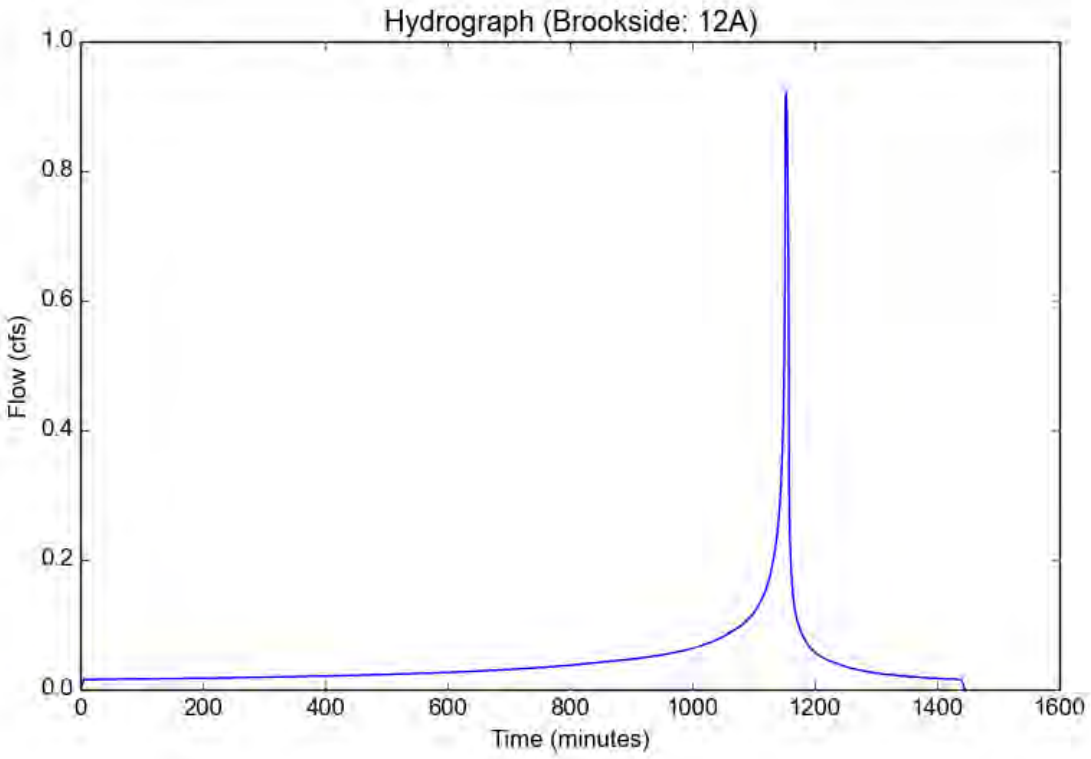
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/25-yr/Brookside Existing - 12A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.33
Flow Path Length (ft)	406.0
Flow Path Slope (vft/hft)	0.0197
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.314
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	3.1253
Undeveloped Runoff Coefficient (Cu)	0.8867
Developed Runoff Coefficient (Cd)	0.8909
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	0.9188
Burned Peak Flow Rate (cfs)	0.9188
24-Hr Clear Runoff Volume (ac-ft)	0.0859
24-Hr Clear Runoff Volume (cu-ft)	3743.5221



Peak Flow Hydrologic Analysis

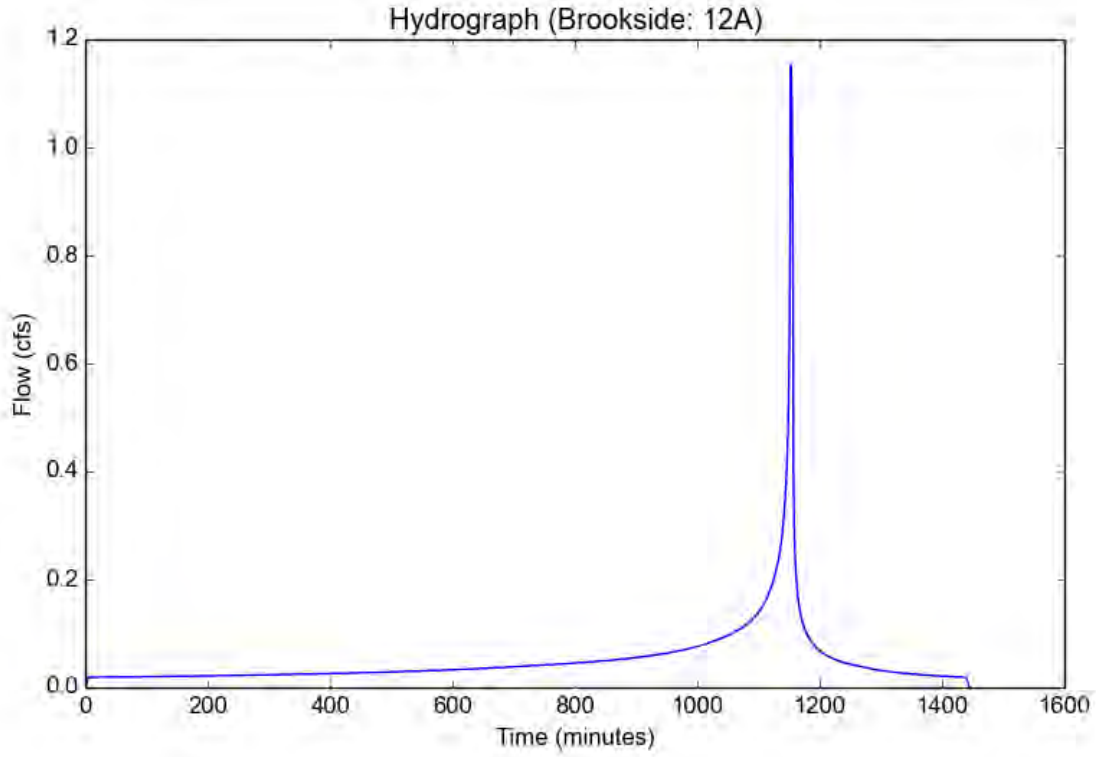
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/50-yr/Brookside Existing - 12A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.33
Flow Path Length (ft)	406.0
Flow Path Slope (vft/hft)	0.0197
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.314
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.1518
Burned Peak Flow Rate (cfs)	1.1518
24-Hr Clear Runoff Volume (ac-ft)	0.1028
24-Hr Clear Runoff Volume (cu-ft)	4480.0454



Peak Flow Hydrologic Analysis

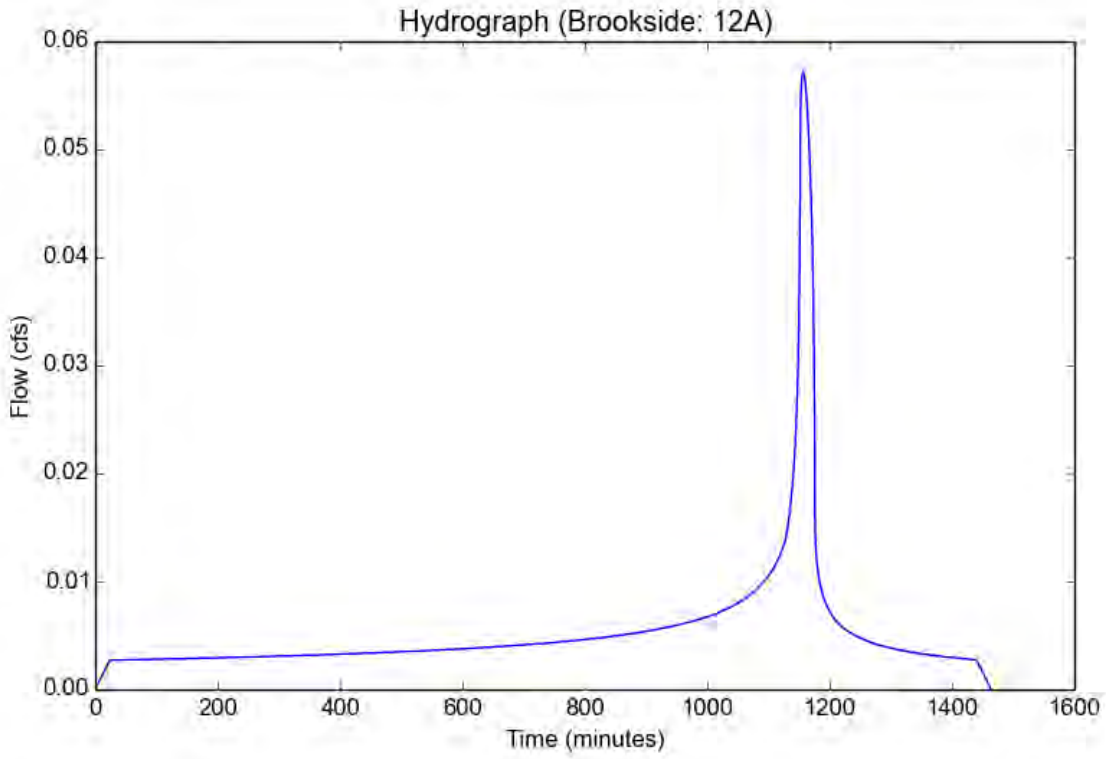
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/85th Percentile/Brookside Existing - 12A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.33
Flow Path Length (ft)	406.0
Flow Path Slope (vft/hft)	0.0197
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.314
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2997
Undeveloped Runoff Coefficient (Cu)	0.4308
Developed Runoff Coefficient (Cd)	0.5781
Time of Concentration (min)	24.0
Clear Peak Flow Rate (cfs)	0.0572
Burned Peak Flow Rate (cfs)	0.0572
24-Hr Clear Runoff Volume (ac-ft)	0.0108
24-Hr Clear Runoff Volume (cu-ft)	469.7187



Peak Flow Hydrologic Analysis

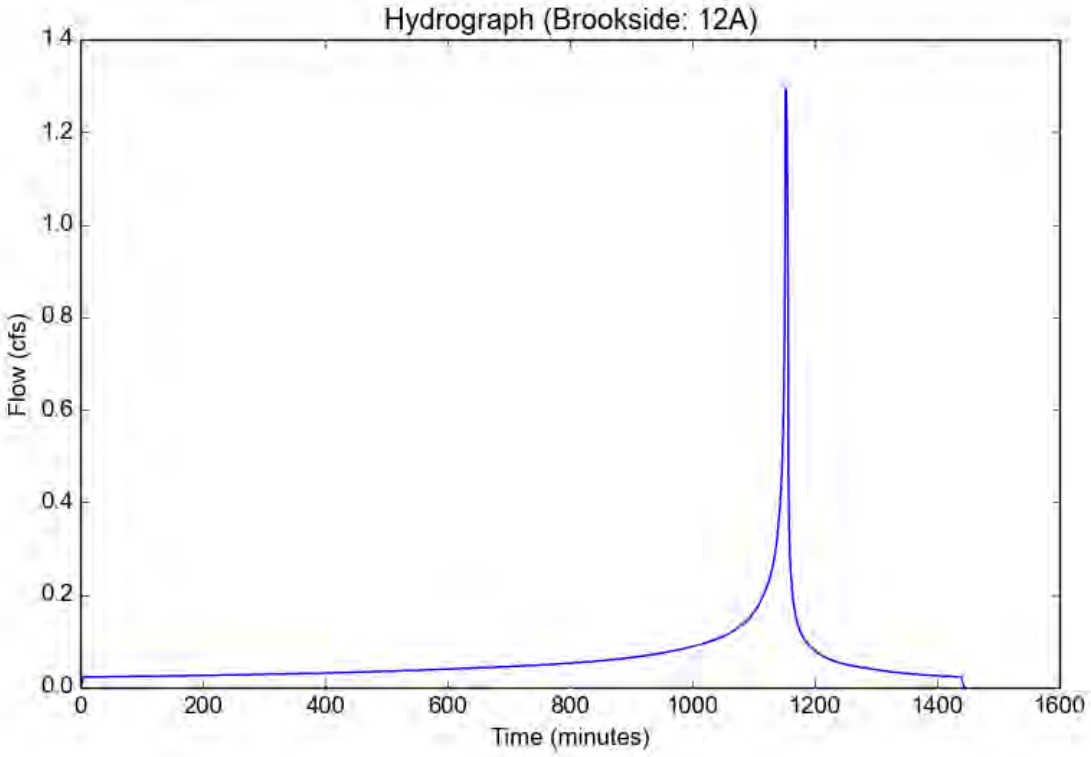
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Existing/100yr/Brookside Existing - 12A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.33
Flow Path Length (ft)	406.0
Flow Path Slope (vft/hft)	0.0197
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.314
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	4.3512
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.2923
Burned Peak Flow Rate (cfs)	1.2923
24-Hr Clear Runoff Volume (ac-ft)	0.1202
24-Hr Clear Runoff Volume (cu-ft)	5236.6735



Proposed Conditions HydroCalc Results

Peak Flow Hydrologic Analysis

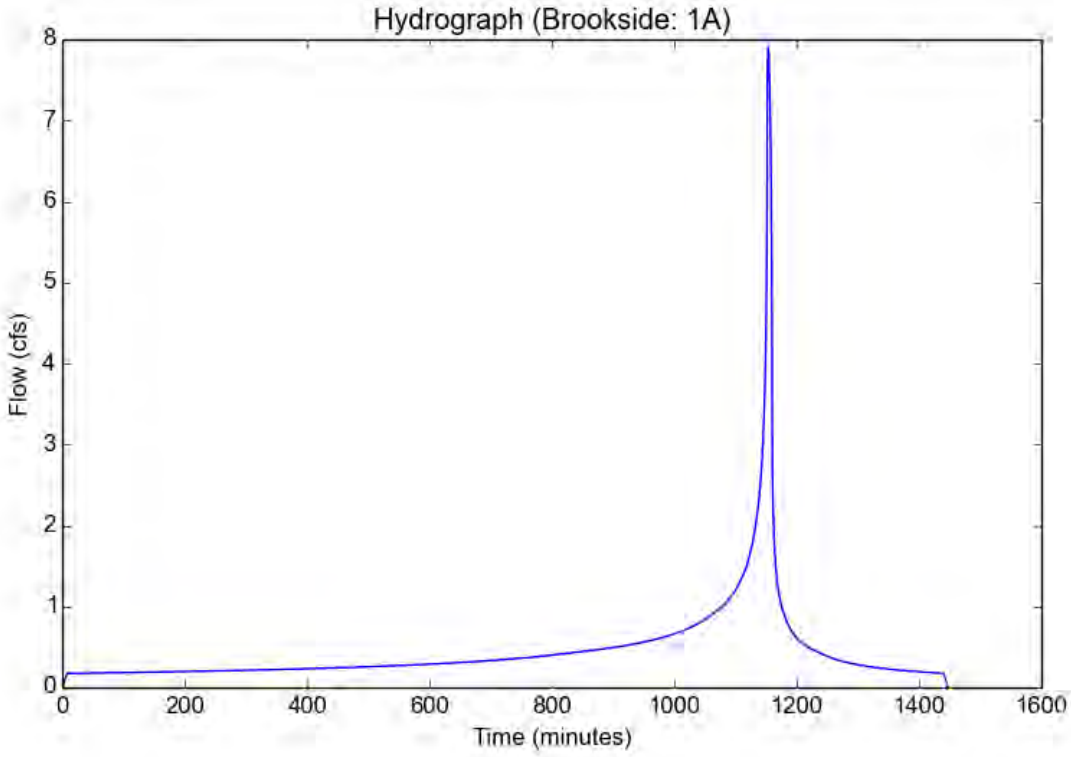
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed- 1A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	3.28
Flow Path Length (ft)	866.7
Flow Path Slope (vft/hft)	0.04038
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.384
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.7301
Undeveloped Runoff Coefficient (Cu)	0.8717
Developed Runoff Coefficient (Cd)	0.8826
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	7.9033
Burned Peak Flow Rate (cfs)	7.9033
24-Hr Clear Runoff Volume (ac-ft)	0.9089
24-Hr Clear Runoff Volume (cu-ft)	39591.0966



Peak Flow Hydrologic Analysis

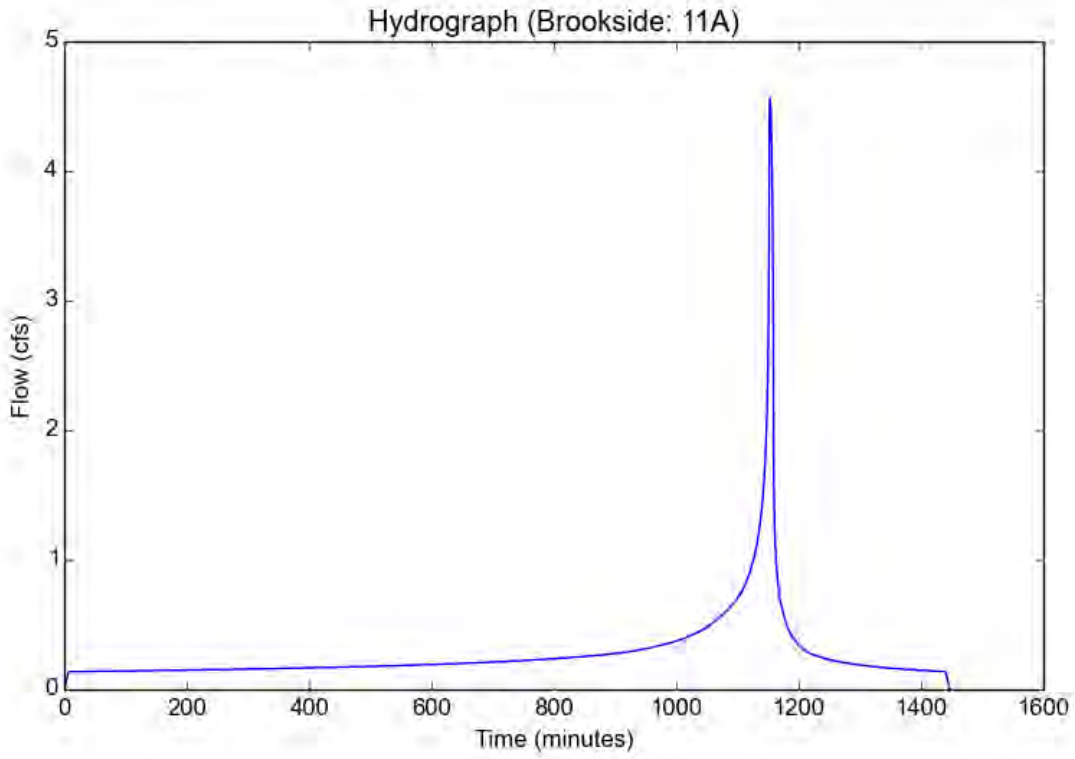
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed- 11A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	1.53
Flow Path Length (ft)	494.1
Flow Path Slope (vft/hft)	0.00607
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	4.559
Burned Peak Flow Rate (cfs)	4.559
24-Hr Clear Runoff Volume (ac-ft)	0.5593
24-Hr Clear Runoff Volume (cu-ft)	24363.0331



Peak Flow Hydrologic Analysis

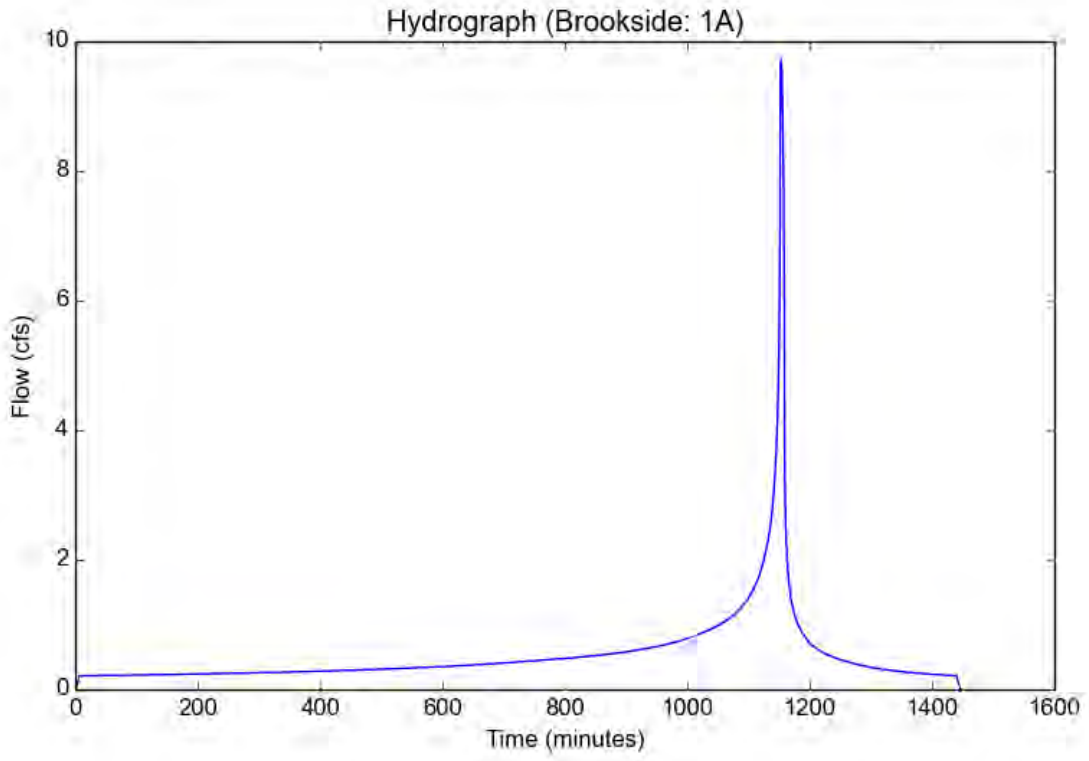
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 1A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	3.28
Flow Path Length (ft)	866.7
Flow Path Slope (vft/hft)	0.04038
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.384
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.8912
Developed Runoff Coefficient (Cd)	0.8946
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	9.7145
Burned Peak Flow Rate (cfs)	9.7145
24-Hr Clear Runoff Volume (ac-ft)	1.0797
24-Hr Clear Runoff Volume (cu-ft)	47031.3621



Peak Flow Hydrologic Analysis

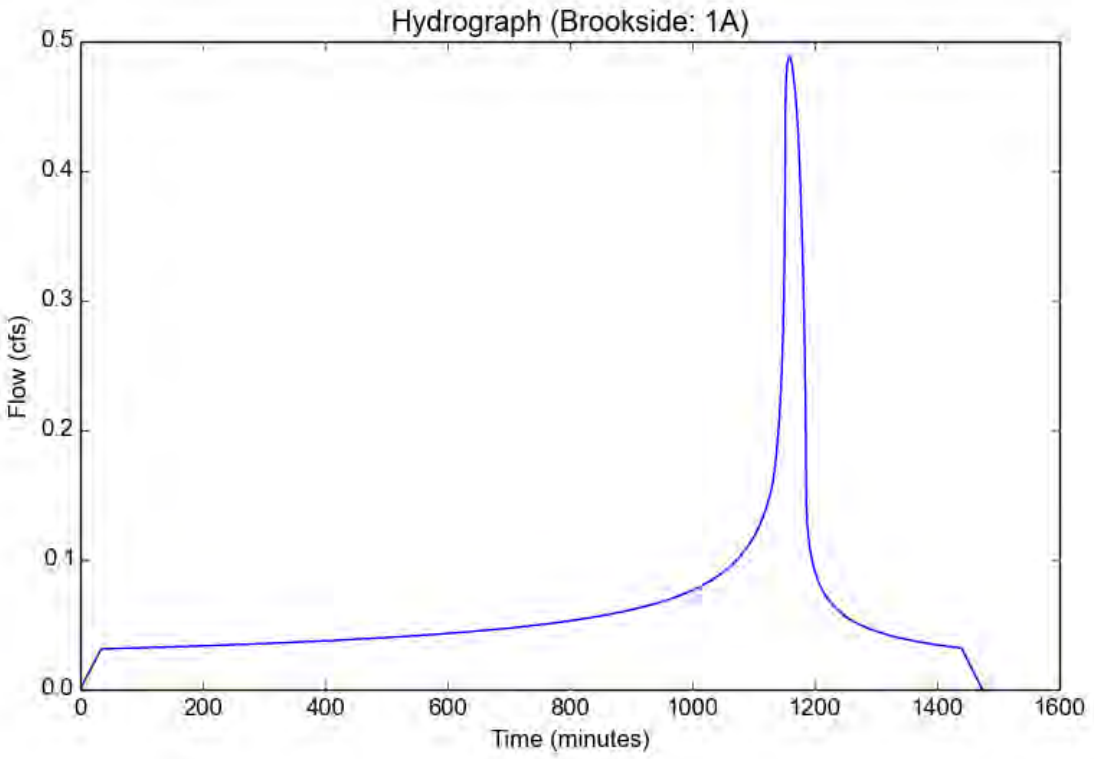
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 1A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	3.28
Flow Path Length (ft)	866.7
Flow Path Slope (vft/hft)	0.04038
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.384
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2545
Undeveloped Runoff Coefficient (Cu)	0.3889
Developed Runoff Coefficient (Cd)	0.5852
Time of Concentration (min)	34.0
Clear Peak Flow Rate (cfs)	0.4884
Burned Peak Flow Rate (cfs)	0.4884
24-Hr Clear Runoff Volume (ac-ft)	0.122
24-Hr Clear Runoff Volume (cu-ft)	5314.9864



Peak Flow Hydrologic Analysis

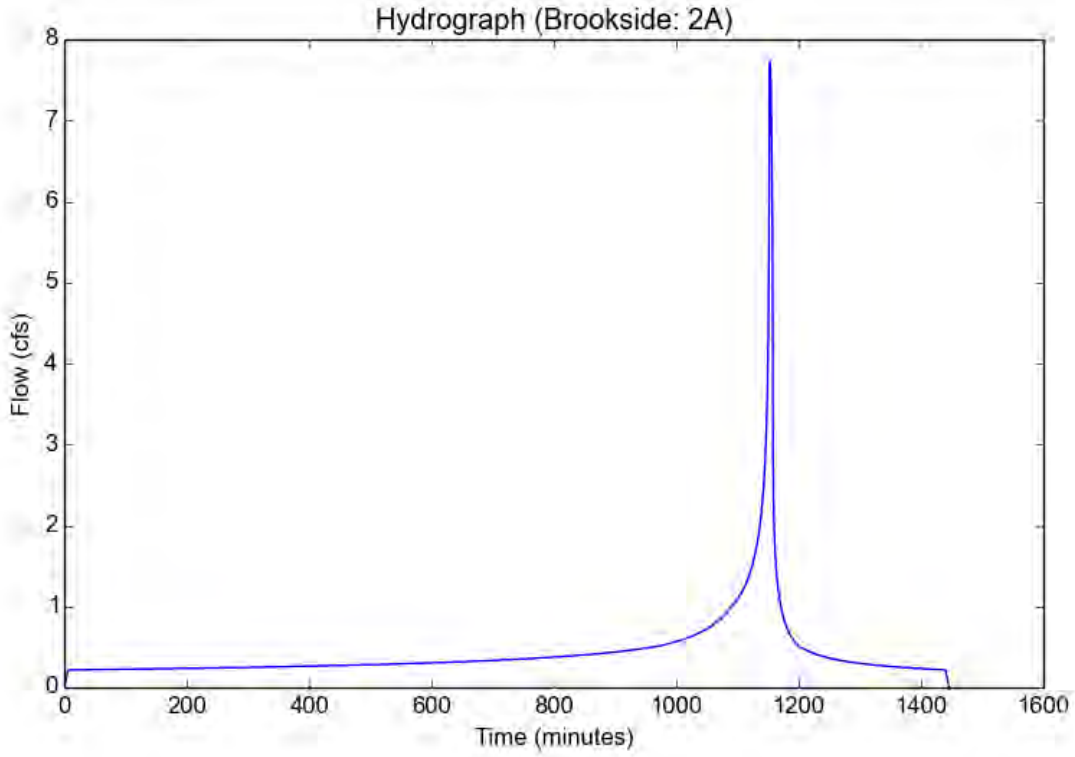
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 2A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	2.75
Flow Path Length (ft)	652.4
Flow Path Slope (vft/hft)	0.04599
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	3.1253
Undeveloped Runoff Coefficient (Cu)	0.8973
Developed Runoff Coefficient (Cd)	0.8991
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	7.7272
Burned Peak Flow Rate (cfs)	7.7272
24-Hr Clear Runoff Volume (ac-ft)	0.8719
24-Hr Clear Runoff Volume (cu-ft)	37981.2372



Peak Flow Hydrologic Analysis

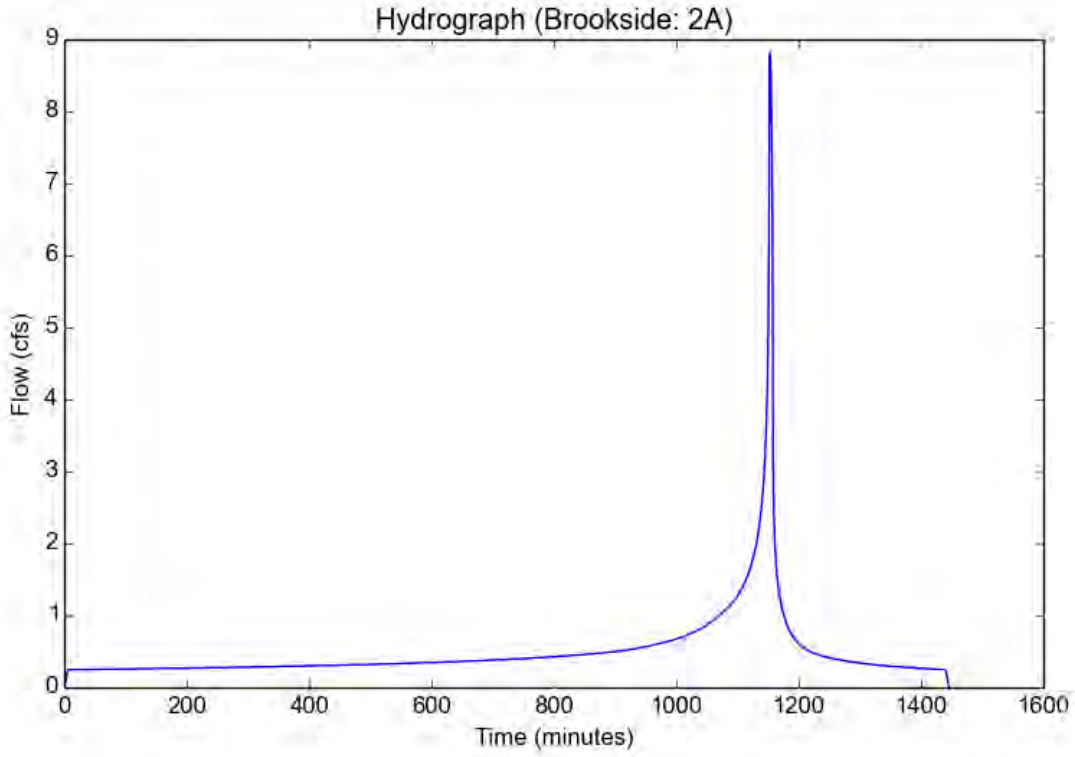
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 2A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	2.75
Flow Path Length (ft)	652.4
Flow Path Slope (vft/hft)	0.04599
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.5596
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	8.81
Burned Peak Flow Rate (cfs)	8.81
24-Hr Clear Runoff Volume (ac-ft)	1.0052
24-Hr Clear Runoff Volume (cu-ft)	43786.0891



Peak Flow Hydrologic Analysis

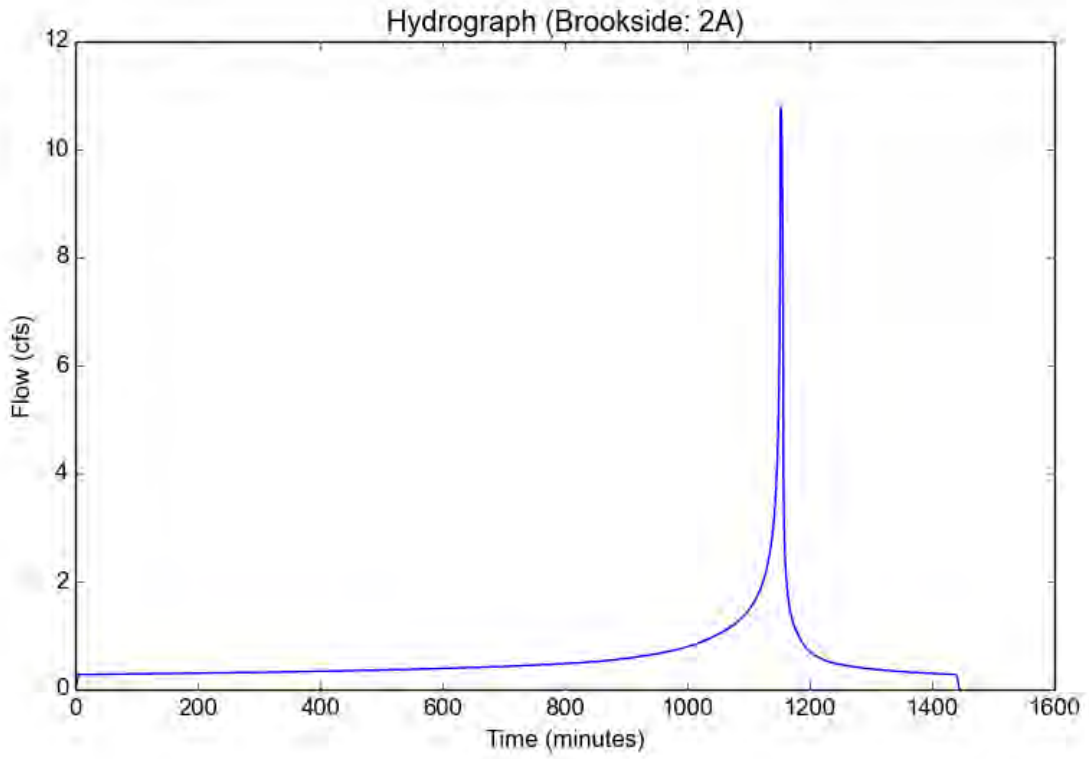
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 2A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	2.75
Flow Path Length (ft)	652.4
Flow Path Slope (vft/hft)	0.04599
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	4.3512
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	10.7692
Burned Peak Flow Rate (cfs)	10.7692
24-Hr Clear Runoff Volume (ac-ft)	1.1414
24-Hr Clear Runoff Volume (cu-ft)	49719.2169



Peak Flow Hydrologic Analysis

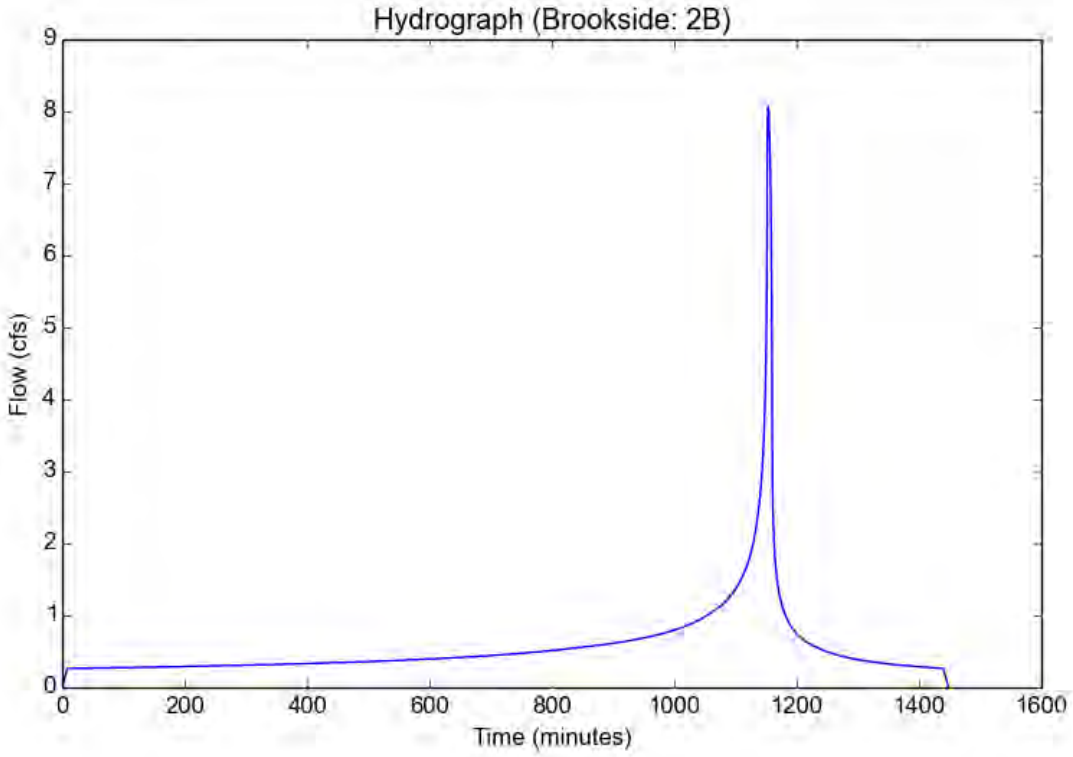
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 2B- 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2B
Area (ac)	3.32
Flow Path Length (ft)	861.6
Flow Path Slope (vft/hft)	0.03714
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.7301
Undeveloped Runoff Coefficient (Cu)	0.8717
Developed Runoff Coefficient (Cd)	0.8901
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	8.0678
Burned Peak Flow Rate (cfs)	8.0678
24-Hr Clear Runoff Volume (ac-ft)	1.1313
24-Hr Clear Runoff Volume (cu-ft)	49278.2024



Peak Flow Hydrologic Analysis

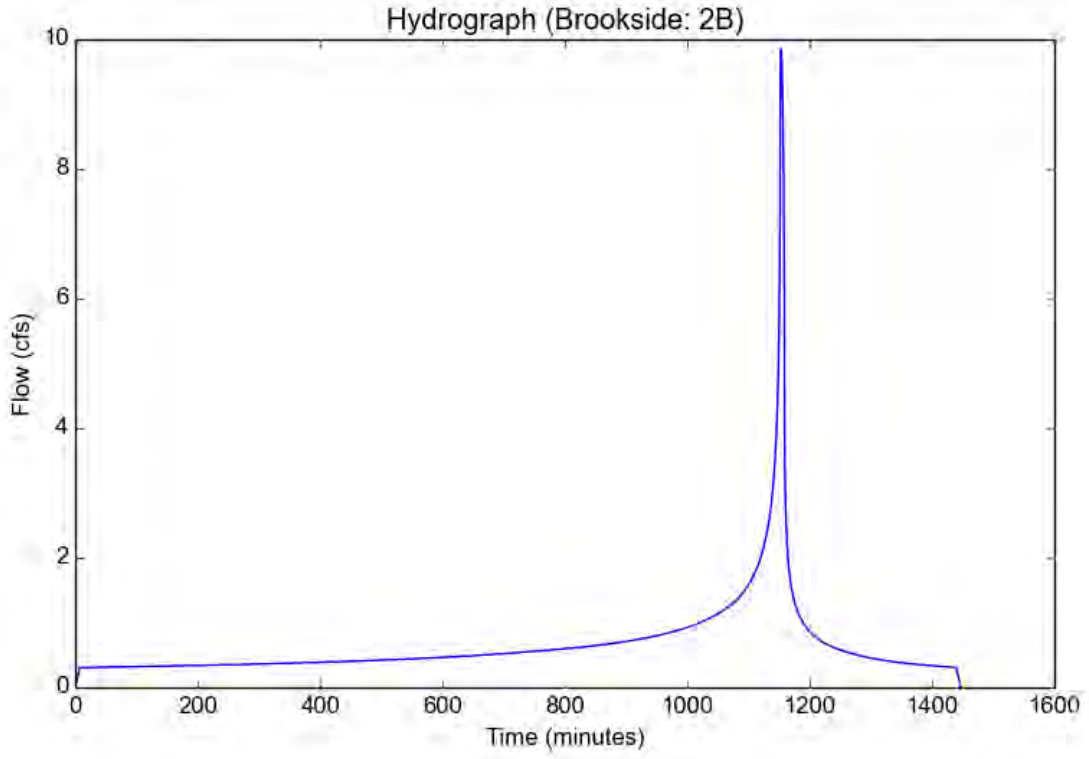
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 2B - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2B
Area (ac)	3.32
Flow Path Length (ft)	861.6
Flow Path Slope (vft/hft)	0.03714
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.8912
Developed Runoff Coefficient (Cd)	0.8969
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	9.8588
Burned Peak Flow Rate (cfs)	9.8588
24-Hr Clear Runoff Volume (ac-ft)	1.3141
24-Hr Clear Runoff Volume (cu-ft)	57240.6477



Peak Flow Hydrologic Analysis

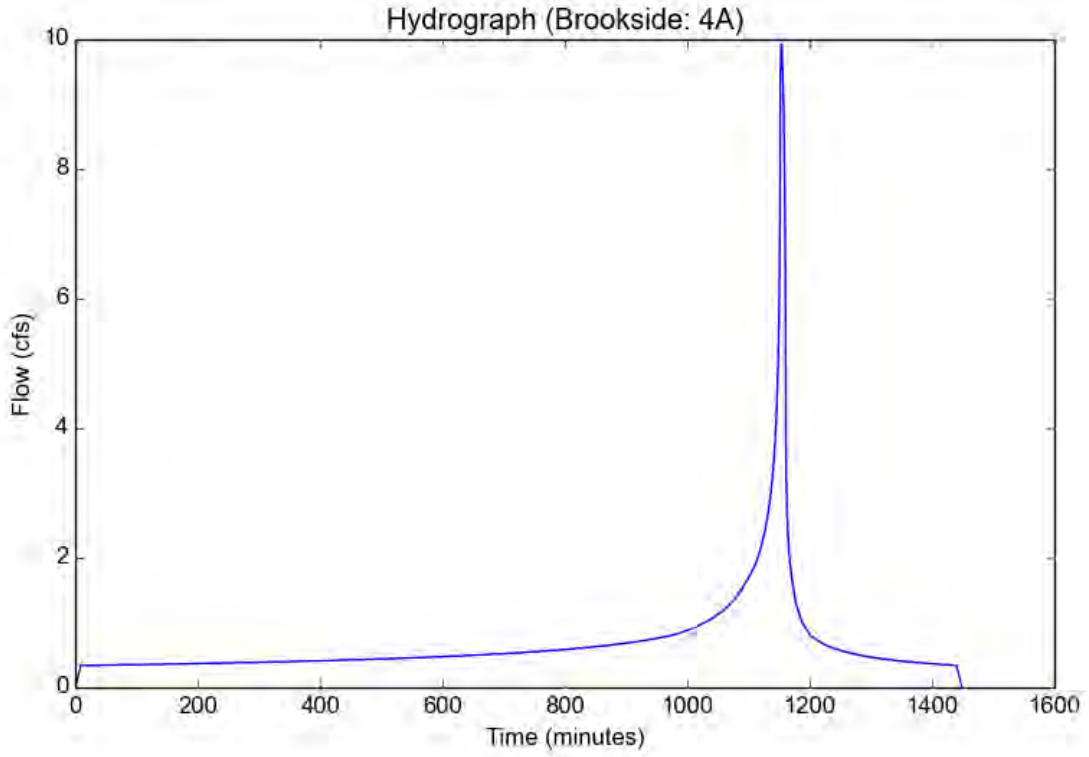
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 4A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	4.31
Flow Path Length (ft)	796.6
Flow Path Slope (vft/hft)	0.0113
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.5831
Undeveloped Runoff Coefficient (Cu)	0.8766
Developed Runoff Coefficient (Cd)	0.8918
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	9.9283
Burned Peak Flow Rate (cfs)	9.9283
24-Hr Clear Runoff Volume (ac-ft)	1.3665
24-Hr Clear Runoff Volume (cu-ft)	59524.5958



Peak Flow Hydrologic Analysis

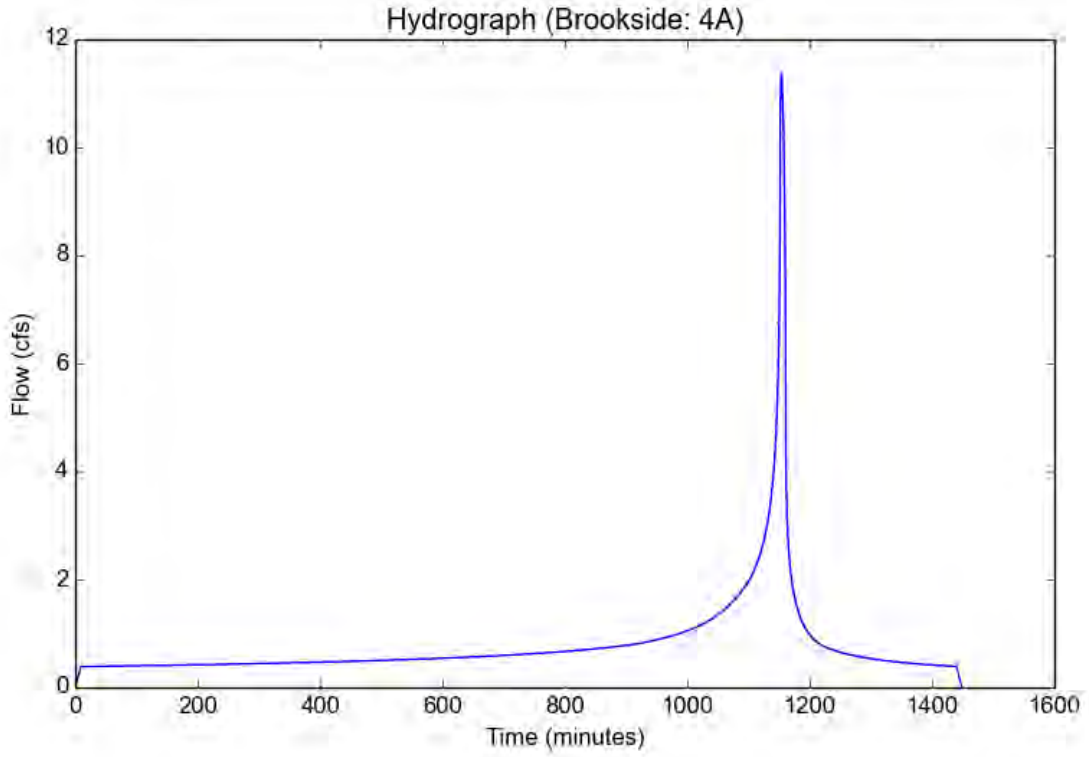
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 4A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	4.31
Flow Path Length (ft)	796.6
Flow Path Slope (vft/hft)	0.0113
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	2.942
Undeveloped Runoff Coefficient (Cu)	0.8903
Developed Runoff Coefficient (Cd)	0.8966
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	11.3689
Burned Peak Flow Rate (cfs)	11.3689
24-Hr Clear Runoff Volume (ac-ft)	1.5755
24-Hr Clear Runoff Volume (cu-ft)	68629.4933



Peak Flow Hydrologic Analysis

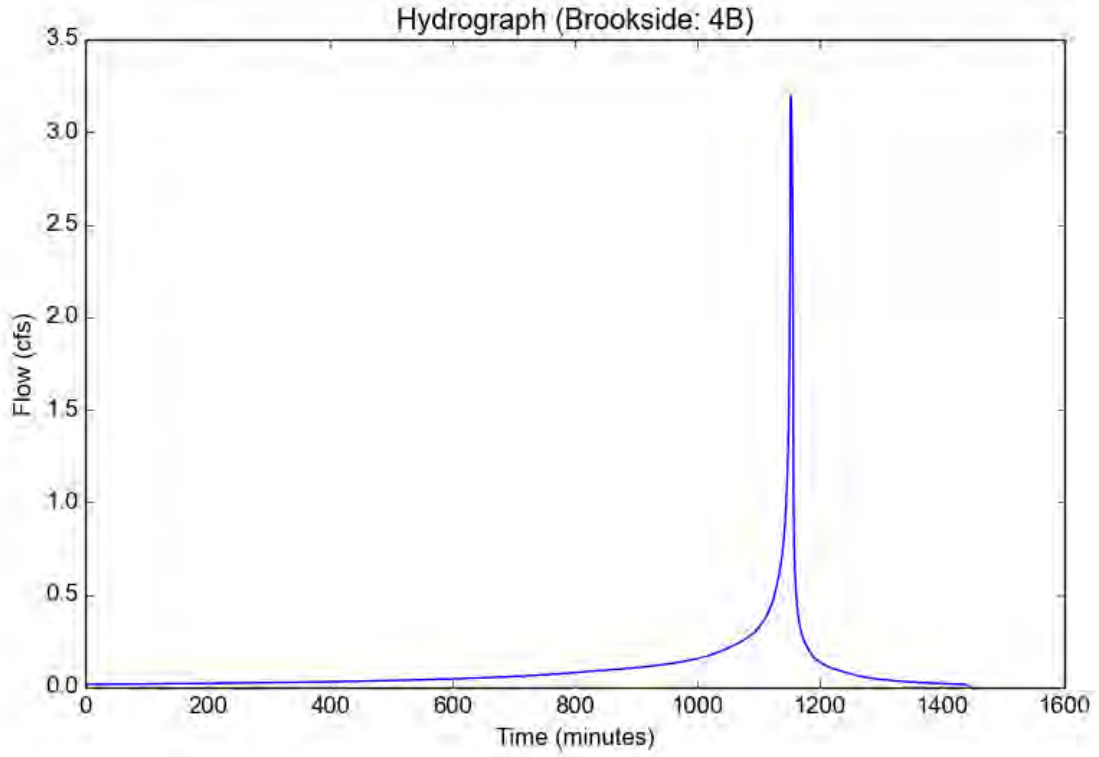
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 4B- 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4B
Area (ac)	1.05
Flow Path Length (ft)	377.9
Flow Path Slope (vft/hft)	0.02646
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	3.405
Undeveloped Runoff Coefficient (Cu)	0.8934
Developed Runoff Coefficient (Cd)	0.8935
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.1945
Burned Peak Flow Rate (cfs)	3.1945
24-Hr Clear Runoff Volume (ac-ft)	0.1971
24-Hr Clear Runoff Volume (cu-ft)	8586.9963



Peak Flow Hydrologic Analysis

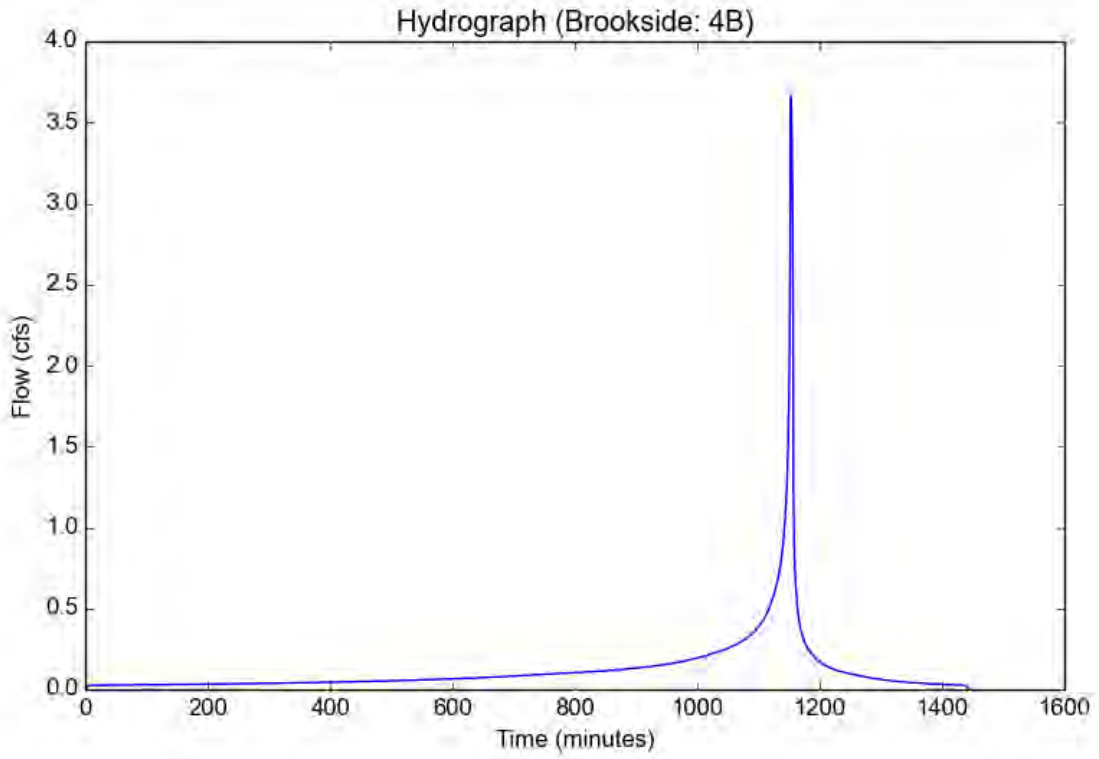
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 4B - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4B
Area (ac)	1.05
Flow Path Length (ft)	377.9
Flow Path Slope (vft/hft)	0.02646
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.6648
Burned Peak Flow Rate (cfs)	3.6648
24-Hr Clear Runoff Volume (ac-ft)	0.2473
24-Hr Clear Runoff Volume (cu-ft)	10772.287



Peak Flow Hydrologic Analysis

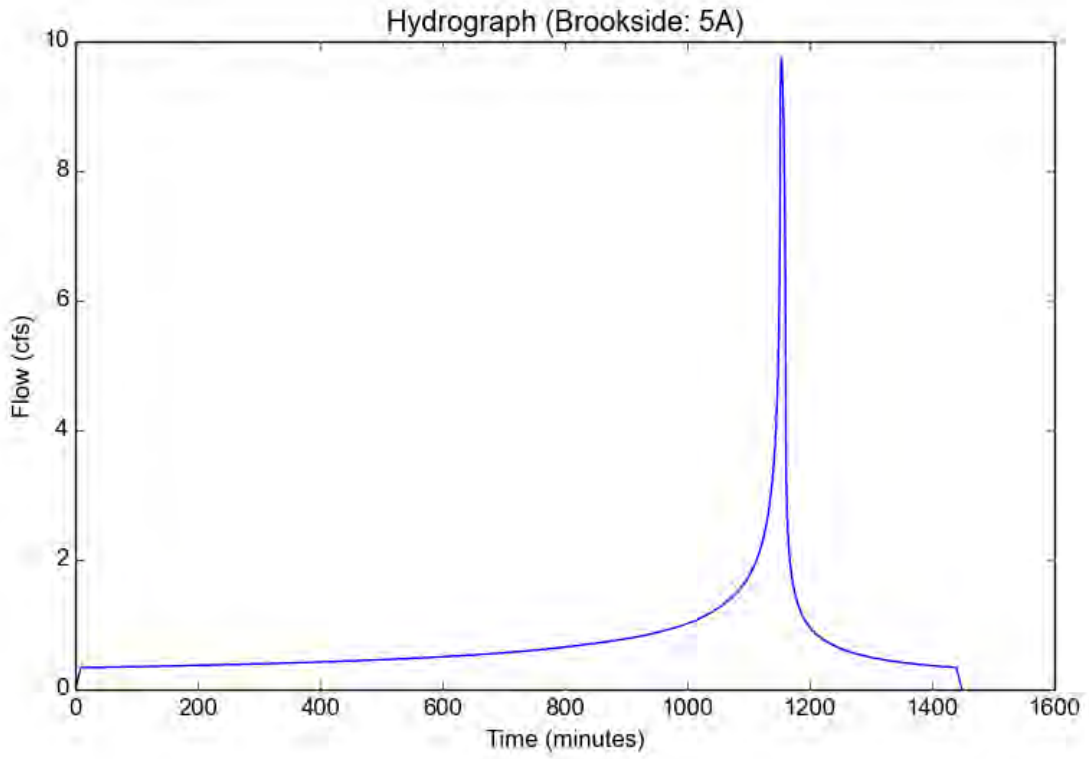
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 5A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5A
Area (ac)	4.24
Flow Path Length (ft)	954.1
Flow Path Slope (vft/hft)	0.03354
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.5831
Undeveloped Runoff Coefficient (Cu)	0.8652
Developed Runoff Coefficient (Cd)	0.8878
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	9.7236
Burned Peak Flow Rate (cfs)	9.7236
24-Hr Clear Runoff Volume (ac-ft)	1.4447
24-Hr Clear Runoff Volume (cu-ft)	62930.9306



Peak Flow Hydrologic Analysis

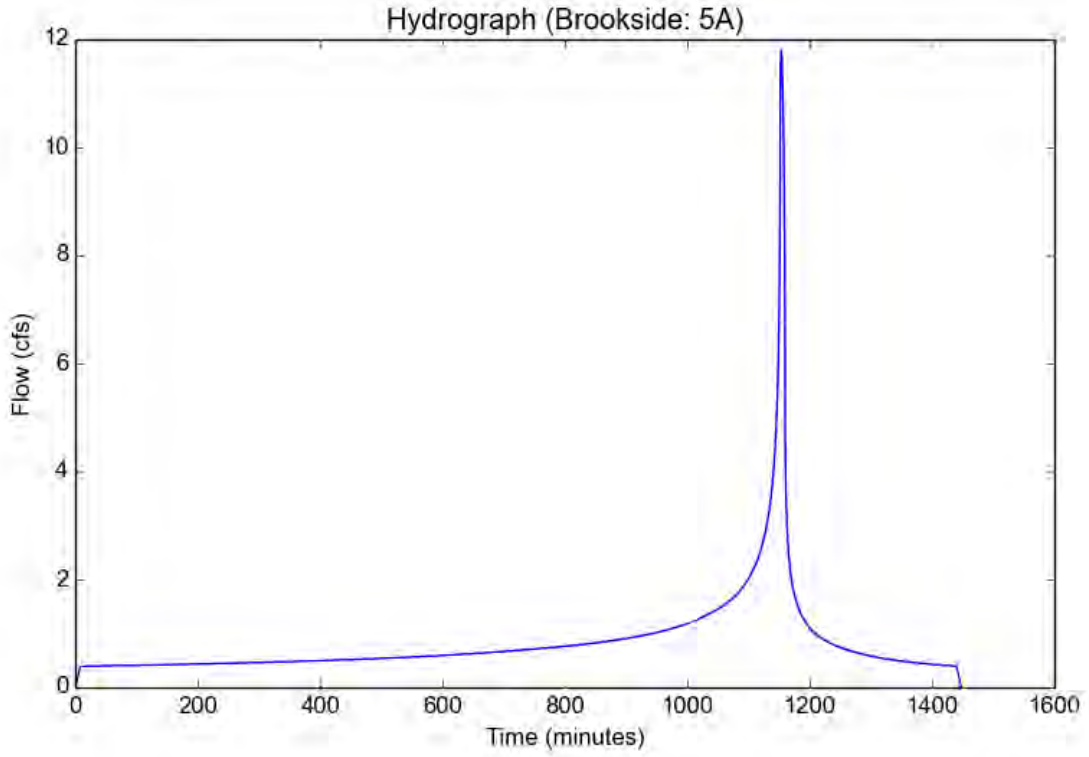
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 5A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5A
Area (ac)	4.24
Flow Path Length (ft)	954.1
Flow Path Slope (vft/hft)	0.03354
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.1094
Undeveloped Runoff Coefficient (Cu)	0.8863
Developed Runoff Coefficient (Cd)	0.8952
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	11.8024
Burned Peak Flow Rate (cfs)	11.8024
24-Hr Clear Runoff Volume (ac-ft)	1.6782
24-Hr Clear Runoff Volume (cu-ft)	73100.5438



Peak Flow Hydrologic Analysis

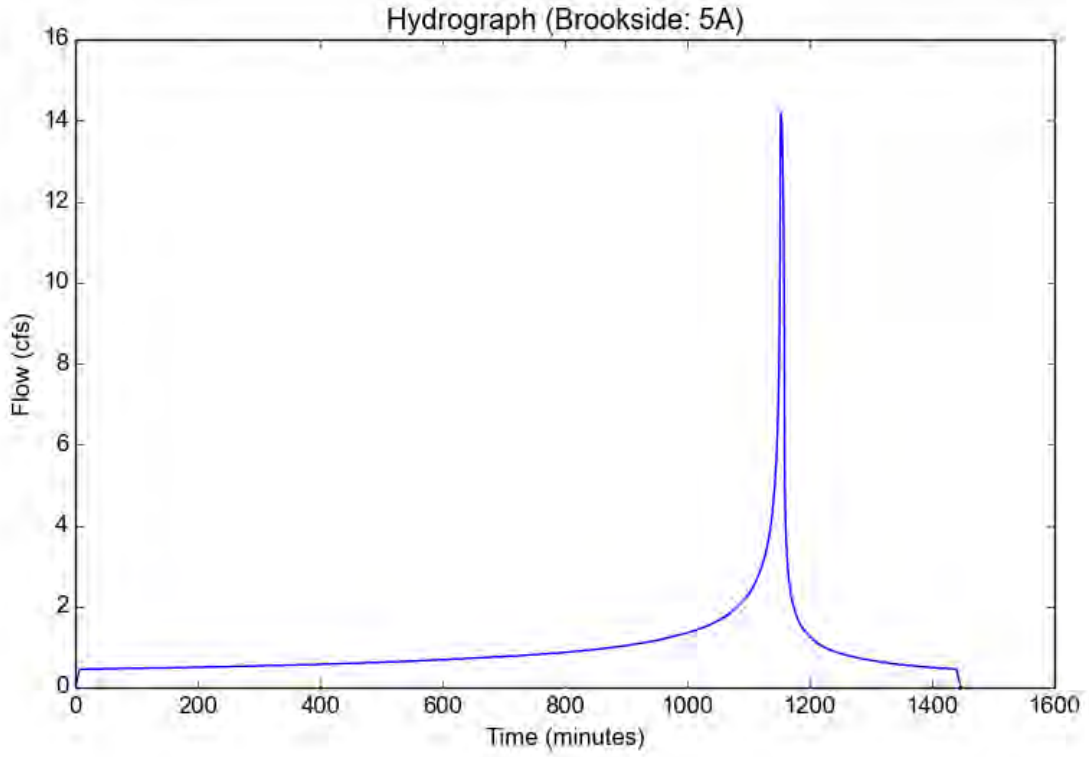
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookeside Proposed - 5A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5A
Area (ac)	4.24
Flow Path Length (ft)	954.1
Flow Path Slope (vft/hft)	0.03354
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.7147
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	14.1755
Burned Peak Flow Rate (cfs)	14.1755
24-Hr Clear Runoff Volume (ac-ft)	1.9148
24-Hr Clear Runoff Volume (cu-ft)	83407.7941



Peak Flow Hydrologic Analysis

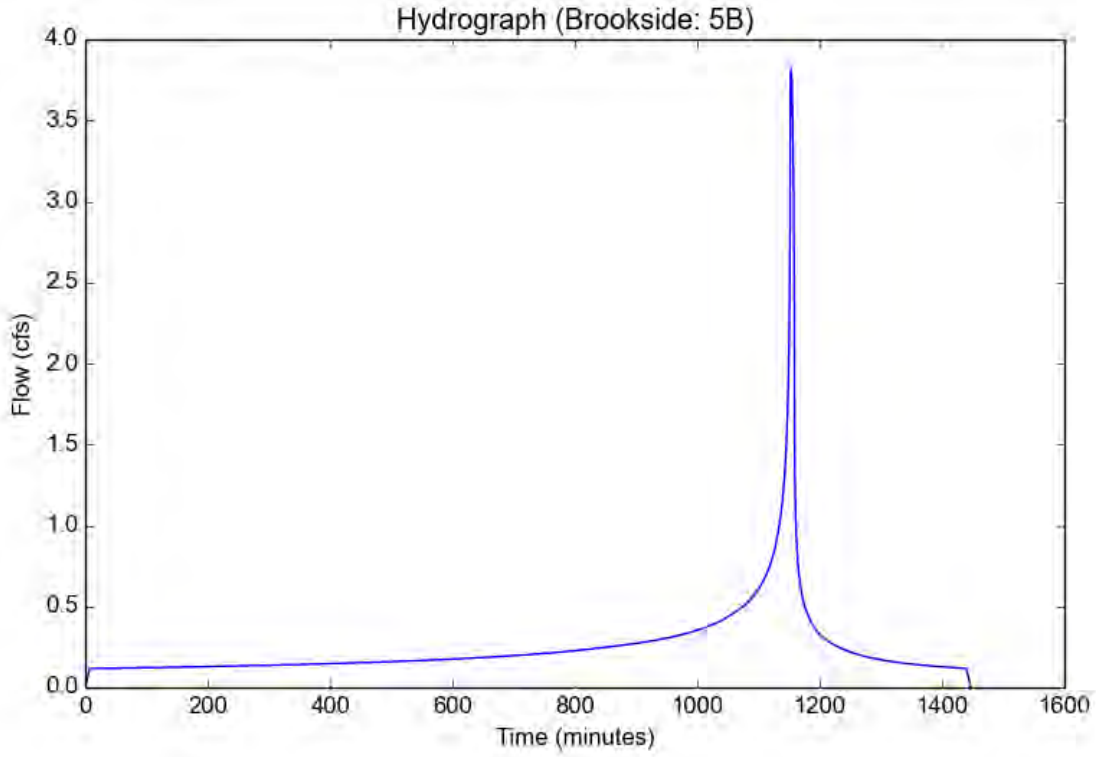
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 5B - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5B
Area (ac)	1.47
Flow Path Length (ft)	542.7
Flow Path Slope (vft/hft)	0.0129
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.9069
Undeveloped Runoff Coefficient (Cu)	0.8796
Developed Runoff Coefficient (Cd)	0.8928
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	3.8153
Burned Peak Flow Rate (cfs)	3.8153
24-Hr Clear Runoff Volume (ac-ft)	0.5009
24-Hr Clear Runoff Volume (cu-ft)	21820.1478



Peak Flow Hydrologic Analysis

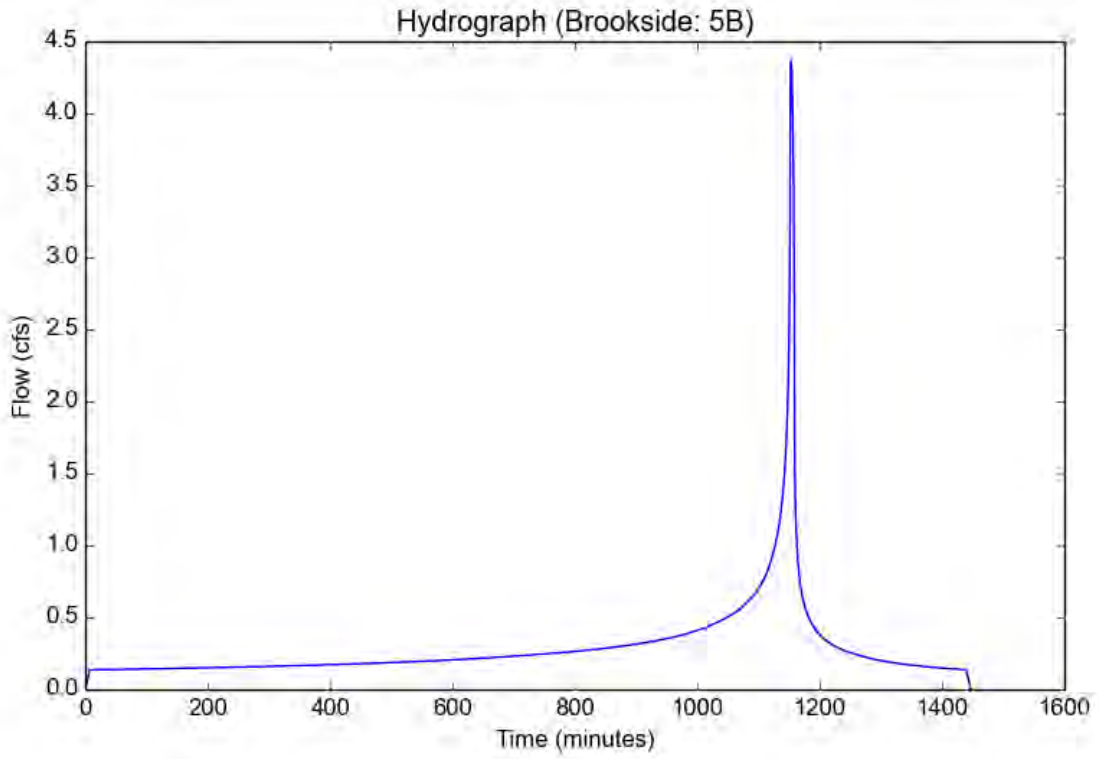
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 5B - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5B
Area (ac)	1.47
Flow Path Length (ft)	542.7
Flow Path Slope (vft/hft)	0.0129
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.8912
Developed Runoff Coefficient (Cd)	0.8969
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	4.3652
Burned Peak Flow Rate (cfs)	4.3652
24-Hr Clear Runoff Volume (ac-ft)	0.5818
24-Hr Clear Runoff Volume (cu-ft)	25344.5037



Peak Flow Hydrologic Analysis

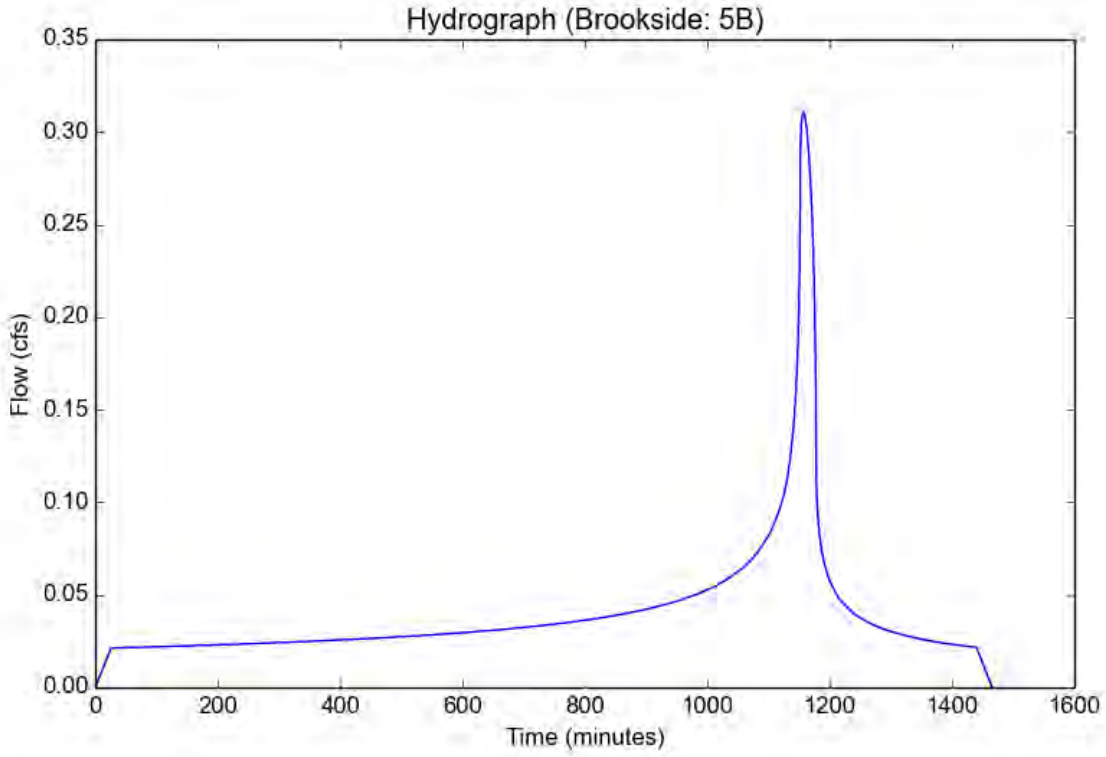
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 5B - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5B
Area (ac)	1.47
Flow Path Length (ft)	542.7
Flow Path Slope (vft/hft)	0.0129
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2886
Undeveloped Runoff Coefficient (Cu)	0.4206
Developed Runoff Coefficient (Cd)	0.7322
Time of Concentration (min)	26.0
Clear Peak Flow Rate (cfs)	0.3107
Burned Peak Flow Rate (cfs)	0.3107
24-Hr Clear Runoff Volume (ac-ft)	0.0807
24-Hr Clear Runoff Volume (cu-ft)	3516.2026



Peak Flow Hydrologic Analysis

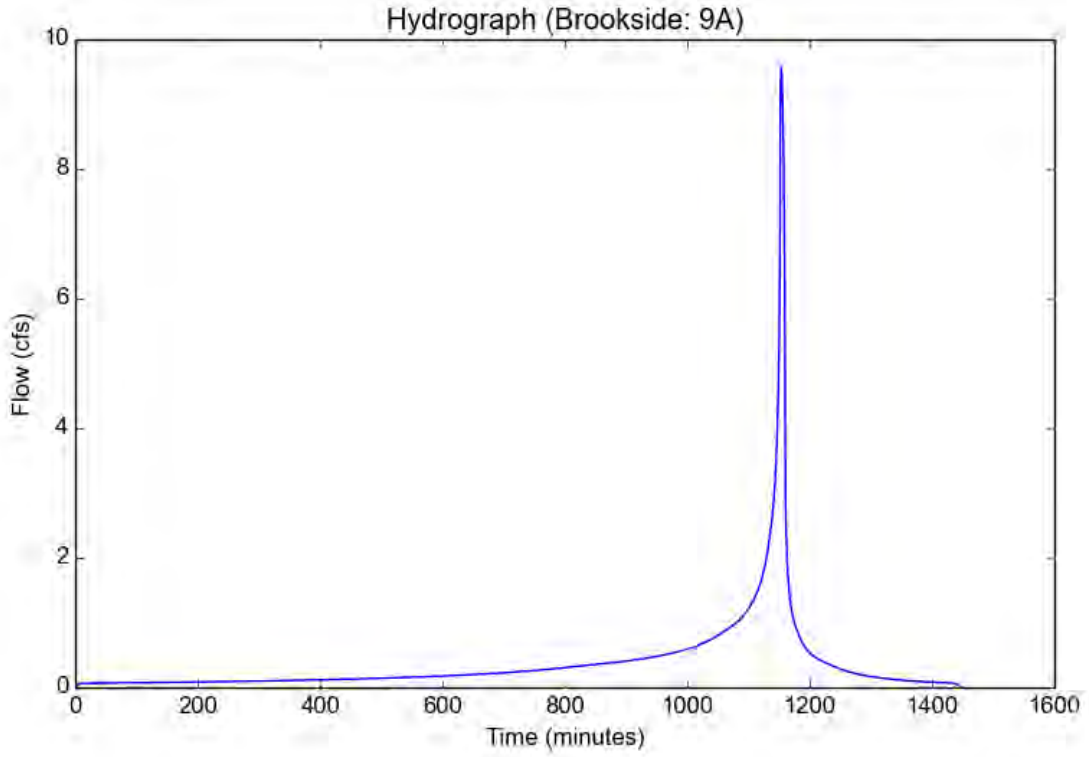
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 9A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	4.02
Flow Path Length (ft)	958.0
Flow Path Slope (vft/hft)	0.05323
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.7301
Undeveloped Runoff Coefficient (Cu)	0.8717
Developed Runoff Coefficient (Cd)	0.872
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	9.5703
Burned Peak Flow Rate (cfs)	9.5703
24-Hr Clear Runoff Volume (ac-ft)	0.7542
24-Hr Clear Runoff Volume (cu-ft)	32853.2662



Peak Flow Hydrologic Analysis

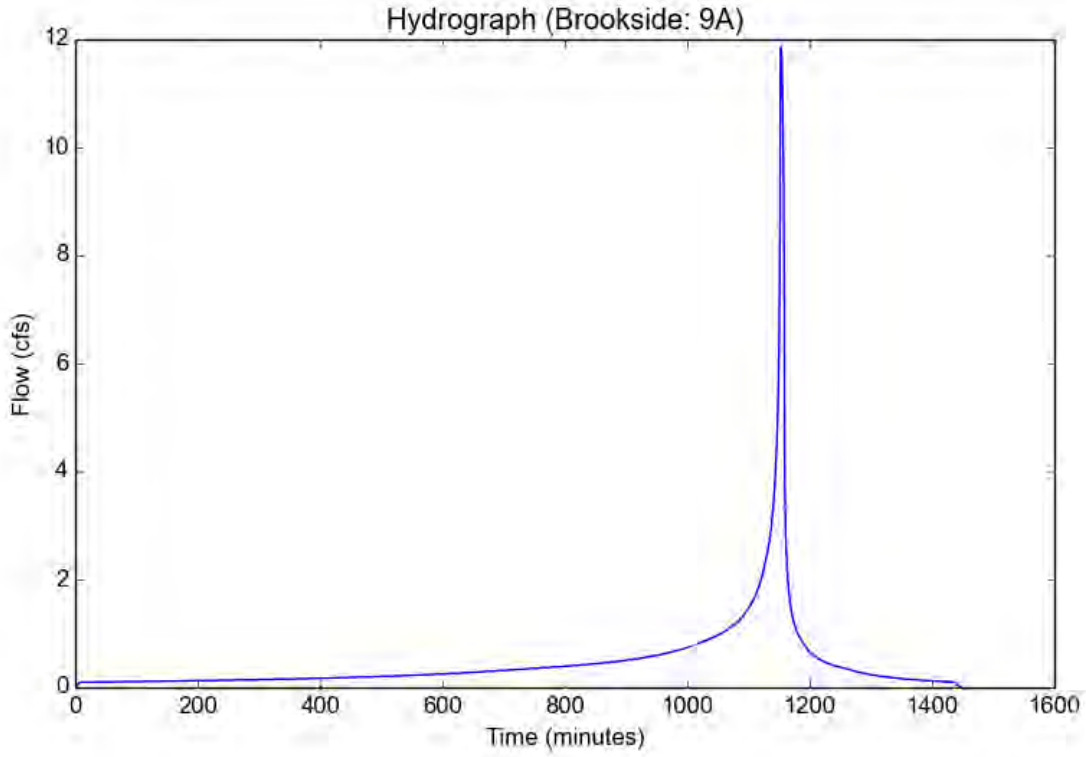
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 9A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	4.02
Flow Path Length (ft)	958.0
Flow Path Slope (vft/hft)	0.05323
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.3108
Undeveloped Runoff Coefficient (Cu)	0.8912
Developed Runoff Coefficient (Cd)	0.8913
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	11.8623
Burned Peak Flow Rate (cfs)	11.8623
24-Hr Clear Runoff Volume (ac-ft)	0.9467
24-Hr Clear Runoff Volume (cu-ft)	41237.6088



Peak Flow Hydrologic Analysis

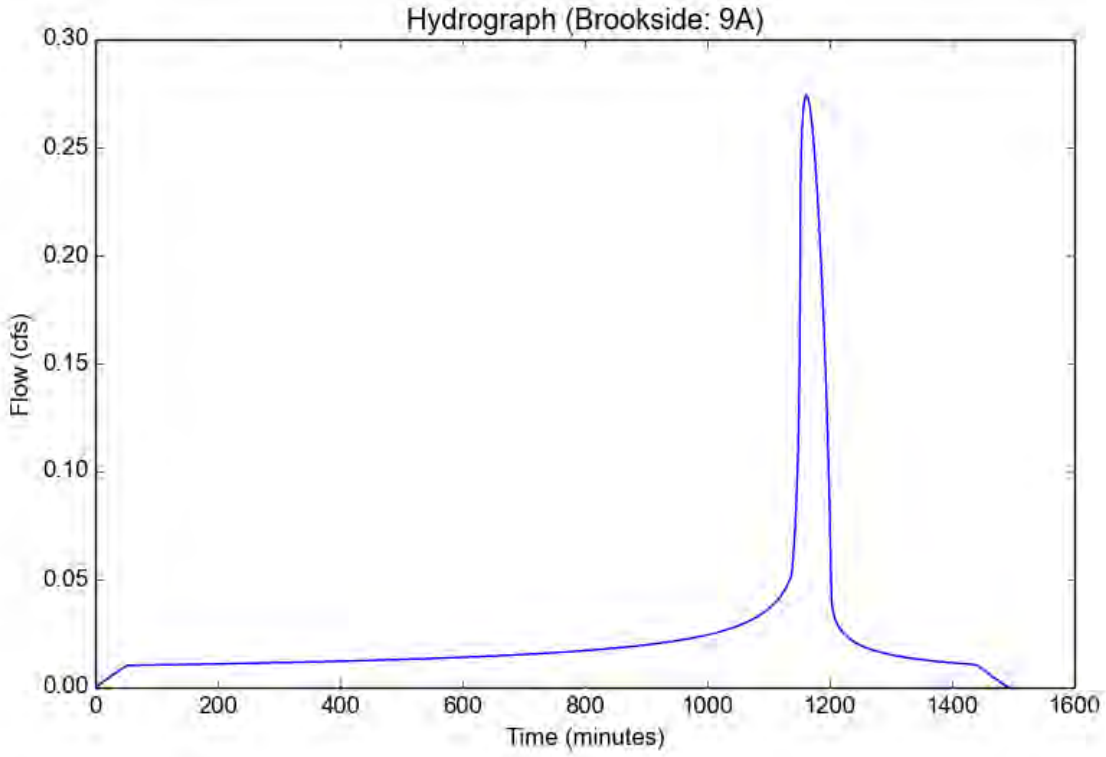
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 9A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	4.02
Flow Path Length (ft)	958.0
Flow Path Slope (vft/hft)	0.05323
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2103
Undeveloped Runoff Coefficient (Cu)	0.3186
Developed Runoff Coefficient (Cd)	0.3244
Time of Concentration (min)	51.0
Clear Peak Flow Rate (cfs)	0.2742
Burned Peak Flow Rate (cfs)	0.2742
24-Hr Clear Runoff Volume (ac-ft)	0.0474
24-Hr Clear Runoff Volume (cu-ft)	2063.4304



Peak Flow Hydrologic Analysis

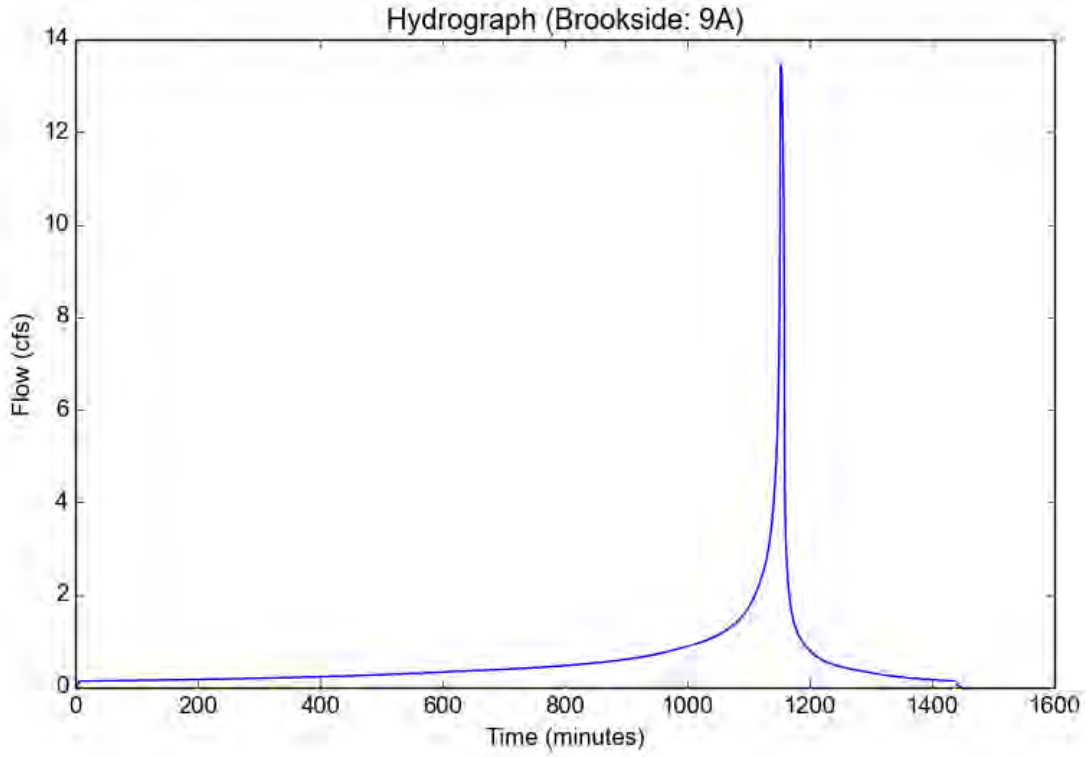
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 9A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	9A
Area (ac)	4.02
Flow Path Length (ft)	958.0
Flow Path Slope (vft/hft)	0.05323
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.7147
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	13.44
Burned Peak Flow Rate (cfs)	13.44
24-Hr Clear Runoff Volume (ac-ft)	1.1476
24-Hr Clear Runoff Volume (cu-ft)	49987.6542



Peak Flow Hydrologic Analysis

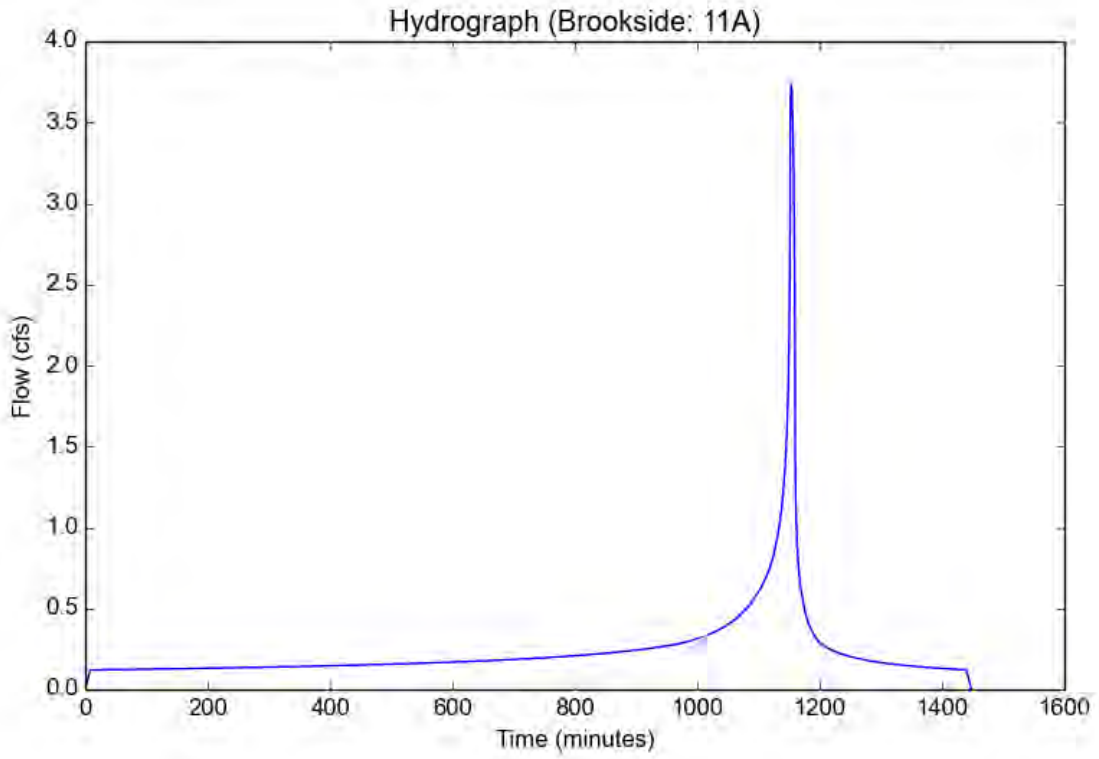
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 11A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	1.53
Flow Path Length (ft)	494.1
Flow Path Slope (vft/hft)	0.00607
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	2.7301
Undeveloped Runoff Coefficient (Cu)	0.8822
Developed Runoff Coefficient (Cd)	0.8938
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	3.7333
Burned Peak Flow Rate (cfs)	3.7333
24-Hr Clear Runoff Volume (ac-ft)	0.4851
24-Hr Clear Runoff Volume (cu-ft)	21130.7172



Peak Flow Hydrologic Analysis

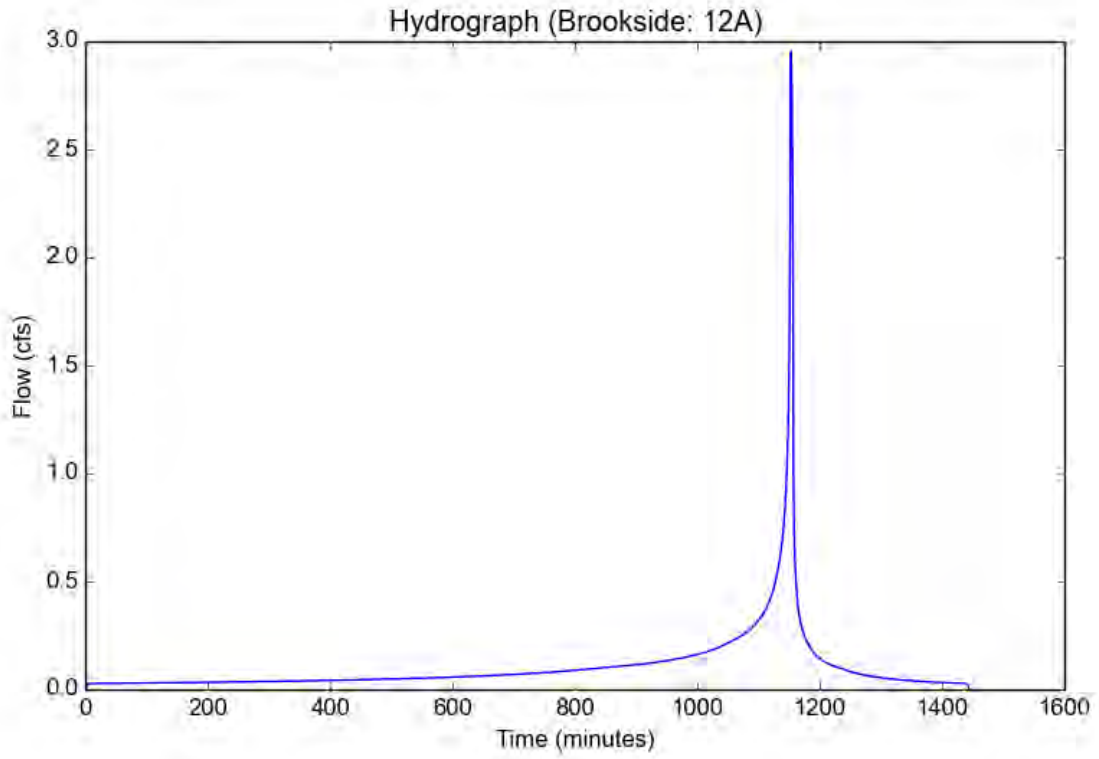
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/25yr/Brookside Proposed - 12A - 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.97
Flow Path Length (ft)	512.5
Flow Path Slope (vft/hft)	0.07414
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.135
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.707
Peak Intensity (in/hr)	3.405
Undeveloped Runoff Coefficient (Cu)	0.8934
Developed Runoff Coefficient (Cd)	0.8943
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.9538
Burned Peak Flow Rate (cfs)	2.9538
24-Hr Clear Runoff Volume (ac-ft)	0.2111
24-Hr Clear Runoff Volume (cu-ft)	9195.7813



Peak Flow Hydrologic Analysis

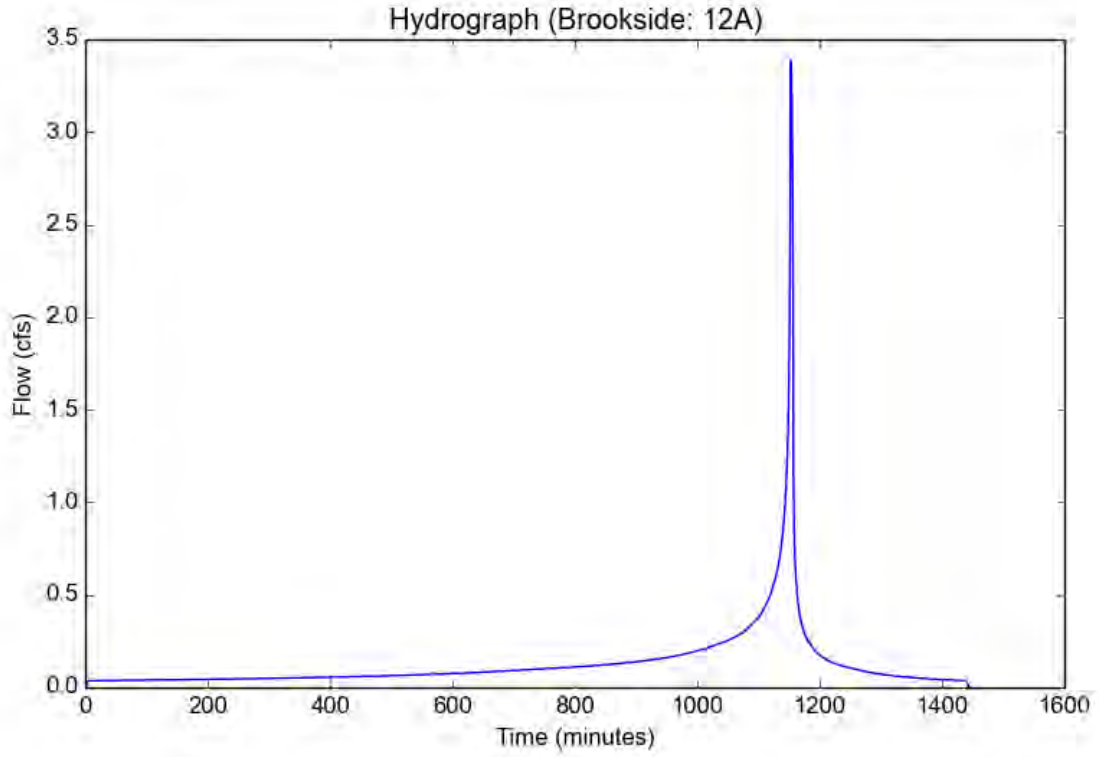
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/50yr/Brookside Proposed - 12A - 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.97
Flow Path Length (ft)	512.5
Flow Path Slope (vft/hft)	0.07414
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.135
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.3856
Burned Peak Flow Rate (cfs)	3.3856
24-Hr Clear Runoff Volume (ac-ft)	0.2588
24-Hr Clear Runoff Volume (cu-ft)	11274.3526



Peak Flow Hydrologic Analysis

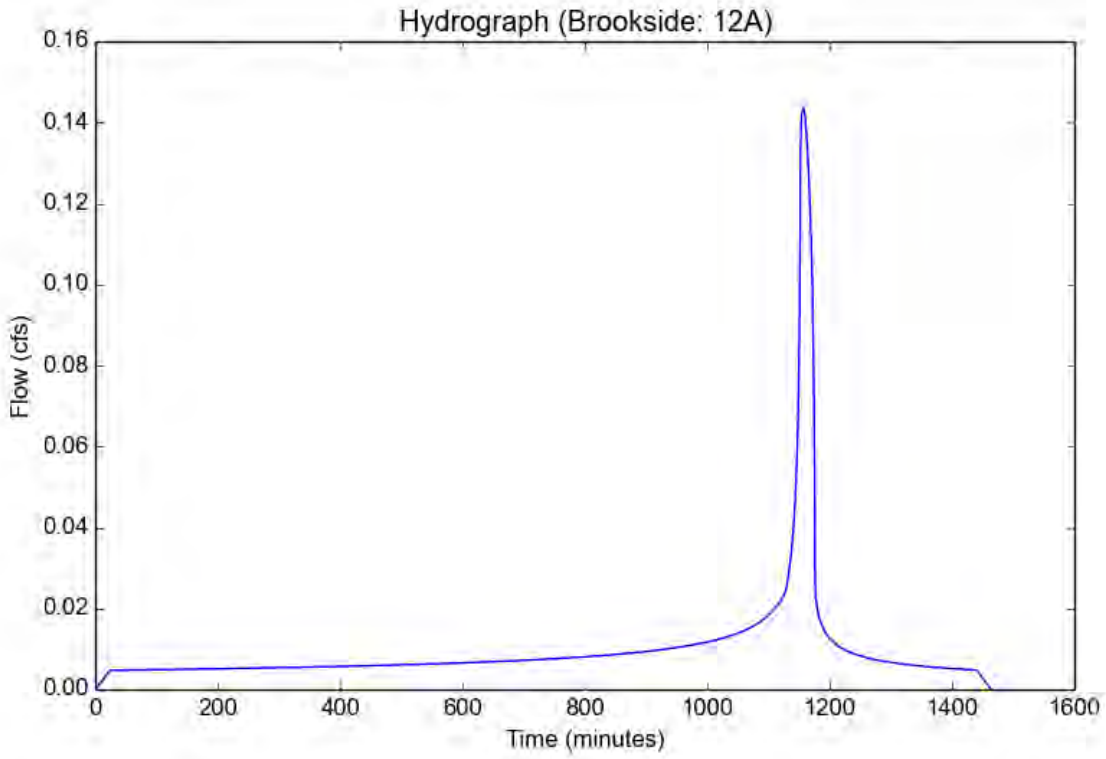
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 12A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.97
Flow Path Length (ft)	512.5
Flow Path Slope (vft/hft)	0.07414
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.135
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2997
Undeveloped Runoff Coefficient (Cu)	0.4308
Developed Runoff Coefficient (Cd)	0.4942
Time of Concentration (min)	24.0
Clear Peak Flow Rate (cfs)	0.1437
Burned Peak Flow Rate (cfs)	0.1437
24-Hr Clear Runoff Volume (ac-ft)	0.0202
24-Hr Clear Runoff Volume (cu-ft)	879.8859



Peak Flow Hydrologic Analysis

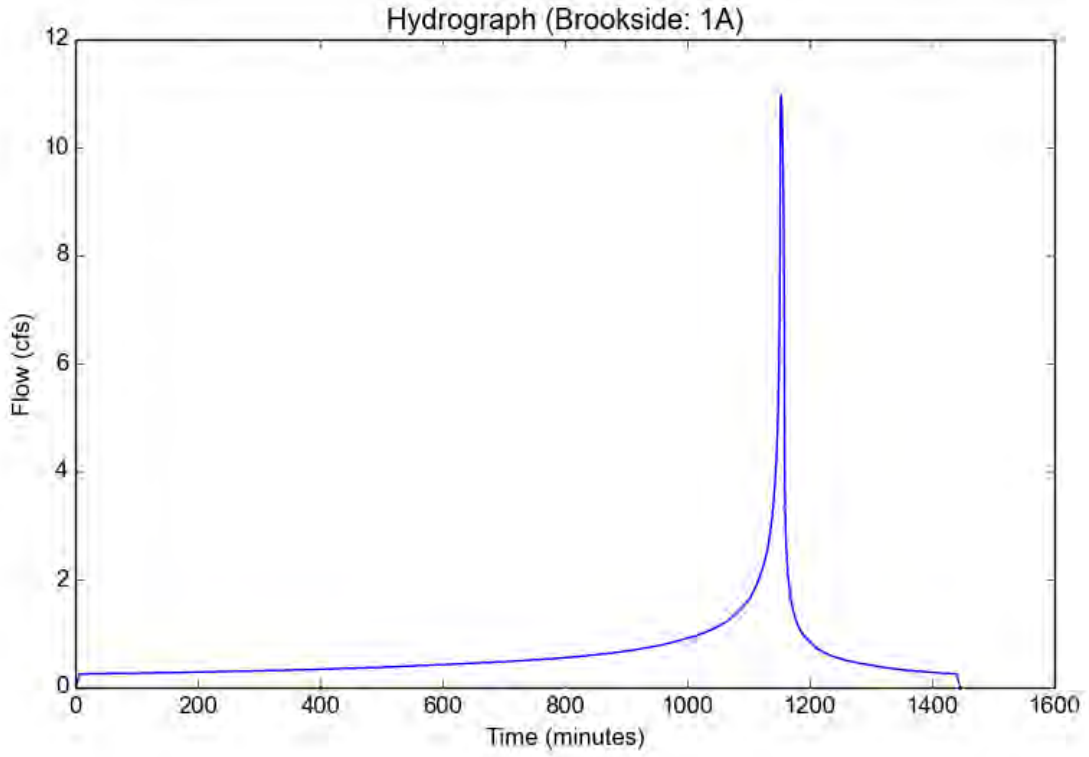
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 1A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	1A
Area (ac)	3.28
Flow Path Length (ft)	866.7
Flow Path Slope (vft/hft)	0.04038
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.384
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.7147
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	10.9659
Burned Peak Flow Rate (cfs)	10.9659
24-Hr Clear Runoff Volume (ac-ft)	1.2548
24-Hr Clear Runoff Volume (cu-ft)	54657.2934



Peak Flow Hydrologic Analysis

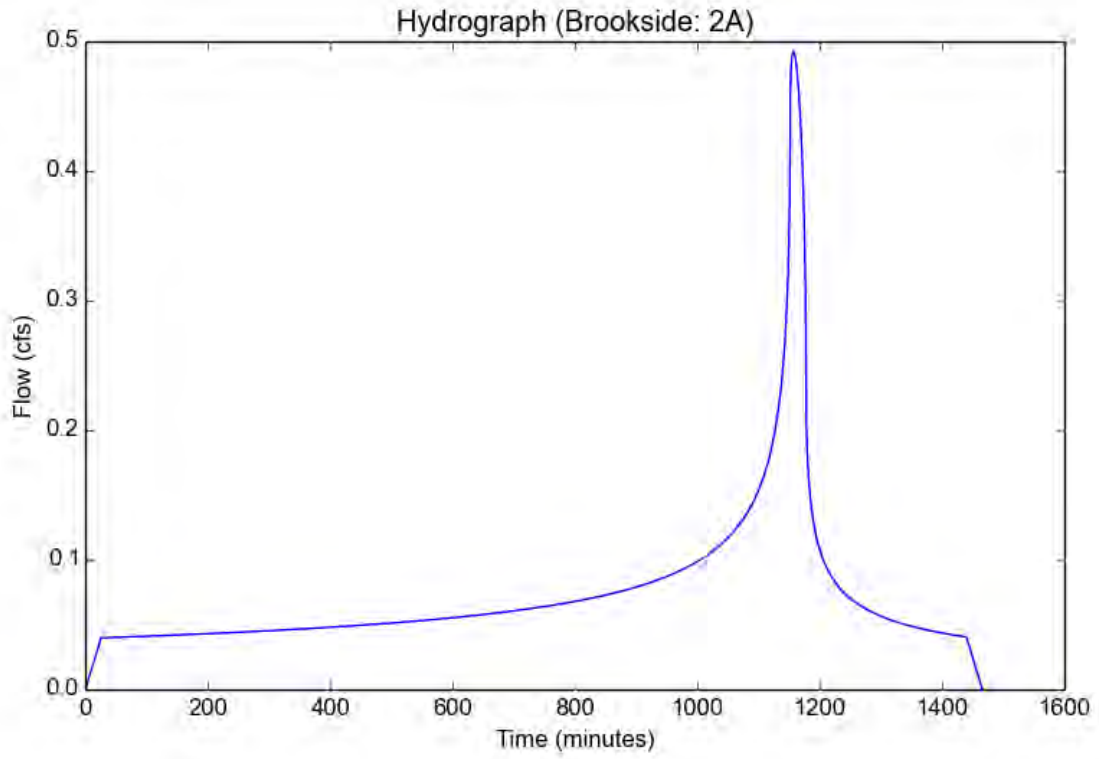
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 2A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2A
Area (ac)	2.75
Flow Path Length (ft)	652.4
Flow Path Slope (vft/hft)	0.04599
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2886
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.62
Time of Concentration (min)	26.0
Clear Peak Flow Rate (cfs)	0.4921
Burned Peak Flow Rate (cfs)	0.4921
24-Hr Clear Runoff Volume (ac-ft)	0.148
24-Hr Clear Runoff Volume (cu-ft)	6444.9554



Peak Flow Hydrologic Analysis

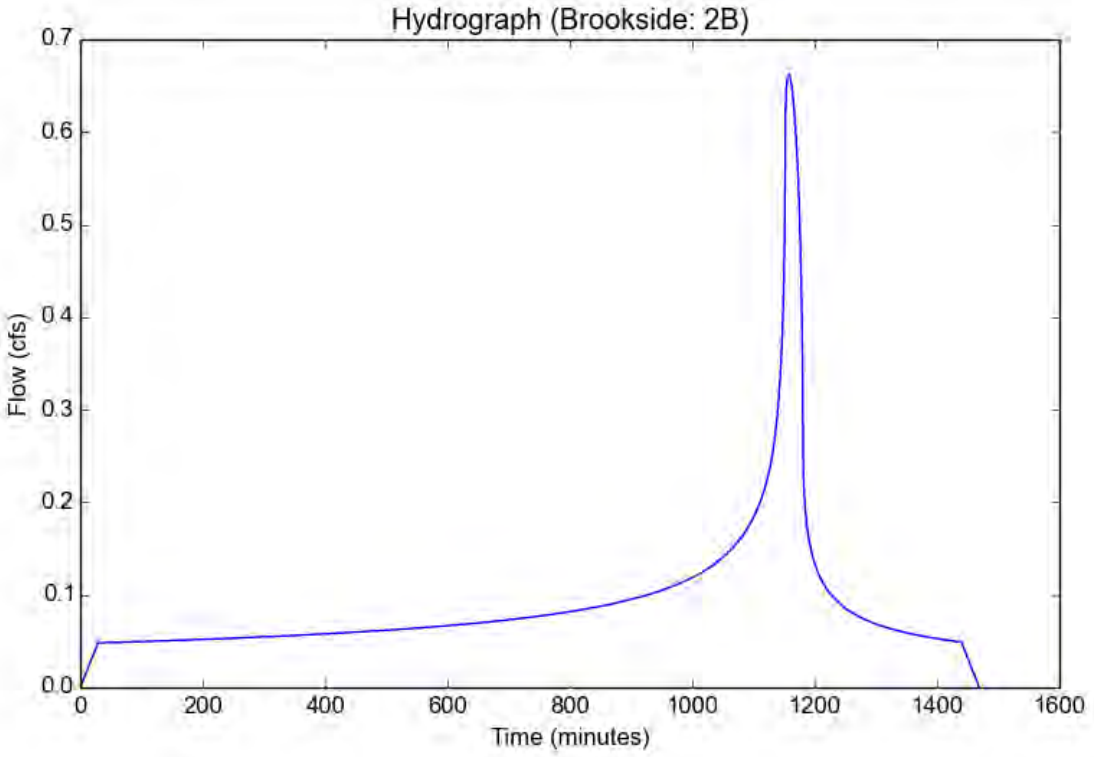
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 2B - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2B
Area (ac)	3.32
Flow Path Length (ft)	861.6
Flow Path Slope (vft/hft)	0.03714
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2742
Undeveloped Runoff Coefficient (Cu)	0.4072
Developed Runoff Coefficient (Cd)	0.7275
Time of Concentration (min)	29.0
Clear Peak Flow Rate (cfs)	0.6623
Burned Peak Flow Rate (cfs)	0.6623
24-Hr Clear Runoff Volume (ac-ft)	0.1822
24-Hr Clear Runoff Volume (cu-ft)	7938.6911



Peak Flow Hydrologic Analysis

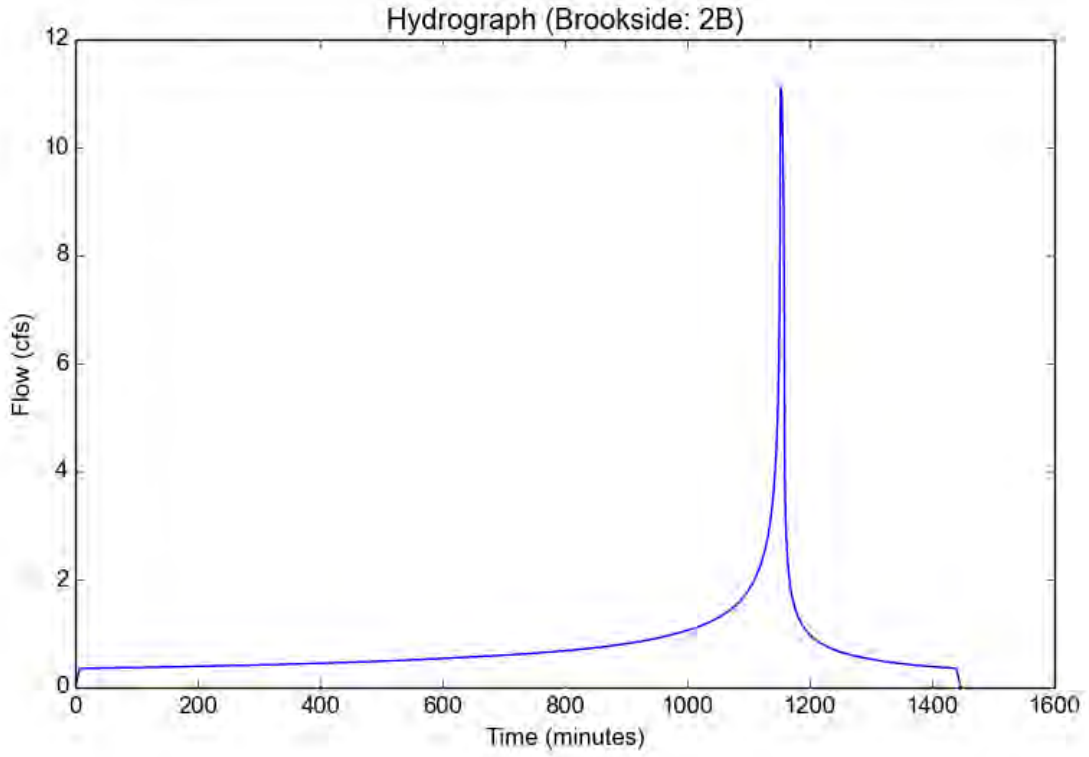
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 2B - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	2B
Area (ac)	3.32
Flow Path Length (ft)	861.6
Flow Path Slope (vft/hft)	0.03714
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.7147
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	11.0997
Burned Peak Flow Rate (cfs)	11.0997
24-Hr Clear Runoff Volume (ac-ft)	1.4993
24-Hr Clear Runoff Volume (cu-ft)	65309.8765



Peak Flow Hydrologic Analysis

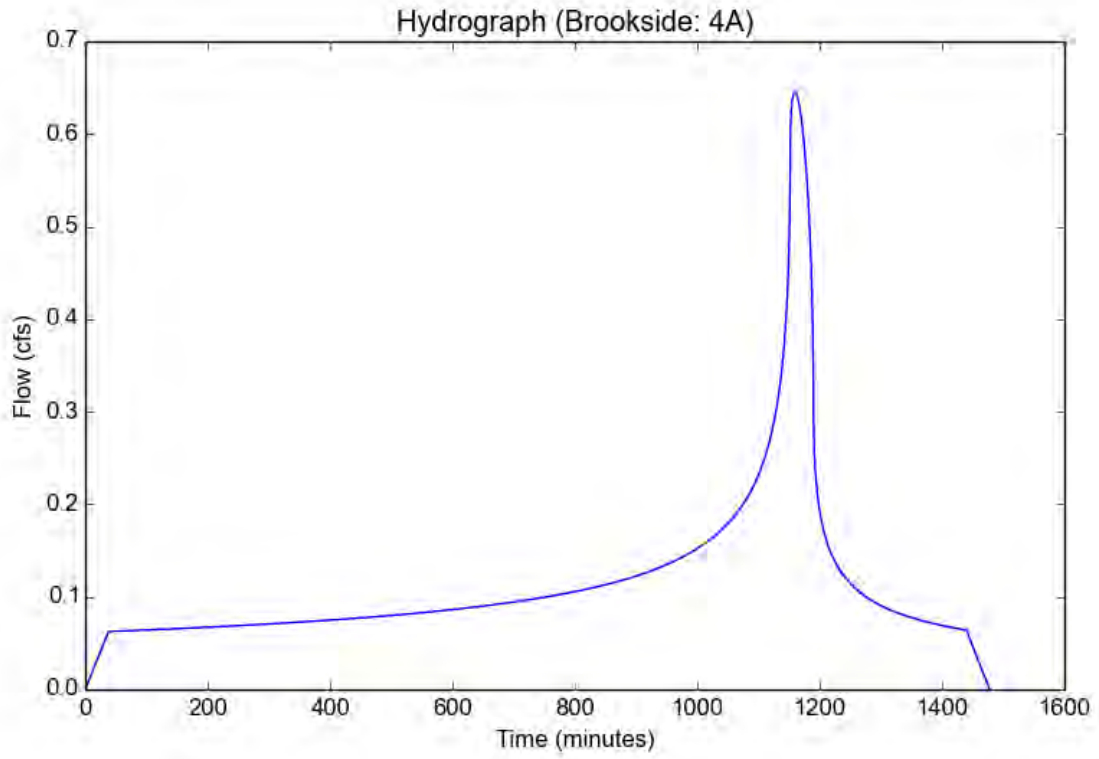
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 4A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	4.31
Flow Path Length (ft)	796.6
Flow Path Slope (vft/hft)	0.0113
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2415
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.62
Time of Concentration (min)	38.0
Clear Peak Flow Rate (cfs)	0.6453
Burned Peak Flow Rate (cfs)	0.6453
24-Hr Clear Runoff Volume (ac-ft)	0.2319
24-Hr Clear Runoff Volume (cu-ft)	10101.103



Peak Flow Hydrologic Analysis

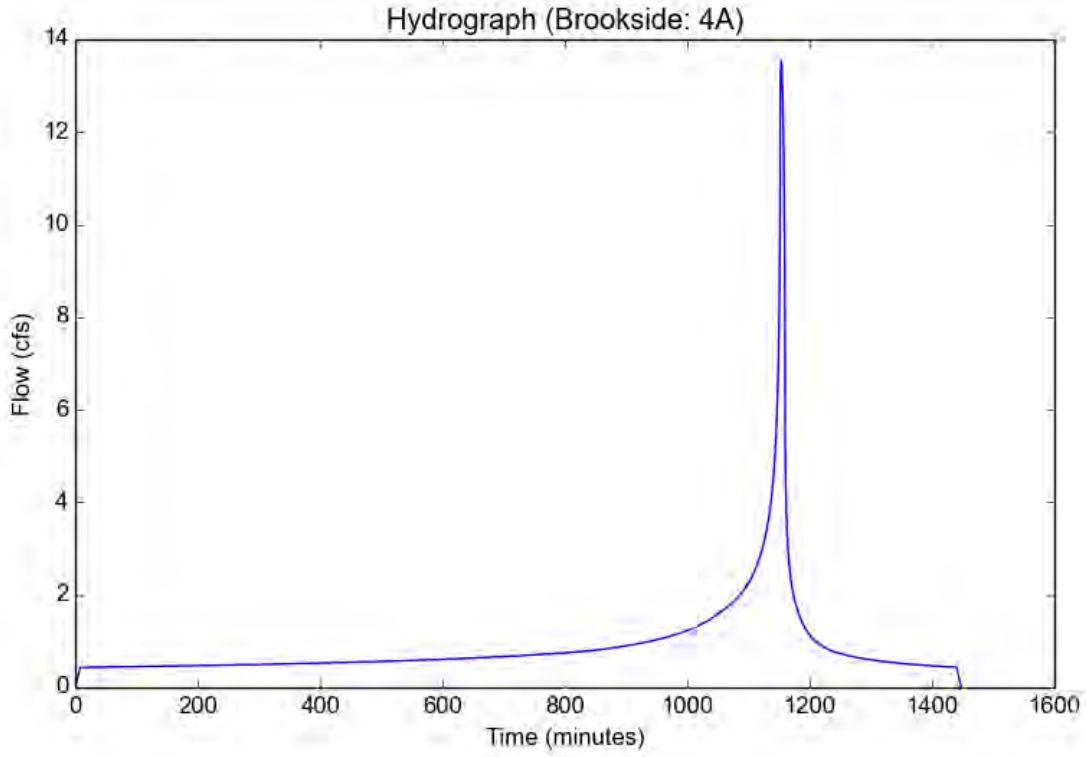
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 4A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4A
Area (ac)	4.31
Flow Path Length (ft)	796.6
Flow Path Slope (vft/hft)	0.0113
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.4888
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	13.533
Burned Peak Flow Rate (cfs)	13.533
24-Hr Clear Runoff Volume (ac-ft)	1.7894
24-Hr Clear Runoff Volume (cu-ft)	77947.0985



Peak Flow Hydrologic Analysis

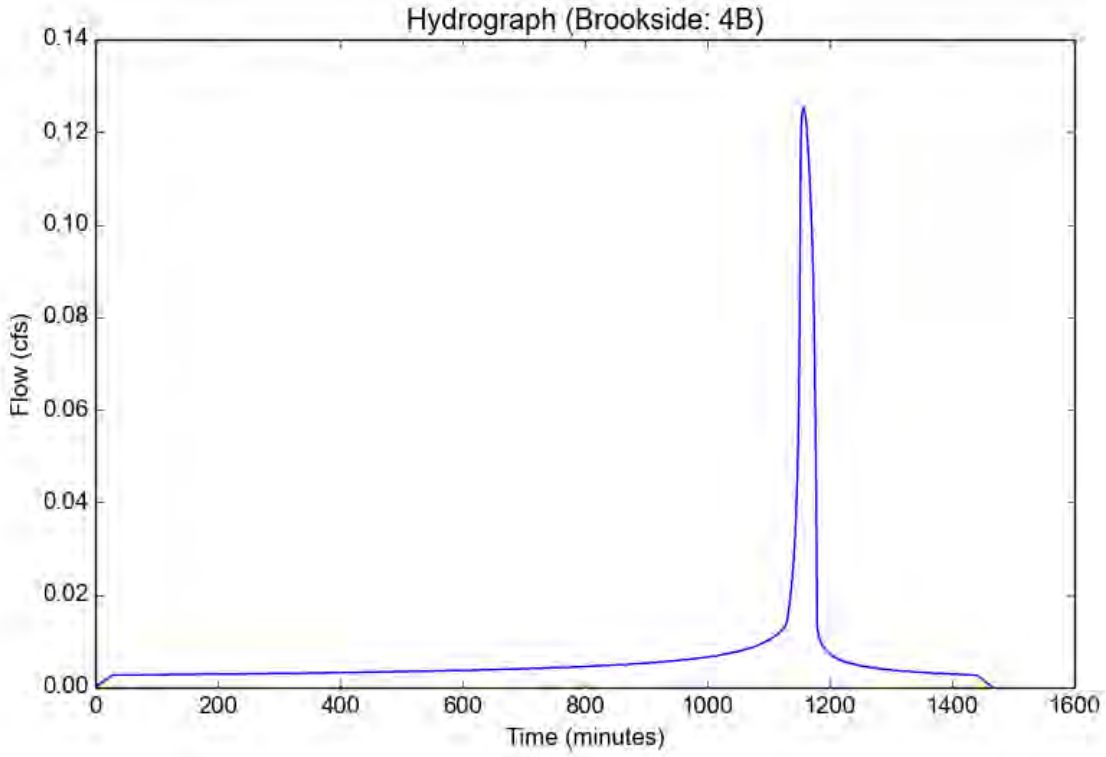
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 4B - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4B
Area (ac)	1.05
Flow Path Length (ft)	377.9
Flow Path Slope (vft/hft)	0.02646
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2836
Undeveloped Runoff Coefficient (Cu)	0.4159
Developed Runoff Coefficient (Cd)	0.4207
Time of Concentration (min)	27.0
Clear Peak Flow Rate (cfs)	0.1253
Burned Peak Flow Rate (cfs)	0.1253
24-Hr Clear Runoff Volume (ac-ft)	0.0131
24-Hr Clear Runoff Volume (cu-ft)	571.4718



Peak Flow Hydrologic Analysis

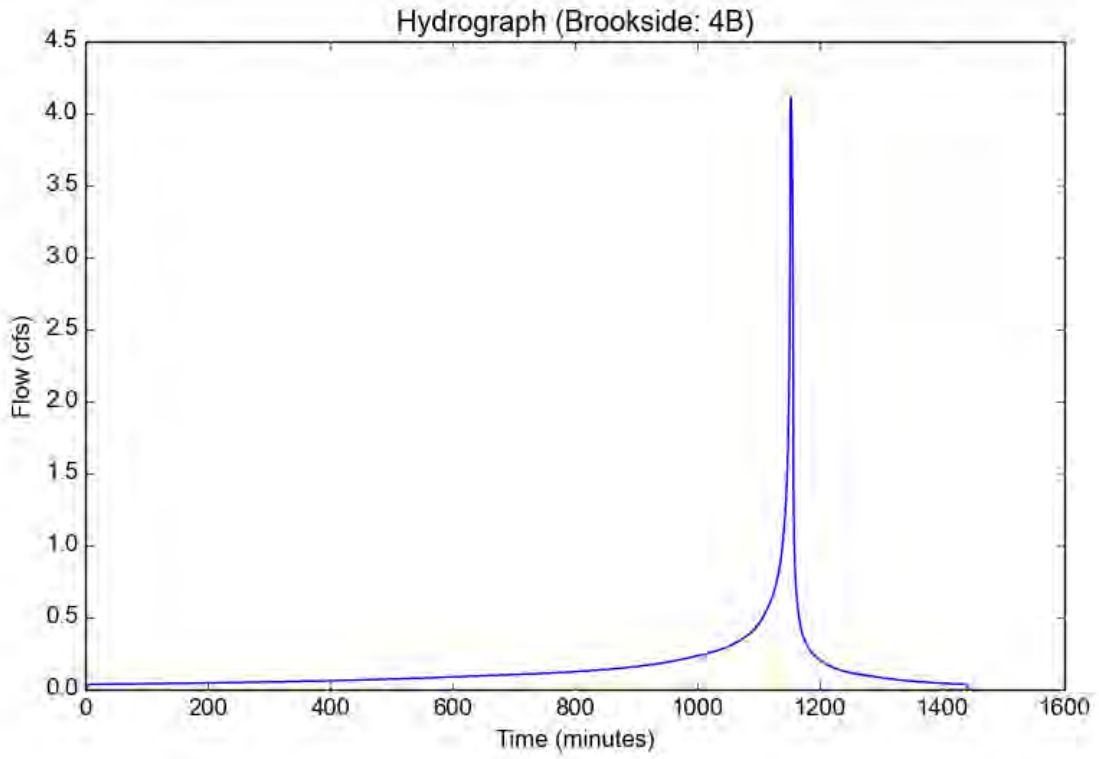
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 4B - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	4B
Area (ac)	1.05
Flow Path Length (ft)	377.9
Flow Path Slope (vft/hft)	0.02646
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	4.3512
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	4.1119
Burned Peak Flow Rate (cfs)	4.1119
24-Hr Clear Runoff Volume (ac-ft)	0.2996
24-Hr Clear Runoff Volume (cu-ft)	13051.079



Peak Flow Hydrologic Analysis

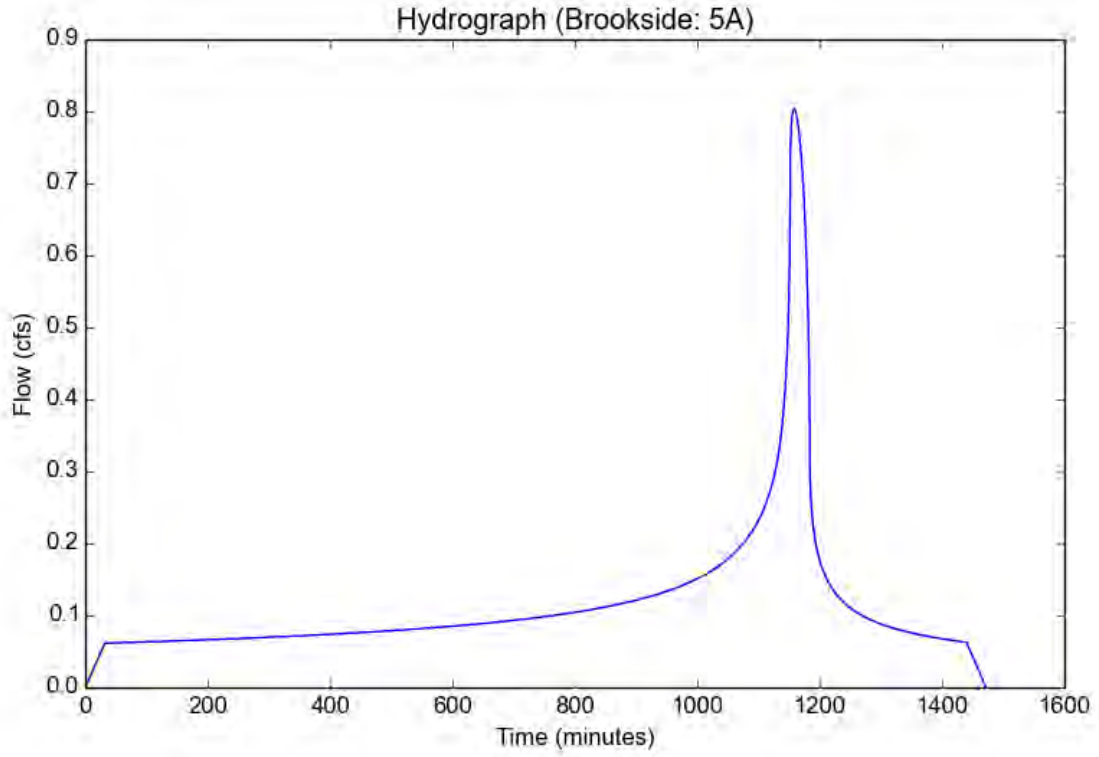
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 5A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5A
Area (ac)	4.24
Flow Path Length (ft)	954.1
Flow Path Slope (vft/hft)	0.03354
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2618
Undeveloped Runoff Coefficient (Cu)	0.3957
Developed Runoff Coefficient (Cd)	0.7235
Time of Concentration (min)	32.0
Clear Peak Flow Rate (cfs)	0.8031
Burned Peak Flow Rate (cfs)	0.8031
24-Hr Clear Runoff Volume (ac-ft)	0.2327
24-Hr Clear Runoff Volume (cu-ft)	10135.0599



Peak Flow Hydrologic Analysis

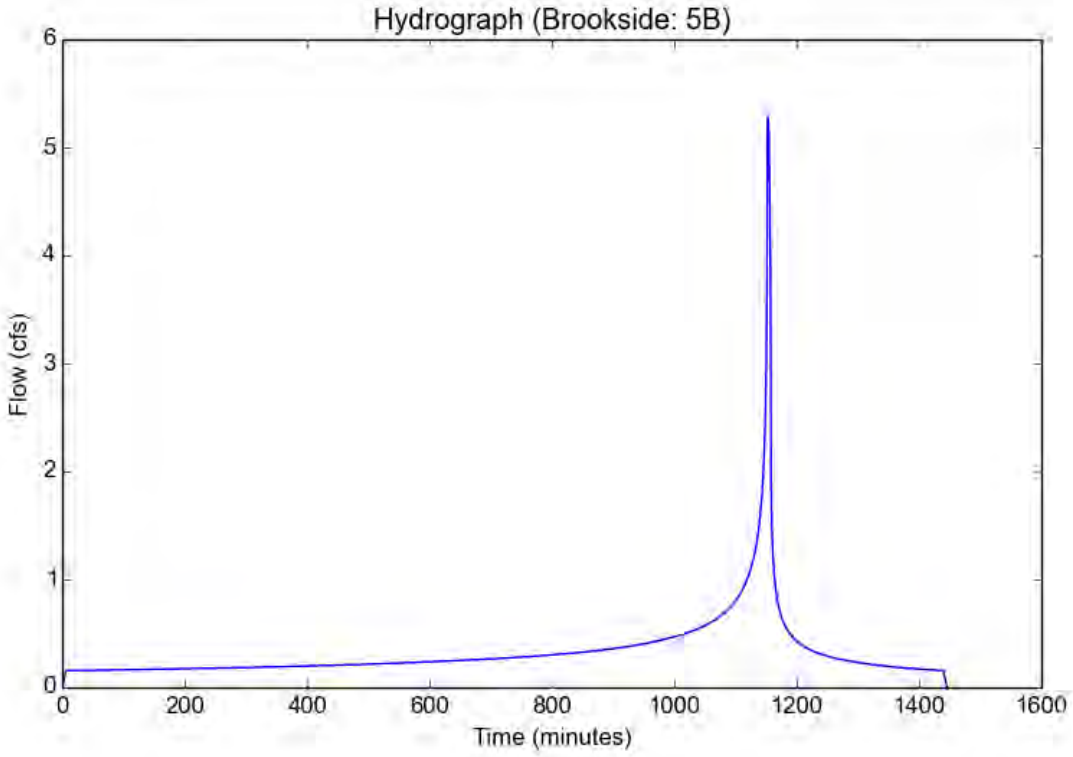
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 5B - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	5B
Area (ac)	1.47
Flow Path Length (ft)	542.7
Flow Path Slope (vft/hft)	0.0129
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.9939
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	5.2839
Burned Peak Flow Rate (cfs)	5.2839
24-Hr Clear Runoff Volume (ac-ft)	0.6638
24-Hr Clear Runoff Volume (cu-ft)	28916.4079



Peak Flow Hydrologic Analysis

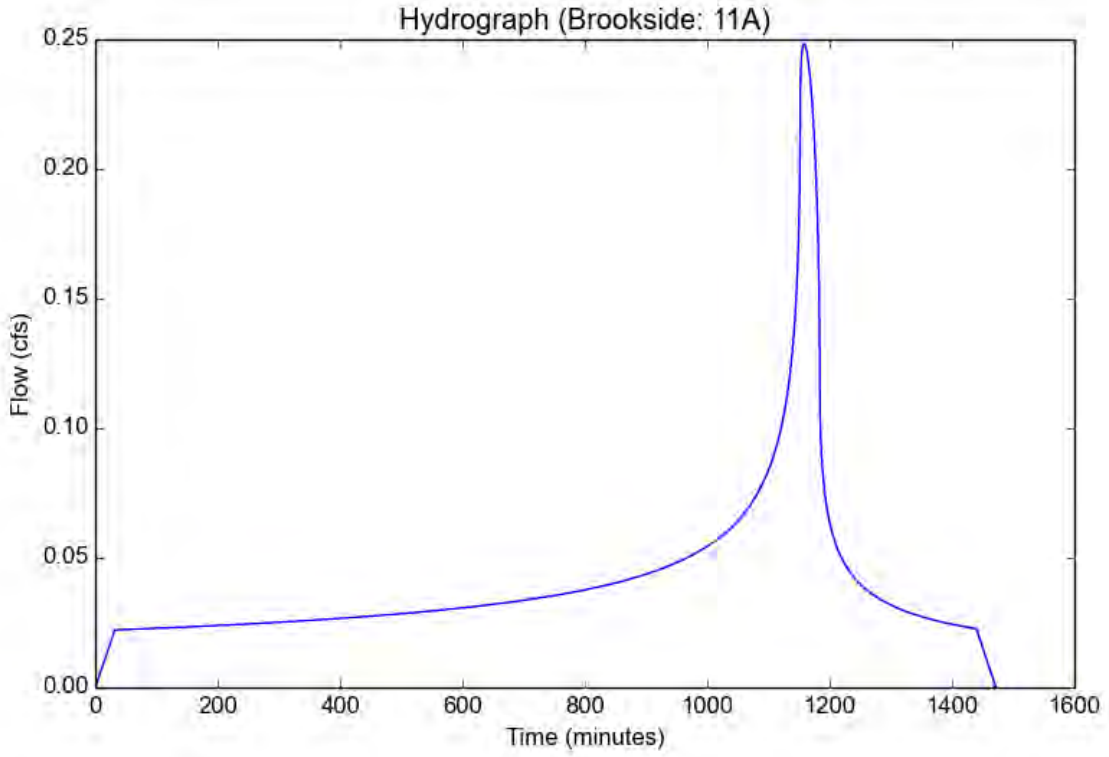
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/85th Percentile/Brookside Proposed - 11A - 85th Percentile.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	1.53
Flow Path Length (ft)	494.1
Flow Path Slope (vft/hft)	0.00607
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2618
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.62
Time of Concentration (min)	32.0
Clear Peak Flow Rate (cfs)	0.2484
Burned Peak Flow Rate (cfs)	0.2484
24-Hr Clear Runoff Volume (ac-ft)	0.0823
24-Hr Clear Runoff Volume (cu-ft)	3585.7549



Peak Flow Hydrologic Analysis

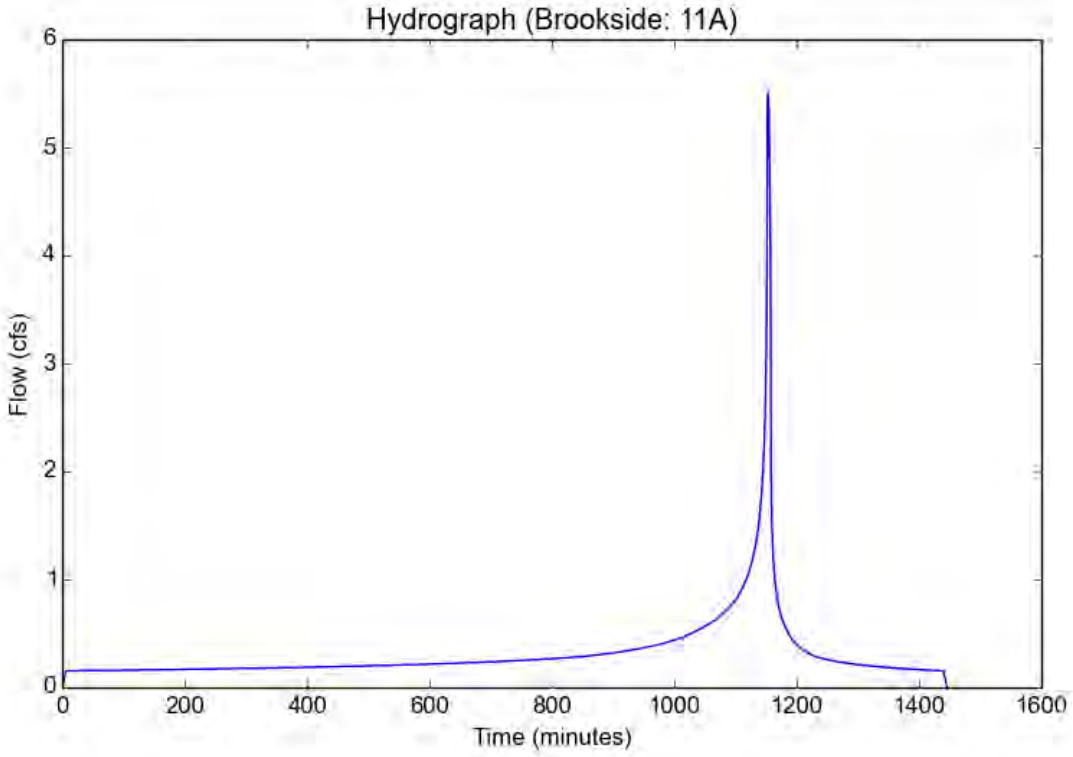
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 11A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	11A
Area (ac)	1.53
Flow Path Length (ft)	494.1
Flow Path Slope (vft/hft)	0.00607
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.65
Soil Type	17
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	3.9939
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	5.4996
Burned Peak Flow Rate (cfs)	5.4996
24-Hr Clear Runoff Volume (ac-ft)	0.6351
24-Hr Clear Runoff Volume (cu-ft)	27664.9381



Peak Flow Hydrologic Analysis

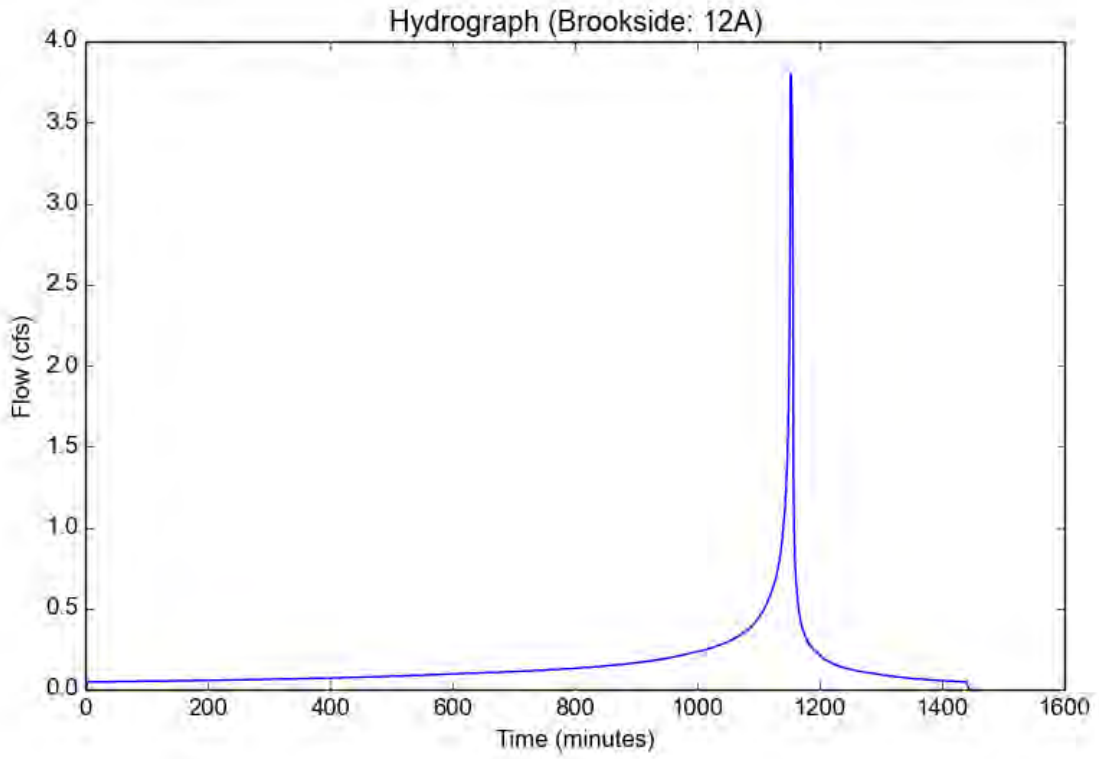
File location: P:/B852/Engineering/Hydrology/On-Site/HydroCalc/Proposed/100yr/Brookside Proposed - 12A - 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Brookside
Subarea ID	12A
Area (ac)	0.97
Flow Path Length (ft)	512.5
Flow Path Slope (vft/hft)	0.07414
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.135
Soil Type	2
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.293
Peak Intensity (in/hr)	4.3512
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.7986
Burned Peak Flow Rate (cfs)	3.7986
24-Hr Clear Runoff Volume (ac-ft)	0.3083
24-Hr Clear Runoff Volume (cu-ft)	13428.395



Attachment B – Geotechnical Report

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
FOR ENTITLEMENT
PROPOSED RESIDENTIAL DEVELOPMENT
TENTATIVE TRACT NO. 72798
ASSESOR'S PARCEL NUMBERS: 8709-093-001, 002, & 003
NORTHEAST CORNER OF NORTH LEMON AVENUE & LA PUENTE ROAD

City of Walnut, California

Prepared for

SPRING MEADOWS HOMES, LLC
18217 Gale Avenue, Suite A
City of Industry, CA 91748

Prepared by

GROUP DELTA CONSULTANTS, INC.
370 Amapola Avenue, Suite 212
Torrance, California 90501

Group Delta Project No. LA1579
March 17, 2023

GROUP DELTA

Spring Meadows Homes, LLC.
18217 Gale Avenue, Suite A
City of Industry, CA 91478

March 17, 2023
Group Delta Project No. LA1579

Attention: Mr. Jack Su

Subject: Preliminary Geotechnical Investigation Report for Entitlement
Proposed Residential Development
Tentative Tract No. 72798
Assessor's Parcel Numbers: 8709-093-001, 002, & 003
Northeast corner of North Lemon Avenue & La Puente Road
City of Walnut, California

Dear Mr. Su,

Group Delta Consultants, Inc. (Group Delta) is pleased to submit this preliminary geotechnical investigation report for entitlement of the proposed residential development in the City of Walnut in California. Our scope of work was performed in general accordance with our proposal dated July 6, 2022, and change orders dated August 9, and September 9, 2022.

We appreciate the opportunity to provide geotechnical services for this project. If you have any questions about this report, or if we can be of further service, please do not hesitate to contact us.

Sincerely,

GROUP DELTA CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER
ETHAN TSAI
NO. GE 3004
EXP. 12/31/23
GEOTECHNICAL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
MICHELLE ALLISON SUTHERLAND
No. EG2577
EXP. 2/29/24
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Ethan Tsai, G.E.
Associate Engineer

Michelle A. Sutherland, C.E.G.
Associate Engineering Geologist

Distribution: Addressee (PDF file)

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Project Description 1

1.2 Scope of Work 3

2.0 GEOTECHNICAL FIELD EXPLORATION 4

2.1 Previous Field Investigation 4

2.2 Current Field Investigation 4

3.0 LABORATORY TESTING 5

4.0 SITE AND SUBSURFACE CONDITIONS 6

4.1 Site and Surface Conditions 6

4.2 Subsurface Conditions 6

4.3 Groundwater 7

5.0 GEOLOGIC AND SEISMIC SETTINGS 9

5.1 Geologic Setting 9

5.2 Seismic Setting 9

6.0 GEOLOGIC/SOILS GEOTECHNICAL EVALUATION 11

6.1 Earthquake Fault Rupture 11

6.2 Seismic Induced Ground Failure 11

6.3 Landslides 12

6.3.1 Documented Landslides 12

6.3.2 Potential Landslide from the Proposed Development 13

6.4 Soil Stability 15

6.4.1 Erosion 15

6.4.2 Collapse and/or Expansion 15

6.5 Wastewater Disposal 16

6.6 Geologic Feature 16

6.7 Naturally Occurring Methane, Asbestos, and Radon 16

7.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS 17

7.1 General 17

7.2 Site Preparation and Grading 18

7.3 Preliminary Foundation Recommendations 19

7.3.1 Mat Foundation 19

7.3.2 Spread Footings 19
7.3.3 Pile Foundation (Bridge) 19
7.4 Floor Slab 19
7.5 Retaining Wall 20
7.6 Seismic Design Parameters per CBC 2022/ASCE 7-22 20
7.7 Soil Corrosion Potential 21
7.8 Stormwater Infiltration 21
8.0 LIMITATIONS 23
9.0 REFERENCES 24

LIST OF FIGURES

Figure 1	Site Location Map
Figure 2	Exploration Location Plan
Figure 2A	Historical Topography
Figure 3.1	Cross-Section A-A’
Figure 3.2	Cross-Section B-B’
Figure 3.3	Cross-Section D-D’
Figure 3.4	Cross-Section 2-2’
Figure 3.5	Cross-Section 3-3’
Figure 3.6	Cross-Section 5-5’
Figure 3.7	Cross-Section 6-6’
Figure 3.8	Cross-Section 8-8’
Figure 3.9	Cross-Section 9-9’
Figure 4	Historically Highest Groundwater Map
Figure 5	Regional Geology Map
Figure 6	Regional Fault and Seismicity Map
Figure 7	Earthquake Zones of Required Investigation Map
Figure 8	Landslide Inventory Map

LIST OF APPENDICES

Appendix A	Current Field Investigation
Appendix B	Current Laboratory Testing
Appendix C	Previous Field Investigation and Laboratory Testing
Appendix D	Liquefaction Analyses
Appendix E	Slope Stability Analyses

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT FOR ENTITLEMENT
PROPOSED RESIDENTIAL DEVELOPMENT
TENTATIVE TRACT NO. 72798
NORTHEAST CORNER OF NORTH LEMON AVENUE & LA PUENTE ROAD
CITY OF WALNUT, CALIFORNIA

1.0 INTRODUCTION

This report was prepared to address the feasibility of the proposed residential development from a geotechnical standpoint in preparation for the project Environmental Impact Report (EIR) submittal. This report includes a review of geotechnical related geological/soils CEQA checklist items for project planning.

The site is located on the northeast corner of North Lemon Avenue and La Puente Road in the City of Walnut, California. The location of the site is shown in Figure 1.

Group Delta previously performed a limited geotechnical investigation for the subject site and presented the results in a report dated August 21, 2013 (Revised on November 6, 2013). An addendum to the report was also provided on March 20, 2019. This report provides updated geology and geotechnical hazard evaluation incorporating the current development plan as well the current California Building Codes (CBC, 2022).

The intent of the assessment is to identify the major geotechnical hazards and geotechnical conditions affecting the site and proposed project. This report **is not sufficient** for final design or for submitting to the building department for design-level approval. A design-level geotechnical investigation will be required for the project.

1.1 Project Description

Location. The project site consists of 25.8 acres located at 800 Meadow Pass Road. It is comprised of Assessor's Parcel Nos. 8709-093-001, -002, and -003 and is bordered by La Puente Road to the south, North Lemon Avenue to the west, Meadow Pass Road to the north, and homes to the east. It is in the southeast portion of the City of Walnut (City), approximately 2.3 miles northwest of the confluence of State Route 60 and State Route 57 (Figure 1). It is depicted on Township 02S, Range 09W, Section 6 of the United States Geological Survey, San Dimas California 7.5-minute quadrangle. The approximate center of the project site is located at latitude 34.024363 °N and longitude -117.866254°W.

Land Use Designations / Proposed Use. The project site has a General Plan designation of Very Low Density and is zoned Residential Planned Development Zone (RPD) with a designation of RPD–28,500–1.3. Pursuant to Section 6.24.030 A2 of the Walnut Municipal Code, the project proposes the development of 27 detached single-family homes under R-1 standards with a minimum lot size of 28,500 square feet. The project requires approval of a Tentative Tract Map and Site Plan/Architectural Review.

Access. All project streets will be public. The northerly 25 homes will take access from Meadow Pass Road and the two most southerly homes will take access from San Vicente Drive, with each street ending in a cul-de-sac to preclude cut-through traffic. A bridge will provide access over Lemon Creek to those homes south of Lemon Creek that will be accessed from Meadow Pass Road.

Open Space. The entirety of Lemon Creek will be preserved and included within 12.2 acres of privately owned and residentially zoned property - over 47% of the site – that will serve as permanent open space. Currently, the site contains approximately 1,876 trees. Through preservation and new plantings, the project will increase the number of trees onsite to approximately 1,936, also increasing the ratio of native to non-native/invasive trees. The developer will improve to City trail standards a public trail that will run through the open space area, passing across the project's primary road. An easement will then be granted to the City for the long-term operation and maintenance of the public trail.

As is common with existing development throughout the City's Residential Planned Development Zone, 9.5 acres of the open space area will be within privately owned residential lots. Those portions of open space, Lemon Creek, and the public trail within private lots will be subject to recorded deed restrictions prohibiting use of the restricted open space by the owners of the private lots, including planting vegetation, installing fencing, or otherwise developing or using the restricted natural open space areas. The restrictions will be enforceable by the City. The remaining 2.7 acres of the open space area will consist of internal slope areas and water quality basins that will be owned by a public agency or the Homeowners Association (HOA) and subject to similar deed restrictions.

The open space will be maintained by a combination of a Lighting and Open Space Maintenance District (LOSMD) through a new zone funded entirely by the project's homeowners (as to the natural open space only), the City (as to the trail only), the flood control district or another public or quasi-public agency (as to stormwater retention basins only), and the project's HOA.

Stormwater / Lemon Creek. Three public storm drain inlets along Meadow Pass Road at the northerly boundary of the project site currently direct offsite stormwater into and through existing public storm drain lines within the project site. That offsite stormwater then enters Lemon Creek through two existing outlets. These public storm drains, which do not capture onsite stormwater now and will not do so when the project is complete, will be realigned under the project streets. One of the existing outlets into Lemon Creek will remain in its current location, while the second will be relocated to a point below the proposed project bridge.

While onsite stormwater historically flows directly into the creek, two water quality basins have been designed to detain any increase in on-site stormwater runoff resulting from the proposed project, up to a 100-year storm event. These basins will treat on-site runoff up to the 85th percentile storm event, consistent with Los Angeles County regulations. One water quality basin will be in the northern portion of the site and will hold and gradually release project stormwater

into an existing public storm drain connection which enters the property from Lemon Avenue. The second water quality basin will be in the southern portion of the site and will hold and gradually release project stormwater into a proposed outlet to Lemon Creek. These water quality basins are designed to assure that project stormwater will enter Lemon Creek onsite at a volume and flow rate no greater than presently occurs. Runoff entering Lemon Creek will then pass offsite into existing public drainage facilities located on public property adjacent to the project site at La Puente Road.

In addition, one of the four existing onsite culverts ("Culvert D," located approximately 100 linear feet upstream of La Puente Road) will be removed, restoring the native creek in this location.

The proposed development plan is shown on Figure 2.

1.2 Scope of Work

Group Delta's scope of work included the following:

- Review available published geotechnical and geologic reports, maps, and subsurface data for the site and surrounding area;
- Perform supplemental geotechnical investigation to evaluate subsurface conditions;
- Evaluate geologic and seismic hazards including local seismicity, surface fault rupture, ground shaking, liquefaction, slope stability, and other considered geologic hazards;
- Provide geotechnical background and evaluation for pertinent geology/soils CEQA Environmental Checklist items;
- Evaluate geotechnical data and perform geotechnical analyses to develop preliminary foundation recommendations for the proposed new construction.
- Prepare a report to present our findings.

Our preliminary recommendations are based on the results of our current and previous field explorations, laboratory tests, and appropriate engineering analyses. The results of current field explorations are presented in Appendix A. The results of current of laboratory tests are presented in Appendix B. The results of previous field explorations and laboratory tests are presented in Appendix C.

2.0 GEOTECHNICAL FIELD EXPLORATION

2.1 Previous Field Investigation

Group Delta previously performed field investigations at the site on 7/19/2013, and on 9/4/2013. The previous field investigation included nine (9) hollow stem auger (HSA) borings to depths ranging from 20 feet to 51.5 feet and eight (8) cone penetration test (CPT) soundings to depths ranging from 8 feet to 50 feet.

In addition, Group delta performed infiltration testing on 2/19/2019 at three locations at depths between 5 to 7 feet below existing ground.

The locations of the previous borings, CPTs, and infiltration tests are shown on Figure 2. Details of the explorations and the logs of the borings are presented in Appendix C.

2.2 Current Field Investigation

The soil conditions beneath the site were further explored by drilling four (4) borings (B-18 to B-21) to depths of 26 to 46 feet below the existing grade using hollow stem auger drilling equipment at the locations shown on Figure 2. In addition, five tests pits were excavated to depths of about 7 to 10 feet below the existing grade at the locations shown on Figure 2. Details of the current explorations and the logs of the borings and test pits are presented in Appendix A.

3.0 LABORATORY TESTING

Laboratory testing was performed on selected soil samples collected from the borings to characterize the subsurface materials and to evaluate their index and engineering properties. The laboratory testing program consisted of the following:

- Soil classification
- Atterberg Limits
- Pocket Penetrometer
- Consolidation
- Direct Shear
- Expansion Index
- Soil Corrosivity

The summary of the current laboratory testing and results with a brief description is presented in Appendix B. The results of the previous laboratory tests are presented in Appendix C.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 Site and Surface Conditions

The project site is located on the northeast of the intersection of North Lemon Avenue and La Puente Road in the City of Walnut, California. The site is an 'L' shaped parcel over 24 acres in area. Lemon Creek enters the center of the property, flowing from the northeast down to the southwest.

The current site grade varies approximately from an elevation of 640 feet on the north boundary adjacent to Meadowpass Road down to elevation 572 feet on the southern boundary adjacent to La Puente Road. The southern portion of the site is free of any structures and mostly developed by prior agricultural and equestrian use. The northern portion of the site has improvements related to the development of Meadowpass Road and an abandoned equestrian facility. In review of the USGS historical topographic map from 1926, it appears that significant cuts and fills have been placed to develop the current landscape at the site, Figure 2A Historical Topographic Map. Some improvements such as trails and fences are present in the property. The surface is mostly unpaved with grass, trees and shrubs.

4.2 Subsurface Conditions

North of Lemon Creek (Lot 1 through Lot 13 and Basin #1)

The subsurface conditions near north of Lemon Creek (Lot 1 through Lot 13 and Basin #1) consists of existing artificial fill (af) soils underlain by alluvium (Qa), organic rich soils (Qor), and bedrock of the Puente Formation (Tpsq). Artificial fill soils consisting of expansive, stiff clay and fragments of bedrock materials were encountered in about 2 to 5 feet thick. Fill soils become thicker toward the Lemon Creek, and were encountered up to 10 feet thick. The origin and compaction of the fill is unknown, however, it was likely associated with the development of Meadow Pass Road and the current developments.

The fill soils are underlain by alluvium (Qa) which consist predominantly of clayey soils. The clayey soils above groundwater are porous, however they are stiff to very stiff, having unconfined compressive strength (UCS) of at least 2 ksf based on in-situ field tests and CPT correlated data. The clayey soils below groundwater become weaker and compressible, having UCS in a range between 0.5ksf and 1.5ksf.

The alluvium is underlain by organic rich soils (Qor). The organic rich soils are very soft and compressible, having UCS on an order of about 0.25 ksf. The organic rich soils have the potential to continue to decompose when they are not saturated. Continued decomposition of the organics in the soil would result in differential volume changes resulting in variable settlements. However, the amount of organic materials is unknown and should be determine during the design phase geotechnical investigation.

The organic rich soils are underlain by Miocene bedrock materials of the Puente Formation Soquel Member (Tpsq). As described regionally, the unit is a tan to light gray sandstone containing concretions and interbedded siltstone and claystone. As observed in test pit and boring samples, the sandstone is fine grained and friable and the claystone/siltstone is thinly bedded, weathered, and contained hard concreted layers. Bedding orientation was not well observed in test pits due to weathering of the near surface rock. Regional bedding mapped dips to the southeast. General bedding measured in test pits dips to the northeast.

Geologic cross sections north portion of the site are shown on Cross Sections A-A', B-B', D-D', 2-2' and 3-3'.

Lot 14 through Lot 27 and Basing #2

The subsurface soils consist of artificial fill (af), alluvium (Qa) and colluvial (Qc) soils underlain by Monterey (Puente) Formation (Tpsq). The alluvium and colluvium consists predominantly of porus, stiff to very stiff clayey soils. The thickness of alluvium is about 5 feet thick or less in the area between Lot 15 and Lot 18, and becomes greater to more than 35 feet near Lot 27 and Basing #2. Based on the in-situ field tests and CPT corelated data, the alluvium has UCS of 2 to 4 ksf.

The alluvium along the eastern outer bank of Lemon Creek contains loose layers of silty sand and sandy silt which may be susceptible to liquefaction when saturated during a significant earthquake event. The limit of the liquefiable soil should be defined in design level geotechnical investigation.

Geologic cross sections on the southern portion of the site are shown on Cross Sections A-A', 5-5', 6-6', 8-8' and 9-9'.

4.3 Groundwater

Current groundwater was encountered at depths of about 18 feet in boring B-14 to 34.5 feet in Boring B-3, below the existing grade in the explorations. The depth of encountered groundwater is presented in the logs in Appendix A. The estimated existing groundwater depths are shown on the cross-sections in Figure 3.1 to 3.9. There is surface water flowing within the unconfined channel of Lemon Creek.

The historical highest groundwater contours and borehole log data (San Dimas Quadrangle, CGS, 1998) does not have adequate coverage at the project site. The adjacent data indicates that the historical highest groundwater at this area is deeper than 20 feet below ground surface. The CGS (1998) groundwater map is shown in Figure 4.

Since shallowest groundwater encountered in the borings is 18 feet below existing grade, the design groundwater level was assumed to be at a depth of 18 feet.

The design groundwater level is deeper than the bottom of the existing Lemon Creek near CPT-2 location. Therefore, we have conservatively assumed a design groundwater level of 12 feet near CPT-2 location for analyses.

5.0 GEOLOGIC AND SEISMIC SETTINGS

5.1 Geologic Setting

The site is located in the Peninsular Range geomorphic province. This province is characterized by northwest trending ridges and valleys. It is a tectonically complex area accommodating rotation stress imposed by the continental plate boundary along the San Andreas Fault. Ridge and valley defining structures include active strike slips fault zones, including the Newport-Inglewood, Elsinore, and San Jacinto.

Locally, the site is situated along the southern margin of the San Jose Hills, centrally within the Puente Hills block. The South San Jose Creek has incised and filled a relatively narrow southwest trending valley, locally known as Los Nogales. The foothills are comprised of elevated and folded Tertiary sedimentary rock. Lemon Creek flows south through the Project Site in an open channel. Young alluvial deposits (Qa) fill the creek floor and overbank areas. Slopes are comprised of Monterey (Puente) Formation, Miocene-aged silt-and sandstone unit, Soquel Tpsq. Regionally, the bedrock is mapped as Tms, see Figure 5. Regional maps indicate bedding dips 35 to 45 degrees to the south-southeast (Dibblee, 2002).

5.2 Seismic Setting

The site is located within the seismically active area of southern California and has a high potential for the site to experience strong ground shaking from local and regional faults. These hazards and their potential impact can be mitigated with proper seismic design. The intensity of ground shaking is highly dependent upon the distance of the fault to the site, the magnitude of the earthquake, and the underlying soil conditions. Data evaluated for the local fault and seismic hazard at the site was obtained from USGS online earthquake catalog and Quaternary Fault Database resources unless otherwise noted. The site in relation to regional seismic faults and significant historical earthquake epicenters is presented in Figure 6, Regional Fault and Seismicity Map.

A search for local historical earthquakes recorded by USGS earthquake online catalog within a 100 km radius of the site from 1800 to present include 168 recorded events with M4.5 or greater (USGS, accessed 8/10/2022). Of the 168 events, 5 were M6.5 and greater and include the 1971 M6.6 San Fernando Earthquake and the 1994 M6.7 Northridge Earthquake. Fifty-one recorded events were M5.0 to M6.0 earthquakes. The closest recorded earthquakes of 4.5 or greater, are the 1935 M4.6 earthquake about 5.8 miles north and the 2014 M5.1 earthquake about 7.0 miles south of the site. No known earthquake related damage has been reported at the site. Construction in this area should be designed with accepted engineering practices and in compliance with current building codes that accommodate strong seismic ground motion.

While not within the search radius, earthquakes of M7.0 and greater have been recorded in southern California. A M7.5 earthquake occurred in 1952 located about 91 miles northeast of the

site and a M7.3 earthquake in 1992 was located about 83 miles east of the site. Construction in this area should be designed with accepted engineering practices and in compliance with current building codes that accommodate strong seismic ground motion.

A list of faults considered capable of producing significant shaking at the site is provided in Table 1 below:

Table 1: List of Known Earthquake Faults Closest to the Subject Site

Abbreviated Fault Name	Fault Type	Max. Magnitude (Mw)	Approximate Closest Distance (Miles)
San Jose	Reverse	6.5	1.0
Elsinore	Strike-Slip	7.5	5.6
San Andreas	Strike-Slip	8.0	26.4

Source: USGS Qfaults maps, Southern California Earthquake Data Center.

6.0 GEOLOGIC/SOILS GEOTECHNICAL EVALUATION

The findings are discussed in the sections below.

6.1 Earthquake Fault Rupture

The site with respect to Quaternary faults mapped by the CGS are illustrated in Figure 6. The closest active surface fault is the San Jose fault, which is considered capable of generating a M6.5 earthquake. It is mapped about 1.0 miles north of the site and trends roughly northeast-southwest. There are no Earthquake Fault Zones of Required Investigation mapped at the site or trending just outside the site, Figure 7.

Based on our review of available published geologic maps there are no mapped active faults that cross through or project toward the site. The site is not within an Alquist-Priolo Zone. Therefore, the potential for surface fault rupture hazard at the site is low.

6.2 Seismic Induced Ground Failure

Liquefaction involves the sudden loss in strength of a saturated, cohesionless soil (sand and non-plastic silts) caused by the build-up of pore water pressure during cyclic loadings, such as those produced by an earthquake. This increase in pore water pressure can temporarily transform the soil into a fluid mass, resulting in a vertical settlement, and can also cause lateral ground deformations. Typically, liquefaction occurs in areas where there are loose to medium dense sands and silts, and where the depth to groundwater is less than 50 feet from the surface. Additionally, vibration caused by seismic shaking can cause seismic settlement (seismic compaction known as dry sand settlement) of loose to medium dense, dry, clean, and silty granular soils. In summary, three simultaneous conditions are required for liquefaction:

- Loose to medium dense cohesionless soils
- Groundwater within 50 feet of the surface
- Strong shaking, such as caused by an earthquake

The northern portion of the site and southern end of the site is located in a mapped liquefaction hazard zone on the California Seismic Hazard Zone Map for San Dimas 7.5-minute Quadrangle (CGS, 1999), as shown in Figure 7.

Liquefaction triggering analyses was performed per the County of Los Angeles Administrative Manual (GS 045.0, Rev. 10/1/14) and the computer program CLiq (GeoLogismiki, 2021) using simplified procedures recommended by NCEER (Youd et al, 2001) were used. The results of the liquefaction triggering analyses indicate that the potential of liquefaction is high in the southern portion of the site near the Lemon Creek and decreases to the eastern portion of the site where building pad are planned. The potential of liquefaction is low in the northern portion of the site.

The limit of high liquefaction potential areas should be determined design-level geotechnical investigation.

Seismically-induced settlement is often caused by loose to medium-dense granular soils densified during ground shaking. Dry and partially saturated soils as well as saturated granular soils are subject to seismically-induced settlement. Up to 4 inches of seismically-induced settlement is estimated locally near the existing Lemon Creek. Mitigation measures to reduce liquefaction-induced settlements, ground displacements, and loss of bearing capacity may include ground improvement and/or mat foundations for the proposed structures. Preliminary recommendations are discussed further below. The Liquefaction Analyses are presented in Appendix D.

Analysis of open slopes along the Lemon Creek indicate liquefaction-induced lateral spreading may occur during a significant seismic event. Preliminary calculations indicate the potential lateral offsets to be less than 12 inches and may be mitigated through mat foundation design. Preliminary foundation recommendations are discussed further below. The lateral spreading analyses are presented in Appendix D.

6.3 Landslides

6.3.1 Documented Landslides

The site does not include slopes recognized for the potential of seismically induced landslide hazards (CGS, 1999) as shown in Figure 7. However, the CGS landslide inventory map from 1998 documents a dormant landslide in north of North Lemon Avenue and Meadow Pass Road, Figure 8. The dormant landslide is described as a debris flow and portions of the debris flow may be present in the northwestern corner of the site. Currently, the inflow of debris and surface water is controlled through storm drains leading into Lemon Creek at the site.

The dormant landslide area is presently developed by residential homes in Tract No. 48286.. The Tract No. 48286 was developed in 1990. Geotechnical reports listed below were prepared during development:

- Leighton and Associates, Inc., 1990, Preliminary Geotechnical Investigation for Tract No. 48286. “Keystone Ridge Estates”, City of Walnut, California, dated January 9, 1990;

- Leighton and Associates, Inc., 1991, Grading Plan Review for Tract No. 48286. “Keystone Ridge Estates”, City of Walnut, California, dated January 9, 1990;

- Leighton and Associates, Inc., 1993, Final Report of Geotechnical Observation and Testing During Rough Grading of Tract No. 48286. “Rodeo Ridge Estates”, City of Walnut, California, dated April 16, 1993; and

- Leighton and Associates, Inc., 1995, Geotechnical Review of the Precise Grading Plans, and Foundation Plans and Response to City of Walnut Plan Correction Sheet for Precise Grading of Tract No. 48286. "J.M. Peters Company, Inc.", City of Walnut, California, dated August 9, 1995.

The dormant debris flow mapped by the CGS landslide inventory map was not identified by the prior reports, however, localized landslides were mapped within the western slopes ascending from Lemon Creek Avenue. There is a buttress constructed at Lemon Creek Avenue along the ascending slope west of the site. The potential for landslide hazard the offsite western slope to impact the project is considered low considering the improvements in place.

6.3.2 Potential Landslide from the Proposed Development

The site is not within a known landslide hazard zone, however, the proposed development includes cuts and fills near existing slopes based on the current proposed grading plan as shown on Figure 2. Slope stabilities analyses were performed on selected critical sections including cross section 2-2', 3-3', 5-5', and 6-6'. Slope stability analyses for each location are discussed below.

Cross Section 2-2': Cut Slopes along North Property Line

Cross Section 2-2' was prepared to evaluate the global stability of the cut slope along north property line. The maximum height of the cut slope is about 30 feet and the cut slope will be no steeper than 2:1 (horizontal:vertical).

The underlying materials of the cut slope consists predominantly of existing fill soils underlain by alluvium and claystone bedrock. Bedrock is not anticipated to be exposed during excavation and therefore adverse bedding condition is not anticipated.

The static and seismic stability analyses indicates that the factor of safety of the proposed cut slope against global instability are great than 1.5 and 1.1 for static case and seismic case, respectively. Therefore, the potential of impacting the neighboring properties due to the proposed cut slopes are considered low.

An assumed shear strength was used in the analyses for the cut slope along north property line. The shear strength should be verified during design-level geotechnical investigation and the slope stability analyses at this location should be updated. If the results of the updated slope stability analyses are below the County's requirement, the cut slope may need to be mitigated. Mitigation options would include, but not limit to, soil nails or ground improvements to strengthen the shear strength of the existing fill soils. Details design recommendation can be provided in design-level geotechnical report.

Cross Section 3-3': South Facing Slope Near Lots 2 to 5

Analyses on Cross Section 3-3' was performed to evaluate the global stabilities of the existing south facing slope along Lemon Creek that might be impacted from the proposed new fills being planned near Lot 2 to Lot 5. Up to 13 feet of fill are being planned to be placed in this area for the proposed building pads.

The results of the analyses indicate that the existing south facing slope may be capable to support new fills up to 1 foot without special reinforcement. For cases where new fills greater than 1 foot that is being placed on top of the existing south facing slope, the factor of safety against global instability will be lower than the County's requirement. Therefore, we recommend that the south facing slope should be reinforced to mitigate slope instability at the locations when fills soils more than 1 foot is being placed.

We recommend that ground improvement may be constructed near the toe of new fill slopes to increase lateral resistance of the existing slope. Deep cement soil mixing (DCSM) may be one applicable improvement option for this location. The stability analyses indicates that the south facing slope with recommended ground improvement may support new fills up to 15 feet and the factor of safety against global instability great than 1.5 and 1.1 for static case and seismic case, respectively.

The results of slope stability analyses are discussed in Appendix E.

Cross Section 5-5': Cut Slope East of Street B

Cross Section 5-5' was prepared to evaluate the global stability of the cut slope east of the proposed Street B. The maximum height of the cut slope is about 25 feet and the cut slope will be no steeper than 2:1. The cut slope is anticipated to expose massive sandstone bedrock materials.

The static and seismic stability analyses indicates that the factor of safety of the existing slope against global instability are greater than 1.5 and 1.1 for static case and seismic case, respectively. Therefore, the potential of impacting the neighboring properties due to the proposed cut slopes are considered low.

The results of slope stability analyses are discussed in Appendix E.

Cross Section 6-6': Fill Slope Near Lot 15 through 20

Analyses on Cross Section 6-6' was to evaluate the global stabilities of the existing west facing slope along Lemon Creek that might be impacted from the proposed new fills being planned near Lot 15 to Lot 20. Up to 10 feet of fill are being planned to be placed in this area for the proposed building pads. The fill slopes are anticipated to be placed on alluvium.

The static and seismic stability analyses indicates that the factor of safety of the existing slope against global instability are greater than 1.5 and 1.1 for static case and seismic case, respectively. Therefore, the potential of global instability impacting by the new fills are considered low.

The results of slope stability analyses are discussed in Appendix E.

Conclusion

Based on the results of the stability analyses discussed in this Appendix, it is our opinion that global stability is not an issue properly addressed by engineered mitigations. The proposed development may be setback from adjacent slopes in accordance with Section 1808.7 of 2022 California Building Code. No other special structural setback is required.

6.4 Soil Stability

6.4.1 Erosion

Substantial soil erosion can occur along slopes and gentle gradients where loose and weakly vegetated soils are present and exposed to surface water flow and/or wind. The site has a stream cutting through the site that is subject to significant erosion. Between the stream's erosional potential and planned exposed land (not covered by concrete/ established trees) there is significant potential for erosion. Slopes steeper than 2 Horizontal: 1 Vertical are subject to higher probability and rate of erosion as well. However, there are several ways to address erosion; including but not limited to establishing deep-rooted vegetation, or fortifying susceptible areas with rock or concrete.

6.4.2 Collapse and/or Expansion

Soft clays and organic rich soils encountered near Lots 2 through Lot 6 pose the risk of collapsing or settlement under weight of proposed new fills. Mitigation measure would consist of supporting the proposed structure on mat foundations established on ground improvement, or deep foundations.

The onsite soils consist predominantly of clayey alluvium underlain by bedrock. The clayey alluvium and bedrock are not subject to hydroconsolidation. Therefore, potential of hydroconsolidation is considered low.

Subsidence in southern California region is typically associated with groundwater withdraw, oil extraction, and/or peat loss. State and local regulation has allowed for monitor programs and general management to reduce the negative impacts of subsidence due to groundwater and oil withdraw. The site is not mapped in an active subsidence area, as defined by the USGS, online mapped of Areas of Land Subsidence in California. Nor is it within an active oil field as defined by the CalGEM GIS Well-Finder. The potential for subsidence hazard at the project site is considered low.

The clayey soils onsite have a high potential for expansion and can significantly impact building slab support, hardscape, pavement and flat works. Mitigation of expansive soils for building slabs , hardscape, pavement and flat works would consist of excavation and replacing the upper expansive clay with non-expansive import soils and/or reinforced pavements.

6.5 Wastewater Disposal

The city provides wastewater disposal through the city sewer systems. The Project will be served by the City's existing sewer system and does not include septic tanks or alternative wastewater disposal systems. The potential for waste-water disposal to be a hazard at the project site is low.

6.6 Geologic Feature

The Project Site is situated on a developed area. It is moderately vegetated by trees, with an active creek (Lemon Creek) cutting through the site. Lemon Creek is outside of the grading limits of the site and should not be impacted by the proposed grading. The site is bounded by streets to the North, South, and West. The east and southeast boundaries of the site are bordered by residential homes. There is no potential hazard of destroying a natural geological feature of significance.

6.7 Naturally Occurring Methane, Asbestos, and Radon

Naturally occurring hazardous elements within subsurface materials can include asbestos, radon, and oil and methane gas. CalGEM GIS Well-Finder indicates the site is outside of major oil drilling areas. The Walnut oil field is 2.5 miles East of the site, and the Sansinena and Brea-Olienda large oil fields are 7.5 miles South of the site. There are no active wells within a 0.75 mile radius of the Project Site. Therefore, the potential for naturally occurring oil and methane onsite is considered low.

The CGS Map Sheet 59 (USGS, 2011) showing known sites with naturally occurring asbestos indicates there are no known asbestos site within a 1-mile radius of the site. Therefore, the potential hazard of naturally occurring asbestos at the site is considered low.

The California Geological Survey Special Radon Potential Zone Map (CGS, 2005) indicates the site is within a zone designated as having moderate potential for indoor radon levels above 4 picocuries per liter. Four picocuries per liter is recommended to be an action level for radon reduction by the U.S. Environmental Protection Agency. Moderate indoor radon potential is described to be 6 to 20 percent of indoor radon measurements are likely to exceed the radon action level of 4 picocuries per liter. Encountering units that have potential to contain radon may require a radon specialist to determine risk at the site.

7.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

7.1 General

Based on the results of our preliminary geotechnical investigation, it is our opinion that the proposed residential development of the site is feasible from a geotechnical standpoint. Preliminary geotechnical recommendations for design planning are discussed in the following sections. A design-level geotechnical report will be required to develop geotechnical recommendations for final design, including drilling and sampling geotechnical borings, performing laboratory testing to confirm engineering parameters and detailed engineering analyses.

The subsurface conditions near north of Lemon Creek (Lot 1 through Lot 13) consist of soils with a high potential for variable settlements. The proposed structures may be supported on mat foundations established on at least 3 feet thick of mechanically stabilized layer (MSL) to mitigate possible differential settlement. The MSL is a reinforced subgrade which consists of aggregate base reinforced by multiple layers of multi-axial geogrids. Details design of MSL should be performed during design-level geotechnical report.

The subsurface conditions near south of Lemon Creek (Lot 14 through Lot 20) consists of alluvium underlain by sandstone bedrock. The proposed structures may be supported on shallow foundations established on properly compacted fill soils or undisturbed native soils and/or bedrock.

The subsurface soils adjacent to the Lemon Creek and near Lot 20 through Lot 27 consists of alluvial deposits, which are susceptible to liquefaction when saturated. The seismically-induced settlement is estimated to be on an order of 4 inches. In addition, lateral displacement (lateral spread) is estimated to be on an order of 3 inches. The limit of the liquefiable alluvial deposit should be defined in design level geotechnical investigation. If the proposed structures are underlain by soils that are susceptible for liquefaction, the structure may be supported on mat foundations. Alternatively, the structures may be supported on piles.

The proposed single span bridge should be supported on deep foundation extending into bedrock.

Based on the results of the stability analyses discussed in this Appendix, it is our opinion that global stability is not an issue if proper engineered mitigation is developed. The proposed structures may be setback from the adjacent slope in accordance with Section 1808.7 of 2022 California Building Code. No other special structural setback is required.

The onsite soils have expansion indices greater than 50 and may be classified as medium expansion. We recommend that the upper two feet of soils below the floor slab be removed and

replaced with non-expansive compacted soils and the floor slab may be supported on grade. Otherwise, the floor slabs may be designed to accommodate medium expansion subgrade.

The proposed paving, concrete walkways, and hardscapes should be supported on at least 2 feet thick of non-expansive compacted fill soils.

In areas where structures straddle transitions from bedrock to fill or alluvium, a 5 foot removal and recompaction of uniform fill below foundations and floor slabs is recommended.

7.2 Site Preparation and Grading

Any suspected fill or any loose soils should be removed and recompacted. In addition, demolition activities may create disturbance of near surface soils, which will also require removal and recompaction. The actual limits for removals or recompaction should be determined during design-level geotechnical investigation. For preliminary planning, we recommend that a minimum of 5 feet below the building pad and 2 feet below the hardscape, flatworks, or pavement should be overexcavated and replaced with properly compacted fill soils.

Where excavations are deeper than about 4 feet, the sides of the excavations should be sloped back at 1:1 (horizontal to vertical) or shored for safety. Unshored excavations should not extend below a plane drawn at 1½:1 (horizontal to vertical) extending downward from adjacent existing footings. We would be pleased to present data for design of shoring if required.

Structural fill or backfill should be compacted to at least 95 percent of the maximum dry density. Fill placed in non-structural areas should be compacted to at least 90 percent of the maximum dry density. The moisture content of the on-site soils at the time of compaction should vary no more than 2% below or above optimum moisture content. The moisture content of the on-site clayey soils at the time of compaction should be between 2% and 4% above optimum moisture content.

All fills should be keyed and benched through all topsoil, slope wash, alluvium or colluvium or creep material into firm material where the slope receiving fill is steeper than 5:1 (Horizontal: Vertical) or as determined by Geotechnical Engineer. The standard acceptable bench height is four feet into suitable material. The key for side hill fills should be a minimum of 15 feet within alluvium or firm materials, with a minimum toe embankment of 2 feet into firm alluvium, unless otherwise specified by the Geotechnical Engineer.

Recommendations for foundation design provided herein are preliminary.

7.3 Preliminary Foundation Recommendations

7.3.1 Mat Foundation

A mat foundation established on improved ground may be designed to impose an average net dead-plus-live load pressure of up to 2,000 pounds per square foot. The allowable bearing pressure may be increased by one-third when considering temporary loads associated with wind and seismic loading. The recommended bearing value is a net value, and the weight of concrete in the footings can be taken as 50 pounds per cubic foot; the weight of soil backfill can be neglected when determining the downward loads.

7.3.2 Spread Footings

Spread footings extending at least one foot into the undisturbed natural soils or properly compacted fill soils and at least 2 feet below the floor slab or lowest adjacent grade, may be designed to impose a net dead-plus-live load pressure of 2,000 pounds per square foot. The allowable bearing pressure may be increased by one-third when considering temporary loads associated with wind and seismic loading. The recommended bearing value is a net value, and the weight of concrete in the footings can be taken as 50 pounds per cubic foot.

7.3.3 Pile Foundation (Bridge)

The proposed bridge may be supported on cast-in-drilled hole concrete pile foundation extending into bedrock. We recommend that a foundation report (FR) should be prepared during design-level geotechnical investigation when details of bridge structural feature is available. The FR should be prepared in accordance with the Caltrans Geotechnical Manual for Foundation Reports for Bridges. We recommend that a bridge engineer should be involved during design phase of the project.

7.4 Floor Slab

The onsite soils have expansion indices greater than 50, and may be classified as medium expansion. We recommend that the upper two feet of soils below the floor slab be removed and replaced with non-expansive compacted soils and the floor slab may be supported on grade. Otherwise, the floor slabs may be designed to accommodate medium expansion subgrade.

If the proposed residential structures are supported on pile foundations, the floor slabs should be structurally supported.

The slab on grade may be supported on native soils, or properly compacted subgrade. To reduce the potential for moisture transmission through slabs where moisture sensitive covering will be installed, moisture barriers and control may be required.

7.5 Retaining Wall

For design of cantilevered retaining walls (unrestrained along the height of the wall), where the surface of the backfill is level, it may be assumed that drained soils will exert a lateral pressure equal to that developed by a fluid with a density of 35 pounds per cubic foot. In addition to the recommended earth pressure, the walls should be designed to resist any applicable surcharges due to foundation, storage, or traffic loads. For backslope inclination of up to 2:1 behind the retaining wall, it may be assumed that drained soils will exert a lateral pressure equal to that developed by a fluid with a density of 50 pounds per cubic foot.

7.6 Seismic Design Parameters per CBC 2022/ASCE 7-22

Seismic design acceleration parameters were developed per the 2022 California Building Code (CBC) and ASCE 7-22 (ASCE/SEI 7-22) for the proposed project and are presented in Table 2. Based on the underlying geology, subsurface exploration data, and shear wave velocity estimates from the CPTs, the site classification for seismic design is Site Class D per Chapter 20 of ASCE 7-16. The site coordinates used in our seismic hazard analysis are -117.8656 (Longitude) and 34.0236 (Latitude).

Table 3. Mapped Seismic Design Acceleration Parameters

Latitude: 34.0236 ° Longitude: -117.8656°	
Site Class	D
Mapped MCE Spectral Response Acceleration at Short Period (S_S)	1.75g
Mapped MCE Spectral Response Acceleration at Period of 1 Second (S_1)	0.62g
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.7
Adjusted MCE Spectral Response Acceleration at Short Period (S_{MS})	1.75g
Adjusted MCE Spectral Response Acceleration at Period of 1 Second (S_{M1})	1.05g
Design Earthquake Spectral Response Acceleration at Short Period (S_{DS})	1.17g
Design Earthquake Spectral Response Acceleration at Period of 1 Second (S_{D1})	0.70g
Peak Ground Acceleration Adjusted for Site Class (PGA_M)	0.82g

Per Section 11.4.8 of ASCE 7-16, a site-specific ground motion hazard analysis is required for "structures on Site Class D and E sites with S_1 greater than or equal to 0.2", unless certain exceptions are met.

According to updated Section 11.4.8 of ASCE 7-16 Supplement 3, a site-specific ground motion hazard analyses is not required where the value of the S_{M1} is increased by 50%. Therefore, if site-specific ground motion analysis is not performed for the project, the revised spectral response acceleration at 1 second provided below should be used for design.

- S_{M1} = 1.58g
- S_{D1}= 1.05g

7.7 Soil Corrosion Potential

Two representative sample of the near-surface material were tested for evaluating corrosion characteristics. The results indicate the test sample had pH of 7.5, and 7.8; a water-soluble sulfate content of 0.002 %, and a soluble chloride content of less than 0.01 %. The sulfate results indicate that sulfate exposure to Portland cement is moderate.

The test sample was also found to have a minimum measured electrical resistivity of less than 1,000 Ohm-cm. The following correlation can generally be used between electrical resistivity and corrosion potential:

Electrical Resistivity (Ohm-Cm)	Corrosion Potential
Less than 1,000	Severe
1,000 to 2,000	Corrosive
2,000 to 10,000	Moderate
Greater than 10,000	Mild

Based on the laboratory test results, the test sample is classified as corrosive to buried metals. Further evaluation/testing and recommendations for corrosion protection should be provided by a corrosion consultant during design-level geotechnical investigation.

7.8 Stormwater Infiltration

Infiltration tests were performed at three locations as shown on Figure 2. Test wells were installed in each boring. The wells consisted of 2-inch diameter PVC pipe. The bottom of the pipe was slotted in the zone to be tested. The bottom end of the pipe was capped. In the slotted zone coarse sand backfill was used. Above the slotted zone the backfill bentonite chips were placed.

Before performing the infiltration tests, each well was filled with water to saturate the soils and attempt to develop a steady state of flow within the test zone.

Following saturation, falling head permeability tests were conducted in each test well in accordance with Los Angeles County Administrative Manual (GS200.1, 2021). The well casing was filled with water and then the level of water in the well was recorded at 10 minute intervals until the difference in last three consecutive readings are within 10%.

The determination of the infiltration rates is based upon the test procedure and calculations discussed in the Administrative Manual GS200.1. Both the in-field and calculated infiltration rate for each of our boring percolation test locations is shown in Table 4.

Table 4: Infiltration Rates

Test ID (Boring)	Soil Type	Test Interval Depth (feet)	Calculated Infiltration Rate (in/hr)
I-1	ML/CL	2-5	0.2
I-2	ML/CL	0-5	0.2
I-3	ML/CL	0-5	0.1

Based on the GS200.1, the required minimum design infiltration rate is 0.3 inches per hour. The site soils consist predominantly of fine grained materials. Therefore, storm water infiltration is not considered feasible at the site. In addition, to prevent water saturate the adjacent slope which may potentially result in slope stability, we recommend that the bottom of the bioretention basins should be lined with an impermeable liner.

8.0 LIMITATIONS

This geotechnical feasibility report was prepared in accordance with generally accepted Geotechnical Engineering principles and practice. The professional engineering work and judgments presented in this report meet the standard of care of our profession at this time. No other warranty, expressed or implied, is made. This report has been prepared for the Spring Meadows Homes, LLC, and their consultants. It may not contain sufficient information for other parties for other purposes or other projects and should not be used for other projects without review and approval by Group Delta. ***This feasibility report will not be sufficient to obtain a building permit from the City. A design-level geotechnical investigation will be required prior to developing final plans for the project.***

9.0 REFERENCES

American Society for Testing and Materials, ASTM International (ASTM), 2008, Annual Book of Standards, Volumes 4.08 and 4.09, Soil and Rock.

California Building Code (CBC), 2019, published by International Code Council, Inc., Illinois, California.

California Geological Survey (CGS), 1997, Seismic Hazard Zone Report for the Anaheim 7.5-Minute Quadrangle, Orange County, California, Seismic Hazard Zone Report 012

California Geological Survey (CGS), 1998, State of California Seismic Hazard Zones Map, Anaheim Quadrangle, Orange County, California, March 25, 1999.

California Geological Survey (CGS), 2011, California Geological Survey Map Sheet 59, Reported Historic Asbestos Mines, Asbestos Prospects, and other Natural Occurrences of Asbestos in California.

County of Los Angeles Department of Public Works (LADPW), 2021, "Guidelines For Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration, GS200.1", Revision on June 30, 2021.

County of Los Angeles Department of Public Works (LADPW), 2014, "Liquefaction/Lateral Spread, GS045.0", Revision on October 1, 2014.

Dibblee, T.W. and Minch, J.A., 2002, Geologic map of the San Dimas and Ontario quadrangles, Los Angeles and San Bernardino Counties, California, Dibblee Foundation Map DF-91, 1:24,000.

Geologismiki, CLiq Version 3.3.1.14, CPT Liquefaction Assessment Software, 2021.

Morse Planning Group, 2019, Brookside Project Draft Environmental Impact Report Volume 1A. https://www.cityofwalnut.org/home/showpublisheddocument/13799

Office of Statewide Health Planning and Development (OSHPD), U.S. Seismic Design Maps, [Online] https://seismicmaps.org/ (accessed September 15, 2021)

United States Geological Survey (USGS), U.S. Seismic Design Maps, [Online] http://geohazards.usgs.gov/designmaps/us/application.php (accessed September 15, 2021)

United States Geological Survey (USGS), 2019, Unified Hazard Tool, [Online] https://earthquake.usgs.gov/hazards/interactive/ (accessed September 15, 2021)

United States Geological Survey (USGS), Quaternary Faults in Google Earth, [Online] http://earthquake.usgs.gov/hazards/qfaults/google.php (accessed September 15, 2021)

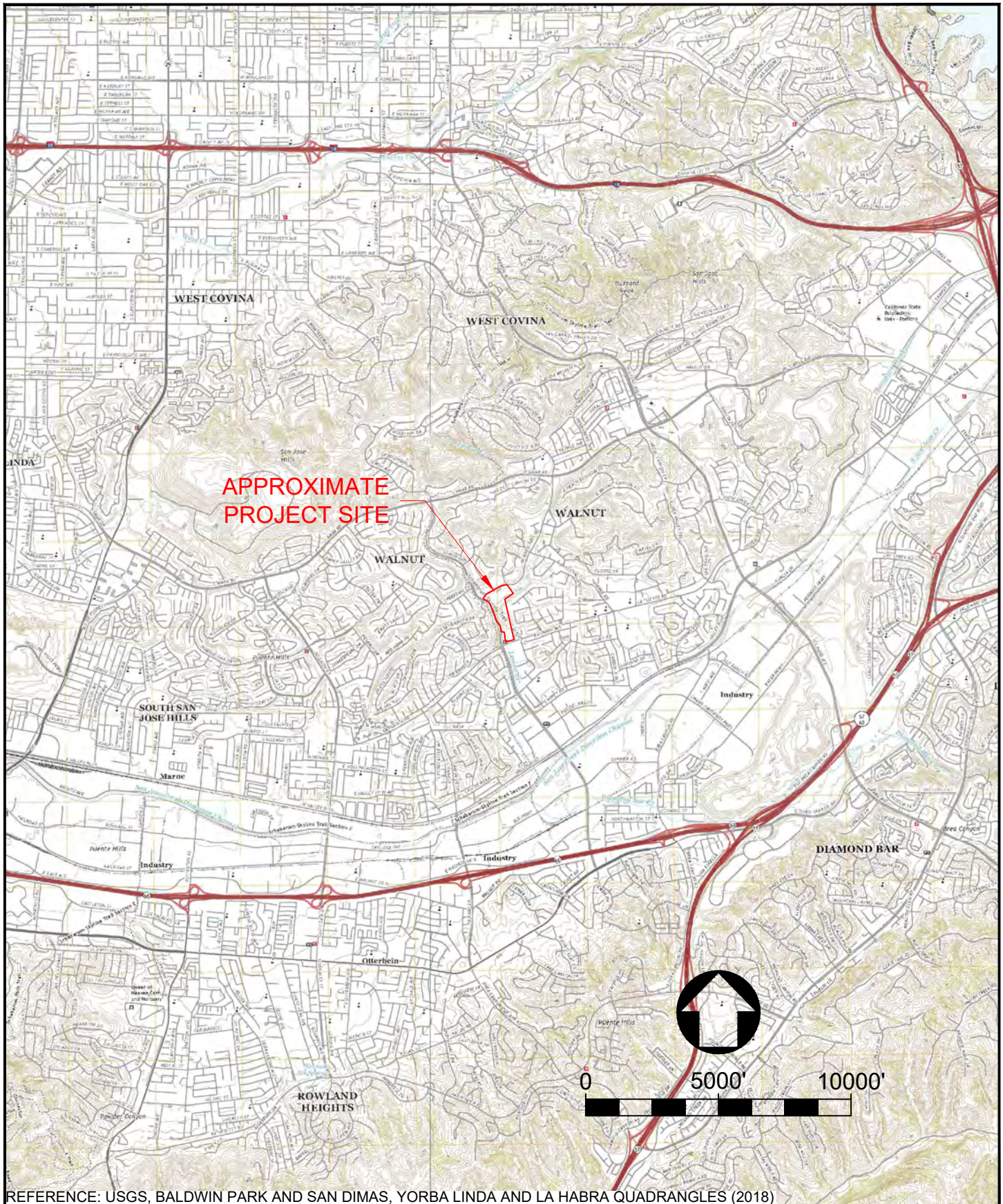
Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833.

Yerkes, R.F., et. Al., 1971, Geology of the Los Angeles Basin- An Introduction, Geological Survey Professional Paper 420-A.

Yerkes, R.F., 1973, Geology and Oil Resources of the Western Puente Hills Area, Southern California, Geological Survey Professional Paper 420-C.

Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180.

FIGURES



REFERENCE: USGS, BALDWIN PARK AND SAN DIMAS, YORBA LINDA AND LA HABRA QUADRANGLES (2018)

DATE: 08/04/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	SITE VICINITY MAP	PROJECT NUMBER: LA1579
REVIEWED BY: AP	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -				THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	FIGURE NUMBER: 1

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 1.dwg
PLOTTED DATE: 8/4/2022 10:50:07 AM SAVED BY: josemiguelt

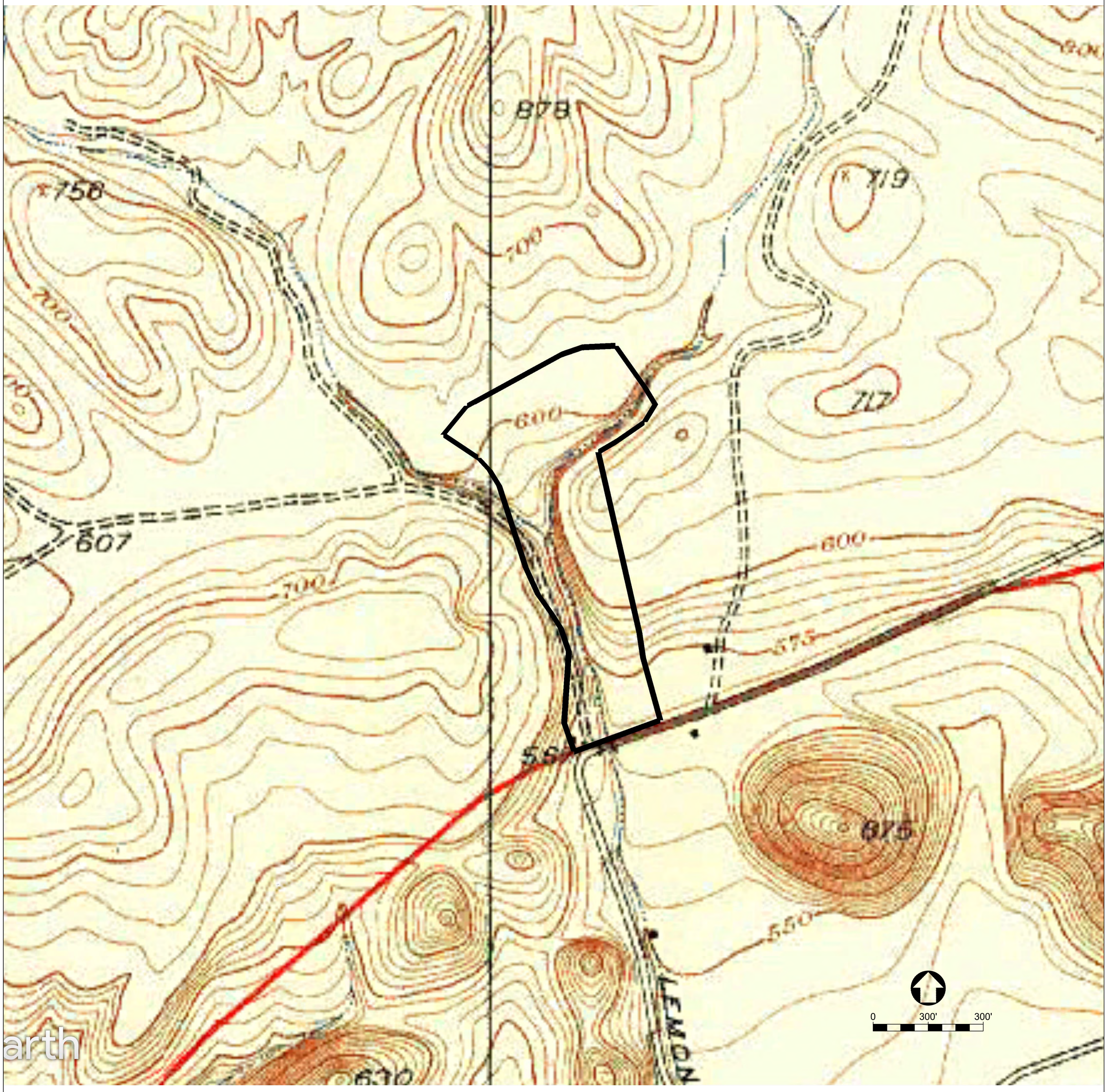


LEGEND:

af	ARTIFICIAL FILL, LOCALIZED PATH CROSSING
Qa	ALLUVIAL DEPOSITS, CLAYEY
Qc	COLLUVIAL DEPOSITS, CLAYEY
Tpsq	SOQUEL MEMBER, PUENTE FORMATION, SANDSTONE AND SILTSTONE INTERBEDDED
TP-5	APPROXIMATE TEST PIT LOCATION
B-21	APPROXIMATE BORING LOCATION
I-3	PREVIOUS APPROXIMATE INFILTRATION TEST LOCATION (GROUP DELTA, 2019)
B-14	PREVIOUS APPROXIMATE BORING LOCATION (GROUP DELTA, 2013)
C-17	PREVIOUS APPROXIMATE CPT LOCATION (GROUP DELTA, 2013)
A A'	CROSS SECTION LOCATION

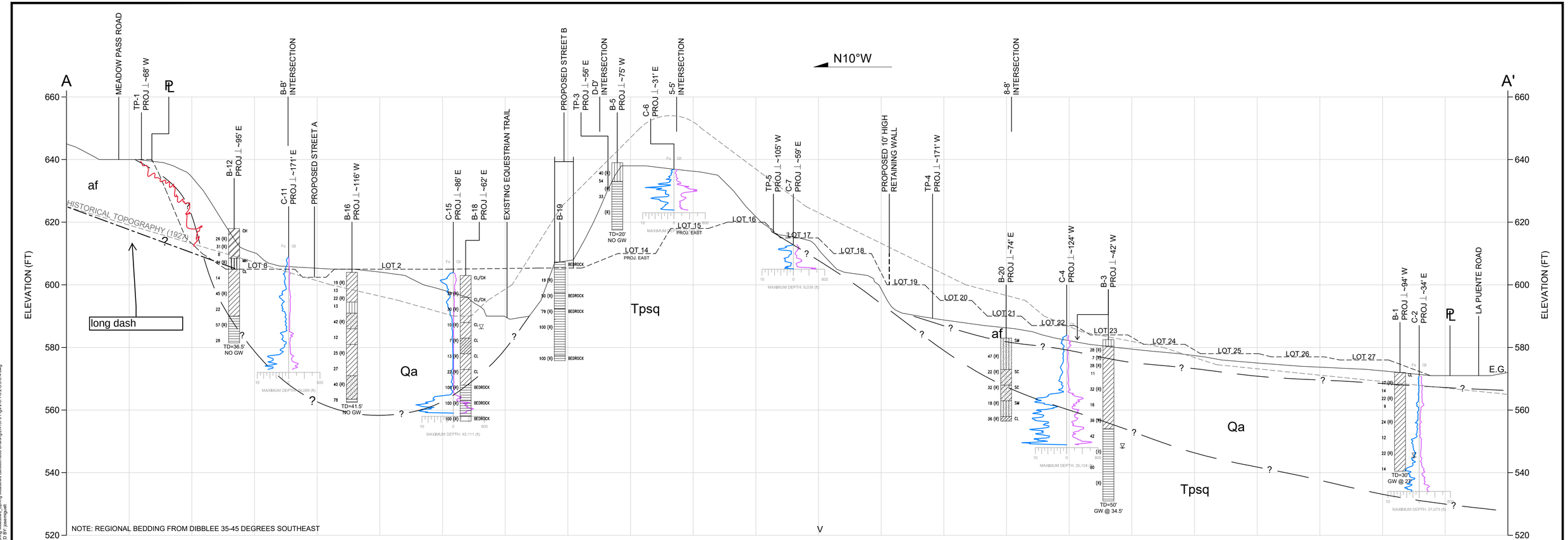
DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	EXPLORATION AND GEOLOGY MAP THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVIEWED BY: MEA/MAS/ET	APPROVED BY: -			PROJECT NUMBER: LA1579 SCALE: AS SHOWN FIGURE NUMBER: 2
REVISED: -				

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs-2-3-1-3-2-3-3-3-4.dwg
PLOTTED DATE: 3/2/2023 11:53:08 AM SAVED BY: josemiguelt



DATE: 03/03/2023	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	HISTORICAL TOPOGRAPHIC MAP THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	PROJECT NUMBER: LA1579
REVIEWED BY: MEA	APPROVED BY: -				SCALE: AS SHOWN
REVISED: -					FIGURE NUMBER: 2A

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows, Spring Meadows Geotech\600 Drafting\LA1579 Fig 2A.dwg
PLOTTED DATE: 3/2/2023 2:48:21 PM SAVED BY: joaemiguel

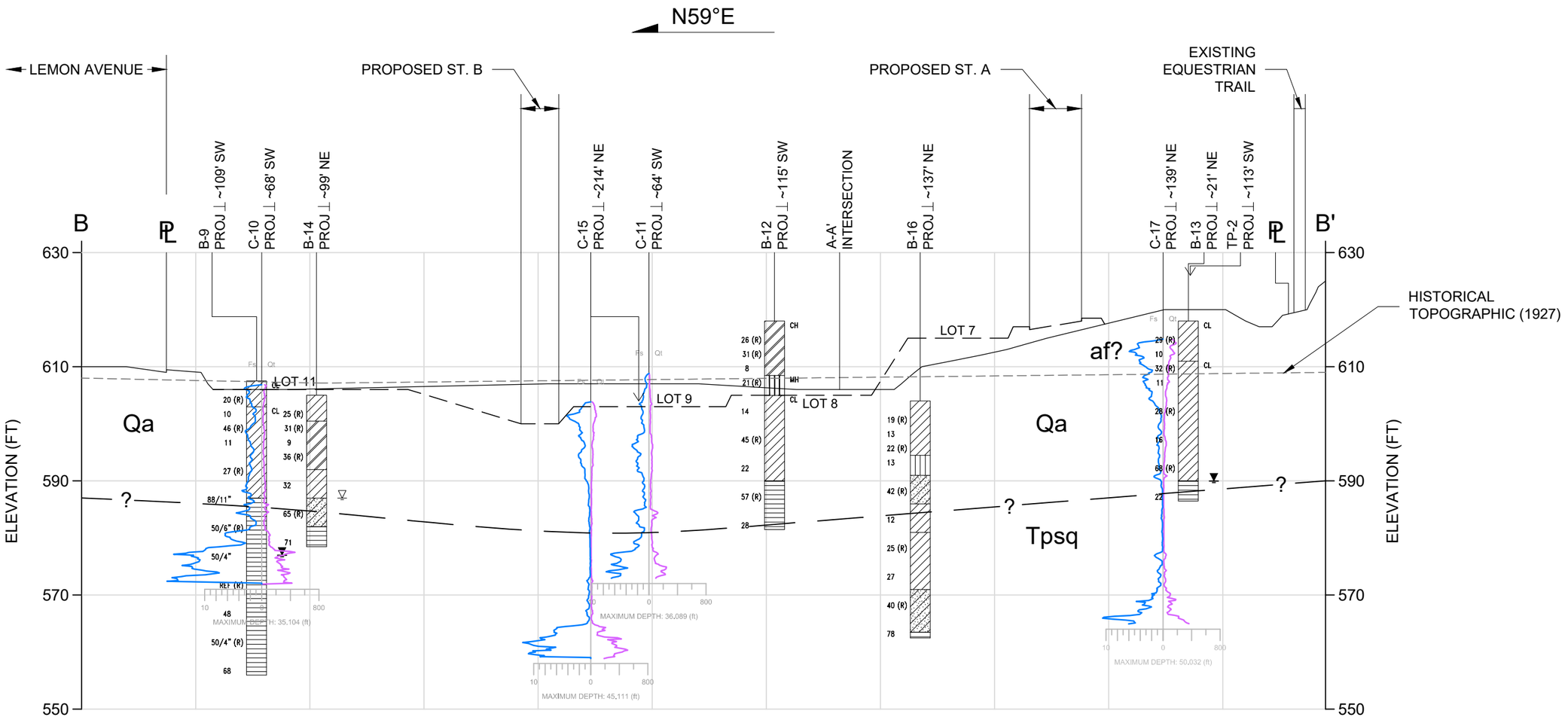


LEGEND:

af	POSSIBLE FILL (CL/ML)	Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)
Qc	MASSIVE COLLUVIUM	GL	GRADING LIMIT
Qa	ALLUVIUM		HISTORICAL TOPOGRAPHY (1927)
Qor	ORGANIC RICH CLAY AND SILT		EXISTING GRADE
			PROPOSED GRADE
		?	GEOLOGY
			BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
			GROUNDWATER ENCOUNTERED DURING DRILLING

DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION A-A'
REVIEWED BY: MEA/MAS	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			PROJECT NUMBER: LA1579 SCALE: AS SHOWN FIGURE NUMBER: 3.1

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 3-2-1-3-2-3-3-3-4.dwg
PLOTTED DATE: 3/3/2023 7:15:38 AM SAVED BY: joseringuett



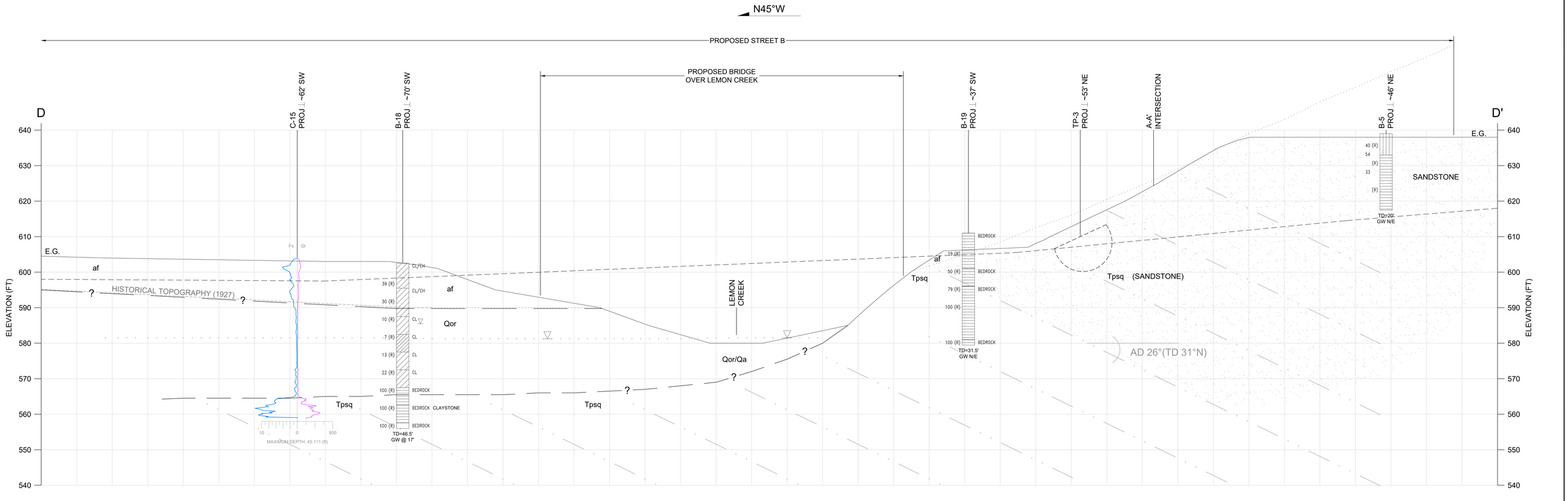
LEGEND:

af	POSSIBLE FILL (CL/ML)	—— ? ——	GEOLOGY
Qc	MASSIVE COLLUVIUM	—— · · ——	BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
Qa	ALLUVIUM	▽	GROUNDWATER ENCOUNTERED DURING DRILLING
Qor	ORGANIC RICH CLAY AND SILT		
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)		
GL	GRADING LIMIT		
– – – – –	HISTORICAL TOPOGRAPHY (1927)		
———	EXISTING GRADE		
— — —	PROPOSED GRADE		

V
20'
10'
SCALE (FT):
H
0' 50' 100'

DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION B-B'
REVIEWED BY: MEA/MAS	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			PROJECT NUMBER: LA1579 SCALE: AS SHOWN FIGURE NUMBER: 3.2

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 2-3.1-3.2-3.3-3.4.dwg
PLOTTED DATE: 3/3/2023 6:16:27 AM SAVED BY: joeringuett



LEGEND:

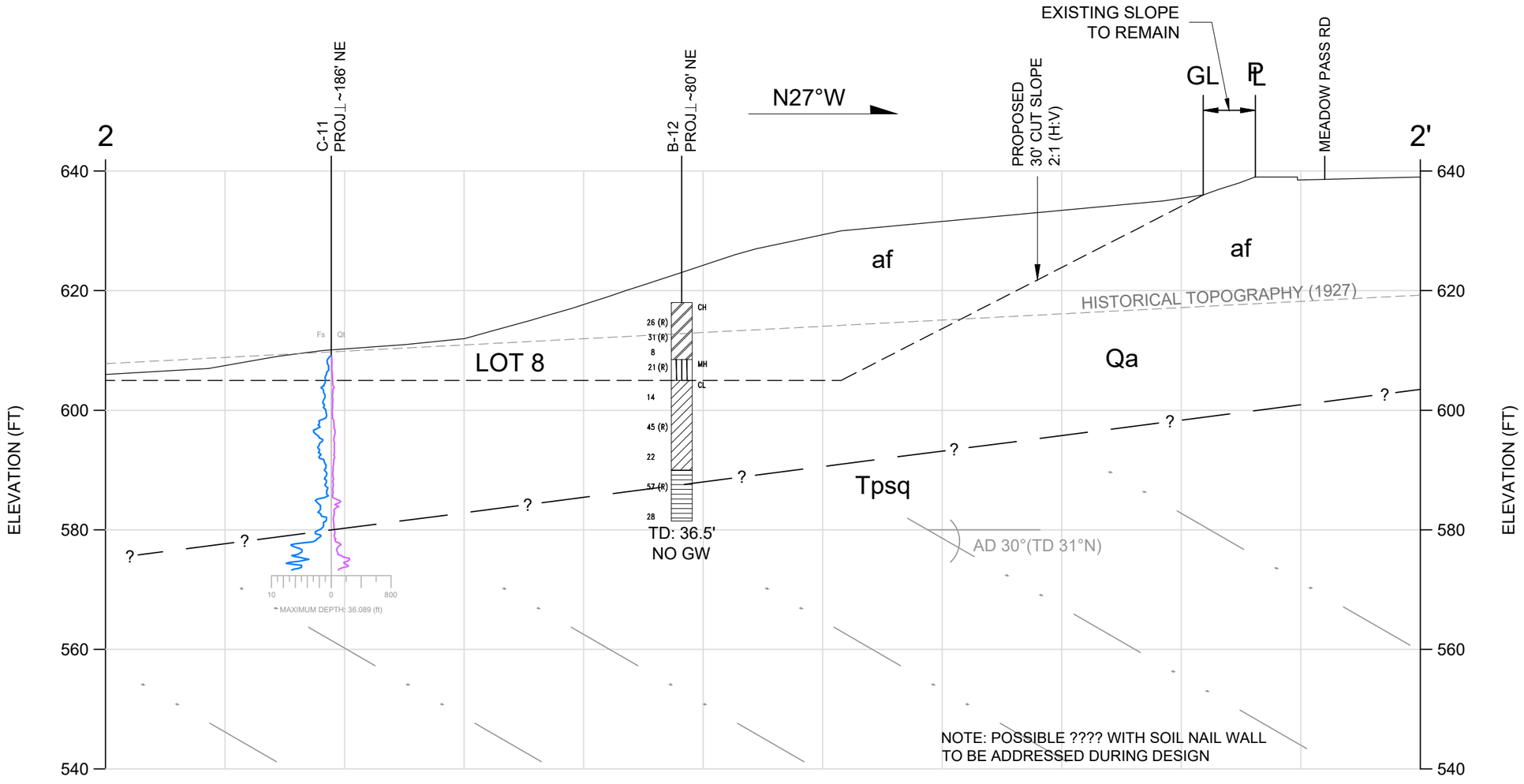
af	POSSIBLE FILL (CL/ML)
Qc	MASSIVE COLLUVIUM
Qa	ALLUVIUM
Qor	ORGANIC RICH CLAY AND SILT
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)
GL	GRADING LIMIT
	HISTORICAL TOPOGRAPHY (1927) (DOTTED WHERE ADJUSTED)
	PROPOSED GRADE
	EXISTING GRADE
—?—	GEOLOGY
	BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
	GROUNDWATER ENCOUNTERED DURING DRILLING, DOTTED WHERE INTERPRETED BETWEEN DATA POINTS

V
10'
5'
SCALE (FT):
0' 5' 10'
H

NOT TO SCALE

DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION D-D'
REVIEWED BY: MEA/MAS	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			PROJECT NUMBER: LA1579 SCALE: AS SHOWN FIGURE NUMBER: 3.3

X:\Projects\2022\LA1579 Walnut, 21515 S Nogales St\Drawings\Figures\Geotechnical\Cross Sections\Geotechnical Cross Sections.dwg, 3.3 D-D', 3/2/2023 3:14:29 PM, Meg



LEGEND:

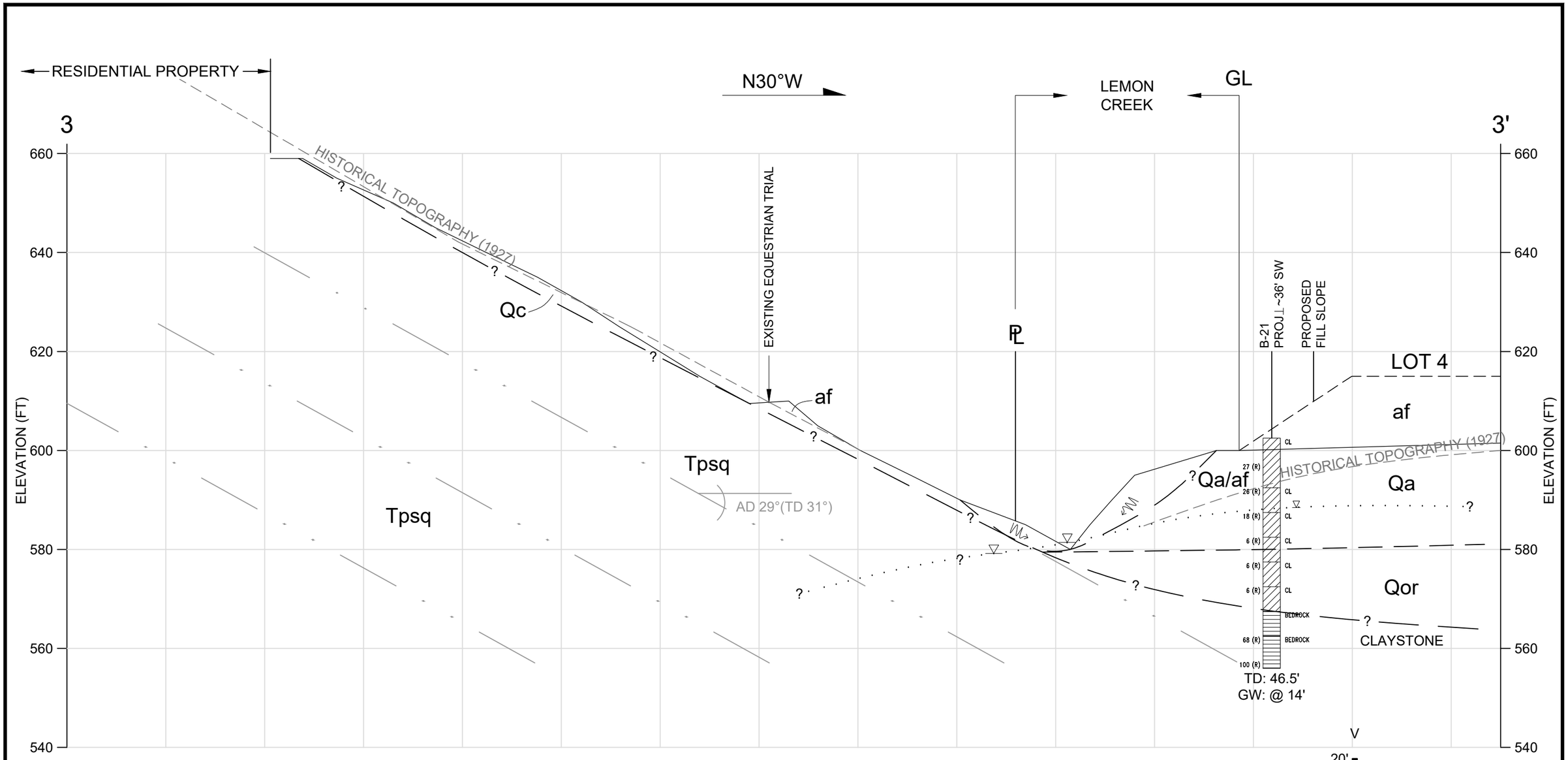
af	POSSIBLE FILL (CL/ML)	—— ? ——	GEOLOGY
Qc	MASSIVE COLLUVIUM	— · — · —	BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
Qa	ALLUVIUM	▽	GROUNDWATER ENCOUNTERED DURING DRILLING
Qor	ORGANIC RICH CLAY AND SILT		
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)		
GL	GRADING LIMIT		
– – – – – –	HISTORICAL TOPOGRAPHY (1927)		
————	EXISTING GRADE		
— — —	PROPOSED GRADE		

V
20'
10'
SCALE (FT):
H
0'
10'
20'

DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION 2-2'
REVIEWED BY: MEA/MAS	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			

PROJECT NUMBER: LA1579
SCALE: AS SHOWN
FIGURE NUMBER: 3.4

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 2-3,1-3,2-3,3-3,4.dwg
PLOTTED DATE: 3/2/2023 6:28:03 AM SAVED BY: josemiguel

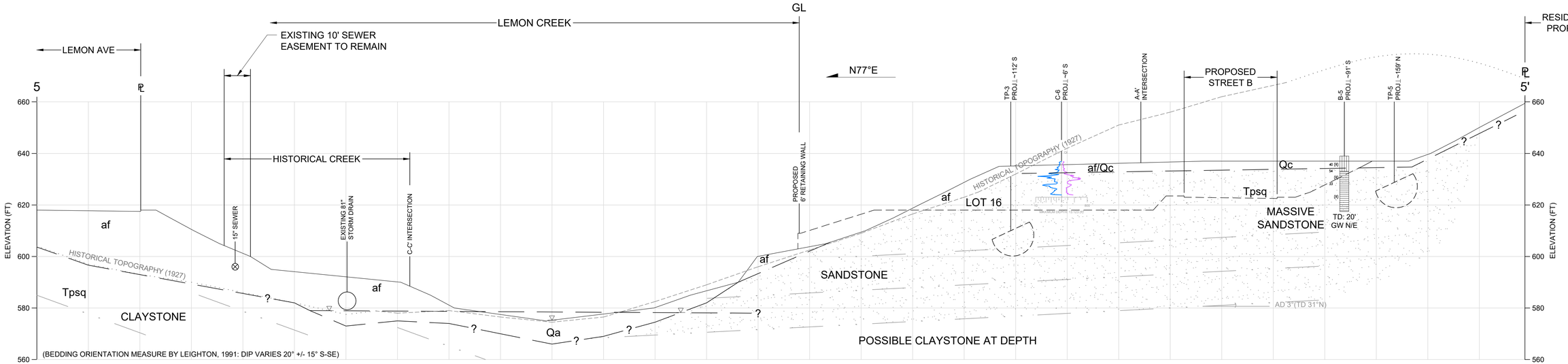


LEGEND:

af	POSSIBLE FILL (CL/ML)	?	GEOLOGY
Qc	MASSIVE COLLUVIUM		BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
Qa	ALLUVIUM		GROUNDWATER ENCOUNTERED DURING DRILLING
Qor	ORGANIC RICH CLAY AND SILT		CANYON WALL SLUMP DEBRIS
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)		
GL	GRADING LIMIT		
	HISTORICAL TOPOGRAPHY (1927)		
	EXISTING GRADE		
	PROPOSED GRADE		

DATE: 12/16/2022	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION 3-3'
REVIEWED BY: MAS/MEA	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			PROJECT NUMBER: LA1579 SCALE: AS SHOWN FIGURE NUMBER: 3.5

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 2-3.1-3.2-3.3-3.4.dwg
PLOTTED DATE: 3/3/2023 0:26:58 AM SAVED BY: josemiguel



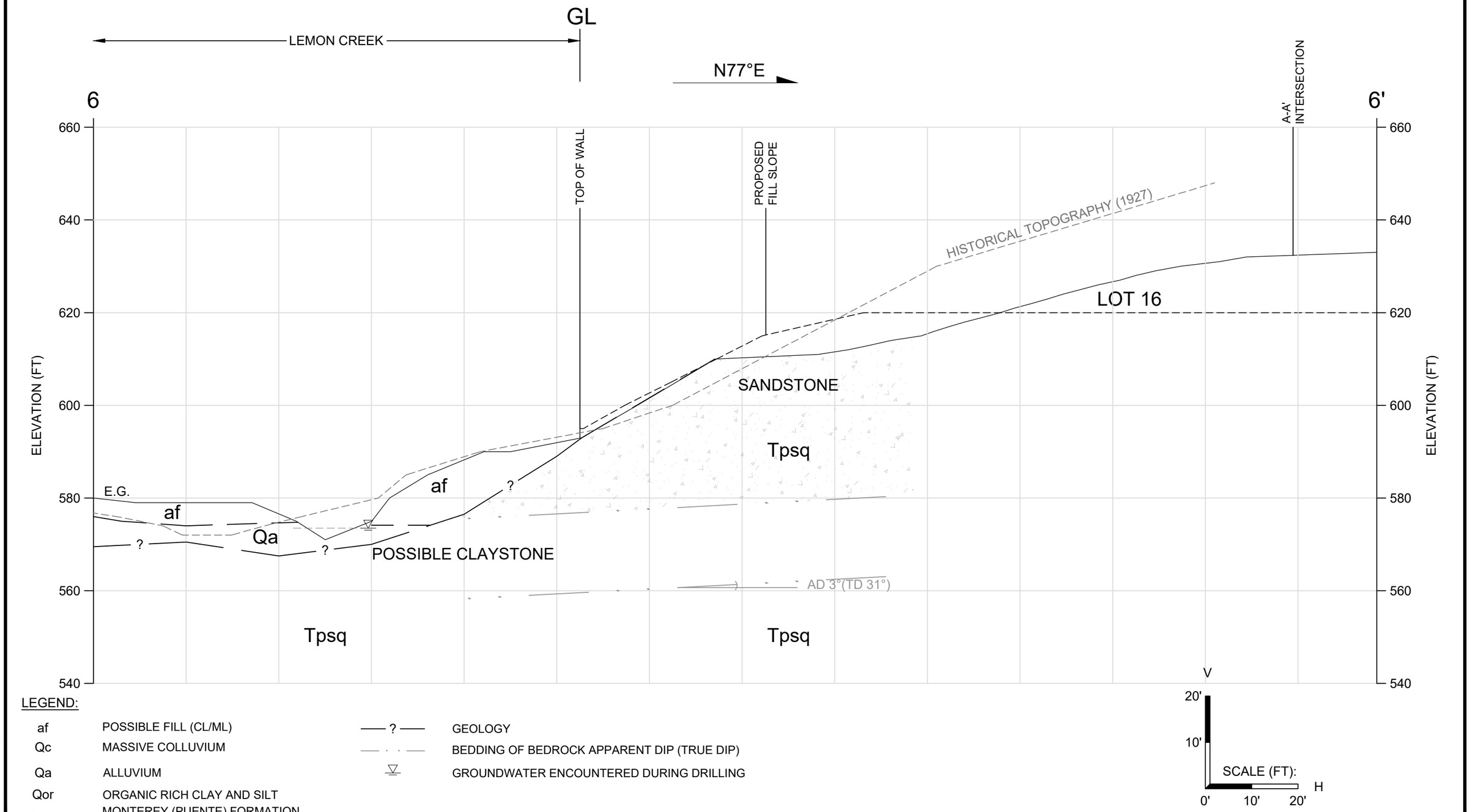
LEGEND:

af	POSSIBLE FILL (CL/ML)
Qc	MASSIVE COLLUVIUM
Qa	ALLUVIUM
Qor	ORGANIC RICH CLAY AND SILT
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)
GL	GRADING LIMIT
	HISTORICAL TOPOGRAPHY (1927)
	INTERPRETED
	EXISTING GRADE
	PROPOSED GRADE
?	GEOLOGY
	BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
▽	GROUNDWATER ENCOUNTERED DURING DRILLING

V
20'
10'
SCALE (FT):
0' 10' 20' H

DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION 5-5'
REVIEWED BY: MEA/MAS	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			PROJECT NUMBER: LA1579 SCALE: AS SHOWN FIGURE NUMBER: 3.5

FILE PATH: N:\Projects\1500_1699\LA1577 Zung Meadow_Zung Meadow Geotech\600 Drafting\LA1577 Fig 3.1-3.2-3.3-3.4.dwg
PLOTTED DATE: 3/3/2024 2:53:51 AM SAVED BY: jsanchez



LEGEND:

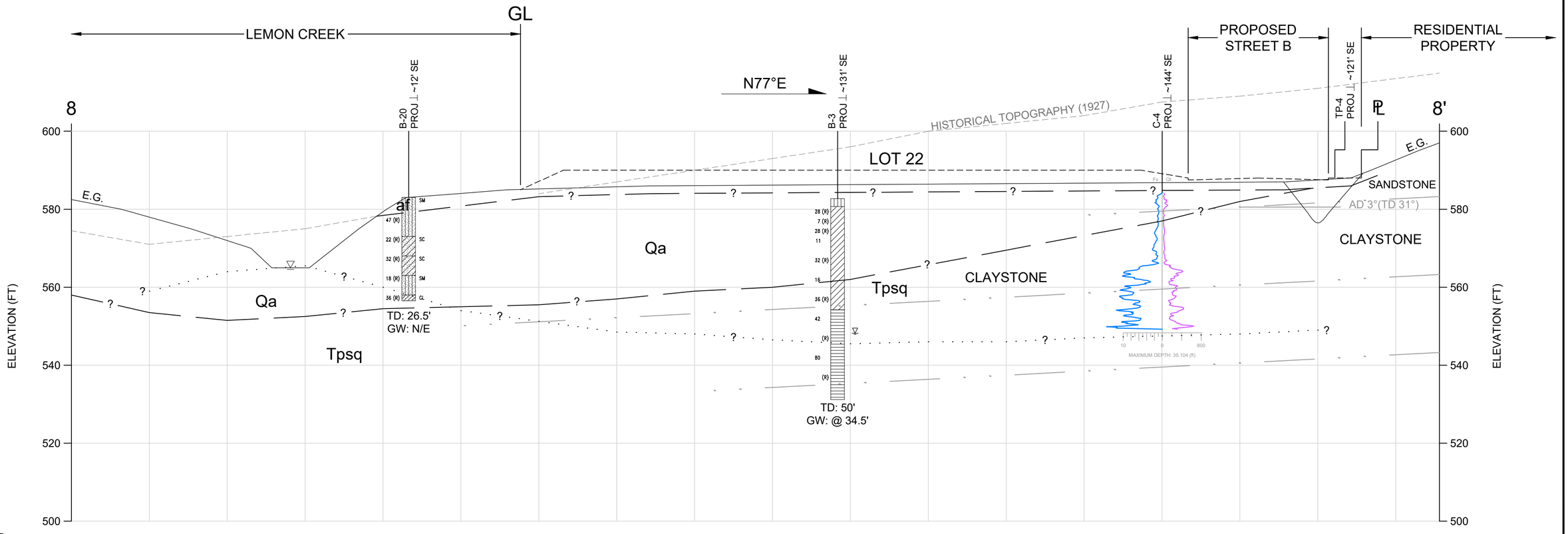
af	POSSIBLE FILL (CL/ML)	?	GEOLOGY
Qc	MASSIVE COLLUVIUM		BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
Qa	ALLUVIUM		GROUNDWATER ENCOUNTERED DURING DRILLING
Qor	ORGANIC RICH CLAY AND SILT		
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)		
GL	GRADING LIMIT		
	HISTORICAL TOPOGRAPHY (1927)		
	EXISTING GRADE		
	PROPOSED GRADE		

V
20'
10'
SCALE (FT):
H
0' 10' 20'

DATE: 03/03/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION 6-6'
REVIEWED BY: MEA/MAS	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			

PROJECT NUMBER: LA1579
SCALE: AS SHOWN
FIGURE NUMBER: 3.7

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 2-3.1-3.2-3.3-3.3.4.dwg
PLOTTED DATE: 3/3/2023 9:39:28 AM SAVED BY: jseemgatt



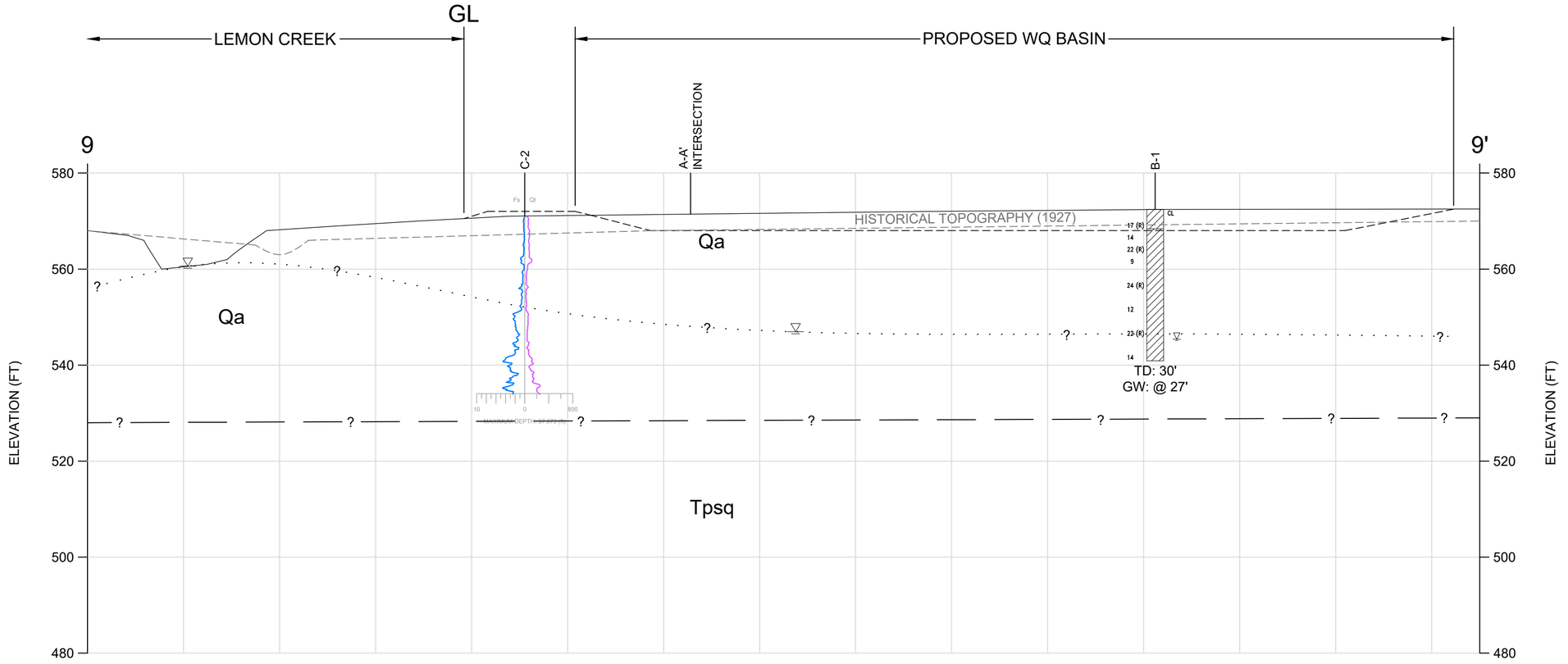
LEGEND:

af	POSSIBLE FILL (CL/ML)	?	GEOLOGY
Qc	MASSIVE COLLUVIUM		BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
Qa	ALLUVIUM		GROUNDWATER ENCOUNTERED DURING DRILLING, DOTTED WHERE INTERPRETED BETWEEN DATA POINTS
Qor	ORGANIC RICH CLAY AND SILT		
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)		
GL	GRADING LIMIT		
	HISTORICAL TOPOGRAPHY (1927)		
	EXISTING GRADE		
	PROPOSED GRADE		

V
20'
10'
SCALE (FT):
H
0' 10' 20'

DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	CROSS SECTION 8-8'
REVIEWED BY: MEA/MAS	APPROVED BY: -		THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			PROJECT NUMBER: LA1579 SCALE: AS SHOWN FIGURE NUMBER: 3.8

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 2-3.1-3.2-3.3-3.4.dwg
PLOTTED DATE: 3/3/2023 6:24:23 AM SAVED BY: joseimguell



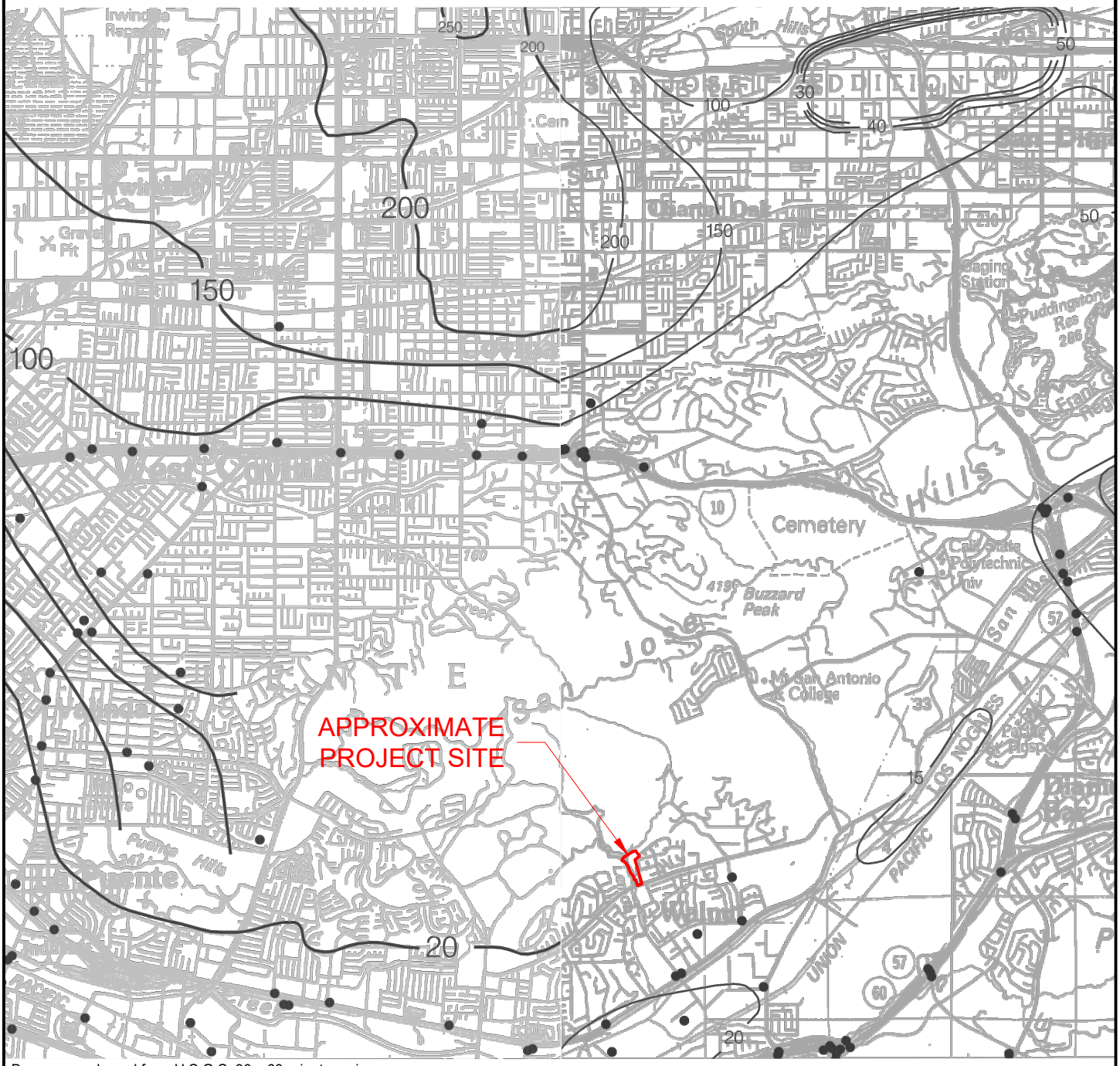
LEGEND:

af	POSSIBLE FILL (CL/ML)	——?——	GEOLOGY
Qc	MASSIVE COLLUVIUM	— · — · —	BEDDING OF BEDROCK APPARENT DIP (TRUE DIP)
Qa	ALLUVIUM	· · ▽ · ·	GROUNDWATER ENCOUNTERED DURING DRILLING, DOTTED WHERE INTERPRETED BETWEEN DATA POINTS
Qor	ORGANIC RICH CLAY AND SILT		
Tpsq	MONTEREY (PUENTE) FORMATION, SOQUEL MEMBER (SANDSTONE AND CLAYSTONE)		
GL	GRADING LIMIT		
– – – – –	HISTORICAL TOPOGRAPHY (1927)		
———	EXISTING GRADE		
— — —	PROPOSED GRADE		

V
20'
10'
SCALE (FT):
H
0' 10' 20'

DATE: 03/02/2023	DRAWN BY: JMT	GROUP DELTA CONSULTANTS, INC	CROSS SECTION 9-9'
REVIEWED BY: MEA/MAS	APPROVED BY: -	370 Amapola Ave. Suite 212 Torrance, CA. 90501	THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA
REVISED: -			PROJECT NUMBER: LA1579 / SCALE: AS SHOWN / FIGURE NUMBER: 3.9

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Figs 2-3-1-3-2-3-3-3-4.dwg
PLOTTED DATE: 3/3/2023 6:24:10 AM SAVED BY: joseminguell



Base map enlarged from U.S.G.S. 30 x 60-minute series

Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Baldwin Park and San Dimas Quadrangles.

● Borehole Site 30 Depth to ground water in feet

ONE MILE
SCALE

REFERENCE: CGS, 1998, SEISMIC HAZARD ZONE REPORT, PLATE 1.2
GROUND WATER, FOR BALDWIN PARK (SHZR 022) AND SAN DIMAS (SHZR 032)
7.5-MINUTE QUADRANGLES, LOS ANGELES, CALIFORNIA.

DATE: 08/05/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	HISTORICAL HIGHEST GROUND WATER	PROJECT NUMBER: LA1579
REVIEWED BY: -	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -				THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	FIGURE NUMBER: 4

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Fig 4.dwg
PLOTTED DATE: 8/5/2022 10:02:09 AM SAVED BY: josemiguelt

SAN DIMAS AND ONTARIO MAP (DF-91)

LEGEND

SURFICIAL SEDIMENTS

af | Qa | Qg

af *artificial fill*
Qg *alluvial gravel and sand of stream channels, some artificially channelized*
Qa *alluvial gravel and sand of valley areas*

Qls

LANDSLIDE AND TALUS RUBBLE

— UNCONFORMITY —

Qoa | Qog

OLDER, DISSECTED SURFICIAL SEDIMENTS

Qoa *low remnants of elevated alluvial gravel*
Qog *high remnants of elevated older alluvial gravel, including coarse boulder gravel*

— UNCONFORMITY —

SEDIMENTARY AND VOLCANIC ROCKS

Tscg | Tscs

SYCAMORE CANYON FORMATION

Sycamore Canyon Formation (uppermost member of Puente Formation of Durham & Yerkes 1964, Tan 1998) shallow marine clastic; latest Miocene age.
Tscg *conglomerate, light gray, of cobbles and pebbles of plutonic rocks in sandstone matrix.*
Tscs *sandstone, light gray, similar to **Tms**. Includes some conglomerate similar to **Tscg**, and siltstone.*

Tm | Tmy | Tmcg | Tms | Tmlv

MONTEREY (PUENTE) FORMATION

Monterey Formation (Puente form of Eldridge & Arnold, 1907, Durham & Yerkes 1964: Tan 1998, marine biogenic & clastic; late Miocene age, (Mohnian Stage))
Tm *unassigned shale; similar to **Tmlv** & **Tmly***
Tmy *Yorba shale Member – light gray, thin bedded, diatomaceous, semi-siliceous to clay shale, siltstone, minor sandstone; fish scales.*
Tmcg *conglomerate facies of cobbles & pebbles of plutonic rocks in sandstone matrix lenses in unit **Tms**, deposited as submarine deltas.*
Tms *Soquel sandstone facies, partly intertongued into **Tmy** & **Tmlv**, light gray to tan, moderately lithified, bedded, arkosic, contains concretions, some interbedded silty shale, derived from plutonic terrane & deposited as submarine fans, unfossiliferous*
Tmlv *La Vida Shale Member, white, weathered; thin bedded, platy, siliceous shale, clay shale, and siltstone, some strata of tan dolomite and sandstone; fish scales, foraminifera.*

Tt | Ttc

TOPANGA FORMATION

(of Shelton, 1955; Tan. 1998; marine clastic; middle Miocene age, unfossiliferous, locally intertongued into Glendora volcanics). age late ? Miocene
Tt *sandstone, light gray to tan, moderately lithified, bedded, arkosic, locally pebbly, includes interbedded siltstone or clay shale.*
Ttc *conglomerate (Buzzard Peak Conglomerate member of Woodford et al. 1946, light gray to tan, semi-lithified, vaguely bedded, composed of cobbles and pebbles of mostly plutonic rocks in sandstone matrix.*

Tgv | Tgvc | Tgvb | Tgvp | Tgvt | Tgva | Tgvr | Tgve

GLENDORA VOLCANIC ROCKS

Glendora Volcanics (of Shelton, 1955, Tan, 1999; extrusive volcanic rocks; middle Miocene age locally intertongued into Topanga Formation). (radiometric age ±16 MA (Weigand, P.W., oral communication 2001)
Tgv *undifferentiated volcanic rock, mostly brown andesitic flows and breccias*
Tgvc *volcanic conglomerate, gray to brown, of volcanic detritus.*
Tgvb *basalt flows, gray to black, massive to vesicular.*
Tgvp *basaltic pelagonitic tuff & pillow lavas.*
Tgvt *rhyolitic tuff breccia, tan to white*
Tgva *andesite flows and flow breccias, brown, porphyritic, massive.*
Tgvr *rhyolitic-dacitic flows, tan to light brown, aphanitic, massive to flow-banded, hard, fractured*
Tgve *rhyolite-dacite breccia exposed only at Elephant Hill.*

— UNCONFORMITY —

CRYSTALLINE BASEMENT ROCKS

GRANITIC ROCKS

Tmda

MOUNTAIN MEADOWS DACITE

Mountain Meadows dacite (of Shelton 1955, Tan, 1999 intrusive into qd; early Miocene? Age)
Mda *dacite light gray, hard, massive, fine grained, contains small feldspar phenocrysts and biotite flakes.*

qd | qdb

QUARTZ DIORITIC PLUTONIC ROCKS

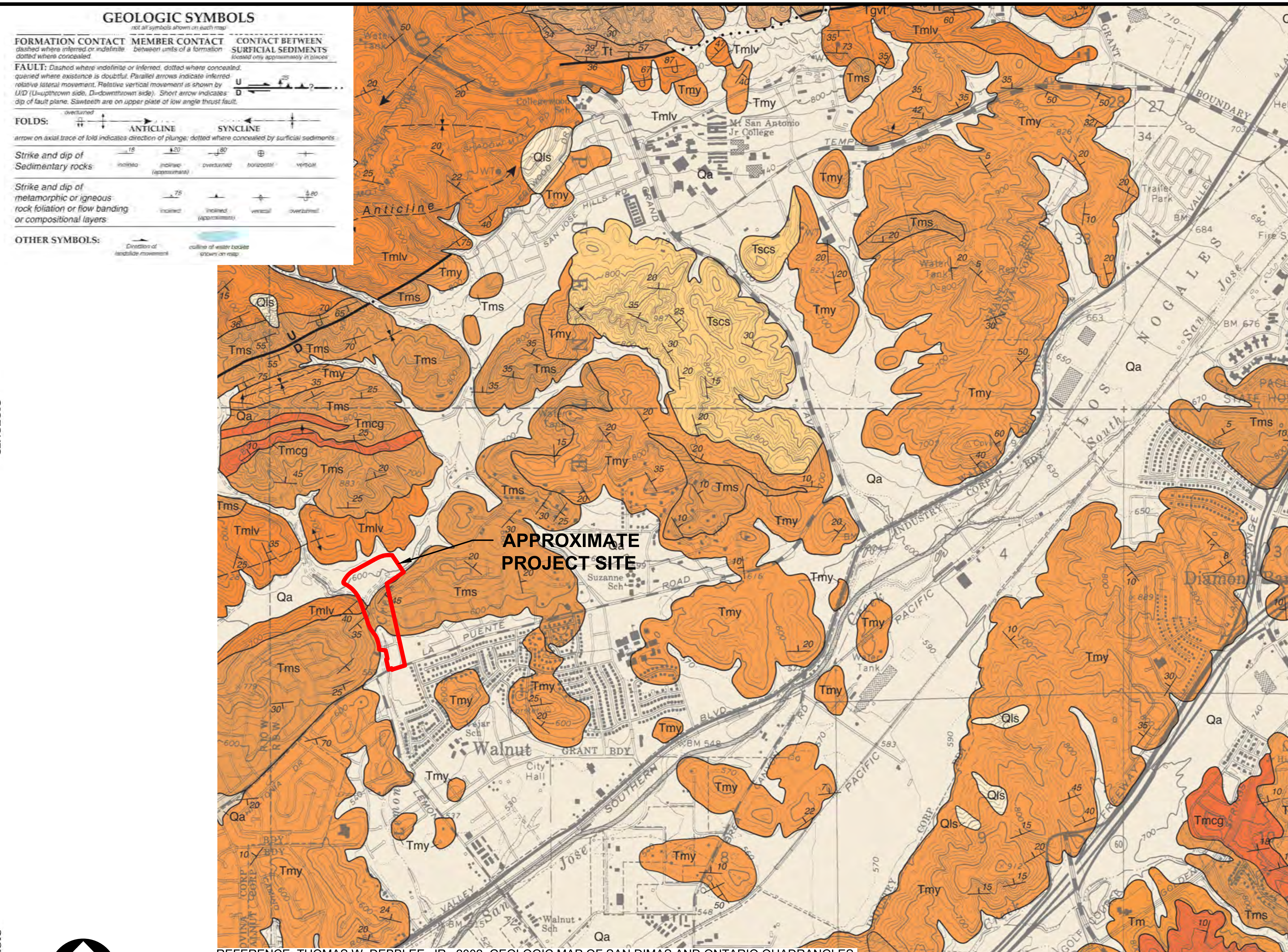
quartz diorite: plutonic igneous rock, late Mesozoic- Cretaceous age
qd *biotite quartz diorite, light gray, massive.*
qdb *Bonsall Tonalite of Larsen 1948 similar to **qd**, but slightly qneissoid & contains dark gray fine grained xenoliths elongated parallel to gneissoid structure up to 9 in. long.*

gr

GRANITIC ROCKS

leucocratic plutonic rocks range from granite to quartz monzonite, possibly granodiorite; intrusive (locally complexly) into all other crystalline rocks; age Cretaceous
gr *granitic rocks, gray-white to tan-white, hard but brittle, fine to medium grained, massive to rarely gnessoid, composed essentially of sodic plagioclase feldspar, K-feldspar, and quartz in nearly equal proportions, and minor amounts of biotile mica or minute flakes.*

Holocene | Pleistocene | QUATERNARY | Miocene | TERTIARY | CENOZOIC | CRETACEOUS | MESOZOIC

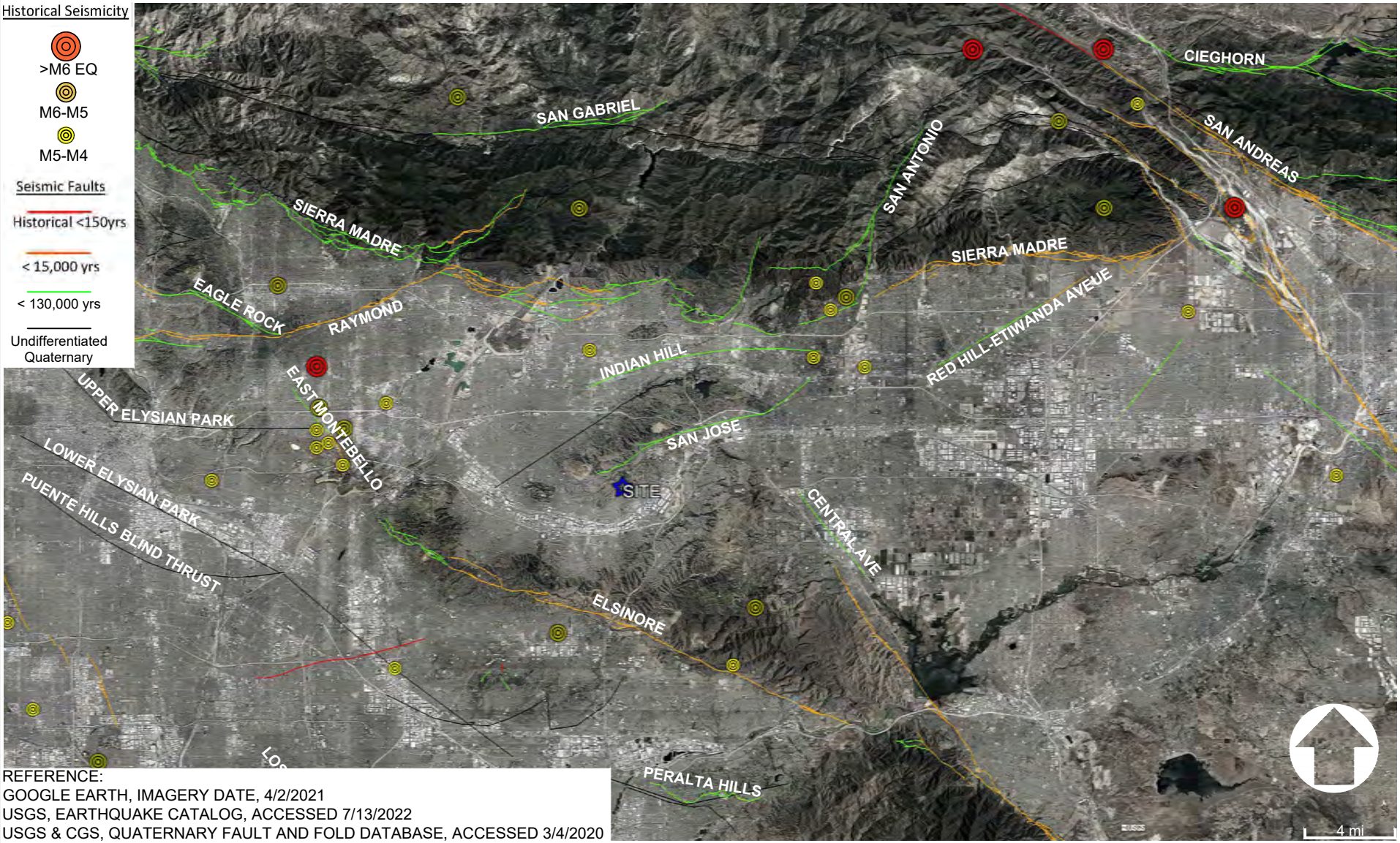


0 2000' 4000'

REFERENCE: THOMAS W. DEBBLEE, JR,. 2002, GEOLOGIC MAP OF SAN DIMAS AND ONTARIO QUADRANGLES

DATE: 09/14/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	REGIONAL GEOLOGY MAP	PROJECT NUMBER: LA1579
REVIEWED BY: -	APPROVED BY: -			THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	SCALE: ASHOWN
REVISED: -					FIGURE NUMBER: 5

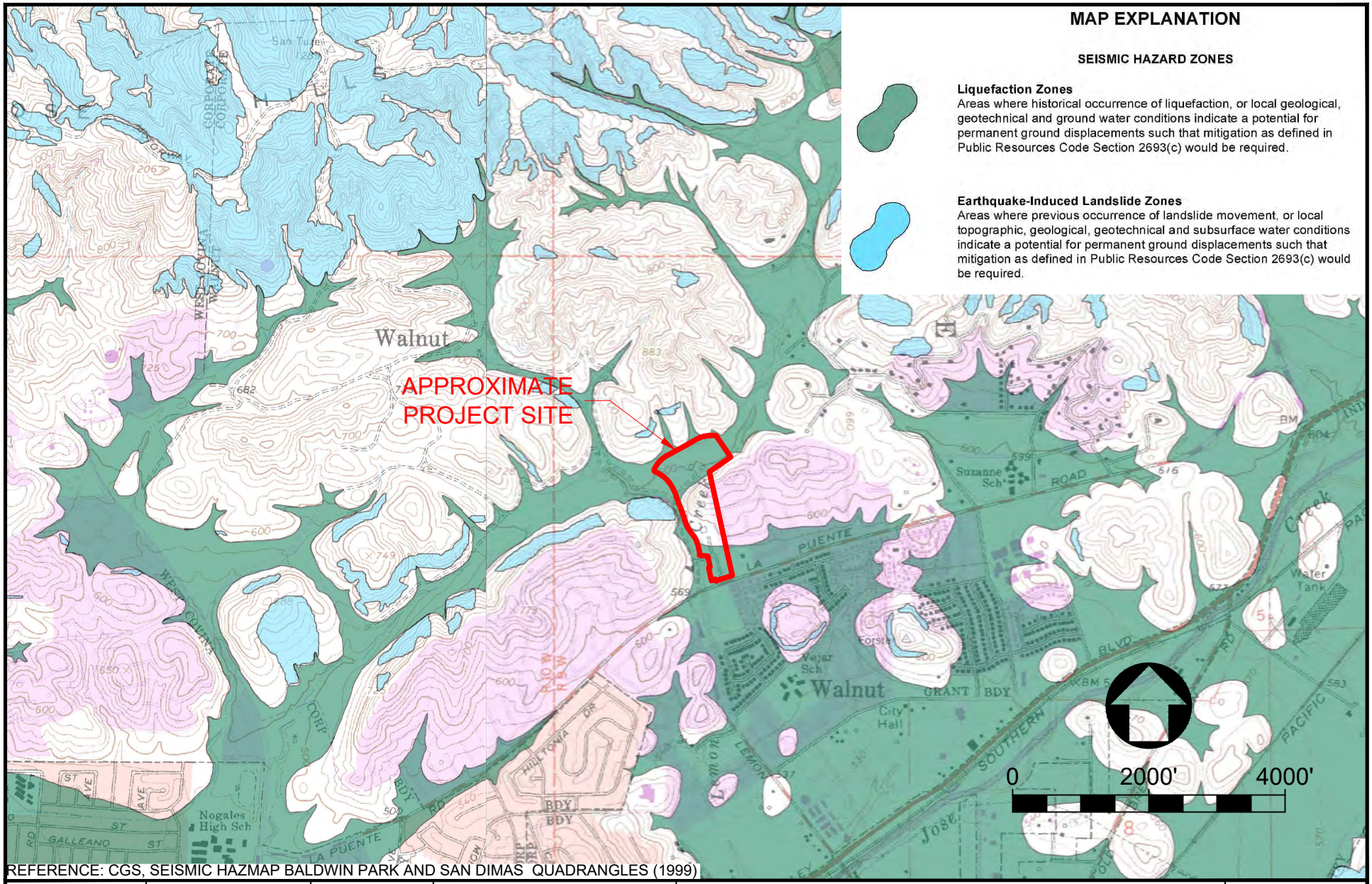
FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Fig 5.dwg
PLOTTED DATE: 9/14/2022 10:21:52 AM SAVED BY: josemiguelt



REFERENCE:
GOOGLE EARTH, IMAGERY DATE, 4/2/2021
USGS, EARTHQUAKE CATALOG, ACCESSED 7/13/2022
USGS & CGS, QUATERNARY FAULT AND FOLD DATABASE, ACCESSED 3/4/2020

DATE: 07/27/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	REGIONAL FAULT AND SEISMICITY MAP	PROJECT NUMBER: LA1579
REVIEWED BY: AP	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -				THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	FIGURE NUMBER: 6

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Fig 6.dwg
PLOTTED DATE: 7/27/2022 9:09:00 AM SAVED BY: josemiguelt

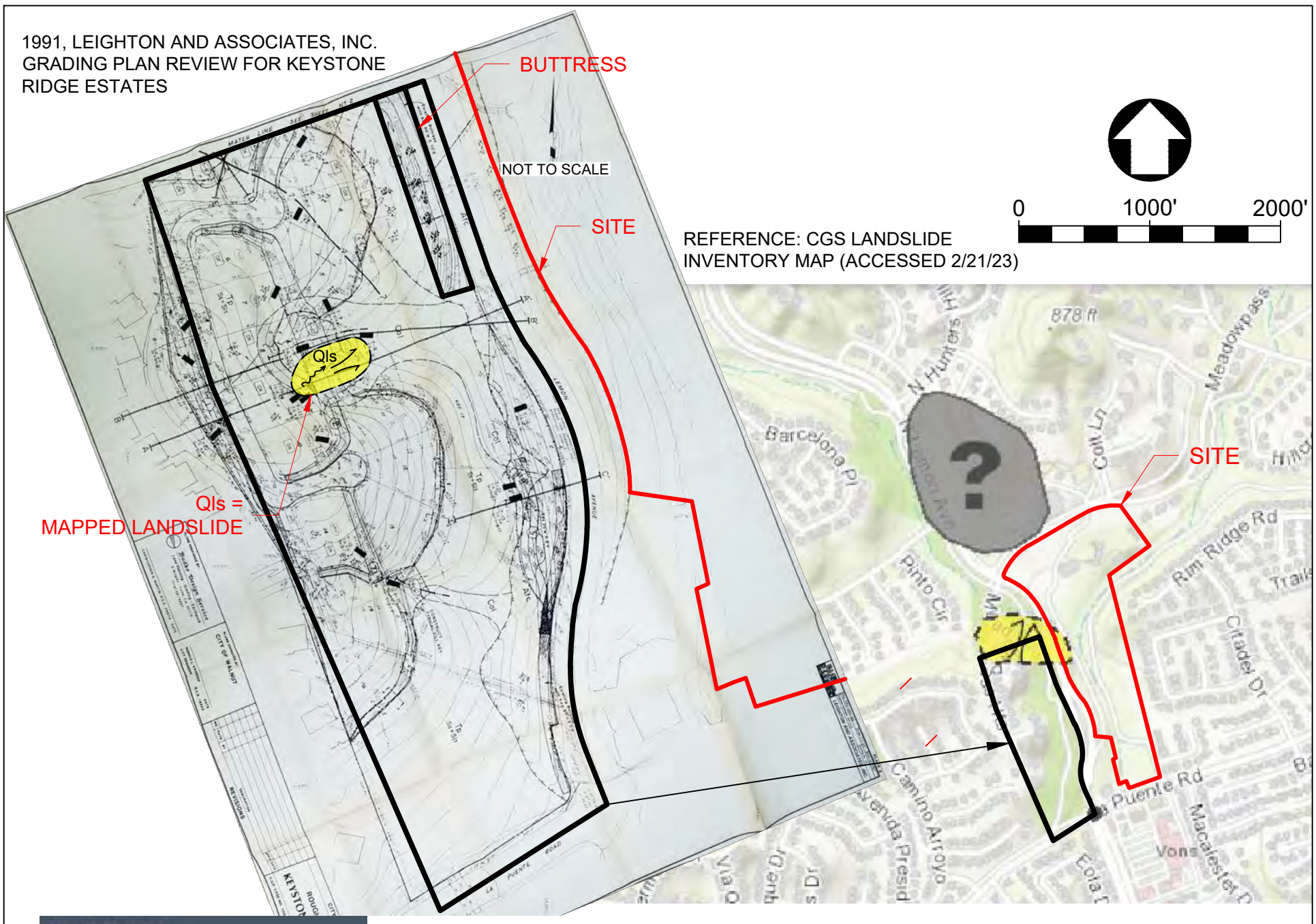


REFERENCE: CGS, SEISMIC HAZMAP BALDWIN PARK AND SAN DIMAS QUADRANGLES (1999)

DATE: 09/14/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	EARTHQUAKE ZONES OF REQUIRED INVESTIGATION MAP THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	PROJECT NUMBER: LA1579
REVIEWED BY: AP	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -					FIGURE NUMBER: 7

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Fig 7.dwg
PLOTTED DATE: 9/14/2022 10:21:12 AM SAVED BY: josemiguelt

1991, LEIGHTON AND ASSOCIATES, INC.
GRADING PLAN REVIEW FOR KEYSTONE
RIDGE ESTATES





Map Explanation

Landslide Inventory

- The landslide inventory is a work in progress. Portions of the data need review and cleaning, and data is not available for the entire state.
- The absence of mapped landslides in any particular location is not an indication that there are no landslides or of reduced susceptibility to landsliding.
- Mapping of landslides reflects the standards of the project and time the map was prepared. Many maps show landslide source areas (scarps) separate from landslide deposits, other maps combine scarps and deposits into a single feature. The amount of information recorded about each landslide has increased over time, so more information is available for more recently mapped landslides.

CGS Landslide Mapping

7.5-minute quadrangles that have some form of landslide mapping are indicated with a gray border. Not all quads are available in the inventory at present, and the absence of mapped landslides does not indicate that landslides are not present or that the area is less susceptible to landslides.

Landslide (Single Feature Detail):

Activity	dormant, relative age not specified
Slide Type	rock slide
Interpretation Confidence	probable (75% confident it is a landslide; one or two geomorphic features suggesting a landslide origin; features recognizable but subdued by erosion)
Thickness	moderate - 10 to 50 ft.
Direction of Movement	20
Year Mapped	1998
Citable Product	CGS, Seismic Hazard Zone Report 032

DATE: 03/09/2023	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	LANDSLIDE INVENTORY MAP THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	PROJECT NUMBER: LA1579
REVIEWED BY: MEA	APPROVED BY: -				SCALE: AS SHOWN
REVISED: -					FIGURE NUMBER: 8

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579-Landslide.dwg
PLOTTED DATE: 3/9/2023 10:49:27 AM SAVED BY: josemiguelt

APPENDIX A
CURRENT FIELD INVESTIGATION

APPENDIX A
CURRENT FIELD EXPLORATION

A.1 Introduction

Group Delta conducted supplemental subsurface explorations in November of 2022 as part of the additional geotechnical investigation for slope stability assessment for the Residential Development (Tentative Tract No. 72798) in Walnut, California. The explorations consisted of four (4) hollow-stem borings and five (5) test pit excavations. The exploration locations and numbers are shown in Figure 2 of the main report. A summary table of the recent field explorations conducted by Group Delta is provided in Table A-1.

Table A-1
Summary of Subsurface Explorations

Exploration No.	Date Performed	*Ground Surface Elevation (feet, MSL)	Total Depth (ft)	Groundwater Depth (ft)	Exploration Type
TP-1	11/1/22	635	8	Not Encountered	Test Pit
TP-2	11/1/22	625	10	Not Encountered	Test Pit
TP-3	11/2/22	610	12	Not Encountered	Test Pit
TP-4	11/2/22	595	10.8	Not Encountered	Test Pit
TP-5	11/2/22	628	7.8	Not Encountered	Test Pit
B-18	11/23/22	603	46.5	17	Hollow-Stem Auger
B-19	11/23/22	605	31.5	Not Encountered	Hollow-Stem Auger
B-20	11/23/22	587	26.5	Not Encountered	Hollow-Stem Auger
B-21	11/23/22	600	46.5	14	Hollow-Stem Auger

*Approximate ground surface elevations taken from Michael Baker International Tentative Tract Map (08/10/2022)

A.2 Borings

Hollow-stem auger borings were advanced to depths of 26.5 to 46.5 feet below the ground surface at different areas of the site. The borings were drilled on November 23, 2022, by 2R Drilling, Inc. (Group Delta's subcontractor) by way of a CME 75 drill rig. Borings B-18 and B-21 were conducted within the northern parcel and Borings B-19 and B-20 within the southern parcel. The ground surface elevations in the area of the borings ranged from approximately of 587 feet to 605 feet. The borings were performed under the supervision of a Group Delta field engineer, who maintained detailed logs of the soils and bedrock encountered, classified the materials in accordance with the Unified Soil Classification System (USCS) and the Caltrans Soil and Rock

Logging, Classification, and Presentation Manual (2010), obtained samples, and measured groundwater levels.

Driven samples and bulk samples of the encountered subsurface materials were obtained from the borings. Driven samples were collected with a Modified California Sampler lined with 1-inch-high brass sample rings. The Modified California sampler has an outside diameter of 3 inches, and a cutting shoe with an inside diameter of 2.42 inches. The driven samples were retained in brass rings, placed in sealed plastic canisters to prevent moisture loss, and transported to Group Delta's laboratory for testing and further evaluation. The Modified California samplers were driven into the soil and/or rock at the bottom of the borehole using a 140-pound hammer free-falling 30 inches. The penetration resistance (or "blow count") in blows per six inches of driving was recorded on the logs. Bulk samples were obtained at various depth ranges and placed into polyethylene bags.

A key for soil classification and a boring record legend are presented in Figures A-1a to A-1b and A-2a to A-2c, respectively. The boring logs are presented in Figures A-3a to A-6b.

A.3 Test Pit Excavations

A total of five (5) exploratory test pits were excavated on November 1 and November 2, 2022 throughout the site to assess the subsurface conditions, particularly as it related to characterizing the contacts between fill materials, native soils, and shallow bedrock. The test pits were excavated by SoCal Underground, Inc. (Group Delta's subcontractor) using a backhoe. The depths of the test pits ranged from 8 to 12 feet below the ground surface. The subsurface materials were visually classified and logged by Group Delta's field geologists. The soil and rock types were documented along with other pertinent physical characteristics (e.g., coloration, moisture condition, texture, presence of organics, etc.). Ring and bulk samples were retrieved from the pits at various depths for laboratory testing. After logging had been completed, the test pits were backfilled with the spoils of the excavations. The test pit logs are presented in Figures A-7 to A-11.

A.4 List of Attached Figures

The following figures are attached and complete this appendix:

Figures A-1a to A-1b Key for Soil Classification

Figures A-2a to A-2c Boring Record Legend

Figures A-3a to A-6b Group Delta Boring Logs

Figures A-7 to A-11 Group Delta Test Pit Logs

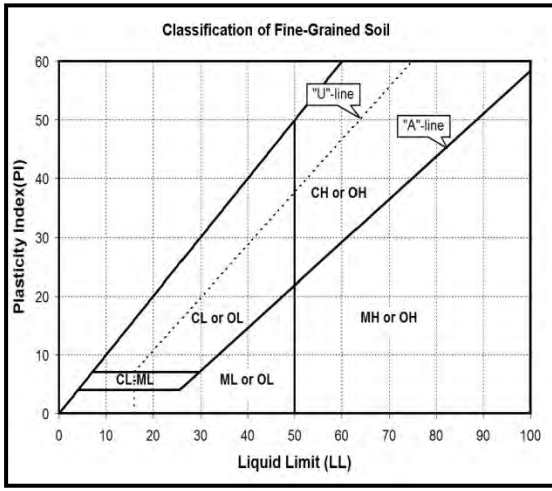
CLASSIFICATION OF INORGANIC FINE GRAINED SOILS (Soils with ≥50% finer than No. 200 Sieve)

GROUP SYMBOL				GROUP NAME
CL	<30% plus No. 200	<15% plus No. 200		Lean clay
		15-25% plus No. 200	%sand ≥%gravel	Lean clay with sand
			%sand <%gravel	Lean clay with gravel
	≥30% plus No. 200	% sand ≥ % gravel	<15% gravel	Sandy lean clay
			≥15% gravel	Sandy lean clay with gravel
		% sand < % gravel	<15% sand	Gravelly lean clay
			≥15% sand	Gravelly lean clay with sand
ML	<30% plus No. 200	<15% plus No. 200		Silt
		15-25% plus No. 200	%sand ≥%gravel	Silt with sand
			%sand <%gravel	Silt with gravel
	≥30% plus No. 200	% sand ≥ % gravel	<15% gravel	Sandy silt
			≥15% gravel	Sandy silt with gravel
		% sand < % gravel	<15% sand	Gravelly silt
			≥15% sand	Gravelly silt with sand
CH	<30% plus No. 200	<15% plus No. 200		Fat clay
		15-25% plus No. 200	%sand ≥%gravel	Fat clay with sand
			%sand <%gravel	Fat clay with gravel
	≥30% plus No. 200	% sand ≥ % gravel	<15% gravel	Sandy fat clay
			≥15% gravel	Sandy fat clay with gravel
		% sand < % gravel	<15% sand	Gravelly fat clay
			≥15% sand	Gravelly fat clay with sand
MH	<30% plus No. 200	<15% plus No. 200		Elastic silt
		15-25% plus No. 200	%sand ≥%gravel	Elastic silt with sand
			%sand <%gravel	Elastic silt with gravel
	≥30% plus No. 200	% sand ≥ % gravel	<15% gravel	Sandy elastic silt
			≥15% gravel	Sandy elastic silt with gravel
		% sand < % gravel	<15% sand	Gravelly elastic silt
			≥15% sand	Gravelly elastic silt with sand

Reference:
ASTM D 2487 and 2488

Laboratory Classification of Clay and Silt

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).



CL: LL<50; above A-Line.

CH: LL≥50; above A-Line.

ML: LL<50; below A-Line, or PI<4, or Non-Plastic

MH: LL≥50; below A-Line.

CL-ML: above A-Line and PI=4 to 7

CL/CH, ML/MH: at or near LL=50

ML/CL, MH/CH: at or near the A-Line

Field Identification of Clays and Silts

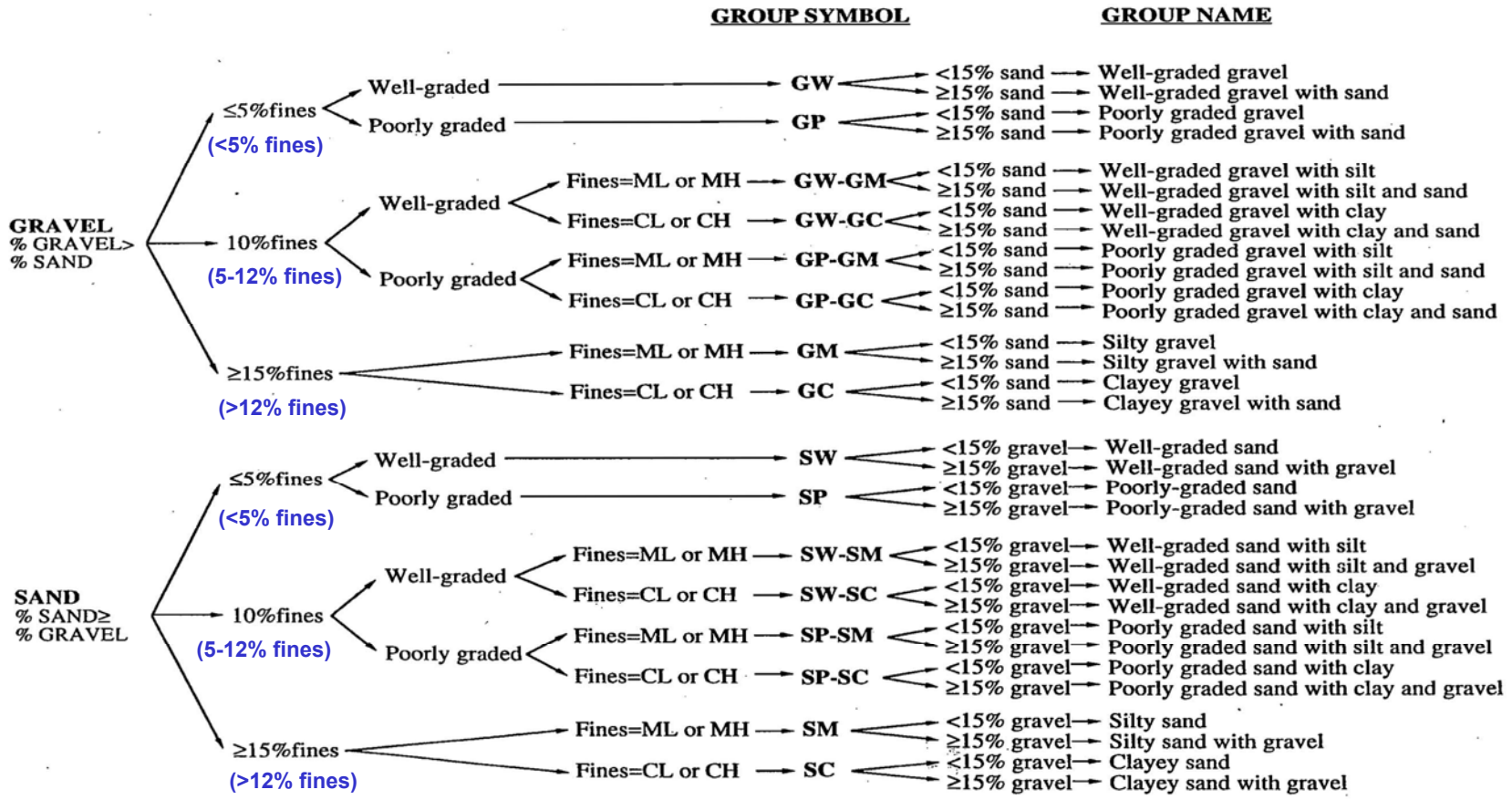
Group Symbol	Dry Strength	Dilatancy	Toughness	Plasticity
ML	None to low	Slow to rapid	Low or thread cannot be formed	Low to nonplastic
CL	Medium to high	None to slow	Medium	Medium
MH	Low to medium	None to slow	Low to medium	Low to medium
CH	High to very high	None	High	High

GROUP DELTA

Project No.: LA-1579

KEY FOR SOIL CLASSIFICATION #1
Figure A-1a

CLASSIFICATION OF COARSE-GRAINED SOILS (Soils with <50% "fines" passing No. 200 Sieve)



Reference:

ASTM D 2487 and 2488

Note: Values estimated to nearest 5% to be used for visual identification, values in parentheses to be used for classification when based on laboratory grain size data.

Granular Soil Gradation Parameters

Coefficient of Uniformity: $C_u = D_{60}/D_{10}$

Coefficient of Curvature: $Cc = D_{30}^2 / (D_{60} \times D_{10})$

D_{10} = 10% of soil is finer than this diameter

D_{30} = 30% of soil is finer than this diameter

D_{60} = 60% of soil is finer than this diameter

Group Symbol	Gradation or Plasticity Requirement
SW	$C_u > 6$ and $1 \leq C_c \leq 3$
GW	$C_u > 4$ and $1 \leq C_c \leq 3$
GP or SP	Clean gravel or sand not meeting requirement for SW or GW
SM or GM	Non-plastic fines or below A-Line or PI<4
SC or GC	Plastic fines or above A-Line and PI>7

GROUP DELTA

Project No.: LA-1579

KEY FOR SOIL CLASSIFICATION #2

Figure A-1b

SOIL IDENTIFICATION AND DESCRIPTION SEQUENCE

Sequence		Refer to Section		Required	Optional
		Field	Lab		
1	Group Name	2.5.2	3.2.2	●	
2	Group Symbol	2.5.2	3.2.2	●	
	Description Components				
3	Consistency of Cohesive Soil	2.5.3	3.2.3	●	
4	Apparent Density of Cohesionless Soil	2.5.4		●	
5	Color	2.5.5		●	
6	Moisture	2.5.6		●	
7	Percent or Proportion of Soil	2.5.7	3.2.4	●	◍
	Particle Size	2.5.8	2.5.8	●	◍
	Particle Angularity	2.5.9			○
	Particle Shape	2.5.10			○
8	Plasticity (for fine-grained soil)	2.5.11	3.2.5		○
9	Dry Strength (for fine-grained soil)	2.5.12			○
10	Dilatency (for fine-grained soil)	2.5.13			○
11	Toughness (for fine-grained soil)	2.5.14			○
12	Structure	2.5.15			○
13	Cementation	2.5.16		●	
14	Percent of Cobbles and Boulders	2.5.17		●	
	Description of Cobbles and Boulders	2.5.18		●	
15	Consistency Field Test Result	2.5.3		●	
16	Additional Comments	2.5.19			○

Describe the soil using descriptive terms in the order shown

Minimum Required Sequence:

USCS Group Name (Group Symbol); Consistency or Density; Color; Moisture; Percent or Proportion of Soil; Particle Size; Plasticity (optional).

◍ = optional for non-Caltrans projects

Where applicable:

Cementation; % cobbles & boulders;
Description of cobbles & boulders;
Consistency field test result

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010)

HOLE IDENTIFICATION

Holes are identified using the following convention:

H-YY-NNN

Where:
H: Hole Type Code
YY: 2-digit year
NNN: 3-digit number (001-999)

Hole Type Code	Description
A	Auger boring (hollow or solid stem, bucket)
R	Rotary drilled boring (conventional)
RC	Rotary core (self-cased wire-line, continuously-sampled)
RW	Rotary core (self-cased wire-line, not continuously sampled)
P	Rotary percussion boring (Air)
HD	Hand driven (1-inch soil tube)
HA	Hand auger
D	Driven (dynamic cone penetrometer)
CPT	Cone Penetration Test
O	Other (note on LOTB)

Description Sequence Examples:

SANDY lean CLAY (CL); very stiff; yellowish brown; moist; mostly fines; some SAND, from fine to medium; few gravels; medium plasticity; PP=2.75.

Well-graded SAND with SILT and GRAVEL and COBBLES (SW-SM); dense; brown; moist; mostly SAND, from fine to coarse; some fine GRAVEL; few fines; weak cementation; 10% GRANITE COBBLES; 3 to 6 inches; hard; subrounded.

Clayey SAND (SC); medium dense, light brown; wet; mostly fine sand,; little fines; low plasticity.

GROUP DELTA

GROUP DELTA CONSULTANTS, INC.
GEOTECHNICAL ENGINEERS AND GEOLOGISTS

FIGURE NUMBER A-2a

PROJECT NAME: Residential Development - Tentative Tract No. 72798

PROJECT NUMBER LA-1579

BORING RECORD LEGEND #1

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (after drilling, date)

DEFINITIONS FOR CHANGE IN MATERIAL

Term	Definition	Symbol
Material Change	Change in material is observed in the sample or core, and the location of change can be accurately measured.	———
Estimated Material Change	Change in material cannot be accurately located because either the change is gradational or because of limitations in the drilling/sampling methods used.	- - - - - - - -
Soil/Rock Boundary	Material changes from soil characteristics to rock characteristics.	~~~~~

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010)

GROUP DELTA

GROUP DELTA CONSULTANTS, INC.
GEOTECHNICAL ENGINEERS AND GEOLOGISTS

FIGURE NUMBER
A-2b

PROJECT NAME:
Residential Development - Tentative Tract No. 72798

PROJECT NUMBER
LA-1579

BORING RECORD LEGEND #2

CONSISTENCY OF COHESIVE SOILS

Descriptor	Shear Strength (tsf)	Pocket Penetrometer, PP Measurement (tsf)	Torvane, TV. Measurement (tsf)	Vane Shear, VS. Measurement (tsf)
Very Soft	< 0.12	< 0.25	< 0.12	< 0.12
Soft	0.12 - 0.25	0.25 - 0.50	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.50	0.50 - 1.0	0.25 - 0.50	0.25 - 0.50
Stiff	0.50 - 1.0	1.0 - 2.0	0.50 - 1.0	0.50 - 1.0
Very Stiff	1.0 - 2.0	2.0 - 4.0	1.0 - 2.0	1.0 - 2.0
Hard	> 2.0	> 4.0	> 2.0	> 2.0

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Descriptor		Size (in)
Boulder		> 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		< 1/300

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CONSISTENCY OF COHESIVE SOILS VS. N_{60}

Description	SPT N_{60} (blows / foot)
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	> 30

Ref: Peck, Hansen, and Thornburn, 1974, "Foundation Engineering", Second Edition

Note: Only to be used (with caution) when pocket penetrometer or other data on undrained shear strength are unavailable. Not allowed by Caltrans Soil and Rock Logging and Classificaton Manual, 2010

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010), with the exception of consistency of cohesive soils vs. N_{60}.

GROUP DELTA

GROUP DELTA CONSULTANTS, INC.
GEOTECHNICAL ENGINEERS AND GEOLOGISTS

FIGURE NUMBER A-2c

PROJECT NAME: Residential Development - Tentative Tract No. 72798

PROJECT NUMBER LA-1579

BORING RECORD LEGEND #3

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	B-18

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	46.5	603	▽ 17.0 / *586.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
CAL-Mod (2.4" I.D.)	N_{60}* = 1.0N_{MC}	AFTER DRILLING ▼ N/A / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	600		Bulk-1			22.83					EI			**COLLUVIUM (Qc)** Lean Cay / Fat Clay (CL/CH), hard, light olive brown with mottling, moist, few rock fragments, medium to high plasticity.
5			R-1	4 15 24	39	28.93	83.93			4.25				
	595		Bulk-2			20.92					EI			- very dark grayish brown, trace fine to medium sand, few rock fragments.
10			R-2	7 12 18	30	21.61	102.41			4				
	590		Bulk-3			22.58								
15			R-3	4 4 6	10					0.75	DS			Lean Clay with Sand (CL), medium stiff, dark grayish brown, very moist, mostly fines, little fine sand, medium plasticity. ▽ Groundwater at 17' bgs.
	585													
20			R-4	2 3 4	7					0.5	C DS			Sandy Lean Clay (CL), soft to medium stiff, dark gray, wet, mostly fines, some fine sand, medium plasticity.
	580													

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-3 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	B-18

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	46.5	603	▽ 17.0 / *586.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
CAL-Mod (2.4" I.D.)	N_{60}* = 1.0N_{MC}	▼ N/A / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-5	4 6 7	13	29.79	91.27			1.75				Lean Clay (CL), stiff, very dark grayish brown, moist, mostly fines, few fine sand, medium plasticity.
	575													
30			R-6	5 6 16	22	25.29	99.23			2.25				- very stiff, dark yellowish brown with gray mottling, trace fine gravel.
	570													
35			R-7	12 50/6"	100	14.91	120.61							**MONTEREY FORMATION BEDROCK (Tpsq)** Claystone, moderately hard, light olive brown with mottling, wet, slightly weathered.
	565													
40			R-8	43 50/3"	100	30.32	87.03							- olive brown
	560													
45			R-9	50/5"	100	24.12	93.23							- very dark gray, moderately weathered, some Sandstone interbeds. Total Depth: 46.5 feet bgs Groundwater encountered at 17ft bgs. Boring backfiled with soil cuttings.
	555													

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-3 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	**B-19**

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	31.5	611	▽ N/A / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
CAL-Mod (2.4" I.D.)	N_{60}* = 1.0N_{MC}	▼ N/A / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	610		Bulk-1											**COLLUVIUM (Qc)** Silty Sand, moderately hard, brown, dry, intensely weathered, friable, caliche stringers common.
5	605		R-1	4 6 13	19									
10	600		R-2	12 20 30	50									**CLAYSTONE** Moderately soft, friable, light olive brown with mottling, extremely weathered, caliche stringers common.
15	595		R-3	12 37 42	79									- moderately hard, yellow, less weathered
20	590		R-4	37 50/4"	100									

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-4 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	**B-19**

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	31.5	611	▽ N/A / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
CAL-Mod (2.4" I.D.)	N_{60}* = 1.0N_{MC}	▼ N/A / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
30	585													
	580		R-5	19 50/5"	100									- light olive brown with mottling, moderately weathered
														Total Depth: 31.5 feet bgs Groundwater not encountered. Boring backfiled with soil cuttings.
35	575													
40	570													
45	565													

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-4 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	**B-20**

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	26.5	583	▽ N/A / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
CAL-Mod (2.4" I.D.)	N_{60}* = 1.0N_{MC}	▼ N/A / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														FILL Silty Sand (SM), medium dense, pale brown, dry, mostly fine sand, some fines, few rock fragments.
	580		Bulk-1			16.49								
5			R-1	8 17 30	47	14.25	101.02							**ALLUVIUM (Qa)** Siltstone rock fragments, chaotic assemblage, angular, silty-clayey material, hard, dry.
	575													Clay, hard, dry, few gravel, some sand, brown.
10			R-2	5 8 14	22						C			Clayey Sand (SC), medium dense, dark brown, moist, mostly fine sand, some fines, few rock fragments, weakly cemented.
	570													
15			R-3	7 14 18	32	14.47	94.38							- yellowish brown
	565													
20			R-4	7 8 10	18						DS			Silty Sand with Gravel (SM), medium dense, pale brown, slightly moist, mostly fine sand, little fines, few gravel, weakly cemented.
	560													

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-5 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	**B-20**

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	26.5	583	▽ N/A / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
CAL-Mod (2.4" I.D.)	N_{60}* = 1.0N_{MC}	AFTER DRILLING ▼ N/A / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-5	8 15 21	36	16.08	109.30			>4.5				Sandy Lean Clay (CL), hard, dark brown, moist, mostly fines, some fine sand, slightly porous, few rootlets, weakly cemented, caliche stringers common. Total Depth: 26.5 feet bgs Groundwater not encountered. Boring backfiled with soil cuttings.
	555													
30														
	550													
35														
	545													
40														
	540													
45														
	535													

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-5 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	B-21

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	46.5	602.5	▽ 14.0 / *588.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
CAL-Mod (2.4" I.D.)		▼ N/A / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	600		Bulk-1			14.54								**FILL** Lean Clay with Sand (CL), very stiff, very dark brown, moist, mostly fines, little fine sand, medium plasticity.
5			R-1	10 12 15	27					4	C DS			
	595													
10			R-2	5 11 15	26	21.21	96.20			3.5				**ALLUVIUM (Qc)** Lean Clay (CL), very stiff, very dark grayish brown, moist, mostly fines, little fine sand, medium plasticity, porous.
	590													Groundwater encountered at 14' bgs. ▽
15			R-3	4 7 9	18	33.46	86.25			2				Dark grayish brown, stiff, wet, caliche stringers common.
	585													
20			R-4	3 2 4	6	39.43	79.61			1				- medium stiff, porous (1/8" wide), caliche stringer casts disolving.
	580													

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-6 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Spring Meadows Homes, LLC	LA1579	**B-21**

SITE LOCATION	START	FINISH	SHEET NO.
Intersection of N. Lemon Ave & Meadow Pass Rd, Walnut, CA	11/23/2022	11/23/2022	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
2R	CME-75	Hollow-Stem Auger	E. Babayan	E. Tsai

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic Trip: 140lb / 30in		8	46.5	602.5	▽ 14.0 / *588.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
CAL-Mod (2.4" I.D.)		▼ N/A / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (tsf)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-5	4 3 3	6	42.89	77.99			0.75				- black, less stiff.
	575													
30			R-6	2 2 4	6					0.25	C			**PEAT (Qor)** soft, wet, sponge texture, trace decomposed organics (peat), sandy, fine sand.
	570													
35			R-7	4 11 50	61									**MONTEREY FORMATION BEDROCK (Tpsq)** Claystone, very dark gray, wet, highly fractured, weathered (No Recovery)
	565													
40			R-8	10 25 43	68	29.42	88.50							- moderately soft, less fractured
	560													
45			R-9	50/5"	100	19.21	102.46							Total Depth: 46.5 feet bgs Groundwater encountered at 14ft bgs. Boring backfiled with soil cuttings.
	555													

GDC_LOG_BORING_2011 LA1579.GPJ GDCLOG.GDT 2/28/23

GROUP DELTA CONSULTANTS, INC.
370 Amapola Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-6 b

Description:

@0': Artificial Fill (af), loose silty sand, angular fine to coarse silty sandstone fragments, possible clay, few vegetation debris: leaves, weeds, light brown, dry, rodent burrows.

@2': Contact with very friable fill, nearly planar horizontal, sharp contact, buff color (lighter than above fill), Tpsq gravel in matrix.

@2'3": Alluvium (Qa), abrupt transition into fat clay, very dark brown, bentonite, high plasticity, silty sand, fine to coarse Tpsq gravel, slightly moist; patchy, mottled, poorly-mixed fill; slight petro. smell.

@3': Excavated out a snapped 1.5" PVC irrigation line, empty & no water flow, second PVC 1/2" pipe also.

Samples:

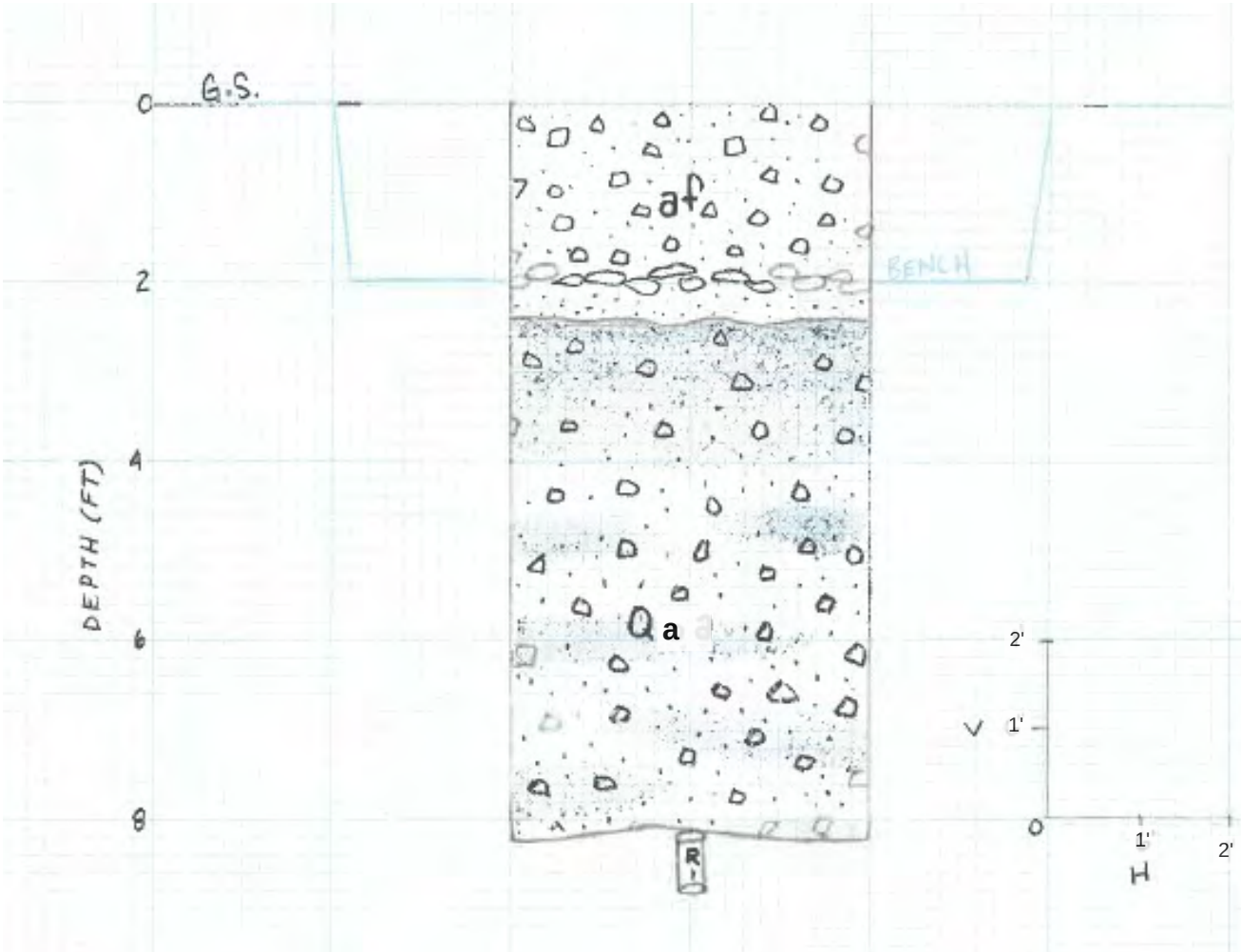
Bulk 0-7'
Ring (R-1) @8': Silty sand with fine to medium Tpsq gravel in matrix, vegetation debris (twigs, seeds, dried grass, etc.), light buff color, dry.

Measurements:

N/A

Graphic: N78°E

TP-1



DATE: 12/05/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	TEST PIT 1	PROJECT NUMBER: LA1579
REVIEWED BY: MA	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -				THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	FIGURE NUMBER: A-7

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Test Pits.dwg
PLOTTED DATE: 12/5/2022 11:24:57 AM SAVED BY: josemiguelt

Description:

@0': Artificial Fill (af) - Silty sand, unconsolidated light brown fill, mostly silty sand with some fine to medium Tpsq gravel fragments.
@2': Fine to coarse gravels of weathered Tpsq, light brown oxidized.

(a) green plastic trash.

@3': Alluvium (Qa): Native Sandy Clay: abrupt undulating planar contact, moderate plasticity, dry, difficult to scrape/ dig, some roots, trace Tpsq fragment gravel, porous, high dry strength.

Backfilled with compacted (sheep's foot wheel) soil cuttings.

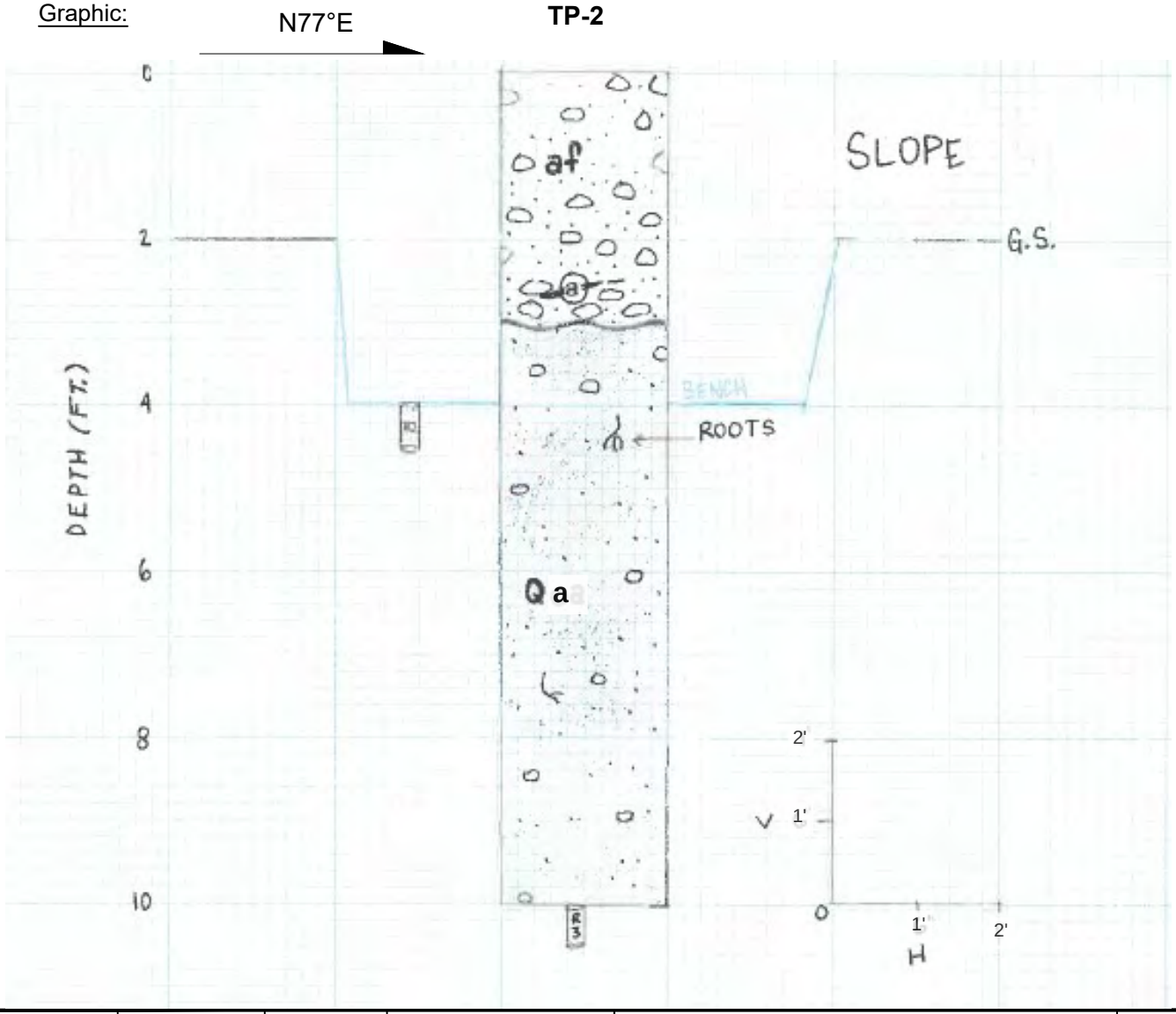
Samples:

Bulk 0-10'
Ring (R-2) @2' below bench, 4' below ground surface (G.S.)
Ring (R-3) @10', 8' below G.S.

Measurements:

N/A

Graphic:



DATE: 12/05/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	LOG OF TEST PIT 2	PROJECT NUMBER: LA1579
REVIEWED BY: MA	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -				THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	FIGURE NUMBER: A-8

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Test Pits.dwg
PLOTTED DATE: 12/5/2022 12:45:07 PM SAVED BY: josemiguelt

Description:

@0-8": Top soil, grassy vegetation, silty sand, rodent burrows, roots.

@8"-12': Tpsq : Monterey (Puente) Formation Soquel Sandstone, light buff color, mottled oxidation & gley. Some clayey pockets, no apparent stratification, fine to medium sand, easily friable, some fine to coarse gravel.

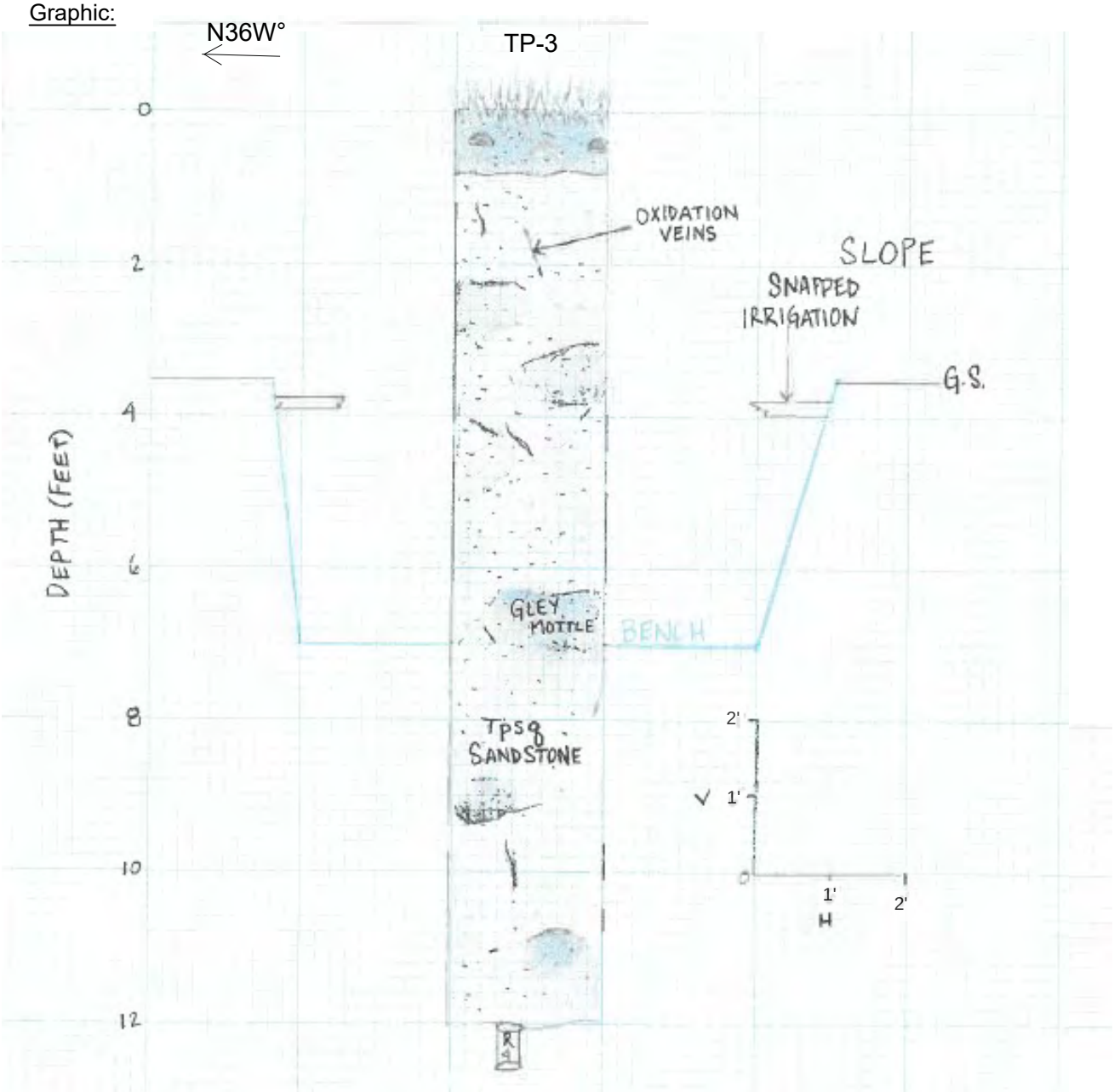
Samples:

Bulk 0-12'
Ring @12' (R-4)

Measurements:

N/A

Graphic:



DATE: 12/07/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	TEST PIT 3	PROJECT NUMBER: LA1579
REVIEWED BY: MA	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -				THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	FIGURE NUMBER: A-9

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Test Pits.dwg
PLOTTED DATE: 12/7/2022 10:26:05 AM SAVED BY: josemiguelt

Description:

@0'- 6" to 10" of organic material (leaves, roots), silty sand top soil, dark brown, moist, bottle found, wires, asphalt pieces.

@10": Colluvium (Qc), Silty sand, light brown, fine to coarse sand, fine to medium Tpsq gravel fragments, dry.

@2': Blocky silty sand, mostly coarse gravel & blocky peds of silty sand, reddish brown, plentiful thick roots.

@3': Silty sand, light brown, fine to coarse sand, no gravel, dry, increase in clay with depth, oxidized mottle.

@4'2": Tpsq Sandstone, light brown, fine grained; alternating with Tpsq Claystone, dark brown, fat clay, difficult to dig through.

@5'6" on Eastern side: Tpsq Claystone.

Samples:

Bulk 0-10'
Ring (R-5) @10.8'

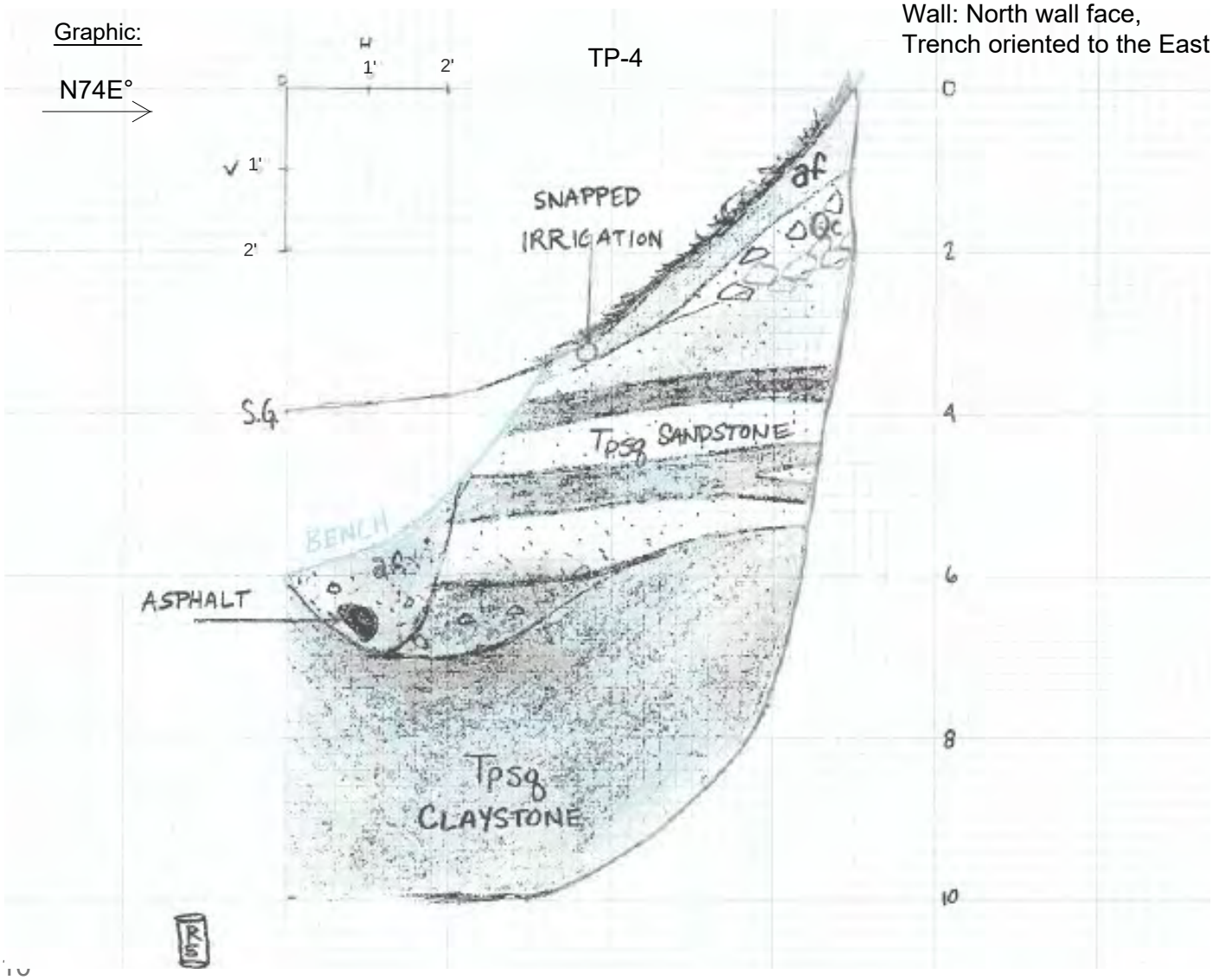
Measurements:

N/A

Graphic:

TP-4

Wall: North wall face,
Trench oriented to the East



DATE: 12/05/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	TEST PIT 4	PROJECT NUMBER: LA1579
REVIEWED BY: MA	APPROVED BY: -			THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	SCALE: AS SHOWN
PREPARED BY: -					FIGURE NUMBER: A-10

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Test Pits.dwg
PLOTTED DATE: 12/5/2022 1:19:09 PM SAVED BY: josemiguelt

Description:

@ Surface: Artificial Fill (af), fine to coarse gravel cover for road, thin 2" layer of silty sand top soil, vegetation debris (pine needles, grass, leaves, etc.)

@ 2"-1'1": Qc, weathered sandstone, darker (more orange) than above and below, consolidated but friable.

@ 1'1": Tpsq sandstone bedrock: yellow buff color, caliche stringers, oxidation staining, very friable, fine to coarse sand as, fine to coarse gravel, excavated, dry, roots.

@ 4'4" Tpsq siltstone bedrock: undulating planar contact, reddish buff color, blocky (jointed), Mn and Fe stained on joint faces, some fine roots, buff color on fresh face, caliche on joint faces 45° joints, warped.

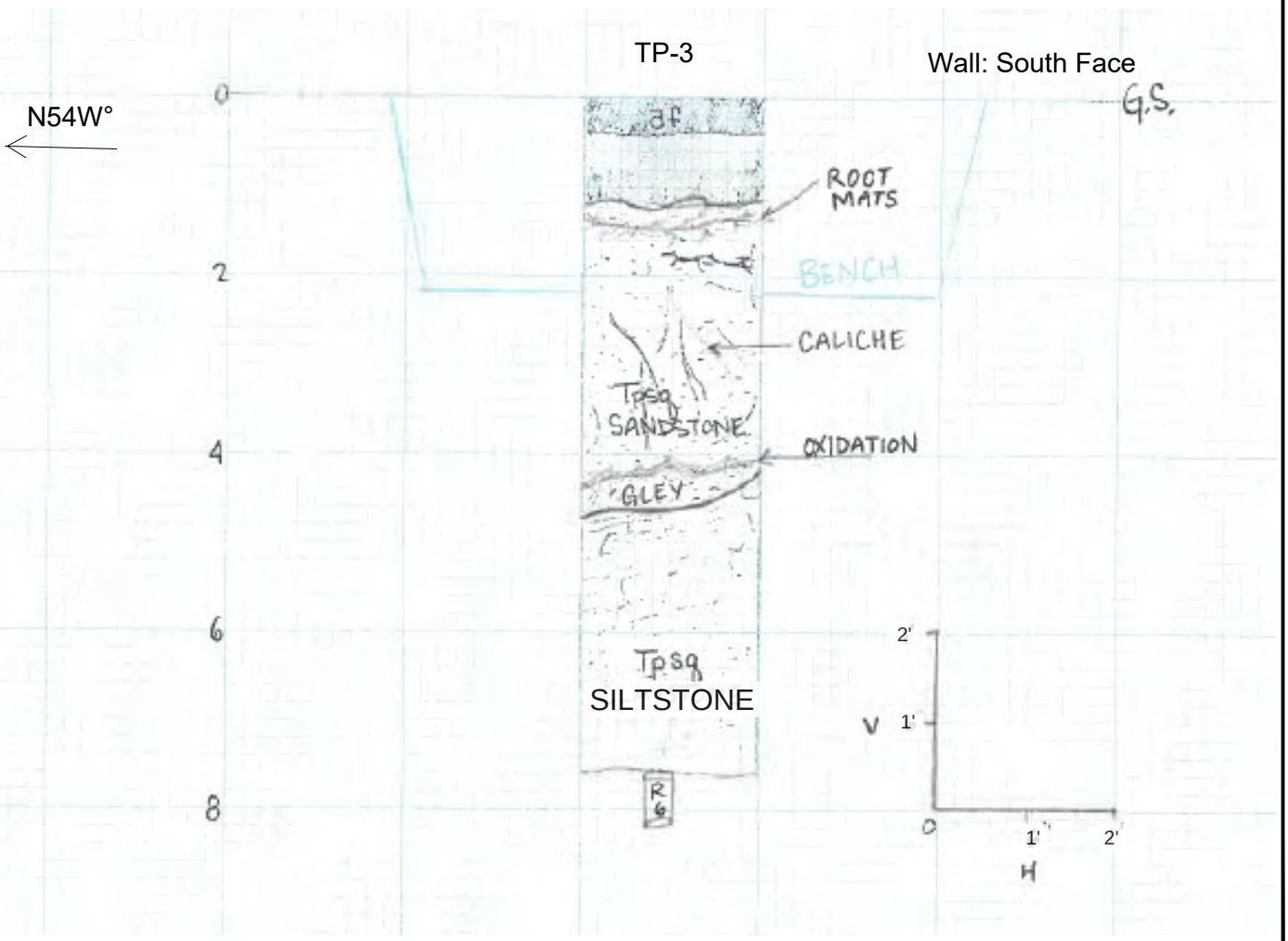
Samples:

Bulk @ 0-7', 7'
Ring (R-6) @ 7.8'

Measurements:

269°, 35°N @4'4" on Western Wall Contact
262°, 31°N @4'5" on Eastern Wall contact

Graphic:



DATE: 12/05/2022	DRAWN BY: JMT	GROUP DELTA	GROUP DELTA CONSULTANTS, INC 370 Amapola Ave. Suite 212 Torrance, CA. 90501	TEST PIT 5	PROJECT NUMBER: LA1579
REVIEWED BY: MA	APPROVED BY: -				SCALE: AS SHOWN
PREPARED BY: -				THE BROOKSIDE TENTATIVE TRACK NO. 72798 CITY OF WALNUT, CA	FIGURE NUMBER: A-11

FILE PATH: N:\Projects\1500-1599\LA1579 Spring Meadows_Spring Meadows Geotech\600 Drafting\LA1579 Test Pits.dwg
PLOTTED DATE: 12/5/2022 1:36:01 PM SAVED BY: josemiguelt

APPENDIX B
CURRENT LABORATORY TESTING

APPENDIX B
CURRENT LABORATORY TESTING

B.1 Introduction

Modified California drive samples and bulk samples were collected during the field explorations and transported to Group Delta's laboratory for further evaluation and testing. Tests were performed on selected samples in accordance with American Society for Testing and Materials (ASTM) as an aid in classifying the in-situ earth materials and to evaluate their engineering properties. Laboratory testing for this investigation included:

- Soil Classification: USCS (ASTM D2487) and Visual Manual (ASTM D2488)
- Moisture content (ASTM D2216) and Dry Unit Weight (ASTM D2937)
- Direct Shear (ASTM D3080)
- Expansion Index (ASTM D4829)
- One-Dimensional Consolidation (ASTM D2435)

A brief description of the laboratory testing program and test results are presented below.

B.2 Soil Classification

The subsurface materials were classified visually in the field using the Unified Soil Classification System (USCS), in accordance with ASTM Test Methods D2487 and D2488 and following Caltrans Soil and Logging Classification and Presentation Manual (2010). Soil classifications were modified as necessary based on further inspection and testing in the laboratory. The soil classifications are presented on the key for soil classification and on the boring logs in Appendix A.

B.3 Moisture Content and Dry Unit Weight

The natural moisture content and dry unit weight of selected ring samples were determined in general accordance with ASTM D2216 and ASTM D2937. Results of these tests are presented on the boring log in Appendix A.

B.4 Direct Shear

Direct shear testing was performed on undisturbed ring samples in accordance with ASTM D3080. After the initial weight and volume measurements were made, the sample was placed in a calibrated shear machine and a selected normal load was applied. Each sample was then saturated, allowed to consolidate, and then were sheared under a constant strain to failure. Shear stress and sample deformations were monitored throughout the test. The test results are presented in Figures B-1 through B-7.

B.5 Expansion Index

Representative bulk samples were obtained and tested to evaluate the expansion potential of the in-situ earth materials. The bulk samples were collected from the upper 10 feet of the surficial materials. The tests were conducted in accordance with ASTM D4829, and the results are presented in Figures B-8 to B-9.

B.6 One-Dimensional Consolidation

The compressibility characteristics of the in-situ soils were determined by performing one-dimensional consolidation testing in general accordance with ASTM D2435, using a floating ring consolidometer and deadweight system. The test specimens consisted of undisturbed ring samples from various depths and comprising predominantly of fine-grained, clayey soils. The tests were run under saturated conditions with the specimens being submerged in water. The test results are presented in Figures B-10 to B-13.

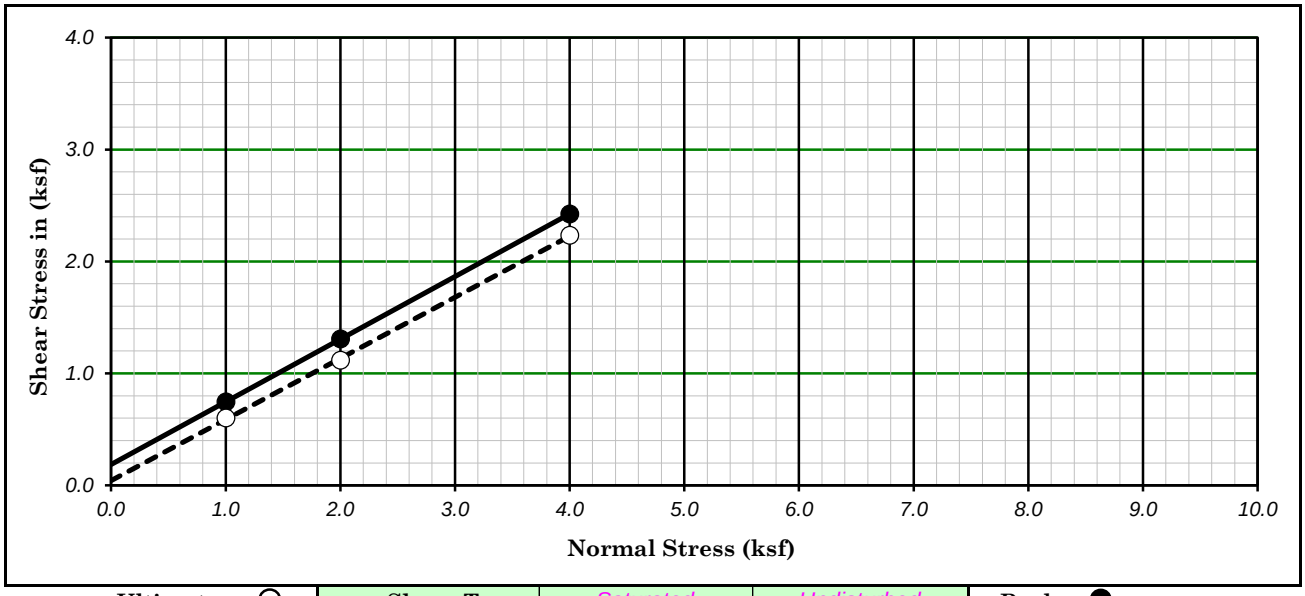
B.7 List of Attached Figures

The following figures are attached and complete this appendix:

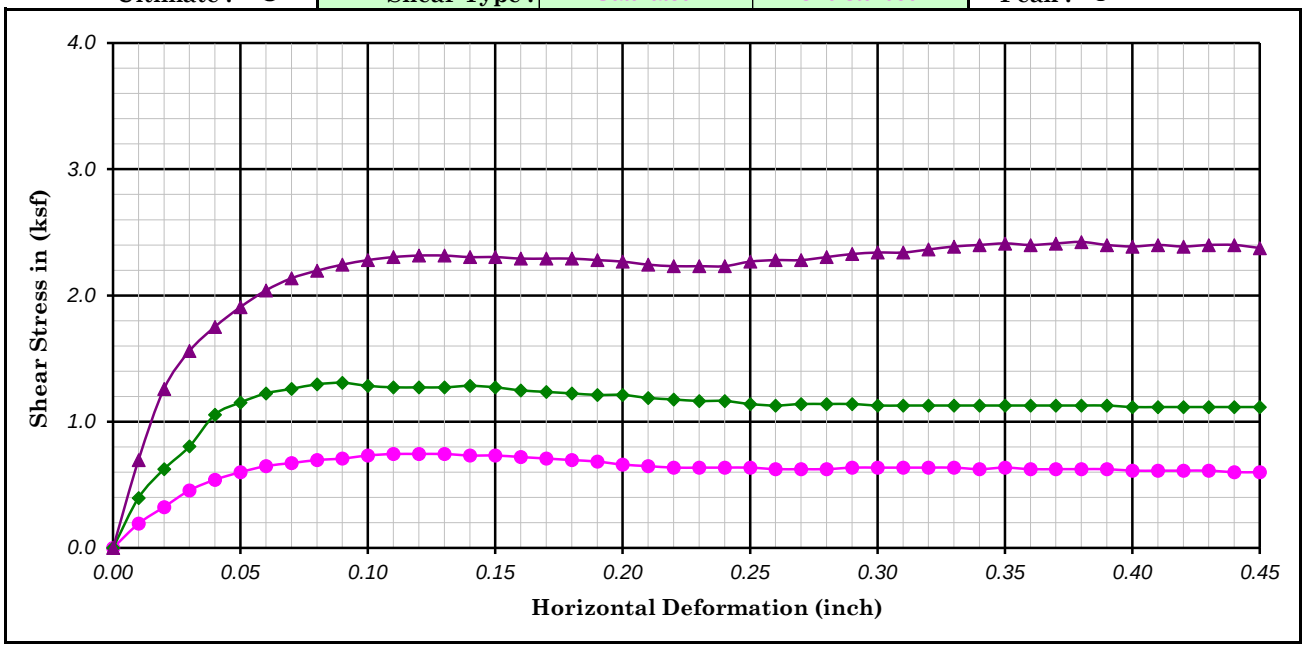
Figures B-1 to B-7 Direct Shear Results

Figures B-8 to B-9 Expansion Index Results

Figures B-10 to B-13 Consolidation Test Results



Ultimate : ○	Shear Type :	Saturated	Undisturbed	Peak : ●



Boring No. : B-18		Strength Intercept (C) :	0.19	(ksf)	Peak	0.04	(ksf)	Ultimate
Sample No. : R-3			8.91	(kPa)		2.01	(kPa)	
Depth (ft/m) : 15.0	4.58	Friction Angle (ϕ) :	29.24	Degree		28.63	Degree	
Description : Olive Brown Sandy Clay					Shear Rate (inch/minute) :		0.0002	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	31.28	93.31	14.69	0.81	1.00	47.88	0.74	35.62	0.60	28.73
◆	34.35	92.43	14.55	0.82	2.00	95.76	1.31	62.63	1.12	53.43
▲	33.79	92.05	14.49	0.83	4.00	191.52	2.42	116.06	2.23	106.87

GROUP DELTA

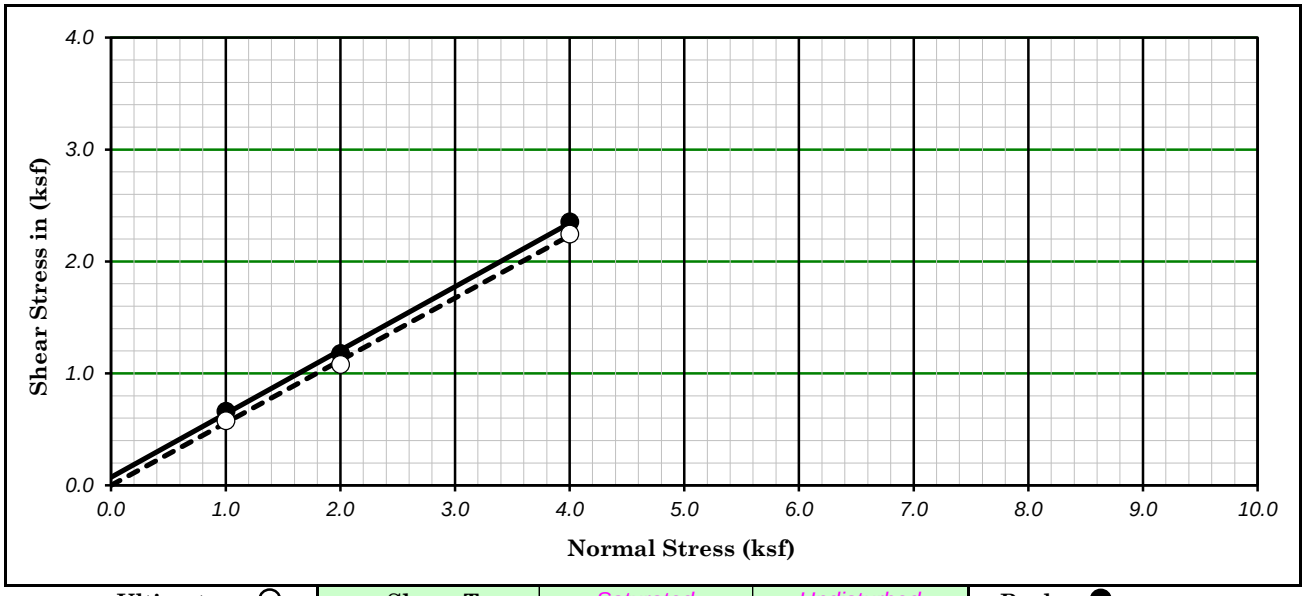
Spring Meadows Homes, LLC

Project No. : LA1579

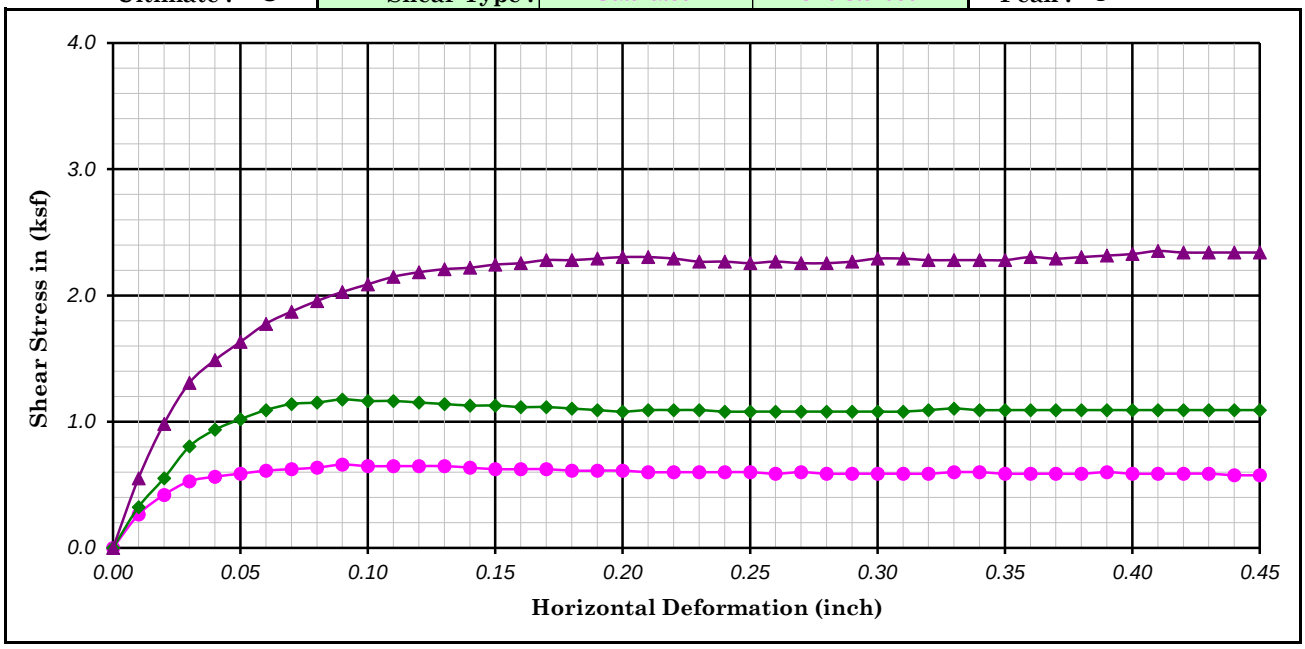
Date : 12/05/22

DIRECT SHEAR TEST
(ASTM D -3080)

Figure No. :



Ultimate : ○	Shear Type :	Saturated	Undisturbed	Peak : ●



Boring No. : B-18		Strength Intercept (C) :	0.07	(ksf)	Peak	0.00	(ksf)	Ultimate
Sample No. : R-4			3.45	(kPa)		0.00	(kPa)	
Depth (ft/m) : 20.0	6.10	Friction Angle (ϕ) :	29.57	Degree		29.15	Degree	
Description : Light Olive Brown Sandy Clay					Shear Rate (inch/minute) :		0.0002	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	33.19	91.49	14.40	0.84	1.00	47.88	0.66	31.60	0.58	27.58
◆	33.30	90.63	14.27	0.86	2.00	95.76	1.18	56.31	1.08	51.71
▲	33.05	93.12	14.66	0.81	4.00	191.52	2.35	112.61	2.24	107.44

GROUP DELTA

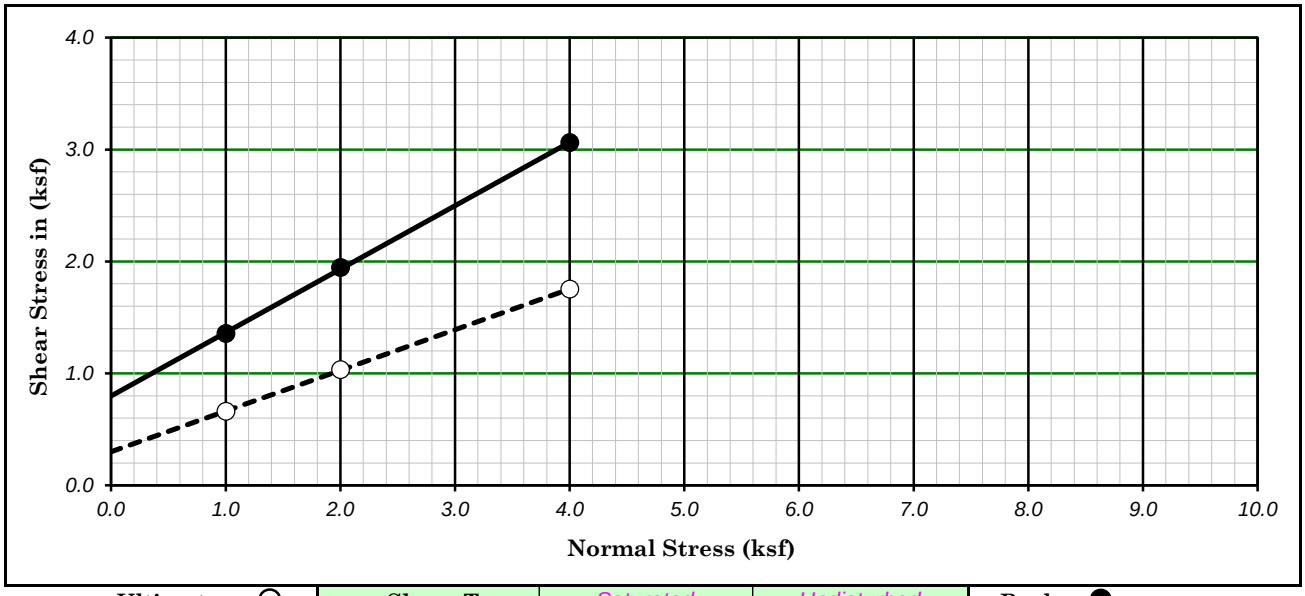
Spring Meadows Homes, LLC

DIRECT SHEAR TEST
(ASTM D -3080)

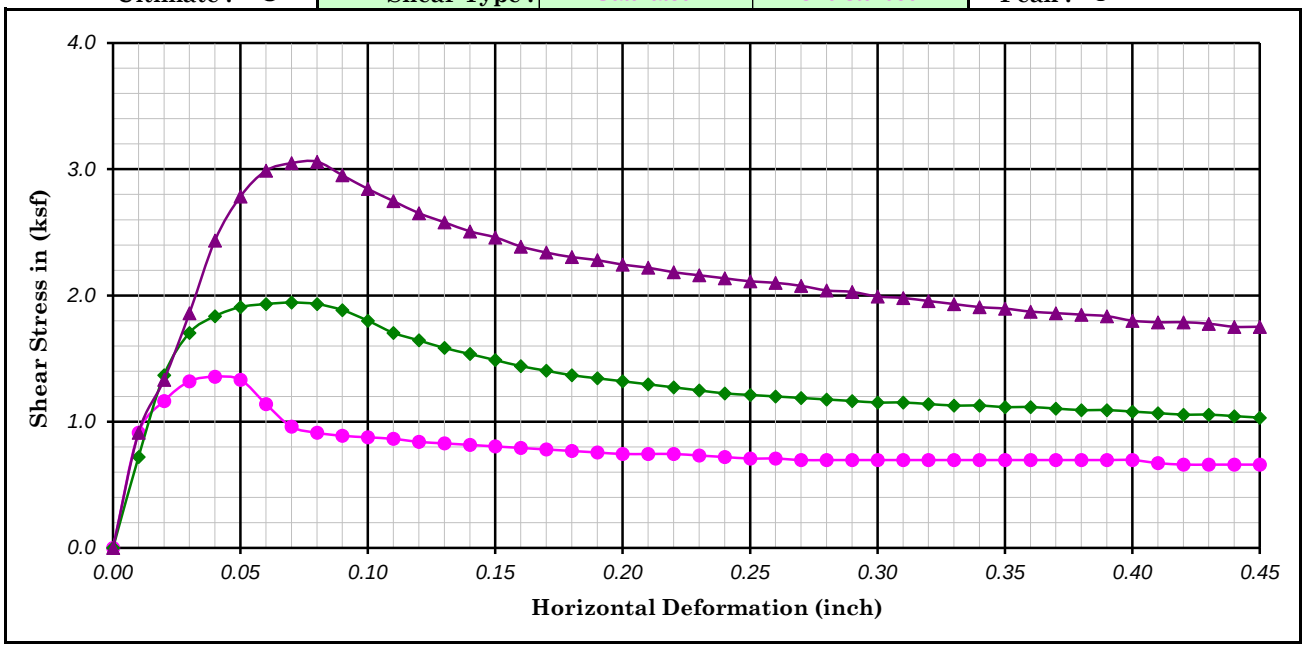
Project No. : LA1579

Date : 12/02/22

Figure No. :



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : B-19		Strength Intercept (C) :	0.80	(ksf)	Peak	0.30	(ksf)	Ultimate
Sample No. : R-2			38.21	(kPa)		14.36	(kPa)	
Depth (ft/m) : 10.0	3.05	Friction Angle (ϕ) :	29.53	Degree		19.97	Degree	

Description : Brown Bedrock / Siltstone, Claystone — Shear Rate (inch/minute) : 0.0004

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	29.61	101.89	16.04	0.65	1.00	47.88	1.36	64.93	0.66	31.60
◆	36.78	98.02	15.43	0.72	2.00	95.76	1.94	93.08	1.03	49.41
▲	34.97	96.99	15.27	0.74	4.00	191.52	3.06	146.51	1.75	83.89

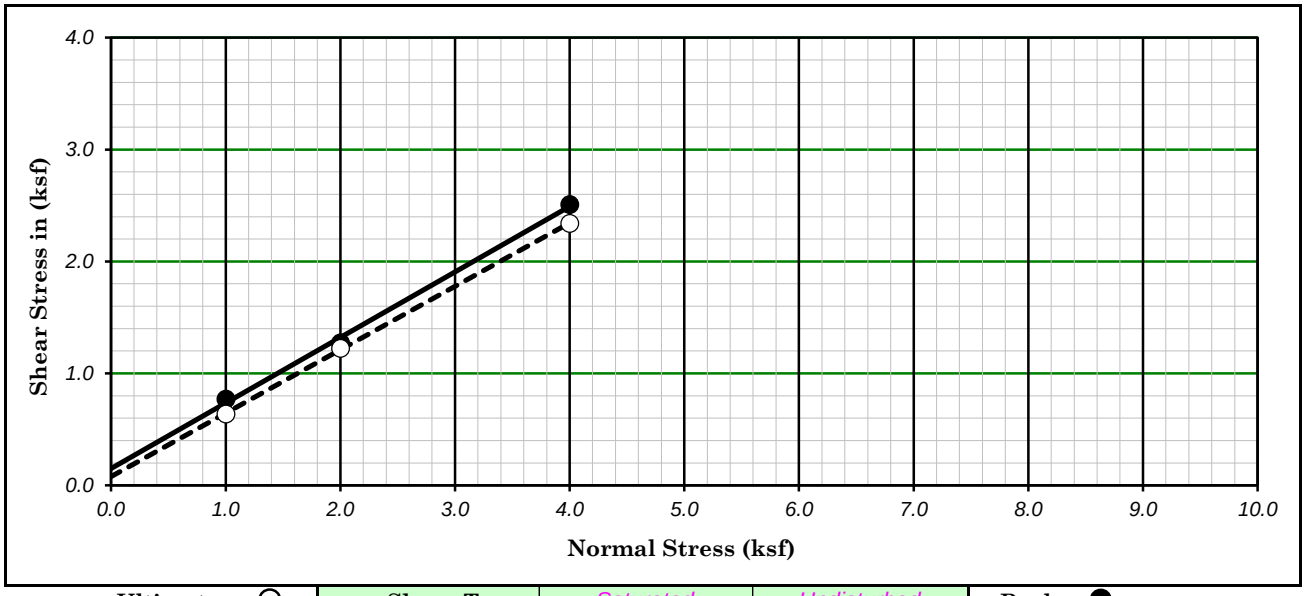
GROUP DELTA

Spring Meadows Homes, LLC

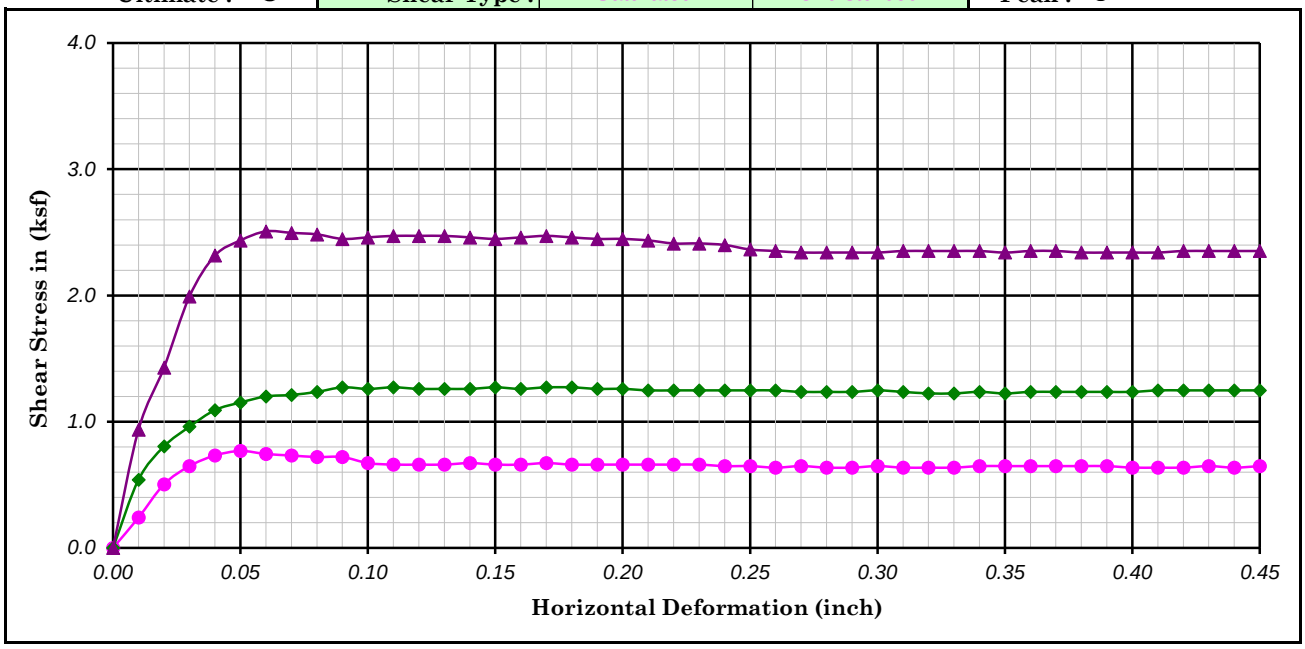
Project No. : LA1579 | Date : 12/06/22

DIRECT SHEAR TEST
(ASTM D -3080)

Figure No. :



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : B-20	Strength Intercept (C) :	0.15	(ksf)	Peak	0.08	(ksf)	Ultimate
Sample No. : R-4		7.18	(kPa)		3.73	(kPa)	
Depth (ft/m) : 20.0 6.10	Friction Angle (ϕ) :	30.35	Degree		29.53	Degree	

Description : Olive Brown Sandy Silt - Sandy Clay — Shear Rate (inch/minute) : 0.0004

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	26.52	100.23	15.78	0.68	1.00	47.88	0.77	36.77	0.64	30.45
◆	27.05	100.37	15.80	0.68	2.00	95.76	1.27	60.90	1.22	58.61
▲	26.40	102.81	16.18	0.64	4.00	191.52	2.51	120.08	2.34	112.04

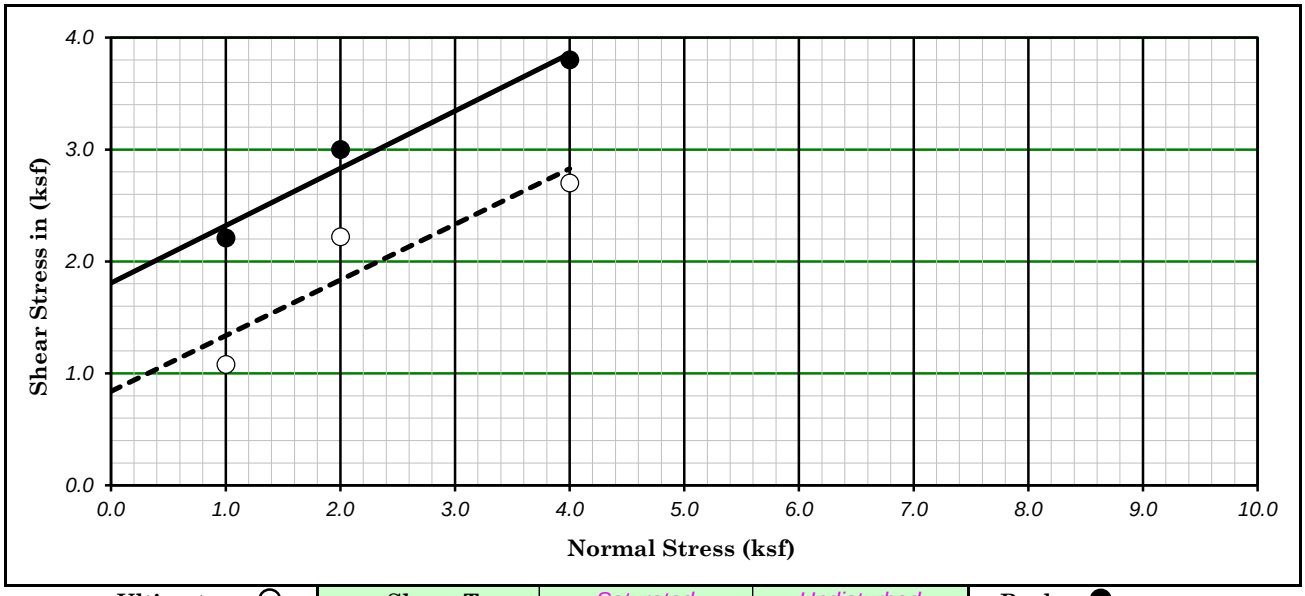
GROUP DELTA

Spring Meadows Homes, LLC

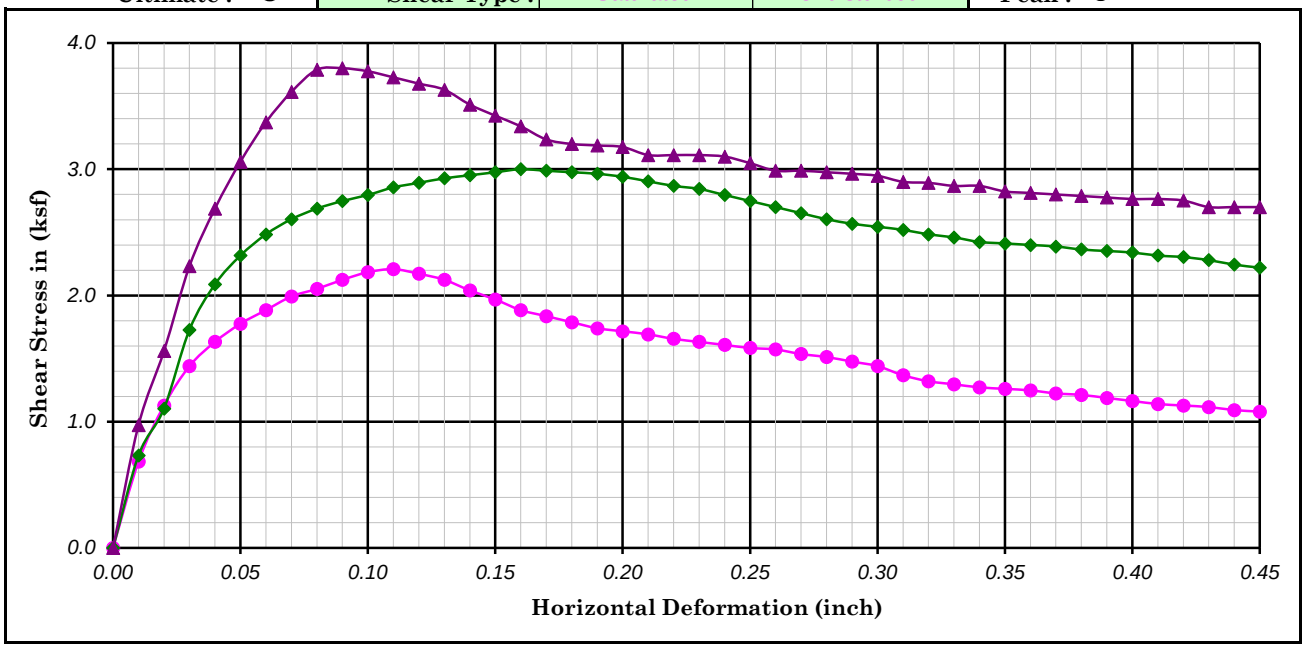
Project No. : LA1579 | Date : 12/07/22

DIRECT SHEAR TEST
(ASTM D -3080)

Figure No. :



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : B-21		Strength Intercept (C) :	1.81	(ksf)	Peak	0.84	(ksf)	Ultimate
Sample No. : R-1			86.57	(kPa)		40.22	(kPa)	
Depth (ft/m) : 5.0	1.53	Friction Angle (ϕ) :	27.11	Degree		26.43	Degree	
Description : Very Dark Grayish Brown Sandy Clay					Shear Rate (inch/minute) :		0.0003	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	26.49	108.46	17.07	0.55	1.00	47.88	2.21	105.72	1.08	51.71
◆	24.76	108.75	17.12	0.55	2.00	95.76	3.00	143.64	2.22	106.29
▲	24.97	109.36	17.21	0.54	4.00	191.52	3.80	181.94	2.70	129.28

GROUP DELTA

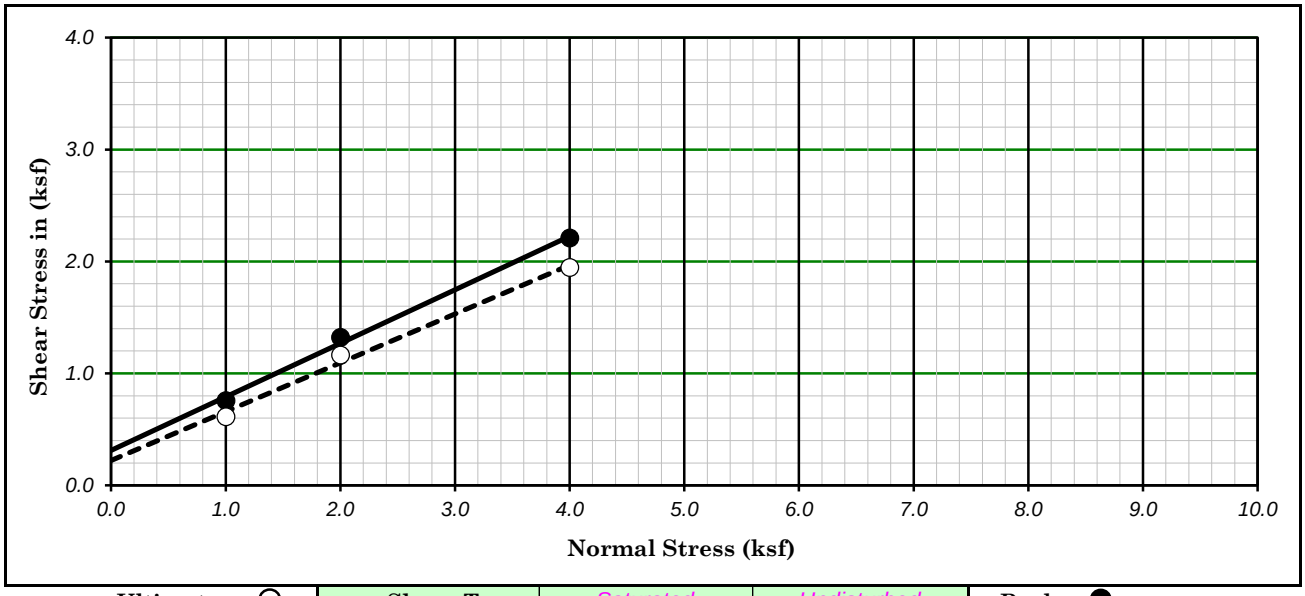
Spring Meadows Homes, LLC

Project No. : LA1579

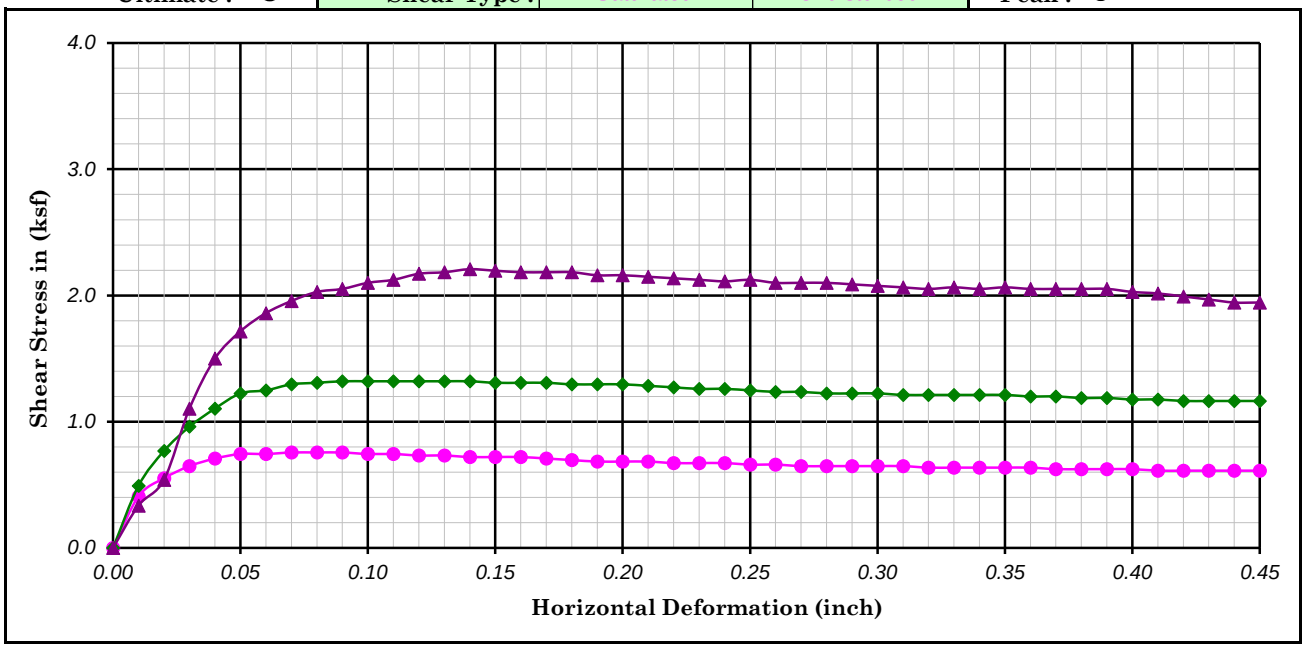
Date : 12/08/22

DIRECT SHEAR TEST
(ASTM D -3080)

Figure No. :



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : TP-1		Strength Intercept (C) :	0.31	(ksf)	Peak	0.22	(ksf)	Ultimate
Sample No. : R-1			14.94	(kPa)		10.63	(kPa)	
Depth (ft/m) : 8.0	2.44	Friction Angle (ϕ) :	25.56	Degree		23.57	Degree	
Description : Dark OliveGray Fat Clay with Sand					Shear Rate (inch/minute) :	0.0002		

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	39.10	85.15	13.40	0.98	1.00	47.88	0.76	36.20	0.61	29.30
◆	39.20	85.11	13.40	0.98	2.00	95.76	1.32	63.20	1.16	55.73
▲	38.52	85.43	13.45	0.97	4.00	191.52	2.21	105.72	1.94	93.08

GROUP DELTA

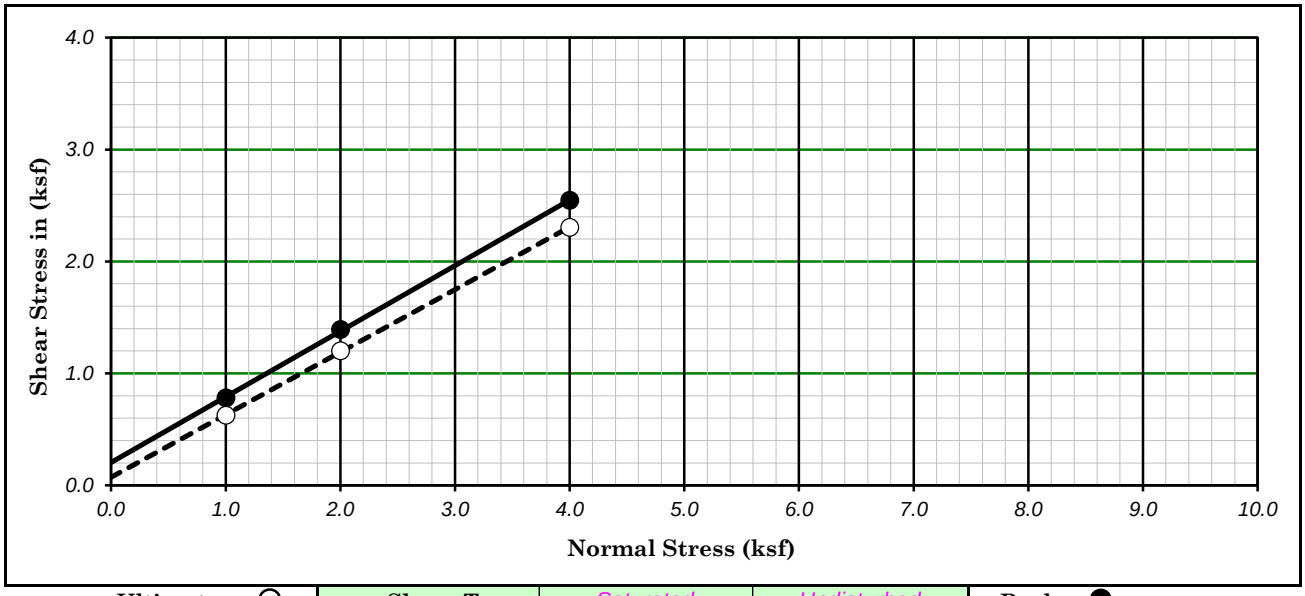
Spring Meadows Homes, LLC

Project No. : LA1579

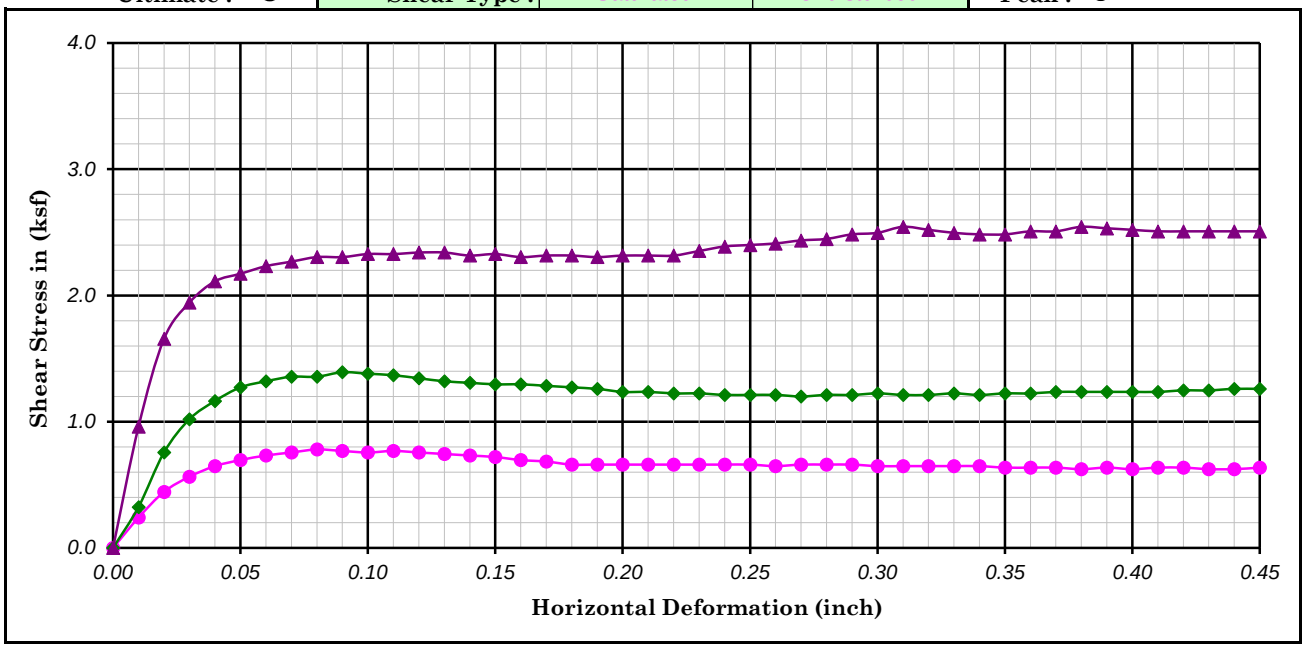
Date : 12/09/22

DIRECT SHEAR TEST
(ASTM D -3080)

Figure No. :



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : TP-4		Strength Intercept (C) :	0.20	(ksf)	Peak	0.07	(ksf)	Ultimate
Sample No. : R-5			9.77	(kPa)		3.45	(kPa)	
Depth (ft/m) : 10.8	3.29	Friction Angle (ϕ) :	30.38	Degree		29.20	Degree	
Description : Brown Clayey Sand					Shear Rate (inch/minute) :		0.0004	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	17.79	113.07	17.80	0.49	1.00	47.88	0.78	37.35	0.62	29.88
◆	18.17	113.60	17.88	0.48	2.00	95.76	1.39	66.65	1.20	57.46
▲	18.76	113.67	17.89	0.48	4.00	191.52	2.54	121.81	2.30	110.32

GROUP DELTA

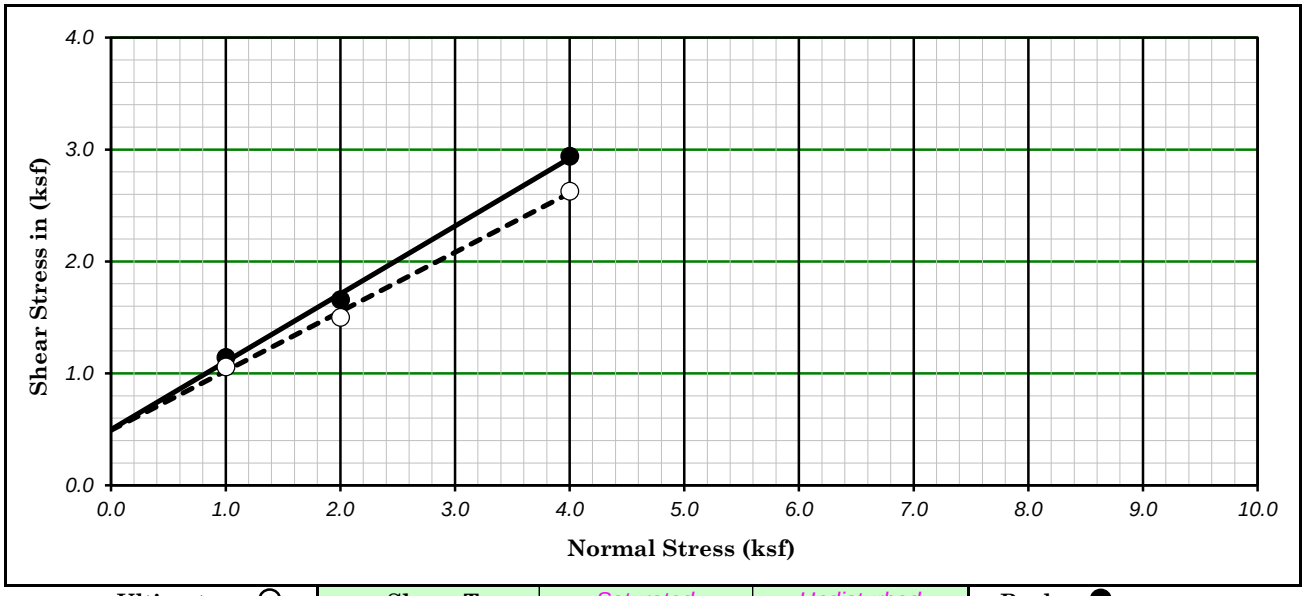
Spring Meadows Homes, LLC

DIRECT SHEAR TEST
(ASTM D -3080)

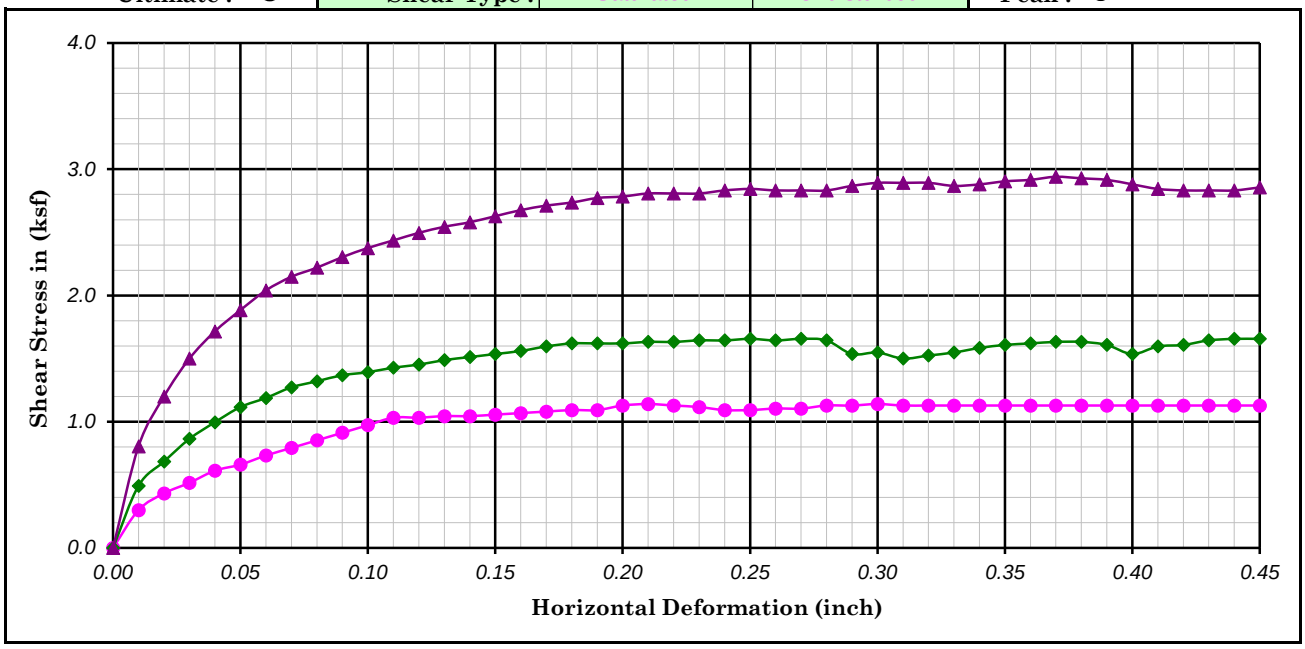
Project No. : LA1579

Date : 12/12/22

Figure No. :



Ultimate : ○	Shear Type :	Saturated	Undisturbed	Peak : ●



Boring No. : TP-5		Strength Intercept (C) :	0.50	(ksf)	Peak	0.49	(ksf)	Ultimate
Sample No. : R-6			23.84	(kPa)		23.56	(kPa)	
Depth (ft/m) : 7.7	2.34	Friction Angle (ϕ) :	31.22	Degree		27.91	Degree	
Description : Yellowish Brown Bedrock (Crushed)					Shear Rate (inch/minute) :	0.0004		

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	17.59	106.21	16.72	0.59	1.00	47.88	1.14	54.58	1.06	50.56
◆	19.21	106.47	16.76	0.58	2.00	95.76	1.66	79.29	1.50	71.82
▲	18.88	107.01	16.84	0.58	4.00	191.52	2.94	140.77	2.63	125.83

GROUP DELTA

Spring Meadows Homes, LLC

DIRECT SHEAR TEST
(ASTM D -3080)

Project No. : LA1579

Date : 12/20/22

Figure No. :

GROUP DELTA

EXPANSION INDEX OF SOIL

ASTM D-4829-10 / UBC 29-2

Lab Number: SO6631

Project Name	: Spring Meadows Homes, LLC	**Sampled By :**		**Date :**	
Project No.	: LA1579	**Prepared By :**	Eric Y.	**Date :**	12/1/2022
Boring No.	: B-18	**Tested By :**	Eric Y.	**Date :**	12/2/2022
Sample No.	: Bulk-1	**Calculated By :**	Eric Y.	**Date :**	12/6/2022
Depth (ft.)	: 0 - 5	**Checked By :**		**Date :**	
Description	: Olive Brown Sandy Clay with Siltstone, Claystone, and Gravel				

Sample Preparation

Weight of Total Soil	3463.00	**Weight of Soil Retained on No. 4 Sieve**	629.30	**% Passing No. 4 Sieve**	81.83

Trail	**1**	**2**	**3**	**4**	**Tested**	**M & D After Test**	
Container No.	SB-2					**Container No.**	
Weight of Wet Soil + Container (gm)	833.80					**Wet Soil+Cont.+Ring**	
Weight of Dry Soil + Container (gm)	744.92					**Dry Soil+Cont.+Ring**	
Weight of Container (gm)	228.54					**Wt. of Container**	
Moisture Content (%)	17.21				17.21	**Moisture Content**	
Weight of Wet Soil + Ring (gm)	538.98						
Weight of Ring (gm) **No.** 2.0	198.64				198.64		
Weight of Wet Soil (gm)	340.34						
Wet Density of Soil (pcf)	102.66					**Wet Density (pcf)**	
Dry Density of Soil (pcf)	87.59					**Dry Density (pcf)**	
Precent Saturation of Soil $S_{(Meas.)}$	50.27				50.27	**(%) Saturation**	

Loading Machine No.		**2**		
Date	**Reading Time**	**Elapsed Time**	**Dial Reading**	**Expansion**
12/02/22	12:15:00	0:10:00		0.0000
12/02/22				
12/02/22	12:25:00	**0:00:00**	**0.3000**	**0.0000**
Add Distilled Water to Sample				
12/02/22	13:25:00	1:00:00	0.3709	0.0709
12/02/22	14:25:00	2:00:00	0.3719	0.0719
12/02/22	15:25:00	3:00:00	0.3723	0.0723
12/02/22	16:25:00	4:00:00	0.3726	0.0726
12/05/22	7:25:00	67 hrs.	0.3739	0.0739
12/05/22	9:25:00	69 hrs.	0.3739	0.0739
12/05/22	12:25:00	72 hrs.	0.3739	0.0739

Remark :

1. *Screen sample through* **No. 4** *Sieve*
2. *Sample should be compacted into a metal ring of the Degree of Saturation of* **50 +/- 2% (48 - 52).**
3. *Inundated sample in distilled water to 24 h, or until the rate of expansion > (0.0002 in./h), no less than 3 h.*

Volume of Mold (ft^3)	0.00731	**Specific Gravity**	2.70
Rammer Weight (lb.)	5.0	**Blows/Layer**	15
Vertical Confining Pressure	1.0 (lbf/in^2) / 6.9 (kPa)		

$$(\%)\ S = \frac{S.G. \times W \times Dd}{Wd \times S.G. - Dd}$$

S.G.=Specific Gravity, **W**=Water Content
Dd=Dry Soil Density, **Wd**=Unit Wt. of Water

$$E.I._{(meas)} = \frac{\text{Change in High}}{\text{Initial Thickness}} \times 1000 = \mathbf{73.90}$$

$$\text{Expansion Index}_{(50)} = EI_{(meas.)} - (50 - S_{(meas.)}) \times \frac{65 + EI_{(meas.)}}{220 - S_{(meas.)}}$$

74	**Medium**

Expansion Index	Potential Expansion
0 - 20	*Very Low*
21 - 50	*Low*
51 - 90	*Medium*
91 - 130	*High*
> 130	*Very High*

GROUP DELTA

EXPANSION INDEX OF SOIL

ASTM D-4829-10 / UBC 29-2

Lab Number: SO6631

Project Name	: Spring Meadows Homes, LLC	**Sampled By :**		**Date :**	
Project No.	: LA1579	**Prepared By :**	Eric Y.	**Date :**	12/1/2022
Boring No.	: B-18	**Tested By :**	Eric Y.	**Date :**	12/2/2022
Sample No.	: Bulk-2	**Calculated By :**	Eric Y.	**Date :**	12/6/2022
Depth (ft.)	: 5 - 10	**Checked By :**		**Date :**	
Description	: Very Dark Grayish Brown Sandy Clay with Siltstone, Claystone				

Sample Preparation

Weight of Total Soil	3591.50	**Weight of Soil Retained on No. 4 Sieve**	122.00	**% Passing No. 4 Sieve**	96.60

Trail	1	2	3	4	Tested	M & D After Test	
Container No.	SB-3					Container No.	
Weight of Wet Soil + Container (gm)	868.60					Wet Soil+Cont.+Ring	
Weight of Dry Soil + Container (gm)	785.43					Dry Soil+Cont.+Ring	
Weight of Container (gm)	232.90					Wt. of Container	
Moisture Content (%)	15.05				15.05	Moisture Content	
Weight of Wet Soil + Ring (gm)	551.44						
Weight of Ring (gm) No. 3.0	200.84				200.84		
Weight of Wet Soil (gm)	350.60						
Wet Density of Soil (pcf)	105.76					Wet Density (pcf)	
Dry Density of Soil (pcf)	91.92					Dry Density (pcf)	
Precent Saturation of Soil $S_{(Meas.)}$	48.74				48.74	(%) Saturation	

Loading Machine No.		3		
Date	**Reading Time**	**Elapsed Time**	**Dial Reading**	**Expansion**
12/02/22	9:55:00	0:10:00		0.0000
12/02/22				
12/02/22	10:05:00	**0:00:00**	**0.3000**	**0.0000**
Add Distilled Water to Sample				
12/02/22	11:05:00	1:00:00	0.3662	0.0662
12/02/22	12:05:00	2:00:00	0.3700	0.0700
12/02/22	13:05:00	3:00:00	0.3710	0.0710
12/02/22	14:05:00	4:00:00	0.3715	0.0715
12/02/22	15:05:00	5:00:00	0.3718	0.0718
12/02/22	16:05:00	6:00:00	0.3721	0.0721
12/05/22	8:05:00	70 hrs.	0.3744	0.0744
12/05/22	9:05:00	71 hrs.	0.3744	0.0744
12/05/22	10:05:00	72 hrs.	0.3744	0.0744

Remark :

1. *Screen sample through* **No. 4** *Sieve*
2. *Sample should be compacted into a metal ring of the Degree of Saturation of* **50 +/- 2% (48 - 52).**
3. *Inundated sample in distilled water to 24 h, or until the rate of expansion > (0.0002 in./h), no less than 3 h.*

Volume of Mold (ft^3)	0.00731	**Specific Gravity**	2.70
Rammer Weight (lb.)	5.0	**Blows/Layer**	15
Vertical Confining Pressure		1.0 (lbf/in^2) / 6.9 (kPa)	

$$(\%)\ S = \frac{S.G. \times W \times Dd}{Wd \times S.G. - Dd}$$

S.G.=Specific Gravity, **W**=Water Content
Dd=Dry Soil Density, **Wd**=Unit Wt. of Water

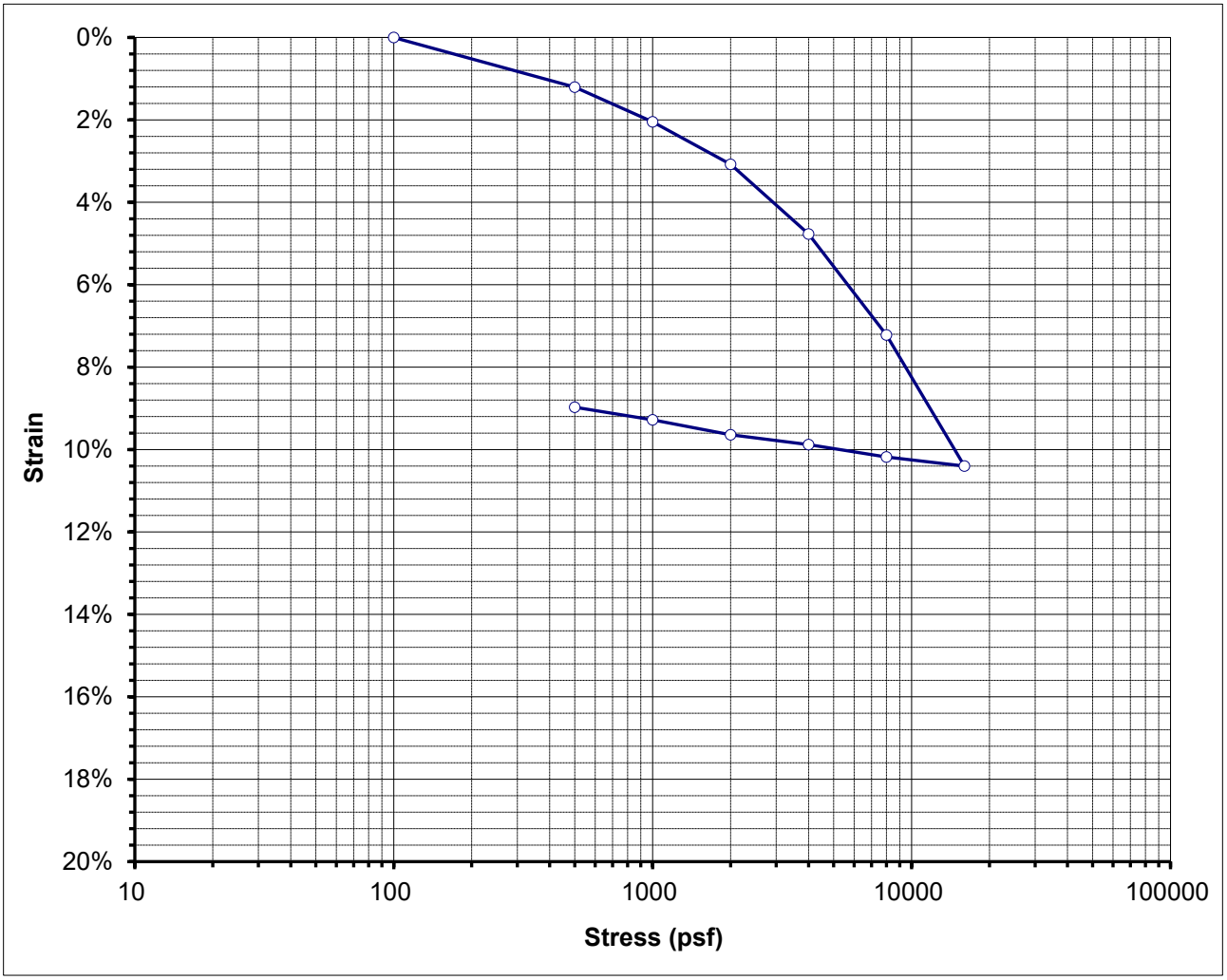
$$E.I._{(meas)} = \frac{\text{Change in High}}{\text{Initial Thickness}} \times 1000 = 74.40$$

$$\text{Expansion Index}_{(50)} = EI_{(meas.)} - (50 - S_{(meas.)}) \times \frac{65 + EI_{(meas.)}}{220 - S_{(meas.)}}$$

73	**Medium**

Expansion Index	Potential Expansion
0 - 20	*Very Low*
21 - 50	*Low*
51 - 90	*Medium*
91 - 130	*High*
> 130	*Very High*

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-18	Sample Depth	20'
Sample No.	R-4	USCS	CL

BEFORE TEST

Initial Moisture Content:	30.82%	
Initial Dry Unit Wt:	90.45	pcf
Initial Total Unit Wt.:	118.33	pcf
Initial Void Ratio:	0.84	
Initial Degree of Saturation:	97.6%	

AFTER TEST

Final Moisture Content:	25.40%	
Final Dry Unit Wt:	99.33	pcf
Final Total Unit Wt.:	124.56	pcf
Final Void Ratio:	0.68	
Final Degree of Saturation:	100.0%	

Water Added at: 0 psf

ATTERBERG LIMITS					
LL=		PL=		PI=	

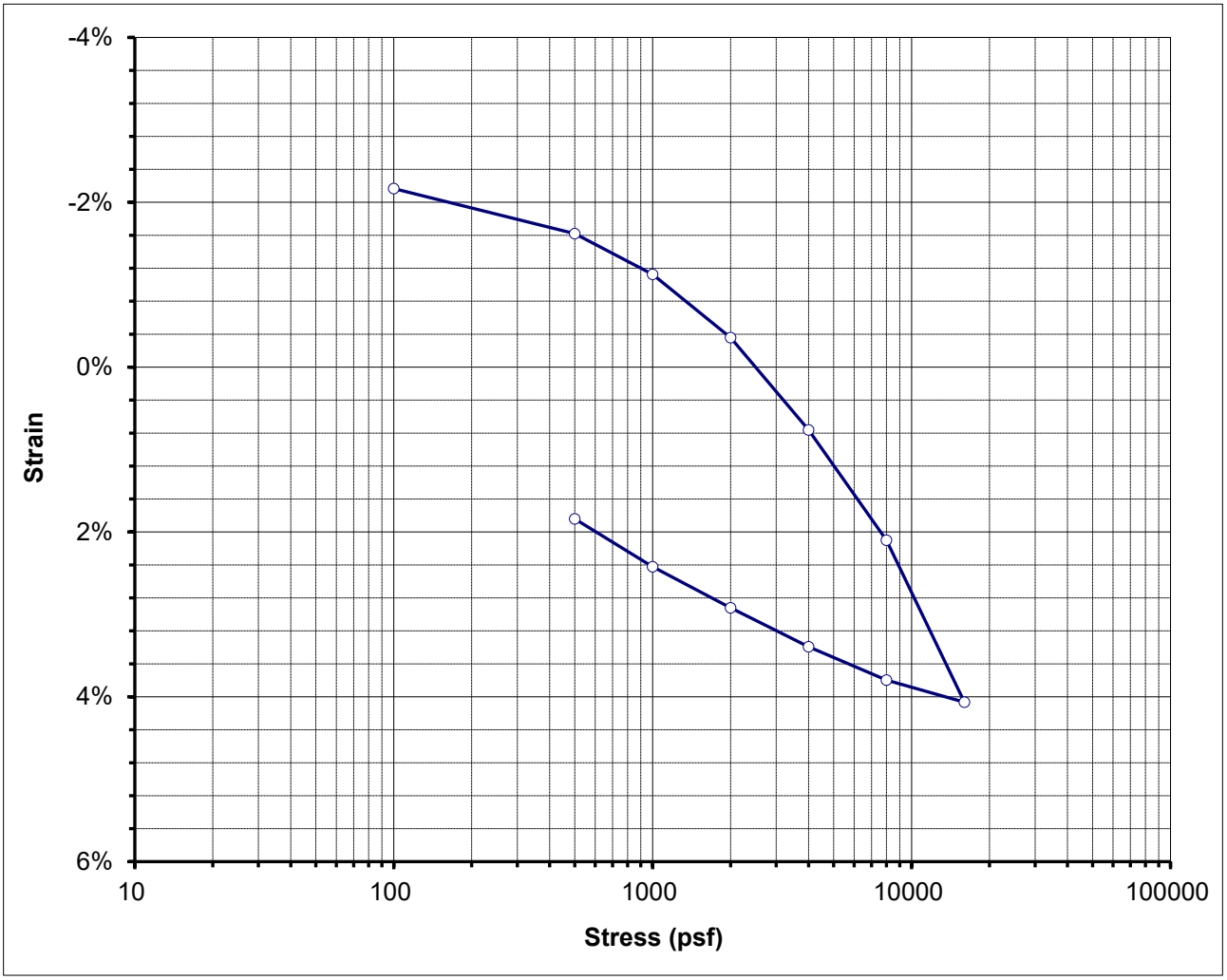
Assumed Specific Gravity of Solids, Gs: 2.67

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.00%	0.844
500	1.20%	0.821
1000	2.05%	0.806
2000	3.08%	0.787
4000	4.77%	0.756
8000	7.22%	0.711
16000	10.40%	0.652
8000	10.18%	0.656
4000	9.88%	0.661
2000	9.64%	0.666
1000	9.28%	0.673
500	8.97%	0.678

PROJECT NUMBER:	PROJECT NAME:	FIGURE NO.
LA1579	Spring Meadows Homes, LLC	B-18 R-4

GROUP DELTA

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-20	Sample Depth	10'
Sample No.	R-2	USCS	CL

BEFORE TEST

Initial Moisture Content:	13.57%	
Initial Dry Unit Wt:	103.45	pcf
Initial Total Unit Wt.:	117.49	pcf
Initial Void Ratio:	0.63	
Initial Degree of Saturation:	58.4%	

AFTER TEST

Final Moisture Content:	19.95%	
Final Dry Unit Wt:	105.35	pcf
Final Total Unit Wt.:	126.37	pcf
Final Void Ratio:	0.60	
Final Degree of Saturation:	90.1%	

Water Added at: 0 psf

ATTERBERG LIMITS					
LL=		PL=		PI=	

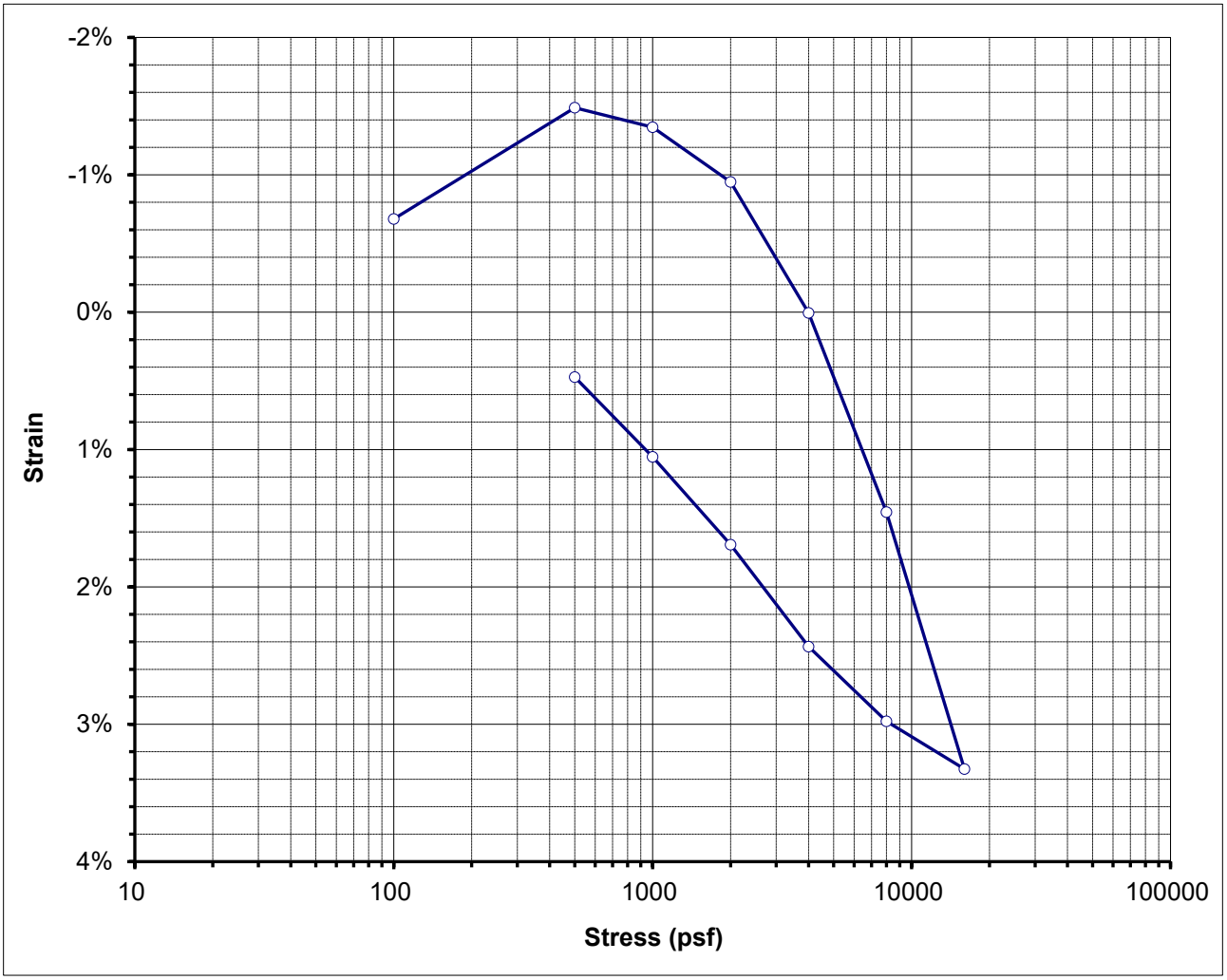
Assumed Specific Gravity of Solids, Gs: 2.70

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	-2.17%	0.661
500	-1.62%	0.652
1000	-1.13%	0.644
2000	-0.36%	0.632
4000	0.76%	0.614
8000	2.10%	0.592
16000	4.07%	0.560
8000	3.80%	0.564
4000	3.39%	0.571
2000	2.92%	0.579
1000	2.42%	0.587
500	1.84%	0.596

PROJECT NUMBER:	LA1579	PROJECT NAME:	Spring Meadows Homes, LLC	FIGURE NO.	B-20 R-2

GROUP DELTA

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-21	Sample Depth	5'
Sample No.	R-1	USCS	CL

BEFORE TEST

Initial Moisture Content:	17.14%	
Initial Dry Unit Wt:	104.93	pcf
Initial Total Unit Wt.:	122.92	pcf
Initial Void Ratio:	0.58	
Initial Degree of Saturation:	78.2%	

AFTER TEST

Final Moisture Content:	21.66%	
Final Dry Unit Wt:	105.39	pcf
Final Total Unit Wt.:	128.22	pcf
Final Void Ratio:	0.58	
Final Degree of Saturation:	100.0%	

Water Added at: 0 psf

ATTERBERG LIMITS					
LL=		PL=		PI=	

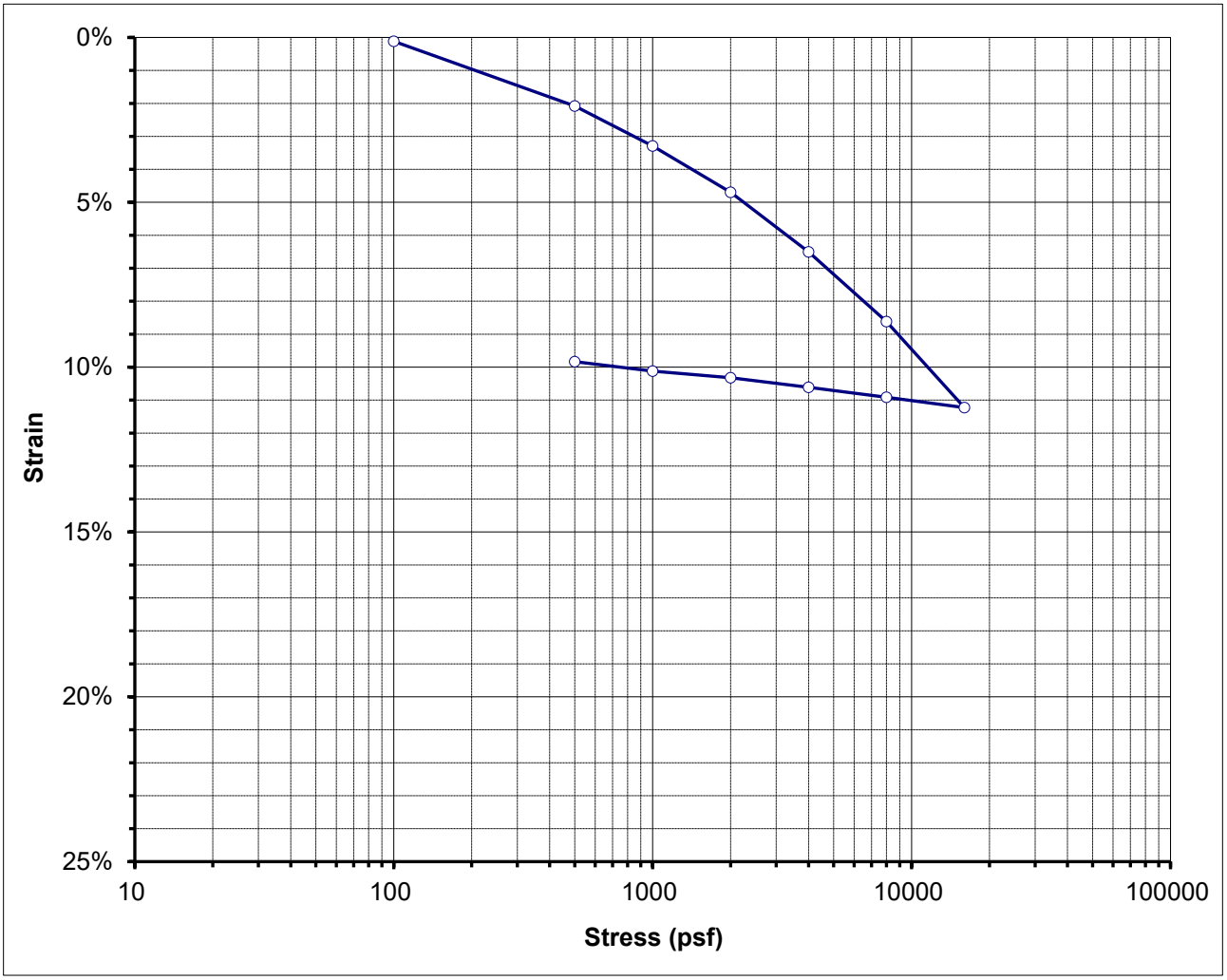
Assumed Specific Gravity of Solids, Gs: 2.66

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	-0.68%	0.594
500	-1.49%	0.607
1000	-1.35%	0.605
2000	-0.95%	0.599
4000	0.01%	0.584
8000	1.46%	0.561
16000	3.33%	0.531
8000	2.98%	0.537
4000	2.43%	0.545
2000	1.69%	0.557
1000	1.05%	0.567
500	0.47%	0.576

PROJECT NUMBER:	PROJECT NAME:	FIGURE NO.
LA1579	Spring Meadows Homes, LLC	B-21 R-1

GROUP DELTA

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-21	Sample Depth	30'
Sample No.	R-6	USCS	CL

BEFORE TEST

Initial Moisture Content:	31.10%	
Initial Dry Unit Wt:	91.10	pcf
Initial Total Unit Wt.:	119.44	pcf
Initial Void Ratio:	0.87	
Initial Degree of Saturation:	97.7%	

AFTER TEST

Final Moisture Content:	25.13%	
Final Dry Unit Wt:	101.00	pcf
Final Total Unit Wt.:	126.38	pcf
Final Void Ratio:	0.69	
Final Degree of Saturation:	100.0%	

Water Added at: 0 psf

ATTERBERG LIMITS					
LL=		PL=		PI=	

Assumed Specific Gravity of Solids, Gs: 2.73

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.12%	0.867
500	2.08%	0.830
1000	3.29%	0.807
2000	4.70%	0.781
4000	6.51%	0.747
8000	8.62%	0.708
16000	11.23%	0.659
8000	10.92%	0.665
4000	10.61%	0.670
2000	10.32%	0.676
1000	10.12%	0.680
500	9.83%	0.685

PROJECT NUMBER:	LA1579	PROJECT NAME:	Spring Meadows Homes, LLC	FIGURE NO.	B-21 R-6

GROUP DELTA

APPENDIX C

PREVIOUS FIELD INVESTIGATION AND LABORATORY TESTING

APPENDIX C – PREVIOUS FIELD INVESTIGATION DATA & LABORATORY TESTING RESULTS

APPENDIX C

PREVIOUS FIELD INVESTIGATION & LABORATORY TESTING

C.1 INTRODUCTION

Group Delta previously conducted subsurface explorations as part of prior geotechnical investigations at the project site (Project Nos. 1148 and 1148B) on July 19, 2013 and September 4, 2013. The investigation consisted of a total of nine hollow stem auger borings and eight cone penetration tests. The exploration locations are shown in Figure 2 of the main report. A summary of the field investigations is provided in Table C-1.

The laboratory testing program performed for this previous investigation included Moisture Content, Dry Unit Weight, Atterberg Limits, Percent Passing No. 200 Sieve, Consolidation, Direct Shear, Pocket Penetrometer, Expansion Index, and Corrosivity. Results of these tests have been attached as part of this Appendix.

C.2 SOIL BORINGS

Nine hollow stem auger borings were advanced to depths of 20-51.5 feet below ground surface. Subsurface materials were visually classified and recorded by GDC field engineer and geologist in accordance with the Unified Soil Classification System (USCS).

Drive samples and bulk samples of the encountered materials were obtained from the borings and recorded on the boring logs. Drive samples were obtained with a California Sampler lined with 1-inch high metal sample rings or a Standard Penetration Test (SPT) sampler. The California Sampler has an outside diameter of 3-inches, and the inside diameter of the rings is 2.42-inches. The samples were retained in brass rings and placed in sealed plastic canisters to prevent moisture loss. Standard penetration tests (SPT) were conducted using a standard 2-inch outside diameter, 1.375-inch inside diameter, split-spoon sampler in accordance with ASTM D 1586. SPT samples were placed in sealable plastic bags to protect the natural moisture. The SPT and California samplers were driven into the soil at the bottom of the borehole using a 140-pound hammer free-falling 30 inches. The penetration resistance (or “blowcount”) in blows per six inches of driving was recorded on the logs. Bulk samples were obtained by a shovel and placed into polyethylene bags. The boring logs are presented at the end of this Appendix.

C.3 CONE PENETRATION TESTS (CPT)

Four cone penetration test (CPT) soundings were conducted at the site on July 19, 2013 within the area of Lot 1. Additional four CPTs were performed in Lot 2 on September 4, 2013. The CPT soundings were advanced to practical refusal, ranging from 8 feet to 50 feet below existing grades. The CPT soundings were performed in general accordance with ASTM D3441. The locations of the soundings are shown in Figure 2 in the main report.

CPTs are advanced from the ground surface with a truck-mounted hydraulic ram that pushes a steel rod with a conical tip and a cylindrical friction-sleeve into the ground. The conical tip has a 60-degree apex angle and a projected cross-sectional area of 1.55 square inches. The cylindrical friction sleeve has a surface area of 23.25 square inches. Both the tip and the sleeve have outside diameters of 1.4 inches.

As the rod is advanced, electronic instruments measure and record both the tip resistance and the frictional resistance on the sleeve. The tip and frictional resistance are then analyzed, using available correlations, to estimate soil classification, density, strength, and compressibility of the subsurface materials. Unlike soil borings, in which drive samples are typically taken at discrete intervals, the CPT provides a continuous record of soil properties with depth. Hence, the CPT can define the subsurface soil profile with much higher resolution than a soil boring, often detecting thin layers that are easily missed with conventional drilling and sampling. The CPT logs and interpretations are presented at the end of this Appendix.

TABLE C-1

GDC FIELD EXPLORATION SUMMARY

Exploration No.	Date Performed	Ground Surface Elevation (feet, MSL)	Total Depth (ft)	Exploration Type
B-1	7/19/2013	573	30	Hollow Stem Auger
C-2	7/19/2013	572	38	Cone Penetration Test
B-3	7/19/2013	583	50	Hollow Stem Auger
C-4	7/19/2013	588	36	Cone Penetration Test
B-5	7/19/2013	640	20	Hollow Stem Auger
C-6	7/19/203	639	14	Cone Penetration Test
C-7	7/19/2013	618	8	Cone Penetration Test
B-8	9/4/2013	589	22	Hollow Stem Auger
B-9	9/4/2013	608	52	Hollow Stem Auger
C-10	9/4/2013	608	35	Cone Penetration Test
C-11	9/4/2013	609	37	Cone Penetration Test
B-12	9/4/2013	617	37	Hollow Stem Auger
B-13	9/4/2013	619	32	Hollow Stem Auger
B-14	9/4/2013	604	27	Hollow Stem Auger
C-15	9/4/2013	602	45	Cone Penetration Test
B-16	9/4/2013	603	42	Hollow Stem Auger
C-17	9/4/2013	615	50	Cone Penetration Test

KEY FOR SOIL CLASSIFICATION

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)				
PRIMARY DIVISIONS			***GROUP SYMBOL***	***SECONDARY DIVISIONS***
COARSE GRAINED SOILS (less than 50% fines passing the No. 200 Sieve)	GRAVEL (% GRAVEL > % SAND)	CLEAN GRAVEL (Less than 5% fines)	GW	Well-graded gravel, gravel with sand, little or no fines
			GP	Poorly-graded gravel, gravel with sand, little or no fines
		"DIRTY" GRAVEL (More than 12% fines)	GM	Silty gravel, silty gravel with sand, silty or non-plastic fines
			GC	Clayey gravel, clayey gravel with sand, clayey or plastic fines
	SAND (% SAND ≥ % GRAVEL)	CLEAN SAND (Less than 5% fines)	SW	Well-graded sand, sand with gravel, little or no fines
			SP	Poorly-graded sand, sand with gravel, little or no fines
		"DIRTY" SAND (More than 12% fines)	SM	Silty sand, silty sand with gravel, silty or non-plastic fines
			SC	Clayey sand, clayey sand with gravel, clayey or plastic fines
FINE GRAINED SOILS (50% or more fines passing the No. 200 Sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		ML	Inorganic silt, sandy silt, gravelly silt, or clayey silt with low plasticity
			CL	Inorganic clay of low to medium plasticity, sandy clay, gravelly clay, silty clay, Lean Clay
			OL	Low to medium plasticity Silt or Clay with significant organic content (vegetative matter)
	SILTS AND CLAYS (Liquid Limit 50 or more)		MH	Inorganic elastic silt, sandy silt, gravelly silt, or clayey silt of medium to high plasticity
			CH	Inorganic clay of high plasticity, Fat Clay
			OH	Medium to high plasticity Silt or Clay with significant organic content (vegetative matter)
HIGHLY ORGANIC SOILS			PT	Peat or other highly organic soils

Note: Dual symbols are used for coarse grained soils with 5 to 12% fines (ex: SP-SM), and for soils with Atterberg Limits falling in the CL-ML band in the Plasticity Chart. Borderline classifications between groups may be indicated by two symbols separated by a slash (ex: CL/CH, SW/GW).

CONSISTENCY CLASSIFICATION				
COARSE GRAINED SOILS		***FINE GRAINED SOILS***		
Blowcount SPT[1] (CAL)[2]	Consistency	Blowcount[3] SPT[1] (CAL)[2]	Consistency	Undrained Shear Strenth[3], S_u (ksf)
0-4 (0-6)	Very Loose	<2 (<3)	Very Soft	< 0.25
		2-4 (3-6)	Soft	0.25 -0.50
5-10 (7-15)	Loose	5-8 (7-12)	Firm	0.50 - 1.0
11-30 (16-45)	Med. Dense	9-15 (13-22)	Stiff	1.0 - 2
31-50 (46-75)	Dense	16-30 (23-45)	Very Stiff	2.0 - 4.0
>50 (>75)	Very Dense	>31 (>45)	Hard	>4.0

MOISTURE CLASSIFICATION
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

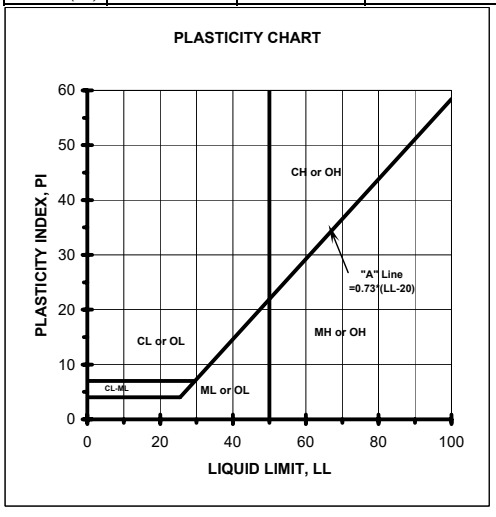
CONSISTENCY NOTES:

1. Number of blows of a 140-lb. hammer falling 30-inches to drive a 2-inch OD (1.375-inch ID) **SPT Sampler** [ASTM D-1585] the final 12-inches of driving
2. Number of blows of a 140-lb. hammer falling 30-inches to drive a 3-inch OD (2.42-inch ID) **California Ring Sampler** the final 12-inches of driving.
3. Undrained shear strength of cohesive soils predicted from field blowcounts is generally unreliable. Where possible, consistency should be based on S_u data from pocket penetrometer, torvane, or laboratory testing.

CLASSIFICATION CRITERIA BASED ON LABORATORY TESTS

Grain Size Classification

CLAY AND SILT	SAND			GRAVEL		COBBLES		BOULDERS	
	Fine	Medium	Coarse	Fine	Coarse				
US Std Sieve	**No. 200**	**No. 40**	**No. 10**	**No. 4**	**3/4"**	**3"**		**12"**		
Grain Size (mm)	0.075	0.425	2	4.75	19.1	76.2		304.8		



Classification of earth materials shown on the logs is based on field inspection and should not be construed to imply laboratory analysis unless so stated.

Granular Soil Gradation Parameters

Coefficient of Uniformity: $C_u = D_{60} / D_{10}$

Coefficient of Curvature: $C_C = (D_{30})^2 / (D_{10} \times D_{60})$

D_{10}= 10% of the soil is finer than this diameter

D_{30}= 30% of the soil is finer than this diameter

D_{30}= 60% of the soil is finer than this diameter

Group Symbol	Gradation or Plasticity Requirement
SW	C_u>6 and C_c between 1 and 3
GW	C_u>4 and C_c between 1 and 3
GP or SP	Clean gravel or sand not meeting requirement for GW or SW
GM or SM	Plots below "A" Line on Plasticity Chart or PI < 4
GC or SC	Plots above "A" Line on Plasticity Chart and PI > 7

FIGURE A- 1A

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (after drilling, date)

DEFINITIONS FOR CHANGE IN MATERIAL

Term	Definition	Symbol
Material Change	Change in material is observed in the sample or core, and the location of change can be accurately measured.	———
Estimated Material Change	Change in material cannot be accurately located because either the change is gradational or because of limitations in the drilling/sampling methods used.	- - - - - - - -
Soil/Rock Boundary	Material changes from soil characteristics to rock characteristics.	~~~~~

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010)

GROUP DELTA CONSULTANTS

GROUP DELTA CONSULTANTS, INC.
GEOTECHNICAL ENGINEERS AND GEOLOGISTS

FIGURE NUMBER **A-1B**

PROJECT NAME

PROJECT NUMBER

BORING RECORD LEGEND

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian	LA-1148	**B-1**

SITE LOCATION	START	FINISH	SHEET NO.
City of Walnut	7/19/2013	7/19/2013	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice		Hollow Stem Auger	EMH	YL

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	Auto	8"	30	573	▽ 27.0 / *546.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")		▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														Artificial Fill (af)
	570		R-1	6 8 9	17	19.3	102			3.0	DS			**Lean Clay (CL)**, dark, brown, moist, very stiff, low plasticity, trace fine sand and silt.
5			S-2	6 7 7	14	15.5								**Silty Clay and Sandy Clay (CL)** brown, very stiff and hard, moist and wet, medium plasticity, trace silt and sand, some carbonate stringers.
	565		R-3	7 11 11	22	16.8	98		32 21 11		C			
10			S-4	4 4 5	9	17.9				4.0				
	560													
15			R-5	7 11 13	24	15.8	109			4.5				
	555													
20			S-6	3 5 7	12	22.4			42 19 23	3.0				
	550													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 8/9/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-2 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian	LA-1148	**B-1**

SITE LOCATION	START	FINISH	SHEET NO.
City of Walnut	7/19/2013	7/19/2013	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice		Hollow Stem Auger	EMH	YL

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	Auto	8"	30	573	▽ 27.0 / *546.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")		▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-7	10 10 12	22	33.5	84			3.0				
	545													
30			S-8	3 4 10	14	30.4								
	540													Total depth: 30 ft. Groundwater encountered at 27 feet. Boring backfilled with tamped cuttings.
35														
	535													
40														
	530													
45														
	525													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 8/9/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE

A-2 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian	LA-1148	B-3

SITE LOCATION	START	FINISH	SHEET NO.
City of Walnut	7/19/2013	7/19/2013	1 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice		Hollow Stem Auger	EMH	YL

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	Auto	8"	50	583	▽ 34.5 / *548.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")		▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														Artificial Fill (af)
														Sandy Silt (ML), tannish brown, slightly moist, low plasticity, some grave and sand, trace clay.
	580		R-1	14 14 14	28	12.0	112			4.0	DS			**Lean Clay (CL)**, brown, moist, medium plasticity, some carbonate stringers, trace sand.
5			S-2	3 3 4	7	17.1				4.0				
	575		R-3	7 13 15	28	18.5	106		45 18 27	4.5	C			
10			S-4	4 5 6	11	16.2			45 18 27	4.0				
	570													
15			R-5	7 15 17	32	16.0	107		34 18 16	4.5	C			
	565													
20			S-6	6 7 9	16	15.7				4.0				
	560													

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-3 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian	LA-1148	**B-3**

SITE LOCATION	START	FINISH	SHEET NO.
City of Walnut	7/19/2013	7/19/2013	2 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice		Hollow Stem Auger	EMH	YL

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	Auto	8"	50	583	▽ 34.5 / *548.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")		▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-7	10 17 19	36	18.8	107			4.5				
	555													
30			S-8	15 19 23	42	21.4								
	550													
35			R-9	50/3"		21.6	99							
	545													
40			S-10	15 37 43	80	30								
	540													
45			R-11	31 50/4"		27.1	93							
	535													

Claystone, grey and brown, thinly laminated, mildy fissile, interbedded with sandstone interbeds.

▽

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 8/9/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE

A-3 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian	LA-1148	B-3

SITE LOCATION	START	FINISH	SHEET NO.
City of Walnut	7/19/2013	7/19/2013	3 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice		Hollow Stem Auger	EMH	YL

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	Auto	8"	50	583	▽ 34.5 / *548.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")		▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
		X	S-12	31 50/2"		28.7								
														Total depth: 50 Ft. Groundwater encountered at 34.5 feet. Boring backfilled with tamped cuttings.
	530													
55														
	525													
60														
	520													
65														
	515													
70														
	510													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 8/9/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-3 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian	LA-1148	**B-5**

SITE LOCATION	START	FINISH	SHEET NO.
City of Walnut	7/19/2013	7/19/2013	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice		Hollow Stem Auger	EMH	YL

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	Auto	8"	20	640	▽ / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")		▼ / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-1	16 18 22	40	15.2	108							**Sandy Silt (ML)**, light brown, slightly moist, some gravels, possible weathered zone of formation.
5	635		S-2	19 24 30	54	7.9								- with lamination of dark brown silty clay, medium plasticity.
			R-3	5 50/6"		5.4	106							**Sandstone**, tannish brown, weathered, slightly moist, heavily fractured.
10	630		S-4	12 15 18	33	6.6								- hard drilling
15	625		R-5	50/3"		3.0	148							- conglomerate ? gravel to cobble size clasts with sandy silt matrix.
20	620		S-6	60/6"										- no recovery
														Total depth: 20 feet. Groundwater not encountered. Backfilled with cutting.

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 8/9/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-4

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	B-8

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	21.5	589	▽ / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														Silty CLAY (CL), tan, moist, mostly fines, low to medium plasticity.
			R-2	18 26 32	58	12.2	119			4.5				- Hard, light brown and white, with Claystone fragments.
	585													
5			R-3	28 35 45	80	25.0	88			4.5				**Lean CLAY (CL)** hard, dark brown, moist, mostly fines, few pores, caliche stringers, and coarse angular sand, low to medium plasticity.
			S-4	5 6 6	12	11.1				2.5				**Silty SAND (SM),** medium dense, brown, moist, mostly sand, some fines.
	580													
10			R-5	12 15 20	35	12.2	114	40		2.5				- Dense, with micropores
	575													
15			S-6	4 5 5	10	10.1								- Medium dense, medium to light brown, nonplastic.
	570													**Sandy Lean CLAY (CL)** hard, medium to reddish brown, moist, mostly fines, some fine sand, low to medium plasticity.
20			R-7	15 18 23	41	12.7	110			4.5				
	565													Boring terminated at 21.5 feet bgs. Groundwater not envountered. Boring backfilled with soil cuttings and tamped.

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-5

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	**B-9**

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	1 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	51.5	608	▽ 30.5 / *577.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	AFTER DRILLING ▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														Sandy Lean CLAY (CL) light brown, moist; mostly fines, some sand, low to medium plasticity.
	605		R-2	8 10 10	20	29.7	88			2.5				- Stiff, light brown and gray fragments, orange mottling.
5			S-3	4 5 5	10	23.5				4.0				**Lean CLAY with SAND (CL)** very stiff, dark brown, moist, mostly fines, little fine sand, medium plasticity.
	600		R-4	16 20 26	46	19.1	106			4.5				- Hard.
10			S-5	4 5 6	11	18.4			45 18 27	3.5				- Very stiff, medium brown, fine to coarse sand, few gravel fragments.
	595													
15			R-6	10 12 15	27	27.8	91			4.0				- Dark brown, litlte angular coarse sand, medium plasticity.
	590													
20			S-7	20 38 50/5"	88/11"	29.9								CLAYSTONE, hard, laminated, light gray with orange oxide, weathered, moist.
	585													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-6 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	B-9

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	2 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	51.5	608	▽ 30.5 / *577.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-8	28 50/6"	50/6"	33.6	85							
	580													
30			S-9	30 50/4"	50/4"	46.5								
	575													
35			R-10	50/6"	REF	30.6	85							
	570													
40			S-11	15 18 30	48	32.2				2.0				- Very stiff.
	565													
45			R-12	40 50/4"	50/4"	20.2	100							
	560													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-6 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	B-9

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	3 of 3

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	51.5	608	▽ 30.5 / *577.5* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	AFTER DRILLING ▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
		X	S-13	16 28 40	68	33.2				2.0				- Cemented, moderately fractured, gray with some weathering on fracture and bedding surfaces.
														Boring terminated at 51.5 feet bgs. Groundwater encountered at 30.5 feet bgs. Boring backfilled with soil cuttings and tamped.
	555													
55														
	550													
60														
	545													
65														
	540													
70														
	535													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-6 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	B-12

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	36.5	617	▽ / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	615													**Fat CLAY (CH)** light olive tan, moist, mostly fines, high plasticity.
			R-2	4 11 15	26	29.5	85			4				- Very stiff, oxidized orange and black angular claystone fragments.
5			R-3	10 14 17	31	30.6	84		65 30 35	4	C			
	610		S-4	3 4 4	8	31.5				2				- Abundant light brown with orange mottling angular claystone fragments.
10			R-5	7 9 12	21	34.7	79		63 34 29	1	C			**Elastic SILT (MH)** medium stiff, medium to light brown, wet, mostly fines, few angular claystone fragments, high plasticity.
	605													**Lean CLAY**, very stiff, dark brown, moist, mostly fines, few claystone fragments, low to medium plasticity.
15			S-6	5 6 8	14	26.1				3				
	600													
20			R-7	15 19 26	45	18.1	105			4.5				- Hard, medium brown, abundant caliche stringers, low plasticity.
	595													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-7 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	**B-12**

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	36.5	617	▽ / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			S-8	9 10 12	22	27.5				4.5				
	590													
														CLAYSTONE, very stiff, very light brown, laminated, fractured.
30			R-9	18 25 32	57	21.7	98			3				
	585													
35			S-10	10 12 16	28	34.1				2.5				- Gray with orange oxides on fracture surfaces.
	580													Boring terminated at 36.5 feet bgs. Groundwater not encountered. Boring backfilled with soil cuttings and tamped.
40														
	575													
45														
	570													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-7 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	**B-13**

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	31.5	619	▽ 28.0 / *591.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														Lean CLAY (CL) tan, moist, mostly fines, medium plasticity.
			R-2	13 14 15	29	13.4	112		37 17 20	4.5				- Hard, dark brown, moist, little caliche and few coarse sand.
	615													
5			S-3	3 4 6	10	12.2				4.5				
			R-4	11 14 18	32	12.5	109			4.5				**Sandy CLAY (CL)** hard, medium brown, mostly fines, some sand, moist, low plasticity, little caliche.
	610													
10			S-5	4 5 6	11	13.0				4				- Very stiff, light brown with yellow brown.
	605													
15			R-6	11 13 15	28	12.8	99			4.5				- Hard, light to medium brown, some caliche.
	600													
20			S-7	7 7 8	16	18.9				4.5				
	595													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-8 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	**B-13**

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	31.5	619	▽ 28.0 / *591.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-8	18 28 40	68	19.8	104			4.5				SANDSTONE, weathered.
	590													
30			S-9	8 9 13	22	20.7								
														Boring terminated at 31.5 feet bgs. Groundwater encountered at 28 feet bgs. Boring backfilled with soil cutting and tamped.
	585													
35														
	580													
40														
	575													
45														
	570													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-8 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	B-14

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	26.5	604	▽ 18.0 / *586.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	AFTER DRILLING ▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														Lean CLAY (CL) tan to medium brown, moist, mostly fines, few subangular to subrounded gravels, medium plasticity.
	600		R-2	10 12 13	25	27.4	89			2.5	DS			- Very stiff, medium brown, few angular claystone fragments and subrounded gravels.
5			R-3	10 15 16	31	24.7	91		50 25 25	2.5				**Lean CLAY/Fat CLAY (CL/CH)** very stiff, dark brown to gray brown, mostly fines, trace claystone fragments, moist, medium to high plasticity.
			S-4	3 4 5	9	23.4				2.5				
	595													
10			R-5	11 16 20	36	17.2	110			4				- Very stiff, dark brown.
	590													**Sandy Lean CLAY (CL)** medium stiff, dark yellowish brown, wet, mostly fines, some sand, low plasticity, trace claystone fragments, highly weathered.
15			S-6	11 14 18	32	26.9				1.5				
	585													▽ **Clayey SAND (SC)** very dense, medium brown, mostly sand, some fines, trace coarse sand and fine gravel, low plasticity.
20			R-7	16 25 40	65	24.6	99	36	30 21 9		C			
	580													**CLAYSTONE,** Very stiff, gray, wet, thinly interbedded with gray sandstone, fractured and weathered.

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-9 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	**B-14**

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	26.5	604	▽ 18.0 / *586.0* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
		X	S-8	14 23 48	71	31.6				4				
														Boring terminated at 26.5 feet bgs. Groundwater encountered at 18 feet bgs. Boring backfilled with soil cuttings and tamped.
	575													
30														
	570													
35														
	565													
40														
	560													
45														
	555													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-9 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	**B-16**

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	1 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	41.5	603	▽ / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
														Lean CLAY (CL) dark brown, moist, mostly fines, slightly porous, few roots and organics, low to medium plasticity,
	600		R-2	7 9 10	19	16.3	105			4.5				- Hard, medium to dark brown, little caliche.
5			S-3	5 6 7	13	18.0				4				- Very stiff.
	595		R-4	7 10 12	22	21.2	100			4.5				- Hard, angular claystone fragments.
10			S-5	5 6 7	13	18.9				0.5				**SILT (ML)** medium stiff, light brown to yellow, moist, mostly fines, claystone fragments.
	590													**Clayey SAND (SC),** dense, medium brown, wet, mostly sand, some fines, trace of claystone fragments, friable, medium plasticity.
15			R-6	15 18 24	42	22.5	98	43	43 19 24	2	C			
	585													**Lean CLAY (CL)** very stiff, gray, moist, mostly fines with claystone fragments.
20			S-7	5 6 6	12	26.7				2				
	580													**Lean CLAY with SAND (CL)** very stiff, medium brown, moist, mostly fines, little sand, medium plasticity.

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-10 a

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Brookside Equestrian - Lot 2	LA-1148B	**B-16**

SITE LOCATION	START	FINISH	SHEET NO.
800 Meadow Pass Rd., Walnut, CA	9/4/2013	9/4/2013	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	CME 75	Hollow Stem Auger	S. Stone	Y. Liu

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Hammer: 140 lbs., Drop: 30 in.	85	8"	41.5	603	▽ / *na* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	N60=1.42*Nspt=0.95*Ncal	▼ / *na* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	MOISTURE (%)	DRY DENSITY (PCF)	PASSING #200 (%)	ATTERBERG LIMITS (LL:PL:PI)	POCKET PEN (TSF)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-8	9 11 14	25	32.3	87		46 21 25	2	C			
	575													
30			S-9	10 12 15	27	19.7				4.5				- Hard, light brown.
	570													**Clayey SAND (SC)** dense, light brown, wet, mostly fine sand, some fines, trace claystone fragments, low plasticity.
35			R-10	15 18 22	40	21.4	100	38	35 20 15					
	565													
40			S-11	15 28 50/6"	78	26.9				4.5				**CLAYSTONE,** hard, gray and brown, moist, laminated, some caliche, weathered.
														Boring terminated at 41.5 feet bgs. Groundwater not encountered. Boring backfilled with soil cuttings and tamped.
	560													
45														
	555													

GDC_LOG_BORING_2011 BORING LOGS.GPJ GDCLOG.GDT 10/3/13

GROUP DELTA CONSULTANTS, INC.
370 Amaploa Ave., Suite 212
Torrance, CA 90501

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

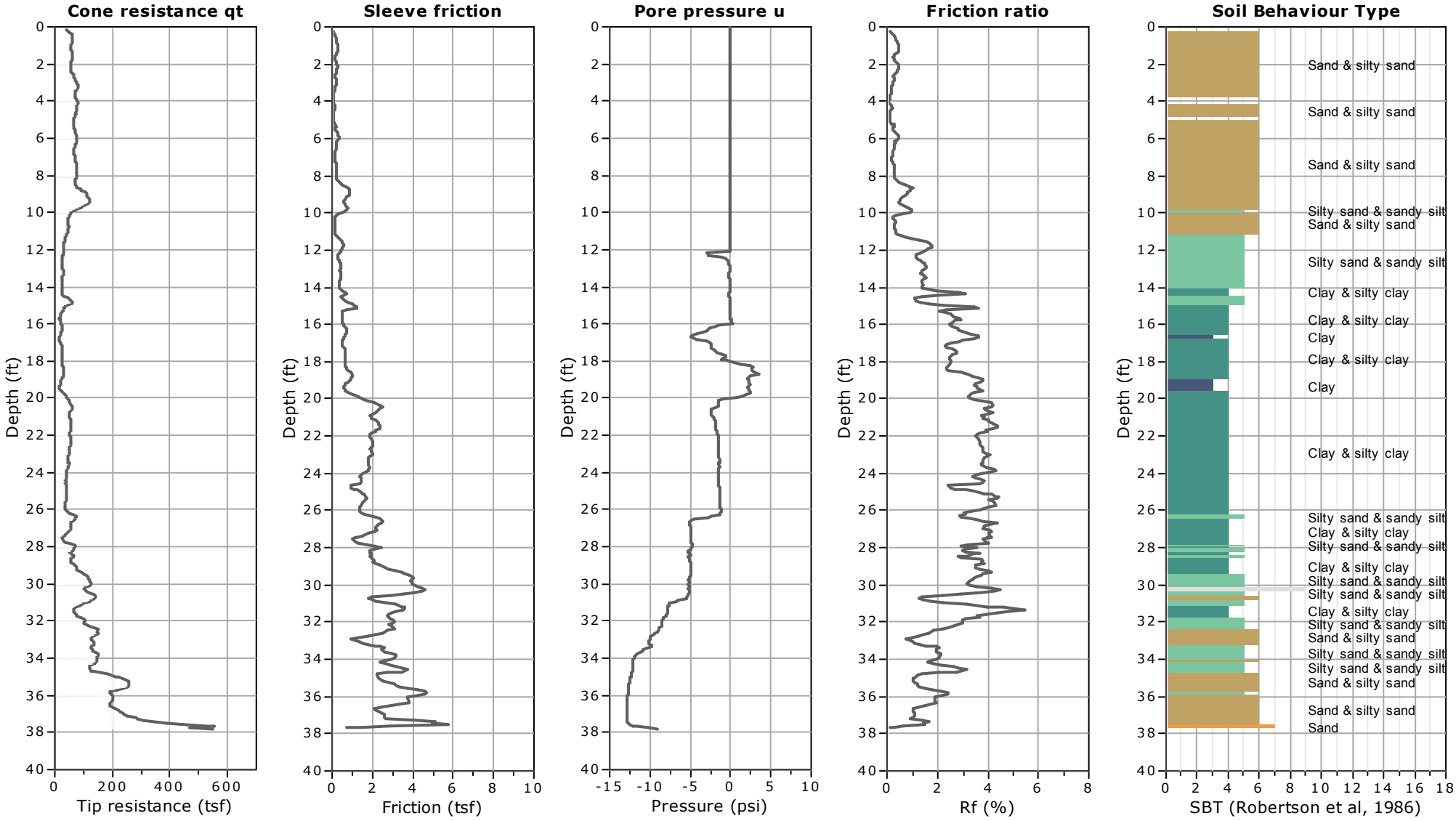
FIGURE
A-10 b

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C- 2

Project: **Group Delta**
Location: **San Vincente Dr. & La Puente Rd. Walnut, CA**

Total depth: 37.84 ft, Date: 7/19/2013
Cone Type: Vertek



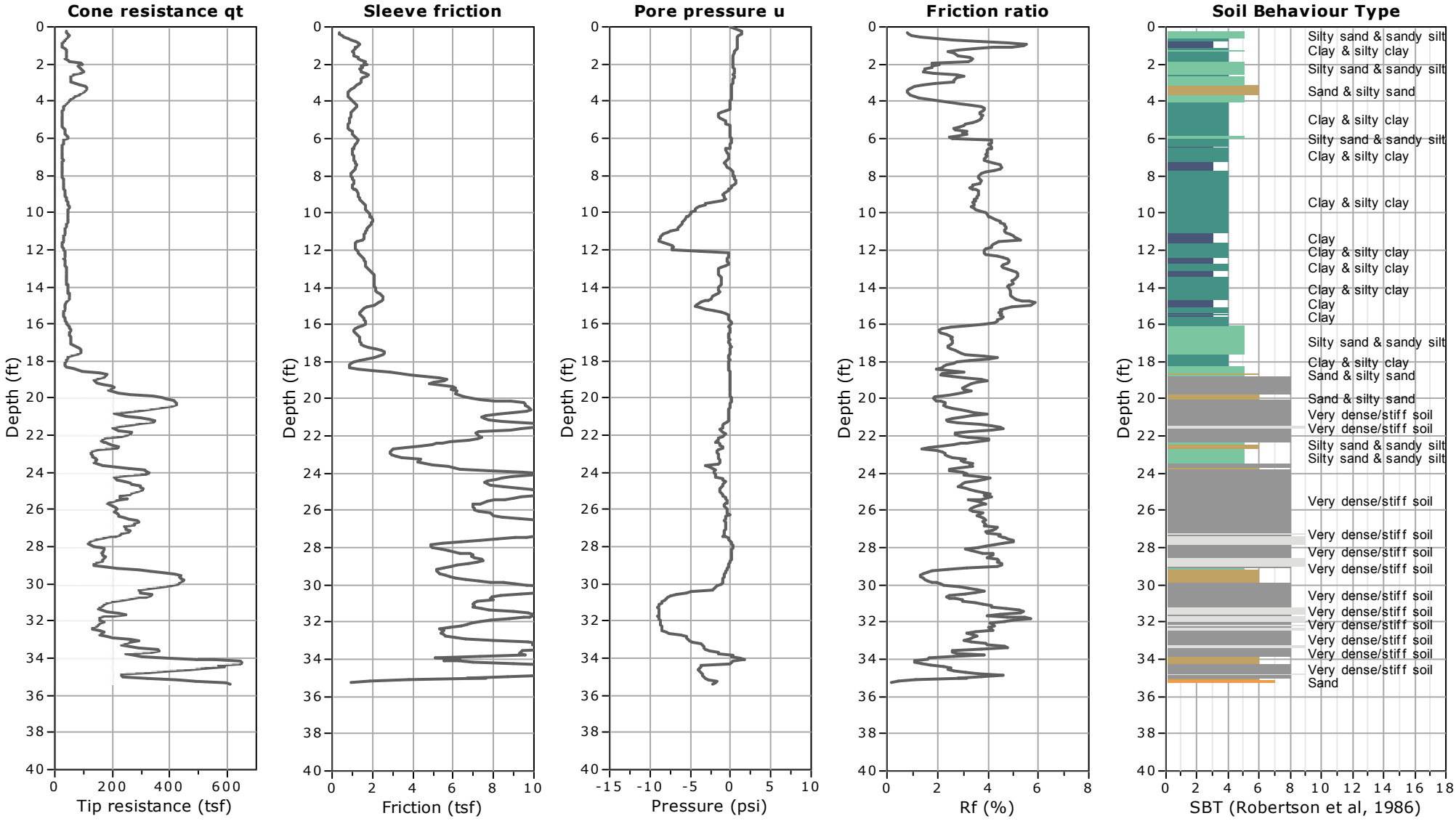
In situ data							Estimations													
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	56.9	0.26	6	2.19E-04	12	433.0615	55	40	345.52779	433.0615	0	0	0	0.33	0	502.78934	-0.11437	0	0	20
2	54.2	0.23	6	2.15E-04	11	413.28321	54	40	329.74724	413.28321	0	0	0	0.33	0	493.45132	-0.10747	0	0	20
3	75	0.19	6	1.07E-03	14	427.70972	64	41	341.25775	427.70972	0	0	0	0.33	0	503.38733	-0.1497	0	0	20
4	76.8	0.06	0	0.00E+00	13	383.32472	0	0	305.84419	383.32472	0	0	0	0.33	0	496.05811	0	0	0	20
5	65.5	0.05	0	0.00E+00	12	362.28759	0	0	289.05925	362.28759	0	0	0	0.33	0	486.44958	0	0	0	20
6	75.7	0.34	6	3.44E-04	15	529.24799	60	41	422.27234	529.24799	0	0	0	0.33	0	549.24542	-0.13414	0	0	20
7	69.2	0.12	6	6.78E-04	13	427.39052	54	40	341.00308	427.39052	0	0	0	0.33	0	511.64856	-0.10534	0	0	20
8	75.5	0.18	6	5.44E-04	15	485.16857	56	40	387.10258	485.16857	0	0	0	0.33	0	537.07349	-0.11101	0	0	20
9	111	0.88	6	2.02E-04	24	854.56857	67	42	681.83663	854.56857	0	0	0	0.33	0	674.74921	-0.16921	0	0	20
10	55	0.38	6	4.65E-05	13	549.18931	47	38	438.18296	549.18931	0	0	0	0.33	0	559.41119	-0.08804	0	0	20
11	44.9	0.15	6	6.52E-05	11	420.24428	41	37	335.30129	420.24428	0	0	0	0.33	0	505.96405	-0.04385	0	0	20
12	29.3	0.46	5	2.04E-06	10	401.06094	34	35	405.83579	508.64752	0	0	0	0.33	0	538.69629	-0.07546	0	0	20
13	26.6	0.4	5	1.49E-06	9	362.46111	31	34	388.17689	486.51504	0	0	0	0.33	0	529.8092	-0.06413	0	0	20
14	25.3	0.35	5	1.30E-06	9	343.47411	29	34	376.85214	472.32134	0	0	0	0.33	0	524.61469	-0.05317	0	0	20
15	41.5	1.17	4	9.89E-07	14	569.44427	0	0	656.7671	823.1481	14	2.90533	3.37526	0.33	15.59372	663.09485	0	1.68355	2.43352	20
16	22.6	0.57	4	2.53E-07	9	303.99824	0	0	0	562.35469	14	1.55101	1.72943	0.33	7.98998	564.09015	0	1.33937	2.66665	20
17	19.3	0.49	4	1.44E-07	8	256.64394	0	0	0	525.94018	14	1.30941	1.38649	0.33	6.40557	549.14111	0	1.24186	2.61882	20
18	26.2	0.68	4	2.64E-07	10	352.73421	0	0	0	647.68244	14	1.79966	1.79858	0.33	8.30946	601.02869	0	1.35745	2.59363	20
19	22.7	0.87	3	7.62E-08	10	303.40278	0	0	0	697.32269	14	1.54797	1.46959	0.33	6.7895	619.73688	0	1.26683	1.74369	20
20	43.6	1.46	4	4.30E-07	16	594.82832	0	0	797.55368	999.60062	14	3.03484	2.73976	0.33	12.65771	725.49683	0	1.56762	2.03708	20
21	50.4	1.74	4	5.04E-07	19	688.77043	0	0	897.25709	1124.5622	14	3.51413	3.02607	0.33	13.98043	764.41199	0	1.62182	1.97923	20
22	51.6	1.75	4	4.98E-07	19	704.7728	0	0	920.40225	1153.5708	14	3.59578	2.958	0.33	13.66597	773.8974	0	1.60925	2.01364	20
23	49.9	2.02	4	2.83E-07	19	680.13584	0	0	0	1233.2279	14	3.47008	2.71427	0.33	12.53994	797.06494	0	1.56261	1.6835	20
24	40.1	1.53	4	1.70E-07	16	542.07915	0	0	0	1077.4765	14	2.76571	2.05817	0.33	9.50872	752.80469	0	1.42151	1.7715	20
25	39	1.37	4	1.69E-07	16	525.84915	0	0	0	1045.8745	14	2.6829	1.91398	0.33	8.8426	744.3515	0	1.38663	1.91916	20
26	38.7	1.33	4	1.57E-07	16	520.82936	0	0	0	1050.7733	14	2.65729	1.81762	0.33	8.39741	746.81683	0	1.36235	1.95801	20
27	57.4	2.03	4	3.58E-07	22	781.09919	0	0	0	1356.6884	14	3.9852	2.66215	0.33	12.29914	834.75641	0	1.55229	1.92389	20
28	68.1	2.44	4	4.81E-07	25	930.03011	0	0	1221.9121	1531.4632	14	4.74505	3.07172	0.33	14.19133	880.72211	0	1.63015	1.9058	20
29	71.2	2.5	4	5.13E-07	26	972.5299	0	0	1262.8674	1582.7938	14	4.96189	3.10226	0.33	14.33243	894.35309	0	1.63568	1.94506	20
30	125.5	4.1	5	2.09E-06	41	1731.75355	47	38	1744.5419	2186.4925	0	0	0	0.33	0	1031.11047	-0.17135	0	0	20
31	112.8	2.86	5	2.74E-06	36	1552.72843	44	38	1488.8339	1866.0052	0	0	0	0.33	0	963.14368	-0.14286	0	0	20
32	103.5	3.09	5	1.42E-06	35	1421.37279	41	37	1534.7418	1923.5431	0	0	0	0.33	0	976.54034	-0.14599	0	0	20
33	124.4	1	6	3.51E-05	31	1298.11862	47	38	1035.7329	1298.1186	0	0	0	0.33	0	827.4859	-0.09251	0	0	20
34	143.5	2.96	5	6.37E-06	42	2042.12562	48	39	1629.3555	2042.1256	0	0	0	0.33	0	1004.32709	-0.14219	0	0	20
35	215.6	2.28	6	7.42E-05	50	1977.1974	61	41	1577.5511	1977.1974	0	0	0	0.33	0	991.72406	-0.1571	0	0	20
36	195.6	4.11	5	1.12E-05	54	2523.72949	56	40	2013.614	2523.7295	0	0	0	0.33	0	1103.20593	-0.1667	0	0	20
37	238.7	2.63	6	7.77E-05	55	2171.56162	63	41	1732.629	2171.5616	0	0	0	0.33	0	1034.17126	-0.16491	0	0	20

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C-4

Project: **Group Delta**
Location: **San Vincente Dr. & La Puente Rd. Walnut, CA**

Total depth: 35.40 ft, Date: 7/19/2013
Cone Type: Vertek



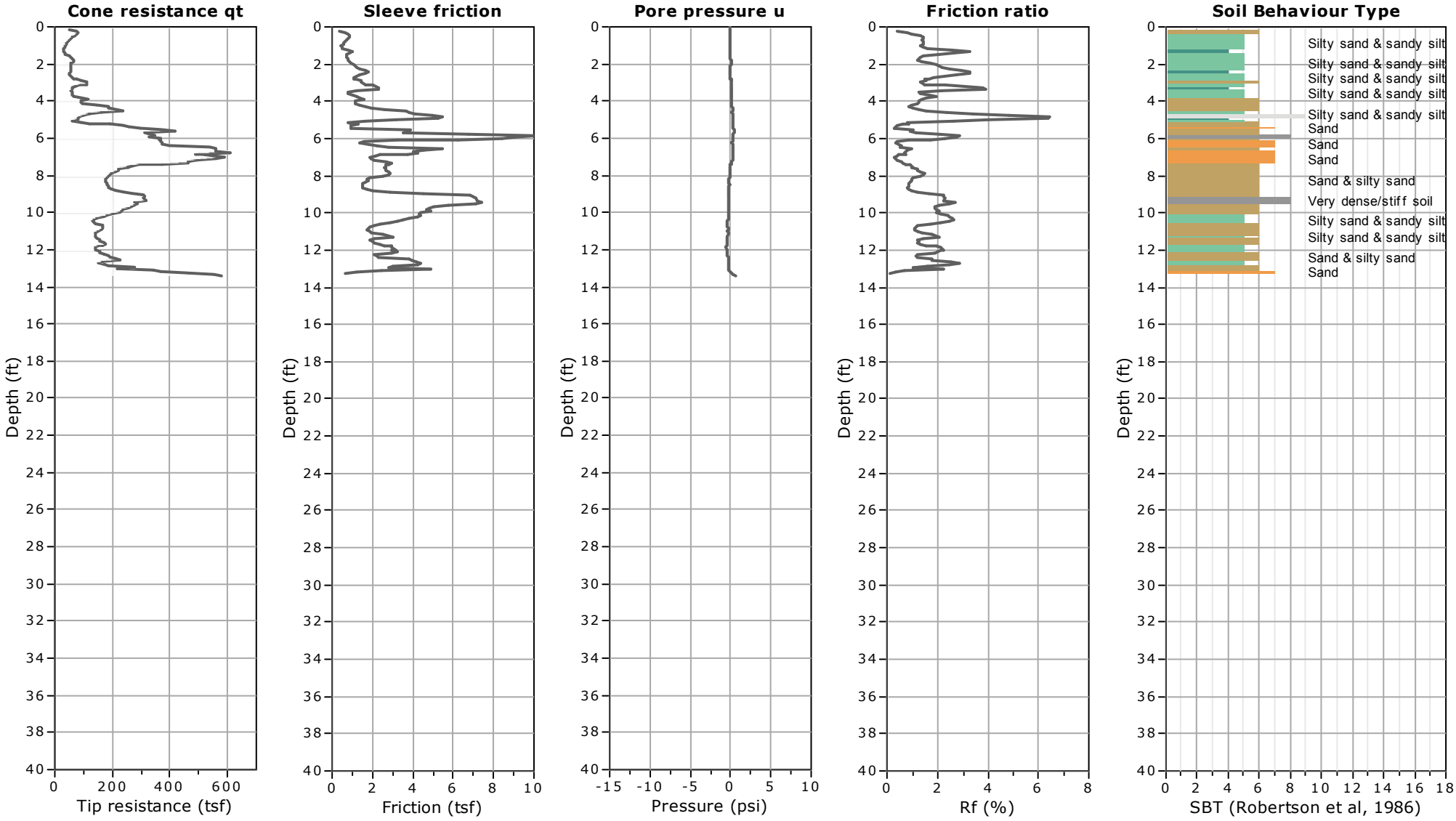
In situ data									Estimations										
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	23.2	1.3	3	1.98E-07	9	324.09806	0	0	0	626.50684	14	1.65356	3.12551	0.33	14.43984	580.05261	0	1.63986	1.24653	20
2	94.6	1.73	6	4.31E-05	23	965.86203	71	42	770.6346	965.86203	0	0	0	0.33	0	704.18805	-0.2101	0	0	20
3	66.1	1.46	5	1.37E-05	18	829.66017	60	41	661.9629	829.66017	0	0	0	0.33	0	658.22919	-0.18228	0	0	20
4	48.8	1.02	5	8.17E-06	14	670.65715	51	39	535.09879	670.65715	0	0	0	0.33	0	600.04858	-0.15206	0	0	20
5	24.1	0.88	4	5.22E-07	9	332.99873	0	0	431.12648	540.34519	14	1.69897	3.21134	0.33	14.8364	545.01324	0	1.65512	1.89204	20
6	47.3	1.22	5	4.76E-06	14	657.12388	50	39	570.30899	714.78727	0	0	0	0.33	0	616.31268	-0.16331	0	0	20
7	27.1	1.07	4	5.60E-07	10	373.42364	0	0	477.31251	598.23167	14	1.90522	3.60119	0.33	16.63749	569.30432	0	1.72127	1.74497	20
8	26	0.93	4	5.85E-07	9	357.31807	0	0	453.23648	568.05639	14	1.82305	3.3333	0.33	15.39987	557.40887	0	1.67636	1.92106	20
9	35.6	1.3	4	8.71E-07	13	490.62841	0	0	579.06502	725.7615	14	2.50321	4.09175	0.33	18.90387	621.61444	0	1.79812	1.88703	20
10	46.6	1.81	4	1.10E-06	16	643.09226	0	0	727.9862	912.40937	14	3.28108	4.88176	0.33	22.55375	688.2771	0	1.91003	1.7765	20
11	35.6	1.66	4	3.67E-07	14	487.80162	0	0	673.11464	843.63702	14	2.48878	3.52545	0.33	16.28757	665.30762	0	1.7088	1.46928	20
12	30.9	1.19	4	3.44E-07	12	421.18114	0	0	0	736.98517	14	2.14888	2.82994	0.33	13.07433	629.00525	0	1.58508	1.76967	20
13	37.9	1.79	4	3.02E-07	15	519.31811	0	0	0	930.12076	14	2.64958	3.25725	0.33	15.04851	696.56598	0	1.66318	1.45061	20
14	43.8	2.09	4	3.49E-07	17	601.07135	0	0	0	1049.2872	14	3.06669	3.51906	0.33	16.25807	735.42572	0	1.70774	1.43797	20
15	35.2	1.75	3	1.73E-07	14	479.29765	0	0	0	949.75406	14	2.4454	2.65424	0.33	12.26257	704.87421	0	1.55071	1.36942	20
16	43.5	1.6	4	4.64E-07	16	595.38782	0	0	787.57685	987.09632	14	3.03769	3.09072	0.33	14.27914	718.99402	0	1.63359	1.86059	20
17	54	1.41	5	1.38E-06	18	741.48909	38	36	805.48418	1009.5402	0	0	0	0.33	0	728.30133	-0.12645	0	0	20
18	39.1	1.08	4	5.11E-07	14	532.05066	0	0	691.47254	866.64559	14	2.71454	2.4926	0.33	11.51583	682.46246	0	1.51774	2.4632	20
19	147.6	5.68	8	3.88E-06	45	2050.11995	61	41	1846.3558	2314.0993	0	0	0	0.33	0	1049.79932	-0.22336	0	0	20
20	386.7	7.3	6	1.21E-04	86	3269.29688	98	45	2608.4816	3269.2969	0	0	0	0.33	0	1238.13049	-0.28459	0	0	20
21	247.2	6.89	8	1.93E-05	65	2908.13698	76	43	2320.3221	2908.137	0	0	0	0.33	0	1167.74133	-0.24341	0	0	20
22	244.7	7.35	8	1.46E-05	66	3024.66674	74	43	2413.2979	3024.6667	0	0	0	0.33	0	1190.90747	-0.24256	0	0	20
23	116.2	3.03	5	4.29E-06	35	1606.45988	50	39	1420.9479	1780.9213	0	0	0	0.33	0	939.13104	-0.16181	0	0	20
24	324.5	10.06	8	1.96E-05	86	3806.18035	83	44	3036.846	3806.1804	0	0	0	0.33	0	1335.93066	-0.26738	0	0	20
25	289.3	10.95	8	8.97E-06	82	3906.78478	76	43	3117.1155	3906.7848	0	0	0	0.33	0	1353.47107	-0.26323	0	0	20
26	214.2	6.99	8	7.13E-06	62	3008.99618	64	41	2400.7948	3008.9962	0	0	0	0.33	0	1187.81836	-0.22084	0	0	20
27	242.2	10.5	9	4.05E-06	74	3366.78226	0	0	3008.2575	3770.3494	14	17.17746	11.12371	0.33	51.39155	1329.62769	0	2.53147	1.60323	20
28	127.2	4.64	4	1.60E-06	42	1756.03238	0	0	1857.4323	2327.9818	14	8.95935	5.47397	0.33	25.28974	1060.19421	0	1.98631	1.89228	20
29	126.1	5.93	4	7.82E-07	45	1739.5702	0	0	2093.2719	2623.5674	14	8.87536	5.1336	0.33	23.71723	1118.07788	0	1.94318	1.46675	20
30	429.8	2.59	6	1.57E-03	75	2281.40226	93	45	1820.2678	2281.4023	0	0	0	0.33	0	1054.6759	-0.2601	0	0	20
31	195.5	6.74	5	3.76E-06	60	2707.88977	56	40	2452.9058	3074.3086	0	0	0	0.33	0	1201.4353	-0.20227	0	0	20
32	161.1	7.21	9	1.21E-06	55	2225.28709	0	0	2474.8558	3101.8193	14	11.35351	6.04001	0.33	27.90485	1206.70703	0	2.0543	1.54319	20
33	254.9	7.74	5	8.00E-06	73	3503.76052	63	41	2795.5536	3503.7605	0	0	0	0.33	0	1281.75916	-0.21315	0	0	20
34	438	5.34	6	2.43E-04	91	3257.38277	88	44	2598.9756	3257.3828	0	0	0	0.33	0	1235.87244	-0.24433	0	0	20
35	232	6.89	5	6.21E-06	68	3333.74824	58	40	2659.9055	3333.7482	0	0	0	0.33	0	1250.27527	-0.19766	0	0	20

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C-6B

Project: **Group Delta**
Location: **San Vincente Dr. & La Puente Rd. Walnut, CA**

Total depth: 13.37 ft, Date: 7/19/2013
Cone Type: Vertek



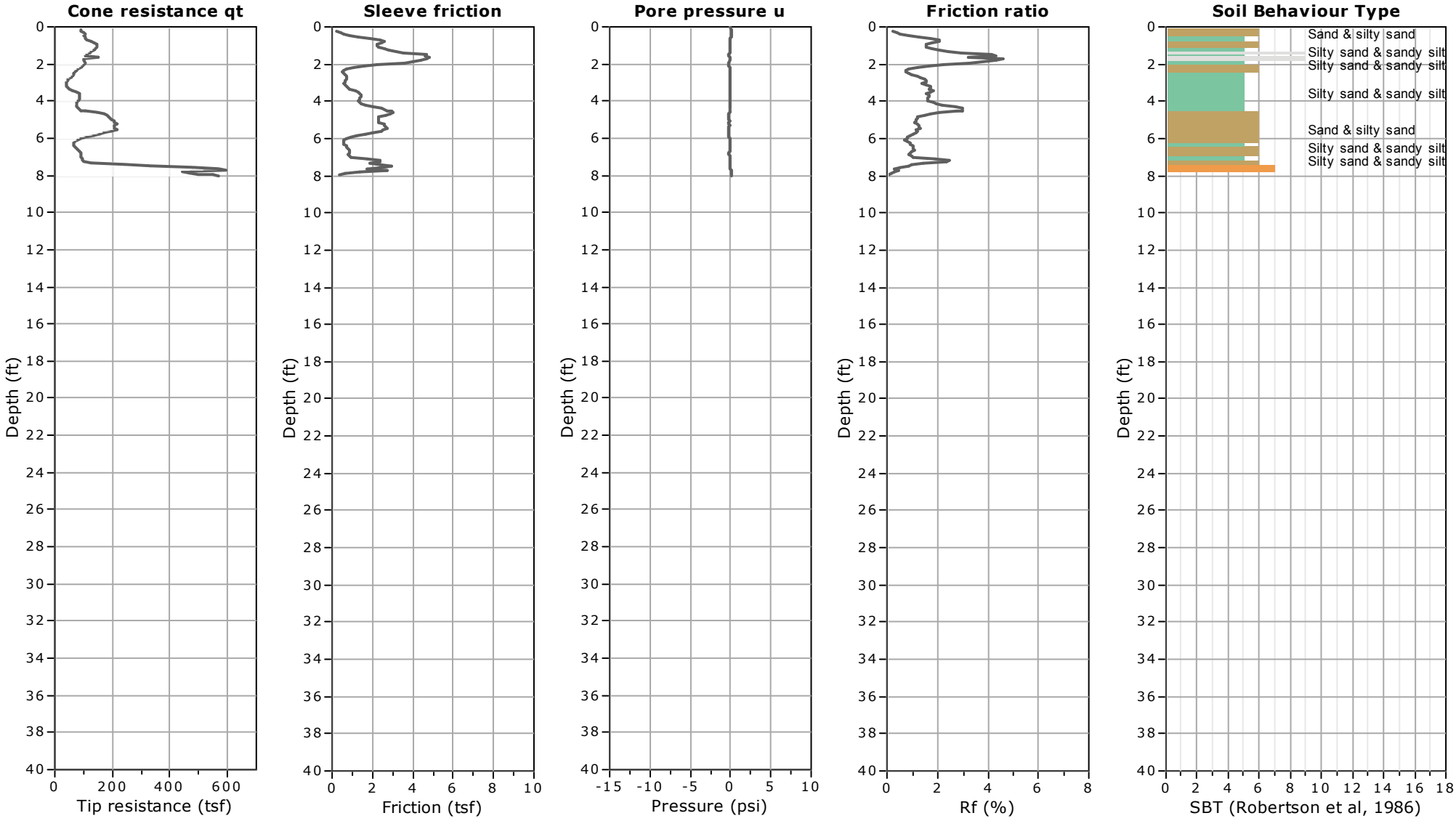
In situ data									Estimations										
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	36.1	0.48	5	1.07E-05	10	474.14706	44	38	378.30882	474.14706	0	0	0	0.33	0	518.22546	-0.102	0	0	20
2	48.4	1.02	5	7.97E-06	14	669.81868	51	39	534.4298	669.81868	0	0	0	0.33	0	599.72357	-0.15193	0	0	20
3	110.2	1.45	6	1.25E-04	24	927.92549	77	43	740.36608	927.92549	0	0	0	0.33	0	692.7655	-0.2164	0	0	20
4	84	0.97	6	9.49E-05	19	742.26708	67	42	592.23437	742.26708	0	0	0	0.33	0	628.76758	-0.18095	0	0	20
5	73.3	2.57	8	5.56E-06	22	1021.99396	63	41	862.34822	1080.8098	0	0	0	0.33	0	738.24915	-0.22178	0	0	20
6	367.1	7.78	8	2.05E-04	78	2828.17755	100	48	2256.5246	2828.1776	0	0	0	0.33	0	1151.57593	-0.36013	0	0	20
7	533.3	2.06	7	1.94E-02	74	1802.78995	100	48	1438.3962	1802.79	0	0	0	0.33	0	941.64807	-0.36571	0	0	20
8	192.4	2.75	6	1.68E-04	42	1534.39372	88	44	1224.2503	1534.3937	0	0	0	0.33	0	869.96912	-0.24958	0	0	20
9	270.3	4.73	6	1.63E-04	59	2167.63732	100	46	1729.4979	2167.6373	0	0	0	0.33	0	1015.52234	-0.28955	0	0	20
10	217	4.28	6	7.81E-05	50	1986.43844	89	44	1584.9243	1986.4384	0	0	0	0.33	0	976.73578	-0.2624	0	0	20
11	150.9	1.71	6	1.27E-04	33	1262.68715	71	42	1007.4632	1262.6872	0	0	0	0.33	0	801.79199	-0.19427	0	0	20
12	131	3.13	5	1.68E-05	35	1578.37339	66	42	1259.3405	1578.3734	0	0	0	0.33	0	882.31689	-0.20652	0	0	20
13	221.3	4.76	6	5.02E-05	53	2192.07363	83	44	1748.9949	2192.0736	0	0	0	0.33	0	1022.901	-0.25064	0	0	20

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C-7B

Project: **Group Delta**
Location: **San Vincente Dr. & La Puente Rd. Walnut, CA**

Total depth: 8.06 ft, Date: 7/19/2013
Cone Type: Vertek



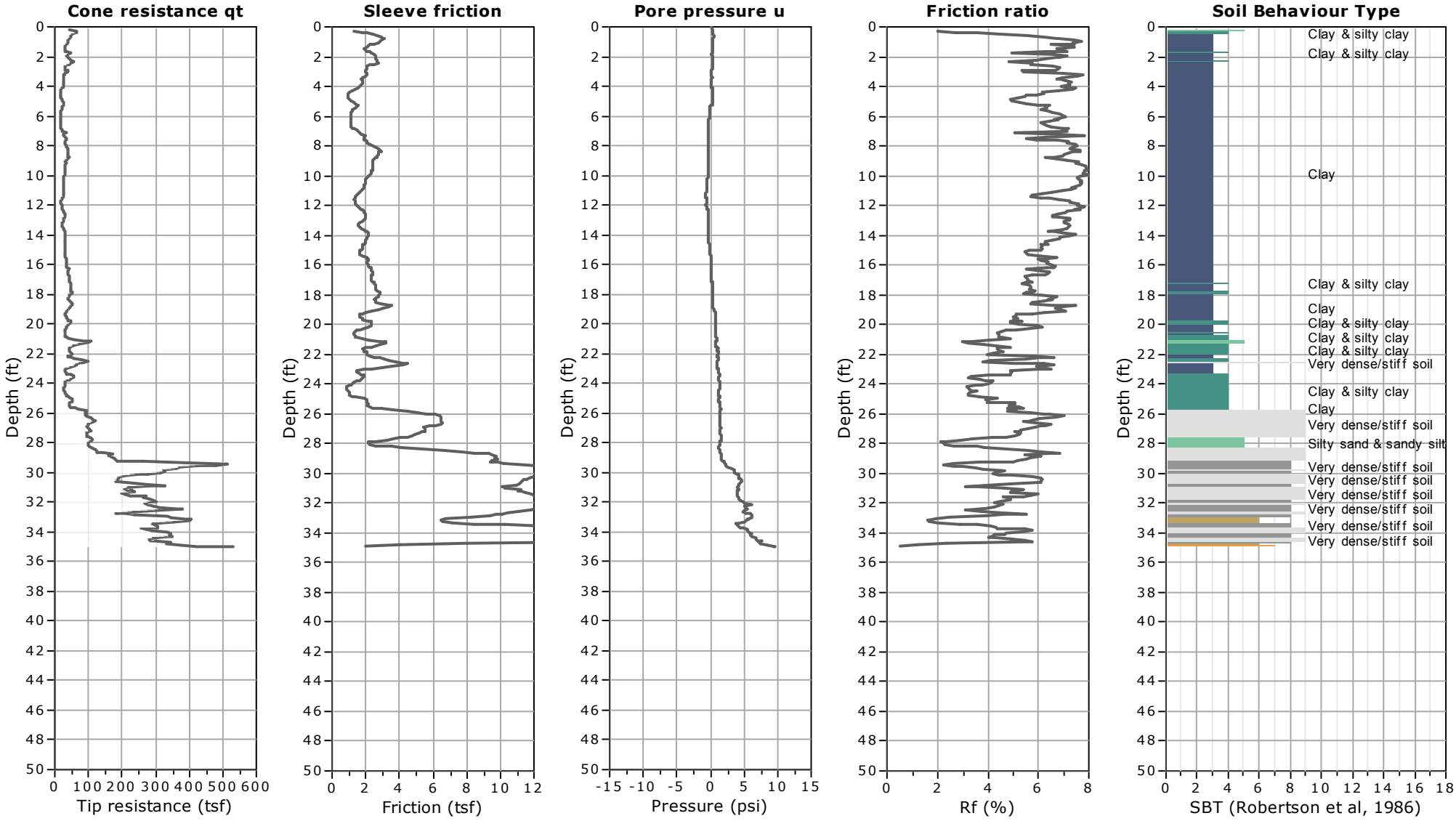
In situ data									Estimations										
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	145.6	2.18	6	1.56E-04	32	1178.26286	89	44	940.10334	1178.2629	0	0	0	0.33	0	769.39996	-0.25355	0	0	20
2	99.8	2.21	6	3.02E-05	25	1086.55034	73	43	866.92846	1086.5503	0	0	0	0.33	0	741.22913	-0.22416	0	0	20
3	40	0.5	5	1.51E-05	11	491.89383	46	38	392.46848	491.89383	0	0	0	0.33	0	526.56476	-0.10753	0	0	20
4	79.2	1.17	6	4.88E-05	19	789.13741	65	42	629.63091	789.13741	0	0	0	0.33	0	645.04639	-0.1823	0	0	20
5	194.4	2.1	6	4.67E-04	38	1289.05597	96	45	1028.5021	1289.056	0	0	0	0.33	0	803.40955	-0.26888	0	0	20
6	96.7	0.77	6	2.00E-04	21	745.84242	67	42	595.08704	745.84242	0	0	0	0.33	0	633.82007	-0.16935	0	0	20
7	92.7	0.77	6	1.45E-04	20	756.90915	64	41	603.91687	756.90915	0	0	0	0.33	0	638.78046	-0.15894	0	0	20
8	551.5	0	0	0.00E+00	39	495.52166	0	0	395.36303	495.52166	0	0	0	0.33	0	203.58307	0	0	0	20

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C-10

Project: **Group Delta/Brookside Equestrian Lot 2**
Location: **800 Meadowpass Heights Rd. Walnut, CA**

Total depth: 35.02 ft, Date: 9/4/2013
Cone Type: Vertek



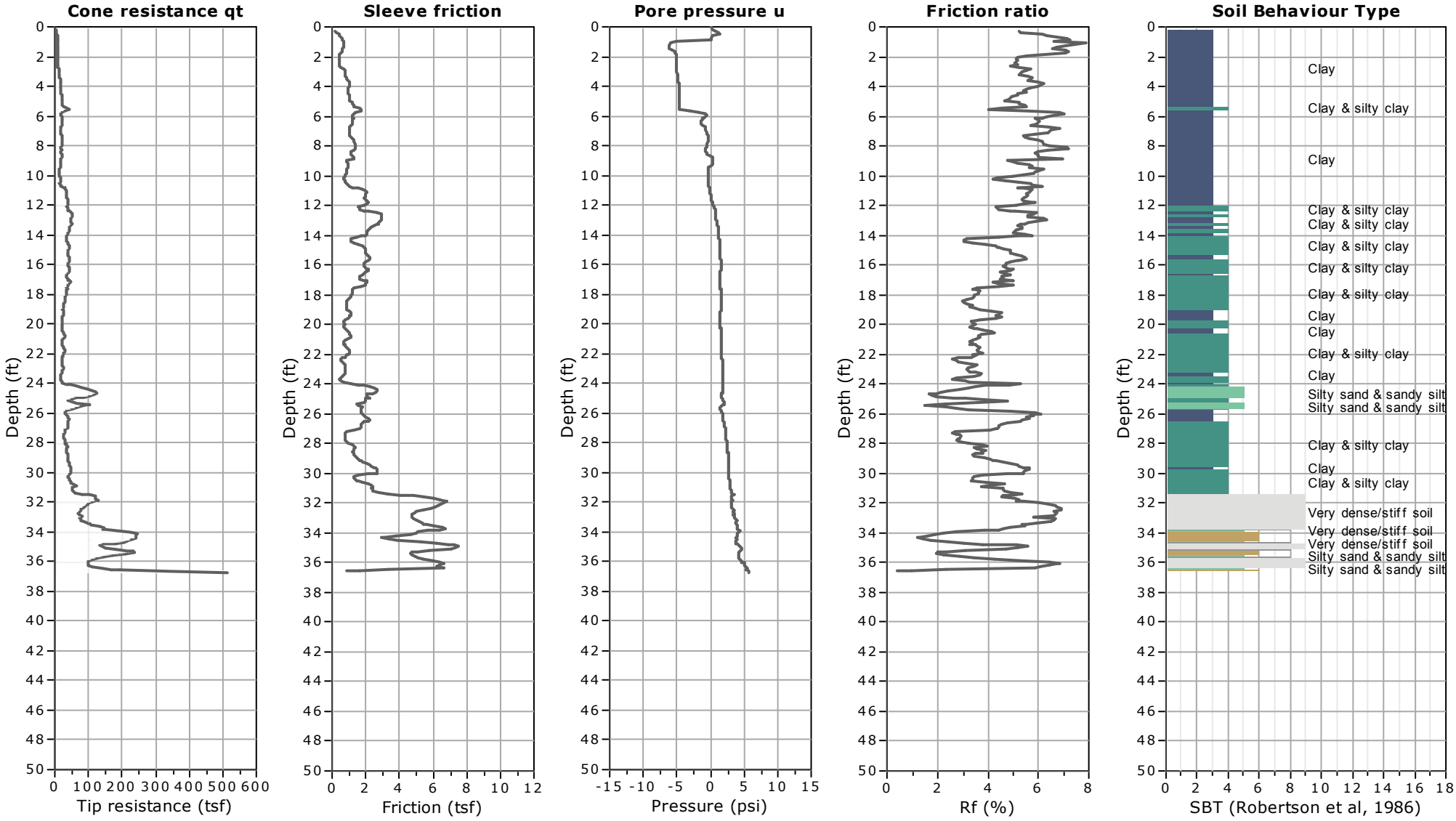
In situ data									Estimations										
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	37.5	2.86	9	2.50E-07	15	524.1758	0	0	0	971.86538	14	2.67437	5.055	0.33	23.35409	702.40216	0	1.93295	0.91639	20
2	36	2.55	9	2.74E-07	14	502.2725	0	0	0	915.75099	14	2.56261	4.84377	0.33	22.37821	684.36176	0	1.90493	0.98485	20
3	37.4	2	9	5.69E-07	14	520.98613	0	0	664.10716	832.34765	14	2.65809	5.02424	0.33	23.21197	656.8642	0	1.92892	1.30247	20
4	23.2	1.63	3	1.15E-07	10	321.33895	0	0	0	685.70055	14	1.63948	3.0989	0.33	14.31691	602.69147	0	1.63507	0.9857	20
5	23.6	1.21	4	2.39E-07	9	326.13073	0	0	0	609.564	14	1.66393	3.14511	0.33	14.5304	573.31403	0	1.64337	1.34765	20
6	16.2	1.14	3	5.18E-08	7	221.61889	0	0	0	546.24845	14	1.13071	2.13723	0.33	9.87399	545.82794	0	1.43996	0.97201	20
7	21.4	1.51	3	9.27E-08	9	293.55473	0	0	0	651.23075	14	1.49773	2.83096	0.33	13.07901	589.18604	0	1.58527	0.97204	20
8	32.9	2.47	9	1.91E-07	13	453.68545	0	0	0	883.40049	14	2.31472	4.36424	0.33	20.16277	673.3786	0	1.83821	0.91839	20
9	33.8	2.41	3	1.84E-07	14	465.36727	0	0	0	911.73053	14	2.37432	4.032	0.33	18.62782	684.40277	0	1.7891	0.96549	20
10	28	2.22	3	9.23E-08	12	383.29763	0	0	0	850.90241	14	1.9556	3.23531	0.33	14.94715	663.99298	0	1.65934	0.86328	20
11	25	1.78	3	8.42E-08	11	340.42069	0	0	0	768.3901	14	1.73684	2.75049	0.33	12.70729	635.841	0	1.56972	0.95624	20
12	19.5	1.48	3	3.97E-08	9	262.57114	0	0	0	678.98979	14	1.33965	2.07305	0.33	9.57748	602.54639	0	1.42502	0.88706	20
13	25.6	1.85	3	7.11E-08	11	347.18092	0	0	0	808.0873	14	1.77133	2.58459	0.33	11.9408	651.15332	0	1.53667	0.93833	20
14	29.3	2.18	3	8.05E-08	13	398.08917	0	0	0	905.92658	14	2.03107	2.83228	0.33	13.08514	685.18677	0	1.58553	0.91305	20
15	28.7	1.72	3	1.13E-07	12	388.8733	0	0	0	832.7834	14	1.98405	2.64219	0.33	12.20694	661.71429	0	1.5483	1.13045	20
16	32.7	2.11	3	1.17E-07	14	444.03961	0	0	0	945.06578	14	2.26551	2.90197	0.33	13.40709	699.7486	0	1.59876	1.05223	20
17	41.5	2.34	3	2.38E-07	16	566.37426	0	0	0	1059.6377	14	2.88966	3.52609	0.33	16.29053	736.99255	0	1.70891	1.2102	20
18	47.5	2.76	3	2.72E-07	19	649.5033	0	0	0	1185.5677	14	3.31379	3.89545	0.33	17.99699	774.82831	0	1.76814	1.17664	20
19	40.5	2.81	3	1.22E-07	17	550.64613	0	0	0	1161.4736	14	2.80942	3.22126	0.33	14.88224	767.69196	0	1.65687	0.9798	20
20	44.3	2.33	4	2.55E-07	17	602.99874	0	0	0	1114.1744	14	3.07652	3.38772	0.33	15.65127	755.33459	0	1.68567	1.29399	20
21	44.4	1.97	4	3.46E-07	17	603.57361	0	0	0	1054.9048	14	3.07946	3.28121	0.33	15.15917	738.56934	0	1.66735	1.53191	20
22	51.2	2.04	4	5.60E-07	19	697.9237	0	0	892.27367	1118.3163	14	3.56084	3.67425	0.33	16.97505	758.60828	0	1.73314	1.7106	20
23	34.8	2.18	3	8.28E-08	15	467.45299	0	0	0	1058.4265	14	2.38496	2.41152	0.33	11.14121	739.36395	0	1.50067	1.07214	20
24	29.7	1.13	4	1.52E-07	12	395.26662	0	0	0	801.78649	14	2.01667	1.98104	0.33	9.15241	657.35657	0	1.40306	1.74897	20
25	47.2	2.07	4	3.15E-07	18	639.38479	0	0	0	1136.5152	14	3.26217	3.11341	0.33	14.38396	765.0354	0	1.63769	1.54441	20
26	91.4	5.76	9	5.14E-07	34	1257.23926	0	0	1632.44	2045.9915	14	6.41449	5.94293	0.33	27.45632	991.02997	0	2.04295	1.09135	20
27	91.1	5.44	9	5.50E-07	33	1252.14298	0	0	1605.9924	2012.8438	14	6.38848	5.75439	0.33	26.58526	984.53491	0	2.02054	1.15087	20
28	96	2.1	5	5.91E-06	28	1319.82945	49	39	1101.3868	1380.4048	0	0	0	0.33	0	837.00879	-0.14833	0	0	20
29	172	9.83	9	1.80E-06	57	2382.90962	0	0	2464.9677	3089.4262	14	12.1577	10.46317	0.33	48.33986	1203.58887	0	2.47901	1.21206	20
30	315	12.08	8	1.34E-05	86	3956.00466	87	44	3156.3867	3956.0047	0	0	0	0.33	0	1361.97034	-0.29201	0	0	20
31	219.8	10.3	9	4.22E-06	67	3050.59725	0	0	2705.7122	3391.1592	14	15.56427	12.84436	0.33	59.34095	1260.99487	0	2.65911	1.48087	20
32	289.5	12.28	8	8.35E-06	83	3955.80366	82	44	3156.2263	3955.8037	0	0	0	0.33	0	1361.93567	-0.28541	0	0	20
33	344.9	7.1	6	7.23E-05	81	3192.30169	90	45	2547.0492	3192.3017	0	0	0	0.33	0	1223.46399	-0.26672	0	0	20
34	336	15.87	9	7.40E-06	97	4695.66068	0	0	3746.5378	4695.6607	14	23.85103	18.55894	0.33	85.7423	1483.8418	0	3	1.47284	20
35	498.1	0	0	0.00E+00	35	446.02236	0	0	355.8689	446.02236	0	0	0	0.33	0	193.14731	0	0	0	20

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C-11

Project: **Group Delta/Brookside Equestrian Lot 2**
Location: **800 Meadowpass Heights Rd. Walnut, CA**

Total depth: 36.72 ft, Date: 9/4/2013
Cone Type: Vertek



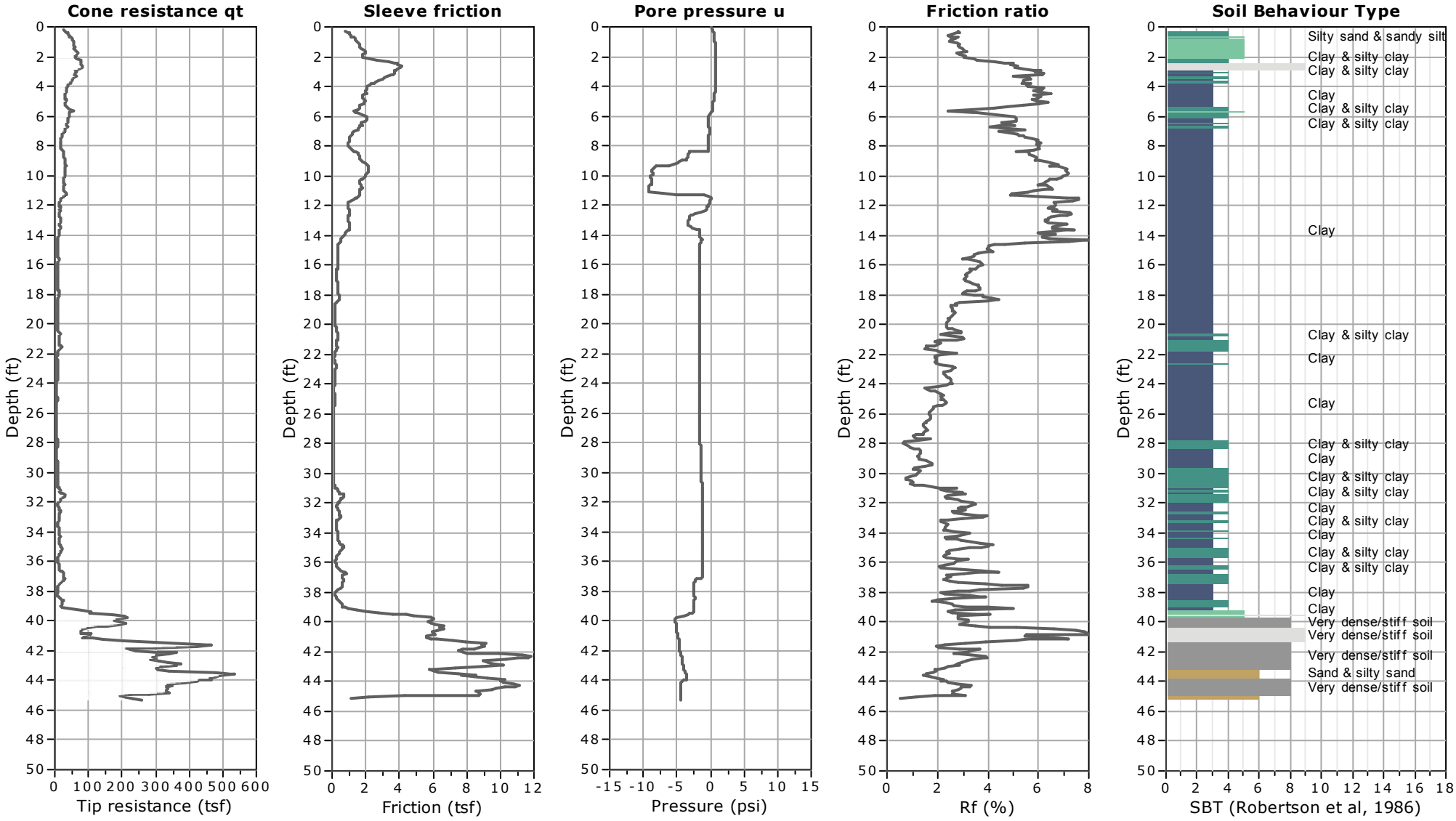
In situ data										Estimations										
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	9.9	0.67	3	2.03E-08	5	136.92194	0	0	0	399.77201	14	0.69858	1.32043	0.33	6.10041	477.38593	0	1.2213	1.02181	20
2	7.3	0.41	3	1.41E-08	4	95.98499	0	0	0	311.29124	14	0.50901	0.96211	0.33	4.44494	429.59763	0	1.09596	1.21665	20
3	13.6	0.75	3	6.15E-08	6	187.20139	0	0	0	447.21748	14	0.95511	1.80532	0.33	8.34056	501.37051	0	1.35919	1.24801	20
4	17.2	1	3	9.16E-08	7	236.80839	0	0	0	526.45159	14	1.20821	2.28371	0.33	10.55074	537.71851	0	1.47298	1.18404	20
5	22.6	1.11	4	2.38E-07	9	311.60538	0	0	0	583.046	14	1.58982	3.00503	0.33	13.88324	562.45862	0	1.61796	1.40363	20
6	17.2	1.2	3	6.04E-08	8	235.85416	0	0	0	565.28325	14	1.20334	2.27451	0.33	10.50823	554.03601	0	1.47094	0.98273	20
7	14.7	1	3	4.43E-08	7	200.01925	0	0	0	507.0673	14	1.02051	1.92893	0.33	8.91164	528.57538	0	1.39033	1.0001	20
8	20.5	1.37	3	9.47E-08	9	280.41051	0	0	0	619.60556	14	1.43067	2.7042	0.33	12.49339	576.65631	0	1.56063	1.0234	20
9	18.3	0.82	4	1.56E-07	8	248.94822	0	0	0	502.38882	14	1.27014	2.28859	0.33	10.57329	528.20557	0	1.47405	1.51798	20
10	14.8	0.78	3	6.46E-08	7	199.03852	0	0	0	471.36536	14	1.0155	1.80692	0.33	8.34799	513.60089	0	1.3596	1.27589	20
11	32.9	1.89	3	2.57E-07	13	451.60864	0	0	0	832.74449	14	2.30413	3.72245	0.33	17.19773	658.95209	0	1.74088	1.19473	20
12	37.1	1.89	4	3.85E-07	14	509.64526	0	0	697.02562	873.60544	14	2.60023	3.96729	0.33	18.32888	674.12421	0	1.77922	1.34827	20
13	46.1	2.88	9	3.44E-07	18	634.83088	0	0	0	1110.9839	14	3.23893	4.74212	0.33	21.90861	749.35657	0	1.89117	1.10214	20
14	34.6	1.98	3	2.18E-07	14	472.99604	0	0	0	898.60776	14	2.41325	3.43174	0.33	15.85466	683.23132	0	1.69313	1.19443	20
15	41	2	4	4.01E-07	16	561.76636	0	0	762.99243	956.28385	14	2.86615	3.86349	0.33	17.84933	703.4342	0	1.76316	1.40442	20
16	39.6	1.91	4	3.53E-07	15	541.3242	0	0	0	942.7598	14	2.76186	3.59763	0.33	16.62104	699.62866	0	1.72069	1.41708	20
17	37.8	1.88	4	2.77E-07	15	515.24595	0	0	0	937.41153	14	2.62881	3.3191	0.33	15.33424	698.28735	0	1.67391	1.37033	20
18	32.5	1.13	4	3.89E-07	12	440.23405	0	0	601.05839	753.32652	14	2.24609	2.73096	0.33	12.61703	636.59607	0	1.56589	1.94794	20
19	23.8	0.86	4	1.61E-07	10	317.60204	0	0	0	637.44576	14	1.62042	1.93692	0.33	8.94857	592.45618	0	1.3923	1.84652	20
20	21.1	0.73	4	1.21E-07	9	278.98219	0	0	0	589.97086	14	1.42338	1.65838	0.33	7.66171	573.64142	0	1.32029	1.91084	20
21	24.9	0.81	4	1.90E-07	10	331.3679	0	0	0	645.5524	14	1.69065	1.90377	0.33	8.7954	597.05029	0	1.3841	2.04548	20
22	27	0.92	4	1.97E-07	11	359.96969	0	0	0	696.78714	14	1.83658	2.00962	0.33	9.28444	617.30786	0	1.40995	1.95636	20
23	24	0.75	4	1.62E-07	10	317.18396	0	0	0	636.24159	14	1.61829	1.7266	0.33	7.9769	594.39484	0	1.33862	2.11456	20
24	27.1	1.35	3	8.00E-08	12	359.74719	0	0	0	819.64832	14	1.83544	1.91058	0.33	8.82688	661.65704	0	1.38579	1.3324	20
25	62.8	2	4	1.33E-06	21	858.64854	0	0	938.74242	1176.5572	14	4.38086	4.37451	0.33	20.21023	777.01465	0	1.83969	2.14662	20
26	28.4	1.78	3	4.74E-08	13	376.2071	0	0	0	942.21405	14	1.91942	1.88303	0.33	8.69958	703.19629	0	1.37892	1.05676	20
27	37.4	1.62	4	1.87E-07	15	501.42747	0	0	0	979.88798	14	2.5583	2.4363	0.33	11.2557	717.16913	0	1.50592	1.54762	20
28	31.7	1.14	4	1.72E-07	13	420.83096	0	0	0	834.70316	14	2.1471	1.9941	0.33	9.21276	670.08533	0	1.40622	1.84575	20
29	37.2	1.51	4	1.87E-07	15	497.00361	0	0	0	971.46471	14	2.53573	2.29612	0.33	10.60808	715.62	0	1.47571	1.64571	20
30	48.3	2.64	3	1.70E-07	20	651.51578	0	0	0	1295.7477	14	3.32406	2.92933	0.33	13.53351	810.93604	0	1.6039	1.23393	20
31	52.3	2.41	4	2.80E-07	20	706.6621	0	0	0	1283.6242	14	3.60542	3.1042	0.33	14.34141	808.6424	0	1.63603	1.4661	20
32	107.7	6.62	9	6.19E-07	39	1481.3512	0	0	1859.8818	2331.0518	14	7.55791	6.36273	0.33	29.39583	1052.26526	0	2.0912	1.11885	20
33	79.2	4.76	3	3.34E-07	30	1081.52412	0	0	0	1902.1629	14	5.51798	4.50597	0.33	20.81756	961.83594	0	1.85841	1.13605	20
34	212	5.11	5	2.09E-05	56	2446.8401	71	42	1952.266	2446.8401	0	0	0	0.33	0	1079.0498	-0.22053	0	0	20
35	132.4	7.33	9	1.03E-06	46	1824.57409	0	0	2088.302	2617.3385	14	9.30905	7.30844	0.33	33.765	1109.9071	0	2.1927	1.24459	20
36	95.2	6.66	9	2.87E-07	37	1302.87183	0	0	0	2355.1326	14	6.64731	5.01084	0.33	23.15008	1058.68762	0	1.92716	0.97813	20

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C-15

Project: **Group Delta/Brookside Equestrian Lot 2**
Location: **800 Meadowpass Heights Rd. Walnut, CA**

Total depth: 45.29 ft, Date: 9/4/2013
Cone Type: Vertek



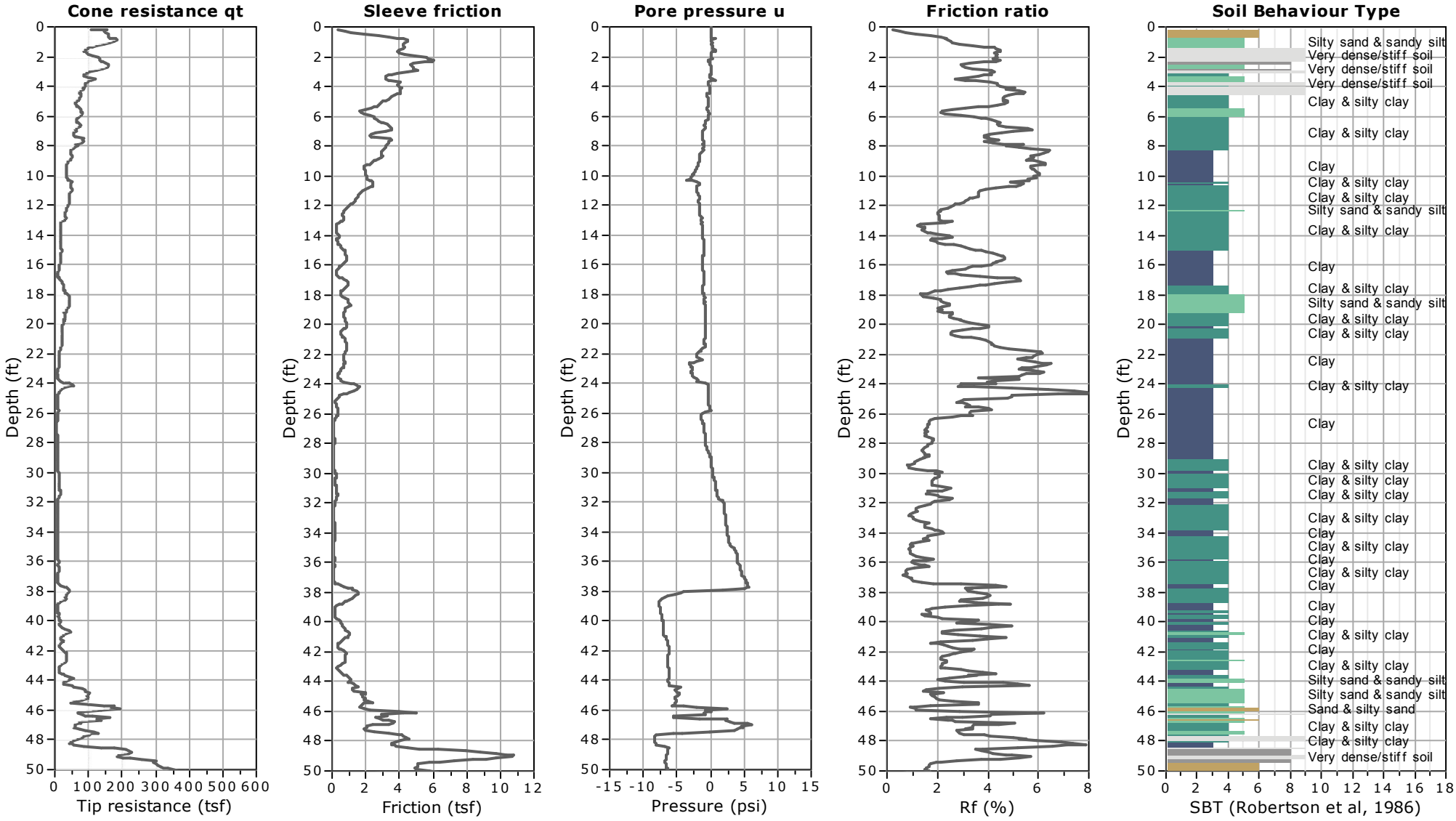
In situ data							Estimations													
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	56	1.44	5	6.97E-06	16	795.23271	55	40	634.49418	795.23271	0	0	0	0.33	0	645.75208	-0.17691	0	0	20
2	56.5	1.82	5	4.20E-06	17	789.37892	55	40	700.81505	878.35487	0	0	0	0.33	0	673.91577	-0.19358	0	0	20
3	62.5	3.71	9	1.15E-06	21	872.49668	0	0	978.85763	1226.8349	14	4.45151	8.4141	0.33	38.87315	779.55621	0	2.30094	1.17587	20
4	36.8	2.08	9	4.81E-07	14	511.79829	0	0	672.52458	842.89747	14	2.61122	4.93563	0.33	22.80262	660.35498	0	1.91721	1.23028	20
5	32.6	1.96	4	3.25E-07	13	452.10502	0	0	0	799.33915	14	2.30666	4.35997	0.33	20.14305	644.96204	0	1.83759	1.15333	20
6	41.3	2.02	9	8.35E-07	15	572.91706	0	0	681.35732	853.96785	14	2.92305	5.52504	0.33	25.5257	664.49963	0	1.99263	1.41811	20
7	28.6	1.27	4	4.85E-07	11	394.28766	0	0	517.2906	648.33755	14	2.01167	3.80239	0.33	17.56706	589.24097	0	1.75358	1.55231	20
8	16.1	0.93	3	7.57E-08	7	218.44462	0	0	0	502.66555	14	1.11451	2.10662	0.33	9.73256	526.9715	0	1.43287	1.17443	20
9	29.1	1.76	3	1.95E-07	12	398.92308	0	0	0	773.37117	14	2.03532	3.44402	0.33	15.91139	637.15906	0	1.6952	1.1333	20
10	28.3	1.98	3	1.22E-07	12	386.07265	0	0	0	815.47233	14	1.96976	3.22724	0.33	14.90987	652.17786	0	1.65792	0.97493	20
11	26.8	1.61	3	1.37E-07	11	364.12775	0	0	0	752.96002	14	1.85779	2.8992	0.33	13.39433	630.90771	0	1.59824	1.13083	20
12	14.3	0.96	3	2.55E-08	7	189.84791	0	0	0	532.09596	14	0.96861	1.50922	0.33	6.97261	542.31152	0	1.27841	0.98879	20
13	15.6	0.97	3	3.28E-08	7	206.75947	0	0	0	553.45747	14	1.0549	1.5769	0.33	7.28529	552.4198	0	1.29774	1.06577	20
14	11.5	0.76	3	1.22E-08	6	148.80329	0	0	0	476.62192	14	0.7592	1.09257	0.33	5.04768	518.28259	0	1.14468	0.97897	20
15	8.8	0.36	3	1.34E-08	5	86.38478	0	0	0	346.79677	14	0.56243	0.78363	0.33	3.62038	454.44254	0	1.02169	1.53106	20
16	9.8	0.36	3	2.02E-08	5	105.06834	0	0	0	360.85363	14	0.63013	0.85072	0.33	3.93032	462.99692	0	1.0508	1.71535	20
17	9.1	0.28	3	2.03E-08	5	85.36178	0	0	0	329.78453	14	0.57633	0.75568	0.33	3.49122	446.80078	0	1.00907	2.01716	20
18	11.4	0.39	3	2.94E-08	5	135.31937	0	0	0	394.25843	14	0.73671	0.93714	0.33	4.3296	481.8338	0	1.08615	1.85123	20
19	6.7	0.17	3	8.64E-09	4	38.38734	0	0	0	265.34503	14	0.39729	0.49298	0.33	2.27755	409.33658	0	0.87191	2.29025	20
20	8.5	0.2	3	1.95E-08	4	64.65268	0	0	0	300.90783	14	0.52216	0.63173	0.33	2.91859	432.16687	0	0.9491	2.55856	20
21	11.7	0.36	3	2.99E-08	6	128.67833	0	0	0	398.59589	14	0.74691	0.87898	0.33	4.0609	485.6384	0	1.06261	2.03326	20
22	7.9	0.17	3	1.46E-08	4	50.15532	0	0	0	286.47618	14	0.47176	0.54243	0.33	2.50602	424.48532	0	0.90089	2.71955	20
23	8.1	0.22	3	9.87E-09	4	51.2081	0	0	0	314.56309	14	0.48239	0.54161	0.33	2.50223	440.63394	0	0.90043	2.14882	20
24	6.1	0.15	3	3.84E-09	4	24.31006	0	0	0	259.81906	14	0.33593	0.36921	0.33	1.70577	407.34595	0	0.78983	2.19476	20
25	6.5	0.14	3	5.49E-09	4	27.4859	0	0	0	261.69989	14	0.36092	0.38855	0.33	1.7951	409.52817	0	0.80374	2.52641	20
26	6.1	0.1	3	5.94E-09	3	22.40146	0	0	0	235.07592	14	0.32892	0.34748	0.33	1.60535	393.2952	0	0.77361	3.22343	20
27	5.8	0.09	3	4.78E-09	3	18.79652	0	0	0	226.03491	14	0.30403	0.31543	0.33	1.45729	387.43295	0	0.74843	3.31055	20
28	9.1	0.04	4	1.24E-07	4	57.38941	0	0	0	221.20932	14	0.53646	0.54581	0.33	2.52165	393.20117	0	0.90281	13.14316	20
29	6	0.07	3	6.93E-09	3	19.13631	0	0	0	216.66252	14	0.3117	0.31323	0.33	1.44714	382.79782	0	0.74664	4.36377	20
30	7.4	0.09	3	1.41E-08	4	32.26398	0	0	0	249.64668	14	0.40828	0.40318	0.33	1.86269	405.91913	0	0.81397	4.44576	20
31	10.3	0.29	3	1.15E-08	5	70.85802	0	0	0	387.93007	14	0.61167	0.59104	0.33	2.73059	483.31934	0	0.92773	2.06703	20
32	10.4	0.35	3	8.03E-09	6	70.06516	0	0	0	416.24459	14	0.61495	0.58131	0.33	2.68566	497.40161	0	0.92248	1.72185	20
33	12.9	0.44	3	1.46E-08	7	112.96006	0	0	0	479.72997	14	0.78964	0.72986	0.33	3.37195	528.64349	0	0.99715	1.75875	20
34	11.4	0.34	3	1.15E-08	6	81.69837	0	0	0	430.34615	14	0.67863	0.61422	0.33	2.8377	505.72812	0	0.94002	1.95605	20
35	18.2	0.64	3	3.39E-08	9	227.42657	0	0	0	605.23969	14	1.16034	1.02621	0.33	4.74109	584.38702	0	1.12041	1.77677	20
36	8.5	0.2	3	5.08E-09	5	36.61288	0	0	0	340.9448	14	0.46376	0.40279	0.33	1.86091	460.01593	0	0.8137	2.27243	20
37	23.6	0.63	4	1.06E-07	10	301.47098	0	0	0	652.36873	14	1.53812	1.3114	0.33	6.05865	605.33862	0	1.21843	2.39263	20
38	7.6	0.17	3	3.07E-09	5	24.96996	0	0	0	317.75954	14	0.39057	0.32619	0.33	1.50698	447.27576	0	0.75706	2.25151	20
39	17.6	0.69	3	1.95E-08	9	194.08906	0	0	0	634.77694	14	1.10069	0.89966	0.33	4.15643	597.25793	0	1.07109	1.5633	20
40	153.6	5.32	8	4.66E-06	46	2118.31599	60	41	1845.3076	2312.7855	0	0	0	0.33	0	1050.99109	-0.21334	0	0	20
41	90.2	5.27	9	4.27E-07	34	1229.86265	0	0	1651.1723	2069.4692	14	6.27481	4.95027	0.33	22.87026	999.25452	0	1.91916	1.16685	20
42	236	7.29	8	1.29E-05	65	2969.0293	73	43	2368.9064	2969.0293	0	0	0	0.33	0	1179.90344	-0.24215	0	0	20
43	356.5	8.54	8	4.99E-05	86	3524.22845	90	45	2811.8844	3524.2285	0	0	0	0.33	0	1285.49756	-0.27402	0	0	20
44	426.7	9.83	8	7.24E-05	100	3947.12976	98	45	3149.3057	3947.1298	0	0	0	0.33	0	1360.44165	-0.29253	0	0	20
45	213	0	0	0.00E+00	15	189.0173	0	0	150.81167	189.0173	0	0	0	0.33	0	125.73643	0	0	0	20

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

CPT: C-17

Project: **Group Delta/Brookside Equestrian Lot 2**
Location: **800 Meadowpass Heights Rd. Walnut, CA**

Total depth: 50.43 ft, Date: 9/4/2013
Cone Type: Vertek



In situ data									Estimations										
Depth (ft)	qc (tsf)	fs (tsf)	SBTn	Ksbt (ft/s)	SPT N60 (blows/ft)	Constrained Mod. (tsf)	Dr (%)	Friction angle (°)	Es (tsf)	Go (tsf)	Nkt	Su (tsf)	Su ratio	Kocr	OCR	Vs (ft/s)	State parameter	Ko	Sensitivity	Peak phi (°)
1	175.3	4.48	8	5.48E-05	42	1715.06649	97	45	1368.4041	1715.0665	0	0	0	0.33	0	908.20111	-0.29471	0	0	20
2	121.4	5.31	8	7.59E-06	35	1697.41893	81	44	1354.3236	1697.4189	0	0	0	0.33	0	902.34552	-0.28533	0	0	20
3	107.2	4.55	8	6.71E-06	31	1531.389	76	43	1221.8529	1531.389	0	0	0	0.33	0	861.69482	-0.27096	0	0	20
4	84.5	4	9	3.41E-06	26	1179.23807	0	0	1087.3073	1362.7585	14	6.01652	11.37222	0.33	52.53968	817.57159	0	2.55067	1.47405	20
5	66.2	3.06	9	2.35E-06	21	922.09275	0	0	909.65301	1140.0984	14	4.70455	8.89239	0.33	41.08284	755.19244	0	2.34486	1.50669	20
6	73.5	2.43	8	6.41E-06	21	1054.9312	63	41	841.70042	1054.9312	0	0	0	0.33	0	730.51288	-0.21771	0	0	20
7	62.4	3.33	9	1.38E-06	21	866.98654	0	0	940.94142	1179.3133	14	4.4234	8.09435	0.33	37.39588	766.65918	0	2.27065	1.30178	20
8	67.1	3.19	9	1.71E-06	22	931.87314	0	0	973.211	1219.7578	14	4.75445	7.79185	0.33	35.99836	780.10895	0	2.24126	1.46062	20
9	43.6	2.52	9	4.29E-07	16	601.9072	0	0	807.41034	1011.9543	14	3.07096	4.82393	0.33	22.28654	718.33032	0	1.90226	1.19426	20
10	33.9	2.02	3	2.26E-07	14	465.07122	0	0	0	878.20484	14	2.37281	3.63695	0.33	16.80272	675.17657	0	1.7271	1.15117	20
11	50.1	1.84	4	1.27E-06	17	691.12637	0	0	761.38169	954.26506	14	3.52615	4.94182	0.33	22.83121	703.03992	0	1.91804	1.87806	20
12	39.3	1.03	5	1.42E-06	13	539.13312	39	36	582.11516	729.58434	0	0	0	0.33	0	627.05389	-0.12803	0	0	20
13	27.7	0.59	5	8.86E-07	10	375.97439	32	35	442.33367	554.39154	0	0	0	0.33	0	558.25067	-0.0911	0	0	20
14	15.8	0.37	4	1.74E-07	6	208.65772	0	0	0	412.91975	14	1.06458	1.42017	0.33	6.5612	492.17664	0	1.25209	2.8197	20
15	20	0.72	4	1.31E-07	8	266.66522	0	0	0	555.42971	14	1.36054	1.76657	0.33	8.16155	557.16345	0	1.34914	1.85184	20
16	14.7	0.59	3	4.58E-08	7	191.66076	0	0	0	483.0191	14	0.97786	1.25335	0.33	5.7905	524.63214	0	1.19971	1.62424	20
17	14.2	0.74	3	2.29E-08	7	183.87271	0	0	0	525.38486	14	0.93813	1.16696	0.33	5.39136	543.3858	0	1.17076	1.24238	20
18	38.4	0.45	5	4.04E-06	12	521.87943	35	35	466.56111	584.75659	0	0	0	0.33	0	576.32391	-0.06233	0	0	20
19	35.8	0.78	5	1.04E-06	12	484.68831	33	35	553.83585	694.14093	0	0	0	0.33	0	617.50623	-0.09797	0	0	20
20	23	0.88	4	1.11E-07	10	304.69513	0	0	0	654.07821	14	1.55457	1.7419	0.33	8.04756	599.92535	0	1.34267	1.73122	20
21	20.9	0.78	3	8.50E-08	9	274.46522	0	0	0	618.43322	14	1.40033	1.52904	0.33	7.06415	586.15308	0	1.28413	1.75939	20
22	12	0.72	3	6.87E-09	7	120.68807	0	0	0	528.7586	14	0.7594	0.81085	0.33	3.74612	546.59521	0	1.03369	1.03362	20
23	10.6	0.56	3	5.58E-09	6	87.43858	0	0	0	473.45002	14	0.65484	0.68125	0.33	3.14739	522.15527	0	0.97392	1.14598	20
24	44.1	1.29	4	7.07E-07	16	596.85457	0	0	731.38107	916.66428	14	3.04518	3.04384	0.33	14.06254	697.2583	0	1.62508	2.31339	20
25	7.9	0.37	3	2.74E-09	5	40.19369	0	0	0	387.9755	14	0.4559	0.44981	0.33	2.07813	480.79578	0	0.84501	1.20752	20
26	10.1	0.34	3	8.48E-09	5	69.94483	0	0	0	407.57291	14	0.60814	0.58681	0.33	2.71107	492.84106	0	0.92545	1.75287	20
27	6.2	0.09	3	5.06E-09	4	19.83787	0	0	0	240.32892	14	0.32657	0.30993	0.33	1.43187	399.15527	0	0.74394	3.55598	20
28	7.3	0.13	3	6.61E-09	4	29.5078	0	0	0	281.74641	14	0.40184	0.37465	0.33	1.73088	425.4642	0	0.79379	3.02928	20
29	7.4	0.11	3	8.46E-09	4	29.62774	0	0	0	272.26333	14	0.40608	0.37225	0.33	1.71978	420.74088	0	0.79204	3.6178	20
30	11	0.22	3	2.09E-08	5	76.70609	0	0	0	375.66418	14	0.65975	0.59319	0.33	2.74054	479.80154	0	0.92888	2.93889	20
31	11.7	0.29	3	1.68E-08	6	86.18598	0	0	0	418.52402	14	0.70634	0.62254	0.33	2.87613	501.27457	0	0.94435	2.38695	20
32	8.9	0.16	3	1.01E-08	5	43.04355	0	0	0	326.80725	14	0.50353	0.43614	0.33	2.01497	453.69415	0	0.83614	3.08412	20
33	8.5	0.09	3	1.71E-08	4	37.22945	0	0	0	278.50276	14	0.47187	0.40254	0.33	1.85971	427.96765	0	0.81352	5.13819	20
34	9.4	0.21	3	7.66E-09	5	46.61487	0	0	0	363.63304	14	0.53271	0.44645	0.33	2.06261	473.67422	0	0.84285	2.486	20
35	5.7	0.07	3	2.66E-09	4	11.42437	0	0	0	228.67677	14	0.26552	0.21952	0.33	1.01419	393.47867	0	0.66116	3.71731	20
36	11.4	0.1	4	5.45E-08	5	71.62175	0	0	0	320.67047	14	0.66989	0.54549	0.33	2.52017	455.77039	0	0.90263	6.56488	20
37	9.6	0.09	3	2.48E-08	5	45.64257	0	0	0	297.22085	14	0.53865	0.43232	0.33	1.99734	441.42981	0	0.83363	5.86527	20
38	43.8	1.5	4	2.81E-07	17	582.47573	0	0	0	1057.3841	14	2.97181	2.36625	0.33	10.93208	745.53735	0	1.49097	1.94159	20
39	9.4	0.21	3	4.95E-09	5	38.59003	0	0	0	373.25483	14	0.50532	0.38963	0.33	1.8001	479.97424	0	0.80451	2.35815	20
40	16.4	0.49	3	2.02E-08	8	148.81533	0	0	0	573.69267	14	1.00173	0.75795	0.33	3.50172	574.56934	0	1.01011	2.00347	20
41	19.4	0.91	3	1.38E-08	10	213.50335	0	0	0	744.28869	14	1.21214	0.89866	0.33	4.1518	640.45154	0	1.07069	1.30539	20
42	25.3	0.76	3	6.55E-08	11	319.45985	0	0	0	754.63651	14	1.6299	1.18497	0.33	5.47458	646.73828	0	1.17691	2.10171	20
43	15.7	0.33	3	2.64E-08	8	123.82032	0	0	0	512.92253	14	0.94009	0.672	0.33	3.10464	550.7168	0	0.96937	2.79177	20
44	35.7	1	4	1.82E-07	14	463.41693	0	0	0	910.07482	14	2.36437	1.68347	0.33	7.77761	701.67181	0	1.32709	2.31708	20
45	95.4	1.66	5	6.08E-06	28	1351.62003	44	38	1078.4202	1351.62	0	0	0	0.33	0	833.96826	-0.11927	0	0	20
46	122.4	4.69	4	1.72E-06	40	1676.44315	0	0	1748.693	2191.6952	14	8.55328	6.07672	0.33	28.07443	1028.75305	0	2.05856	1.78725	20
47	48.6	2.04	4	1.53E-07	20	643.48052	0	0	0	1304.0381	14	3.28306	2.18382	0.33	10.08924	819.58838	0	1.45062	1.57716	20
48	64.6	3.99	3	1.20E-07	27	864.0956	0	0	0	1828.9503	14	4.40865	2.85468	0.33	13.18861	949.59961	0	1.5898	1.08283	20
49	200.1	10.82	9	1.73E-06	66	2760.46365	0	0	2878.1654	3607.3006	14	14.084	9.4517	0.33	43.66688	1300.56006	0	2.39429	1.27563	20
50	352.7	5.76	6	1.07E-04	79	3032.03801	85	44	2419.1793	3032.038	0	0	0	0.33	0	1192.35767	-0.24688	0	0	20

APPENDIX B
LABORATORY TESTING

B.1 General

The laboratory testing program performed for this investigation included Moisture Content, Dry Unit Weight, Atterberg Limits, Percent Passing No. 200 Sieve, Consolidation, Direct Shear, Pocket Penetrometer, Expansion Index, and Corrosivity. Descriptions of these tests are given below.

B.2 Moisture Content and Dry Unit Weight

The natural moisture content of selected SPT and California ring samples and dry unit weight of California ring samples were determined in general accordance with ASTM D 2216 and ASTM D2937. Results of these tests are presented on the boring logs in Appendix A.

B.3 Atterberg Limits

Soil plasticity was evaluated by measuring the Atterberg limits. This test includes Liquid Limit (LL) and Plastic Limit (PL) tests to determine the Plasticity Index (PI) in accordance with ASTM D4318. Results of these tests are illustrated in the plasticity charts shown in Figure B-1A through B-1C, and on the boring logs in Appendix A.

B.4 Percent Passing No. 200 Sieve

Determination of fines verses coarser soil particles was performed by the percent #200 Sieve test. Representative samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. The percentage of fines (i.e., soil passing #200 sieve) are shown on the boring logs.

B.5 Consolidation

The consolidation characteristics of the foundation soils were determined by performing one-dimensional consolidation in general accordance with ASTM D2435, using a floating ring consolidometer and dead weight system. Results of these tests are presented in Figures B-2A to B-2H.

B.6 Direct Shear Test

To determine the shear strength parameters of the on-site soils, direct shear tests were performed on selected undisturbed drive samples in accordance with ASTM D 3080. After the initial weight and volume measurements were made, the sample was placed in a calibrated shear machine and a selected normal load was applied. The samples were submerged, allowed to consolidate, and then were sheared to failure. Shear stress and sample deformation were monitored throughout the test. The process was repeated under two additional normal loads. The test results are graphically presented in Figures B-3A through B-3C.

B.7 Pocket Penetrometer

Undrained shear strengths (S_u) of cohesive samples were measured using a pocket penetrometer. The measured S_u values (in ksf) are presented in the boring logs of Appendix A.

B.8 Soil Expansion Index

Representative grab samples of existing fill soil was collected from the site and tested to determine the expansion index. Testing was performed according to ASTM D4829. The results of the test are presented in Table B-1.

B.9 Soil Corrosivity

Corrosivity testing included performing soil pH and resistivity (Caltrans Test Method 643), water-soluble chlorides (ASTM D512), and water soluble sulfates (ASTM D516). The test results are summarized in Table B-2.

B.10 List Tables and Figures

The following tables and figures are attached and complete this appendix:

Table B-1	Soil Expansion
Table B-2	Soil Corrosivity
Figures B-1A to B-1C	Atterberg Limits Plot
Figures B-2A to B-2H	Consolidation Plots
Figures B-3A to B-3C	Direct Shear Plots

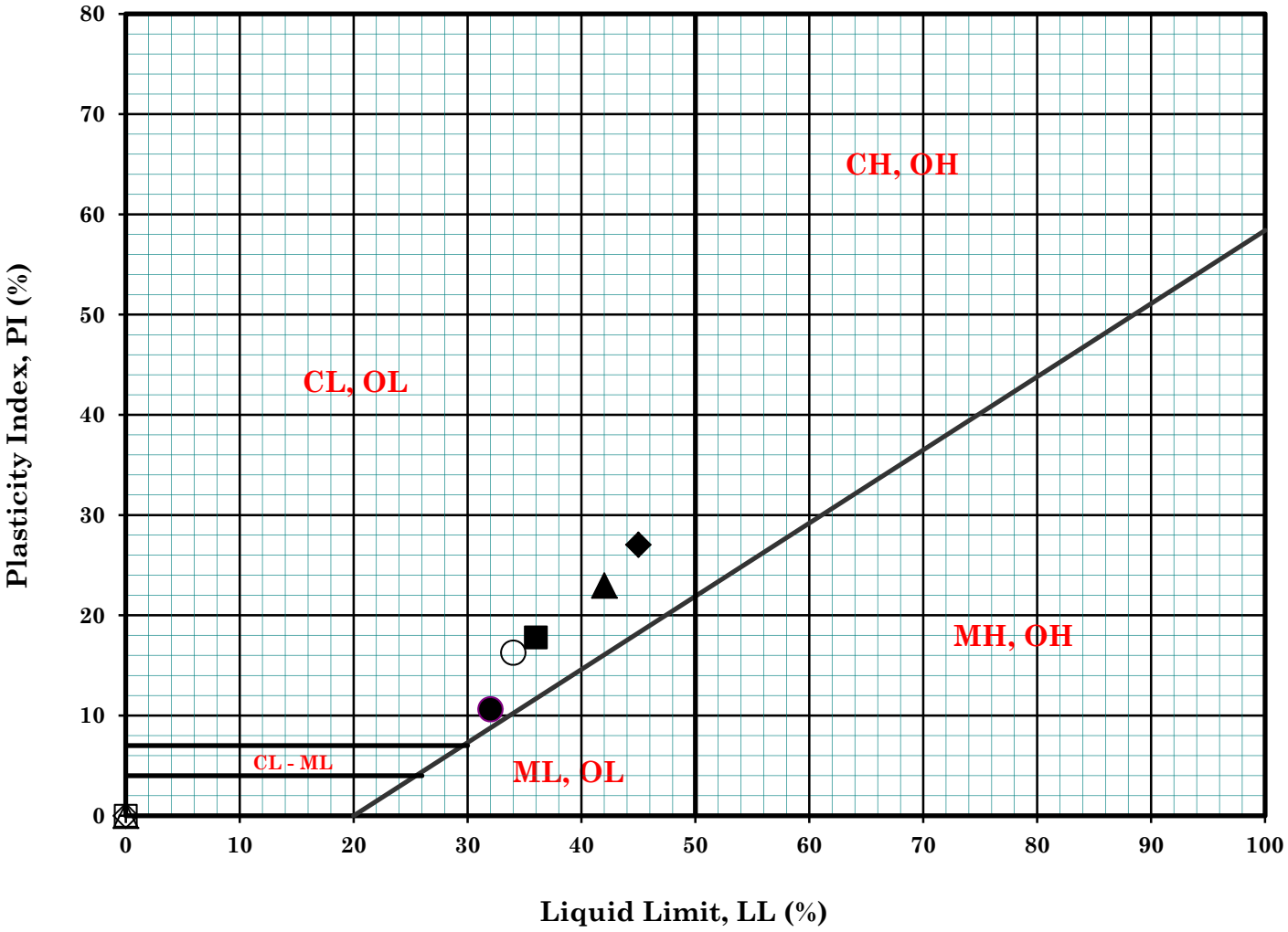
Table B-1. Soil Expansion

Boring	Sample Depth, feet	Expansion Index
B-1	0-5	70 (medium)
B-9	1-3	79 (medium)
B-12	1-5	59 (medium)
B-16	1-3	57 (medium)

Table B-2. Soil Corrosivity

Boring	Sample Depth, feet	pH	Chlorides ppm	Sulfates ppm	Minimum Resistivity ohm-cm
B-1	0 – 5	7.5	46.25	20.5	534
B-16	1 – 3	7.8	0	9.5	673

PLASTICITY CHART



Symbol	Boring No.	Sample No.	Depth (ft)		Depth (m)		MC (%)	LL (%)	PL (%)	PI (%)	Description
●	B-1	R3	7.5	9.0	2.3	2.7	16.75	32	21	11	Dark Yellowish Brown Sandy Clay (CL)
▲	B-1	S6	20.0	21.5	6.1	6.6	22.36	42	19	23	Dark Brown Silty Clay (CL)
◆	B-3	R3	7.5	9.0	2.3	2.7	18.51	45	18	27	Dark Yellowish Brown Sandy Clay (CL)
■	B-3	S4	10.0	11.5	3.1	3.5	16.18	36	18	18	Dark yellowish Brown Sandy Clay (CL)
○	B-3	R5	15.0	16.5	4.6	5.0	15.91	34	18	16	Dark yellowish Brown Sandy Clay (CL)
△											
◇											
□											

Remark :

GROUP DELTA CONSULTANTS

Brookeside Equestrian, Lot 2

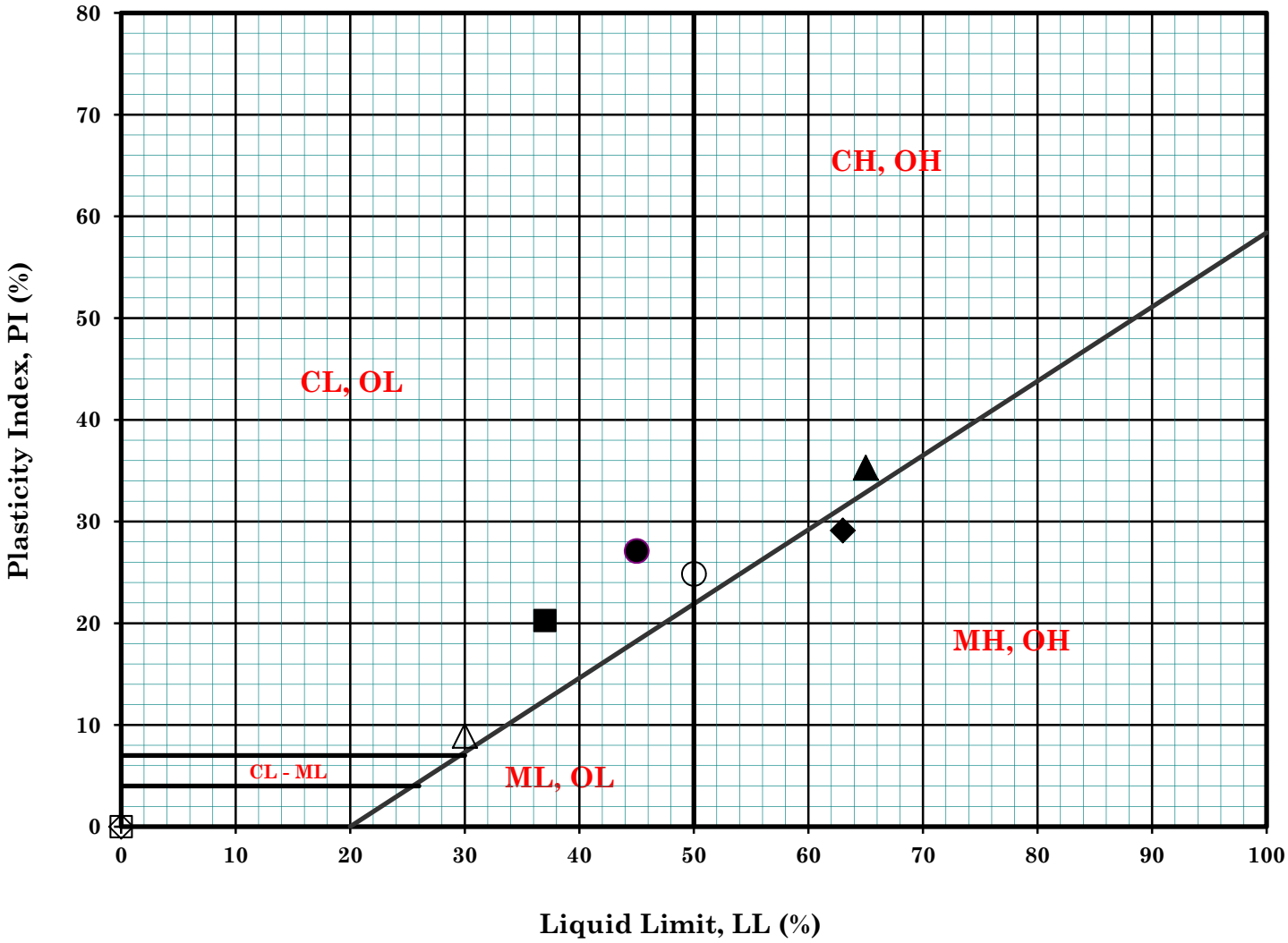
Project No. : LA1148

Date : 8/2/13

ATTERBERG LIMITS
(ASTM D-4318-84)

Fig. NO. B-1A

PLASTICITY CHART



Symbol	Boring No.	Sample No.	Depth (ft)		Depth (m)		MC (%)	LL (%)	PL (%)	PI (%)	Description
●	B-9	S5	10.5	12.0	3.2	3.7	18.38	45	18	27	Lean CLAY with SAND (CL)
▲	B-12	R3	6.0	7.5	1.8	2.3	30.58	65	30	35	Fat CLAY (CH)
◆	B-12	R5	11.0	12.5	3.4	3.8	34.67	63	34	29	Elastic SILT (MH)
■	B-13	R2	3.5	5.0	1.1	1.5	13.42	37	17	20	Lean CLAY (CL)
○	B-14	R3	6.0	7.5	1.8	2.3	24.74	50	25	25	Lean CLAY (CL)/Fat CLAY (CH)
△	B-14	R7	21.0	22.5	6.4	6.9	24.63	30	21	9	Clayey SAND (SC)
◇											
□											

Remark :

GROUP DELTA CONSULTANTS

Brookside Equestrian, Lot 2

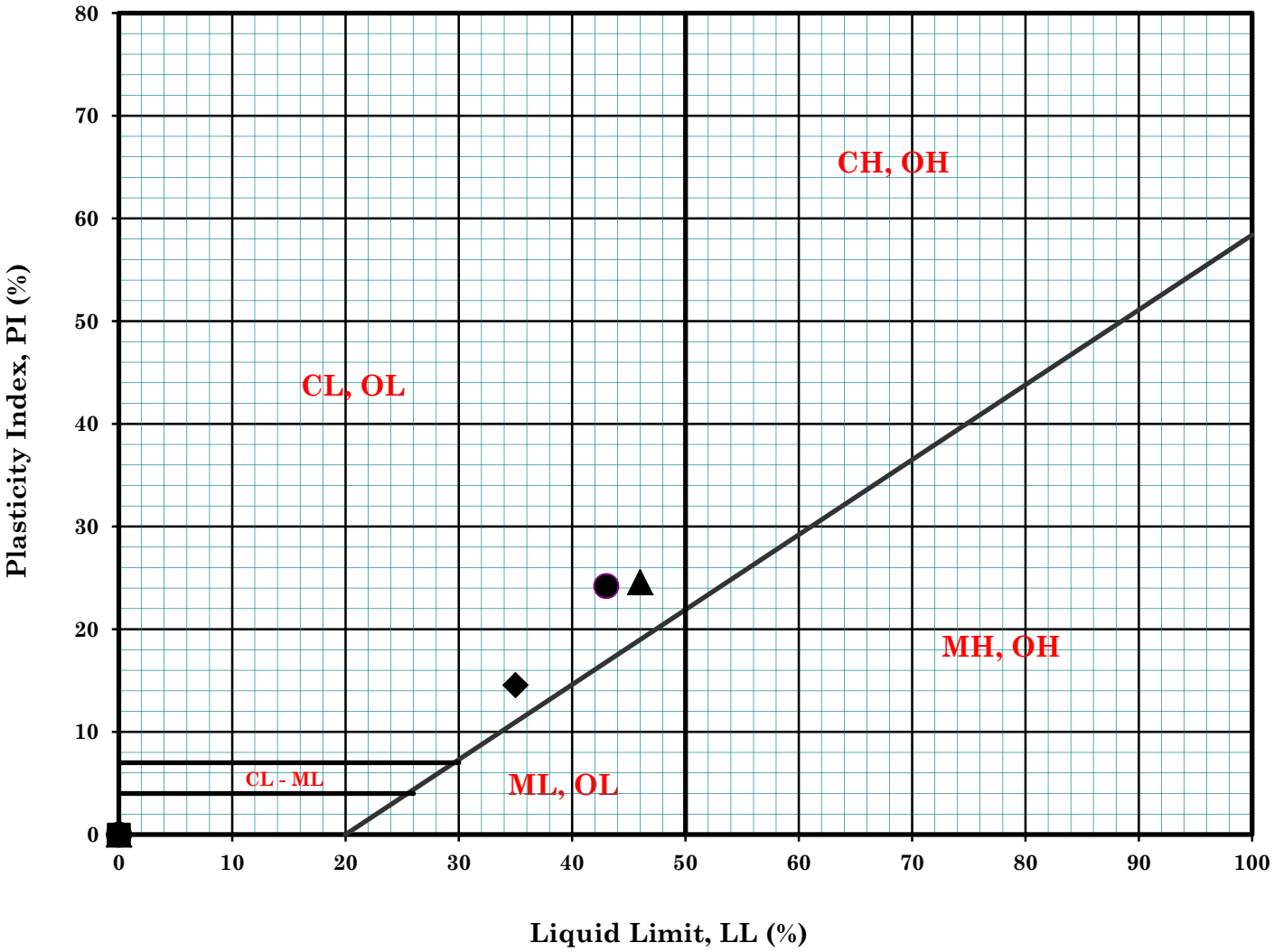
Project No. : LA1148B

Date : 9/23/13

ATTERBERG LIMITS
(ASTM D-4318-84)

Figure No. : B-1B

PLASTICITY CHART



Symbol	Boring No.	Sample No.	Depth (ft)		Depth (m)		MC (%)	LL (%)	PL (%)	PI (%)	Description
●	B-16	R6	16.0	17.5	4.9	5.3	22.51	43	19	24	Clayey SAND (SC)
▲	B-16	R8	26.0	27.5	7.9	8.4	32.26	46	21	25	Lean CLAY with SAND (CL)
◆	B-16	R10	36.0	37.5	11.0	11.4	21.39	35	20	15	Clayey SAND (SC)
■											
○											
△											
◇											
□											

Remark :

GROUP DELTA CONSULTANTS

Brookside Equestrian, Lot 2

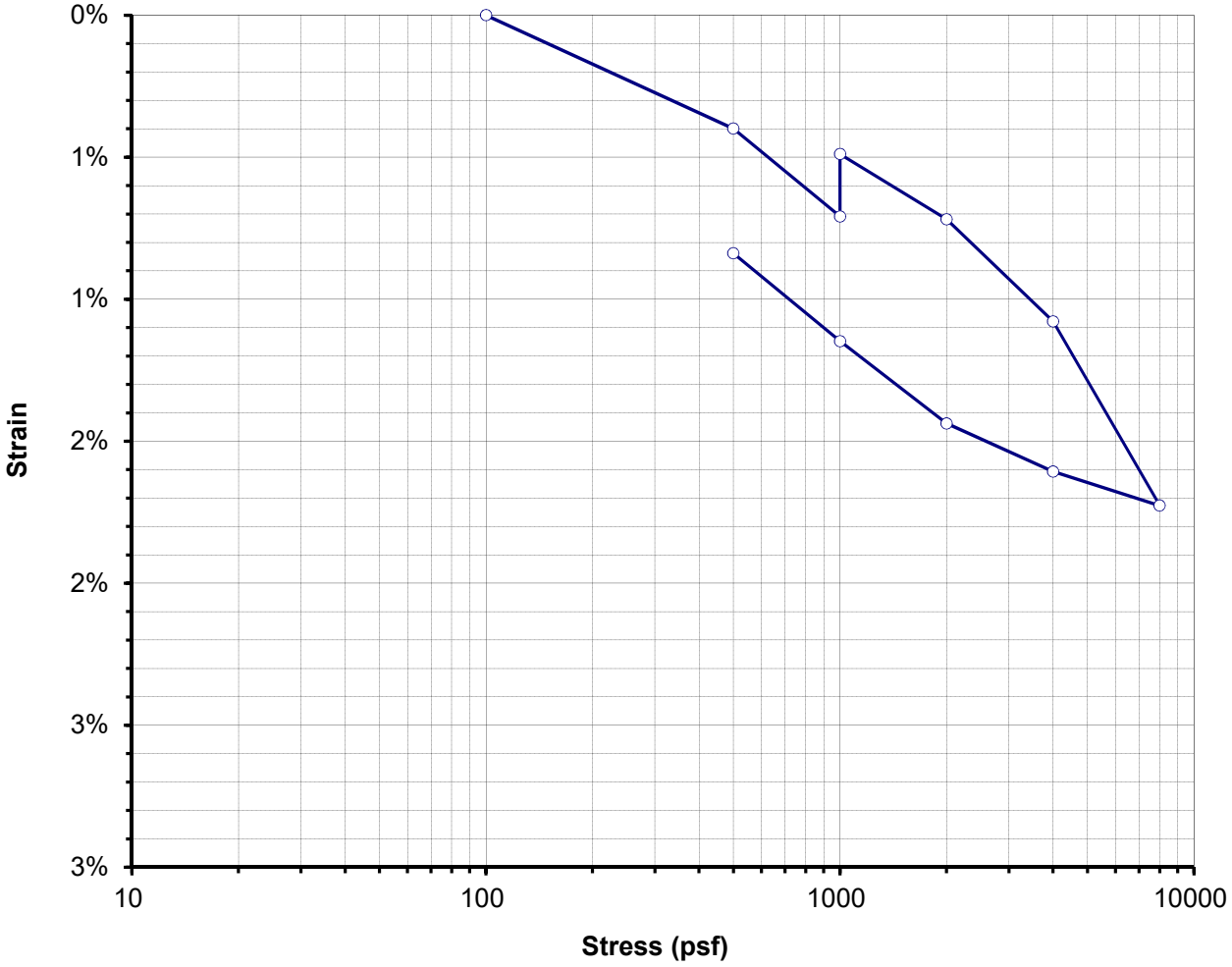
Project No. : *LA1148B*

Date : *9/24/13*

ATTERBERG LIMITS
(ASTM D-4318-84)

Figure No. : B-1C

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-1	**Sample Depth**	7.5 ft
Sample No.	R-3	**USCS**	CL

BEFORE TEST

Initial Moisture Content:	14.5%	
Initial Dry Unit Wt:	106.3	**pcf**
Initial Total Unit Wt.:	121.7	**pcf**
Initial Void Ratio:	0.5087	
Initial Degree of Saturation:	73.2%	

AFTER TEST

Final Moisture Content:	19.6%	
Final Dry Unit Wt:	106.6	**pcf**
Final Total Unit Wt.:	102.4	**pcf**
Final Void Ratio:	0.5042	
Final Degree of Saturation:	99.9%	

Water Added at: 1000 **psf**

ATTERBERG LIMITS					
LL=	32	**PL=**	21	**PI=**	11

Assumed Specific Gravity of Solids, Gs: 2.57

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
500	0.40%	0.5027
1000	0.71%	0.4980
1000	0.49%	0.5014
2000	0.72%	0.4979
4000	1.08%	0.4925
8000	1.73%	0.4827
4000	1.61%	0.4845
2000	1.44%	0.4871
1000	1.15%	0.4914
500	0.84%	0.4961

PROJECT NUMBER: LA-1148

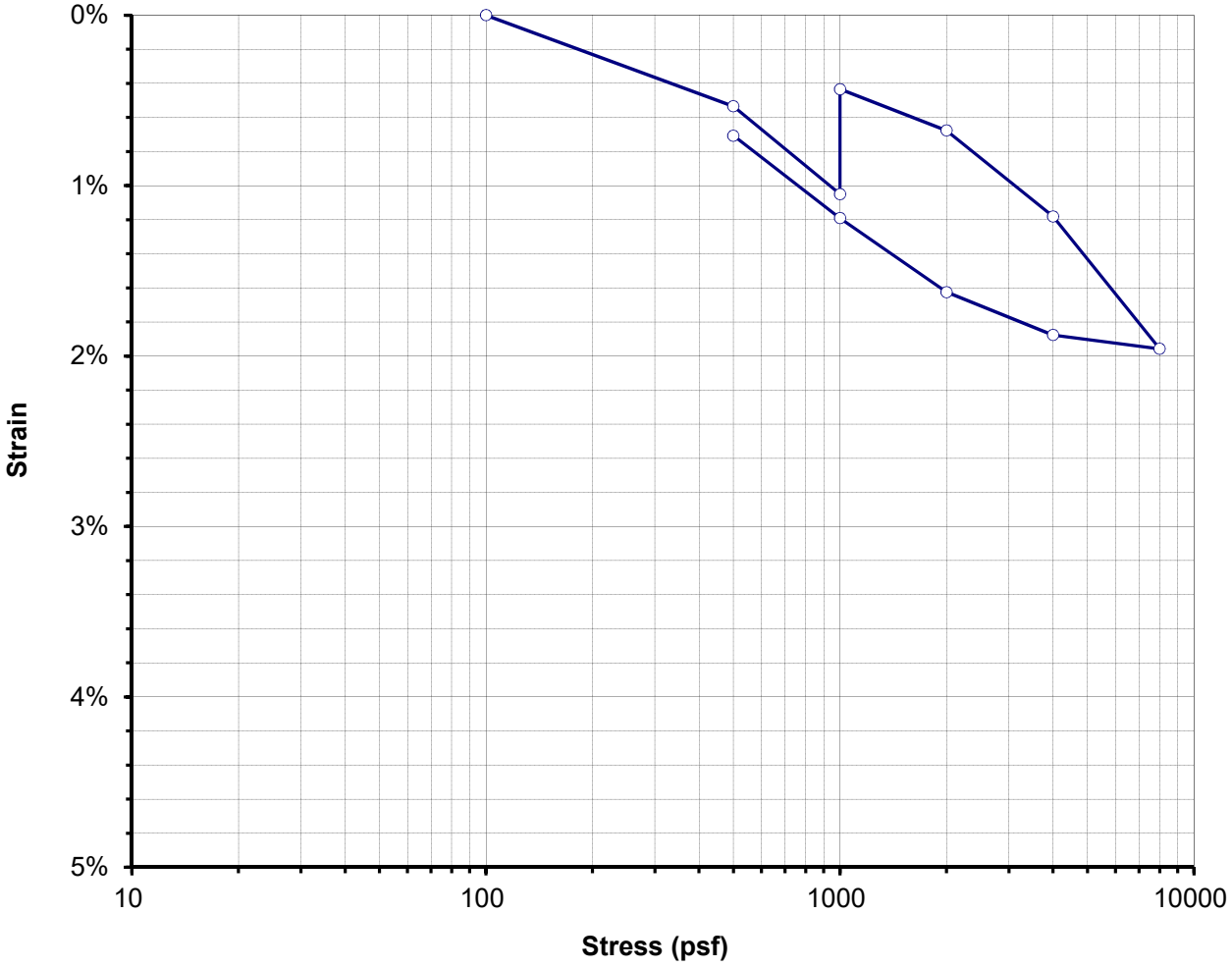
PROJECT NAME: Brookside Equestrian

FIGURE NO.
B-2A

GROUP DELTA CONSULTANTS

N:\Projects\1100-1199\LA-1148 Brookside Equestrian (American Multifamily)\Report\Appendix B Laboratory Test\Consol LA-1148 B-1 @ 7.5ft.xls

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-3	**Sample Depth**	7.5 ft
Sample No.	R-3	**USCS**	CL

BEFORE TEST

Initial Moisture Content:	18.8%	
Initial Dry Unit Wt:	106.4	**pcf**
Initial Total Unit Wt.:	126.4	**pcf**
Initial Void Ratio:	0.5617	
Initial Degree of Saturation:	89.2%	

AFTER TEST

Final Moisture Content:	21.1%	
Final Dry Unit Wt:	106.4	**pcf**
Final Total Unit Wt.:	103.3	**pcf**
Final Void Ratio:	0.5611	
Final Degree of Saturation:	100.0%	

Water Added at: 1000 **psf**

ATTERBERG LIMITS					
LL=	45	**PL=**	18	**PI=**	27

Assumed Specific Gravity of Solids, Gs: 2.66

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
500	0.53%	0.5534
1000	1.05%	0.5454
1000	0.43%	0.5550
2000	0.68%	0.5512
4000	1.18%	0.5433
8000	1.96%	0.5312
4000	1.88%	0.5324
2000	1.62%	0.5364
1000	1.19%	0.5431
500	0.71%	0.5507

PROJECT NUMBER: LA-1148

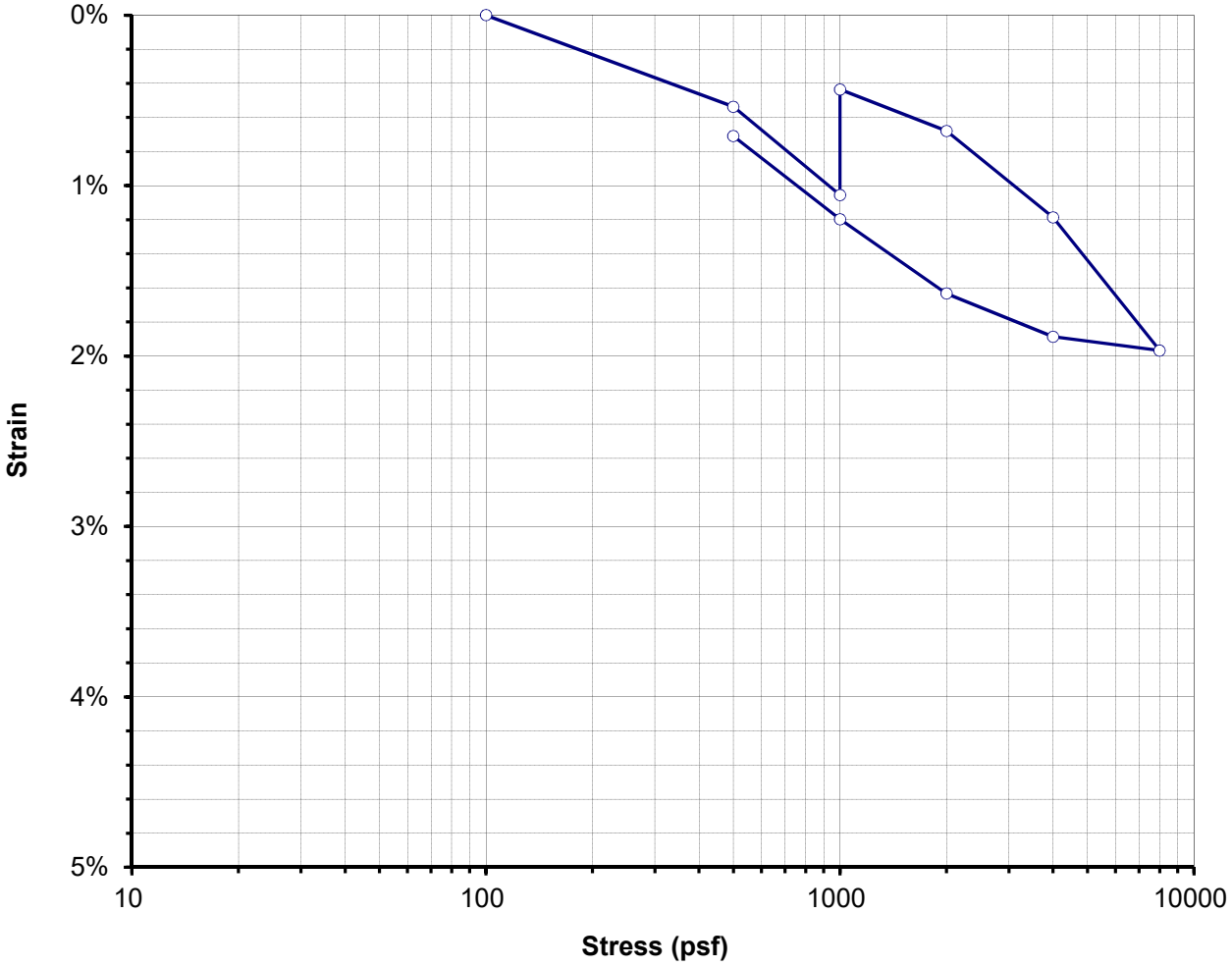
PROJECT NAME: Brookside Equestrian

FIGURE NO.
B-2B

GROUP DELTA CONSULTANTS

N:\Projects\1100-1199\LA-1148 Brookside Equestrian (American Multifamily)\Report\Appendix B Laboratory Test\Consol LA-1148 B-3 @ 7.5ft.xls

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-3	**Sample Depth**	15 ft
Sample No.	R-5	**USCS**	CL

BEFORE TEST

Initial Moisture Content:	16.1%	
Initial Dry Unit Wt:	110.8	**pcf**
Initial Total Unit Wt.:	128.6	**pcf**
Initial Void Ratio:	0.4756	
Initial Degree of Saturation:	88.5%	

AFTER TEST

Final Moisture Content:	17.9%	
Final Dry Unit Wt:	111.2	**pcf**
Final Total Unit Wt.:	104.2	**pcf**
Final Void Ratio:	0.4696	
Final Degree of Saturation:	99.9%	

Water Added at: 1000 **psf**

ATTERBERG LIMITS					
LL=	34	**PL=**	18	**PI=**	16

Assumed Specific Gravity of Solids, Gs: 2.62

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
500	0.54%	0.4676
1000	1.05%	0.4600
1000	0.44%	0.4691
2000	0.68%	0.4655
4000	1.19%	0.4580
8000	1.97%	0.4465
4000	1.89%	0.4477
2000	1.63%	0.4515
1000	1.20%	0.4579
500	0.71%	0.4651

PROJECT NUMBER: LA-1148

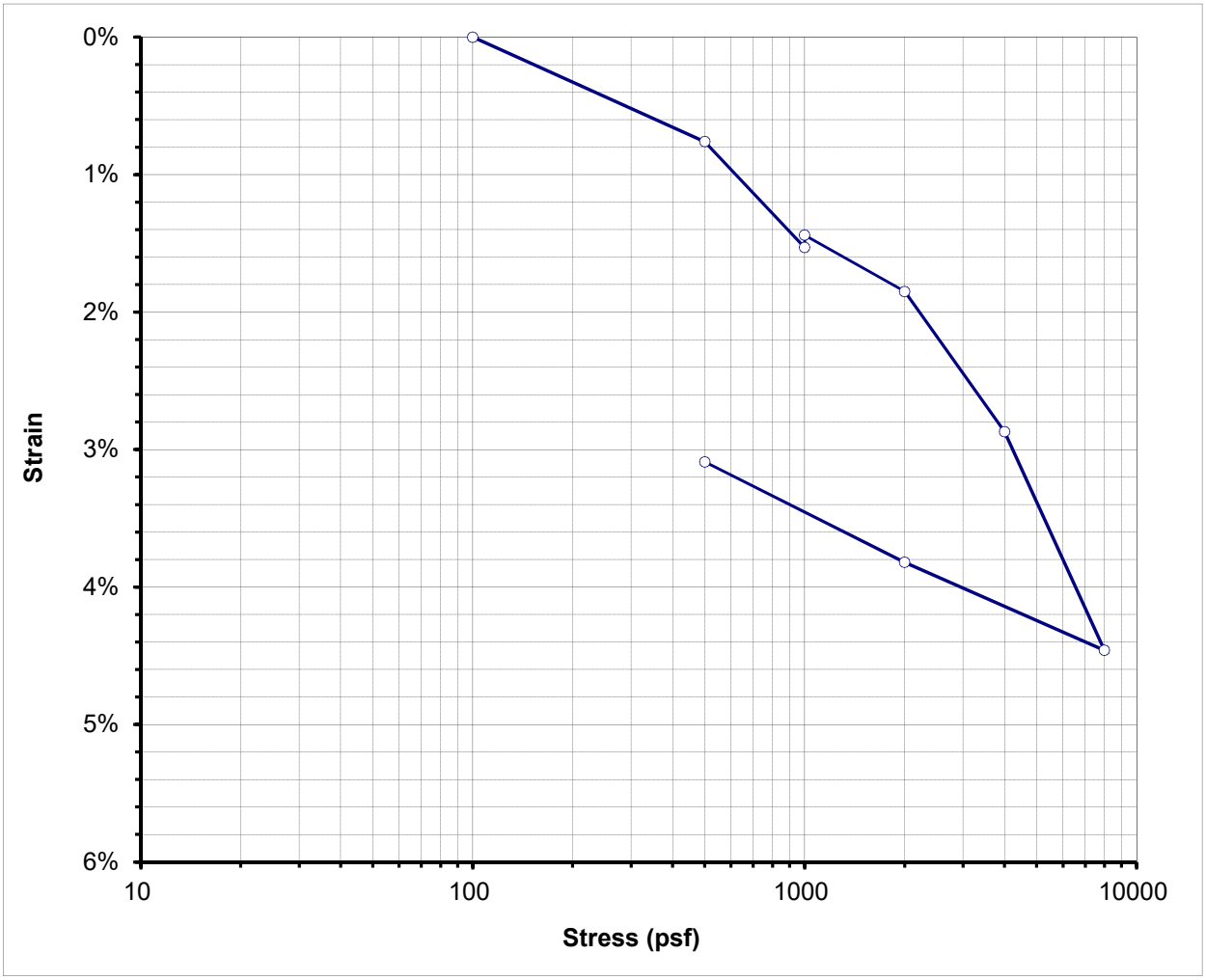
PROJECT NAME: Brookside Equestrian

FIGURE NO.
B-2C

GROUP DELTA CONSULTANTS

N:\Projects\1100-1199\LA-1148 Brookside Equestrian (American Multifamily)\Report\Appendix B Laboratory Test\Consol LA-1148 B-3 @ 15ft.xls

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-12	**Sample Depth**	11
Sample No.	R-5	**USCS**	MH

BEFORE TEST

Initial Moisture Content:	34.9%	
Initial Dry Unit Wt:	80.0	pcf
Initial Total Unit Wt.:	107.9	pcf
Initial Void Ratio:	1.0327	
Initial Degree of Saturation:	88.1%	

AFTER TEST

Final Moisture Content:	37.1%	
Final Dry Unit Wt:	82.7	pcf
Final Total Unit Wt.:	113.3	pcf
Final Void Ratio:	0.9656	
Final Degree of Saturation:	100.0%	

Water Added at: 1000 psf

ATTERBERG LIMITS					
LL=	63	**PL=**	24	**PI=**	39

Assumed Specific Gravity of Solids, Gs: 2.61

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.00%	1.0327
500	0.76%	1.0172
1000	1.53%	1.0016
1000	1.44%	1.0034
2000	1.85%	0.9951
4000	2.87%	0.9743
8000	4.46%	0.9420
2000	3.82%	0.9550
500	3.09%	0.9698
0	2.26%	0.9867

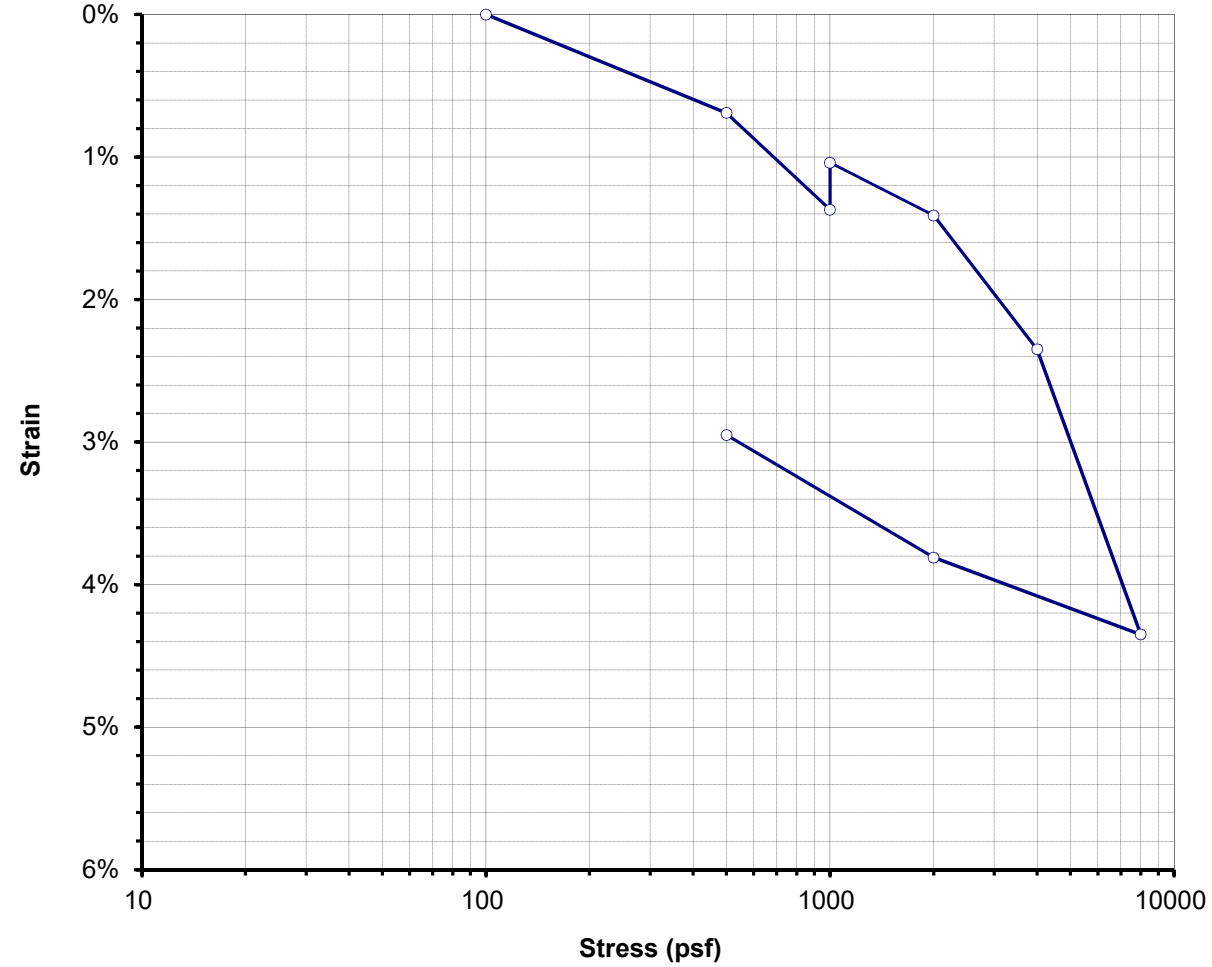
PROJECT NUMBER: LA-1148B

PROJECT NAME: Brookside Equestrian - American Multifamily, Lot 2

FIGURE NO. B-2D

N:\Projects\1100-1199\LA-1148B American Multifamily Walnut Lot 2\Laboratory Tests\Consol LA-1148B B-12 @ 11ft.xls

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-12	**Sample Depth**	6
Sample No.	R-3	**USCS**	CH

BEFORE TEST

Initial Moisture Content:	30.6%	
Initial Dry Unit Wt:	82.4	pcf
Initial Total Unit Wt.:	107.5	pcf
Initial Void Ratio:	0.8829	
Initial Degree of Saturation:	86.0%	

AFTER TEST

Final Moisture Content:	33.9%	
Final Dry Unit Wt:	84.2	pcf
Final Total Unit Wt.:	112.7	pcf
Final Void Ratio:	0.8414	
Final Degree of Saturation:	100.1%	

Water Added at: 1000 psf

ATTERBERG LIMITS					
LL=	65	**PL=**	35	**PI=**	30

Assumed Specific Gravity of Solids, Gs: 2.49

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.00%	0.8829
500	0.69%	0.8699
1000	1.37%	0.8571
1000	1.04%	0.8633
2000	1.41%	0.8563
4000	2.35%	0.8386
8000	4.35%	0.8010
2000	3.81%	0.8111
500	2.95%	0.8273
0	1.68%	0.8512

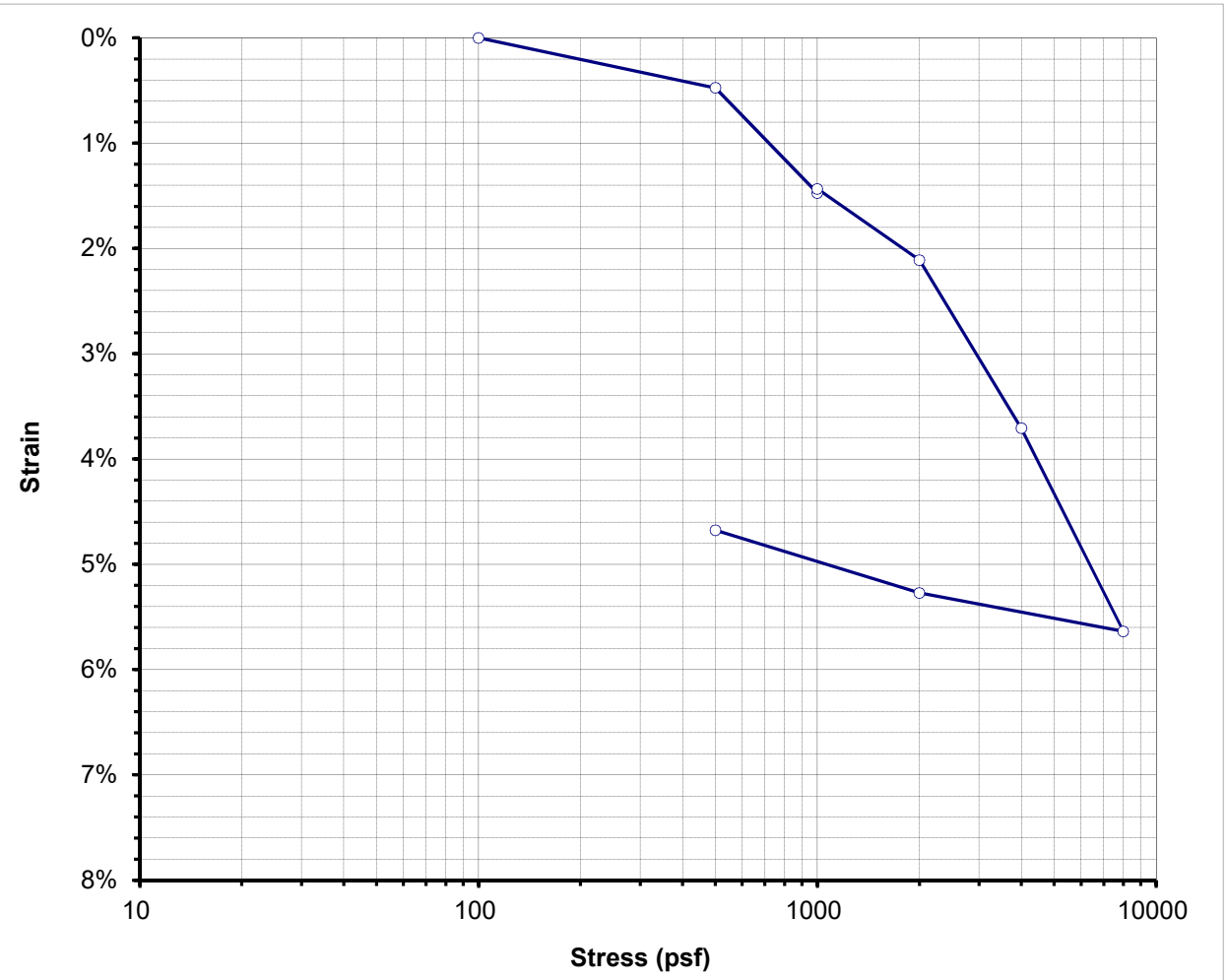
PROJECT NUMBER: LA-1148B

PROJECT NAME: Brookside Equestrian - American Multifamily, Lot 2

FIGURE NO. B-2E

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-14	**Sample Depth**	21
Sample No.	R-7	**USCS**	SC

BEFORE TEST

Initial Moisture Content:	24.7%	
Initial Dry Unit Wt:	100.7	pcf
Initial Total Unit Wt.:	125.6	pcf
Initial Void Ratio:	0.7173	
Initial Degree of Saturation:	95.6%	

AFTER TEST

Final Moisture Content:	22.6%	
Final Dry Unit Wt:	106.3	pcf
Final Total Unit Wt.:	130.3	pcf
Final Void Ratio:	0.6271	
Final Degree of Saturation:	100.0%	

Water Added at: 1000 psf

ATTERBERG LIMITS					
LL=	30	**PL=**	21	**PI=**	9

Assumed Specific Gravity of Solids, Gs: 2.77

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.00%	0.7173
500	0.47%	0.7091
1000	1.47%	0.6920
1000	1.43%	0.6927
2000	2.11%	0.6810
4000	3.71%	0.6536
8000	5.64%	0.6205
2000	5.27%	0.6267
500	4.68%	0.6370
0	3.94%	0.6496

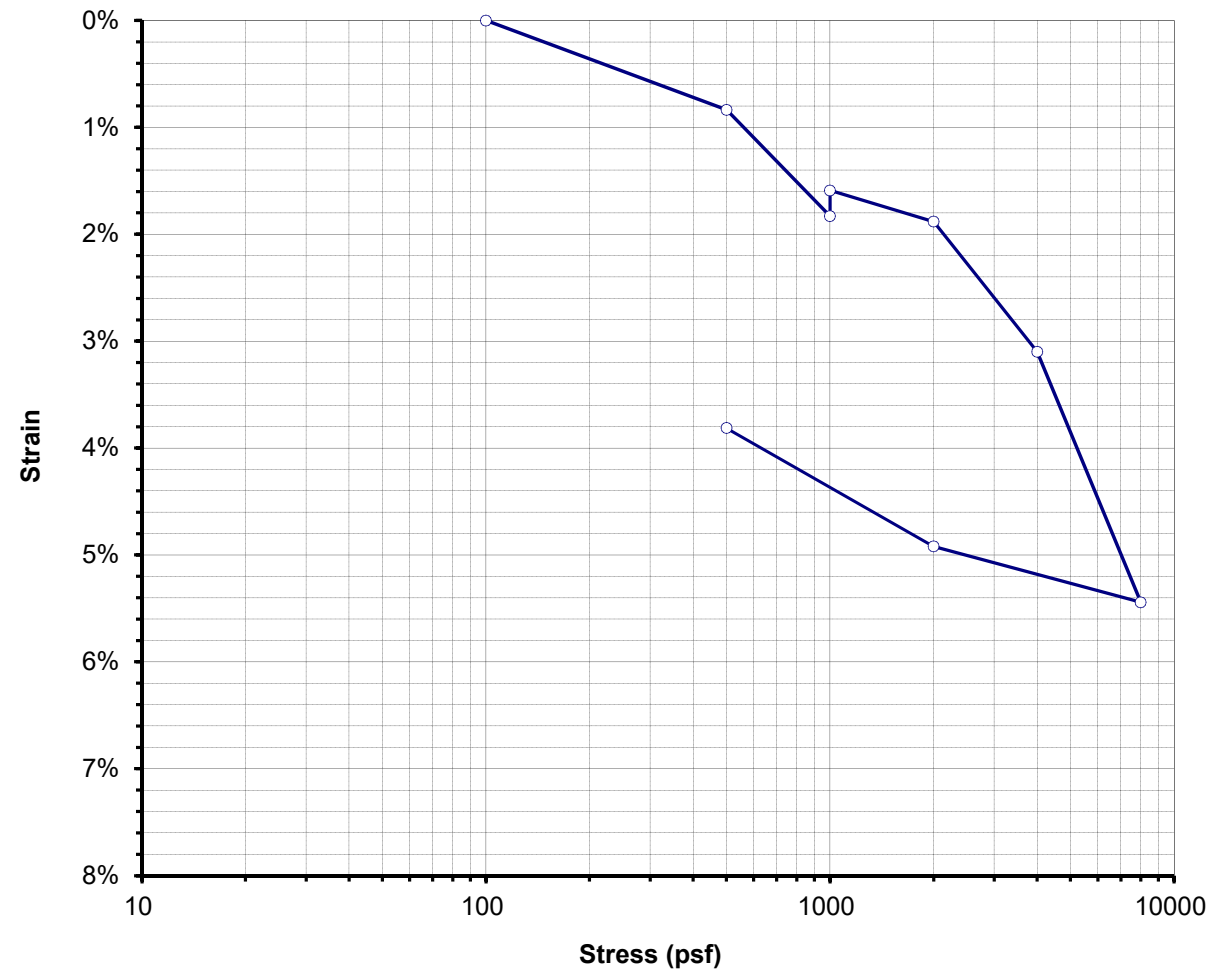
PROJECT NUMBER: LA-1148B

PROJECT NAME: Brookside Equstrian - American Multifamily, Lot 2

FIGURE NO. B-2F

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-16	**Sample Depth**	16
Sample No.	R-6	**USCS**	SC

BEFORE TEST

Initial Moisture Content:	29.5%	
Initial Dry Unit Wt:	92.2	pcf
Initial Total Unit Wt.:	119.4	pcf
Initial Void Ratio:	0.8490	
Initial Degree of Saturation:	94.9%	

AFTER TEST

Final Moisture Content:	28.6%	
Final Dry Unit Wt:	95.6	pcf
Final Total Unit Wt.:	123.0	pcf
Final Void Ratio:	0.7824	
Final Degree of Saturation:	100.0%	

Water Added at: 1000 psf

ATTERBERG LIMITS					
LL=	43	**PL=**	19	**PI=**	24

Assumed Specific Gravity of Solids, Gs: 2.73

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.00%	0.8490
500	0.84%	0.8335
1000	1.83%	0.8151
1000	1.59%	0.8196
2000	1.88%	0.8142
4000	3.10%	0.7917
8000	5.44%	0.7483
2000	4.92%	0.7580
500	3.81%	0.7785
0	2.93%	0.7948

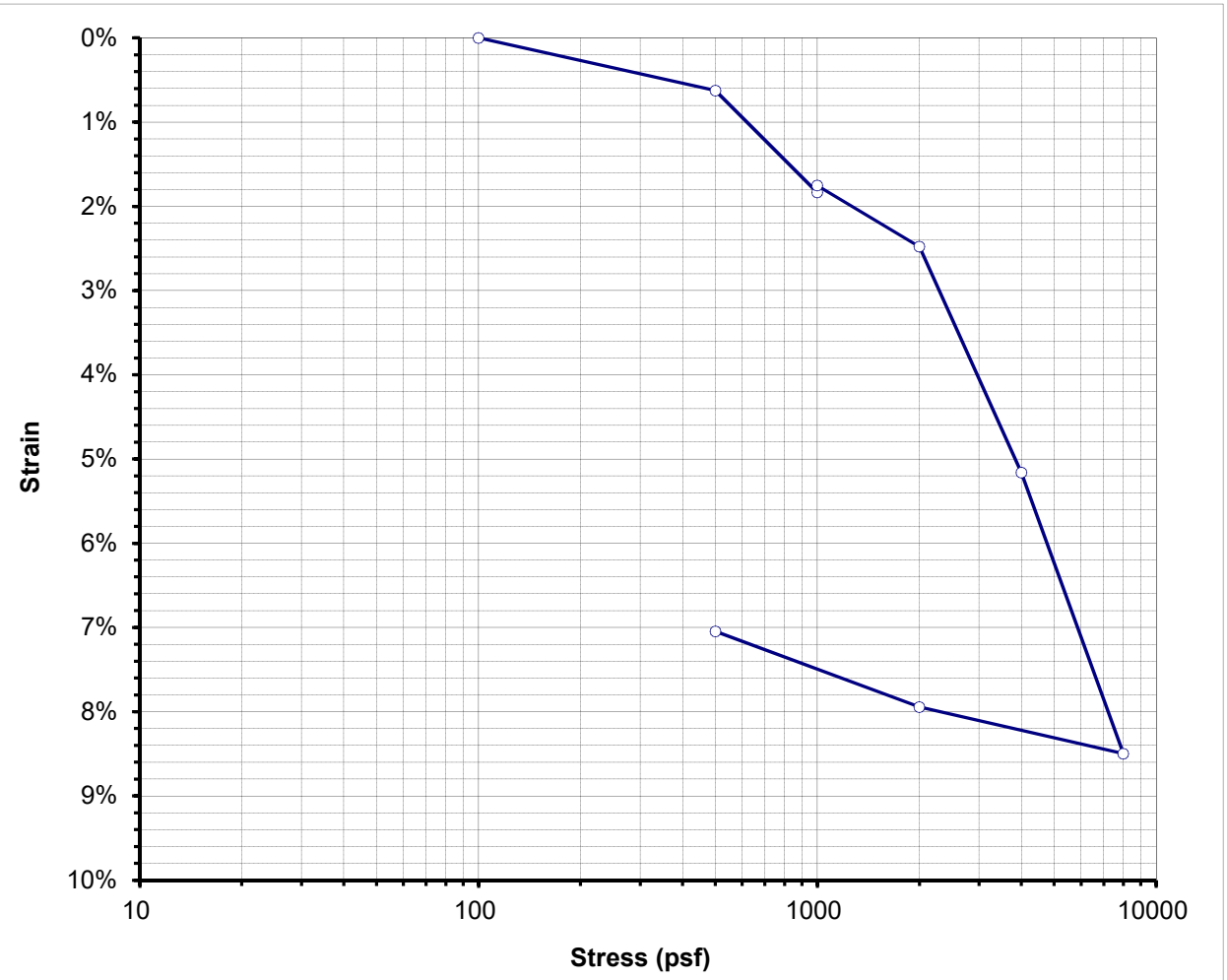
PROJECT NUMBER: LA-1148B

PROJECT NAME: Brookside Equestrian - American Multifamily, Lot 2

FIGURE NO. B-2G

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST RESULTS
ASTM D-2435



Boring No.	B-16	**Sample Depth**	26
Sample No.	R-8	**USCS**	CL

BEFORE TEST

Initial Moisture Content:	36.4%	
Initial Dry Unit Wt:	83.9	pcf
Initial Total Unit Wt.:	114.5	pcf
Initial Void Ratio:	1.0334	
Initial Degree of Saturation:	96.4%	

AFTER TEST

Final Moisture Content:	32.4%	
Final Dry Unit Wt:	90.5	pcf
Final Total Unit Wt.:	119.8	pcf
Final Void Ratio:	0.8854	
Final Degree of Saturation:	100.0%	

Water Added at: 1000 psf

ATTERBERG LIMITS					
LL=	46	**PL=**	21	**PI=**	25

Assumed Specific Gravity of Solids, Gs: 2.74

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.00%	1.0334
500	0.62%	1.0207
1000	1.83%	0.9961
1000	1.75%	0.9978
2000	2.48%	0.9830
4000	5.16%	0.9285
8000	8.50%	0.8606
2000	7.94%	0.8719
500	7.05%	0.8901
0	5.91%	0.9133

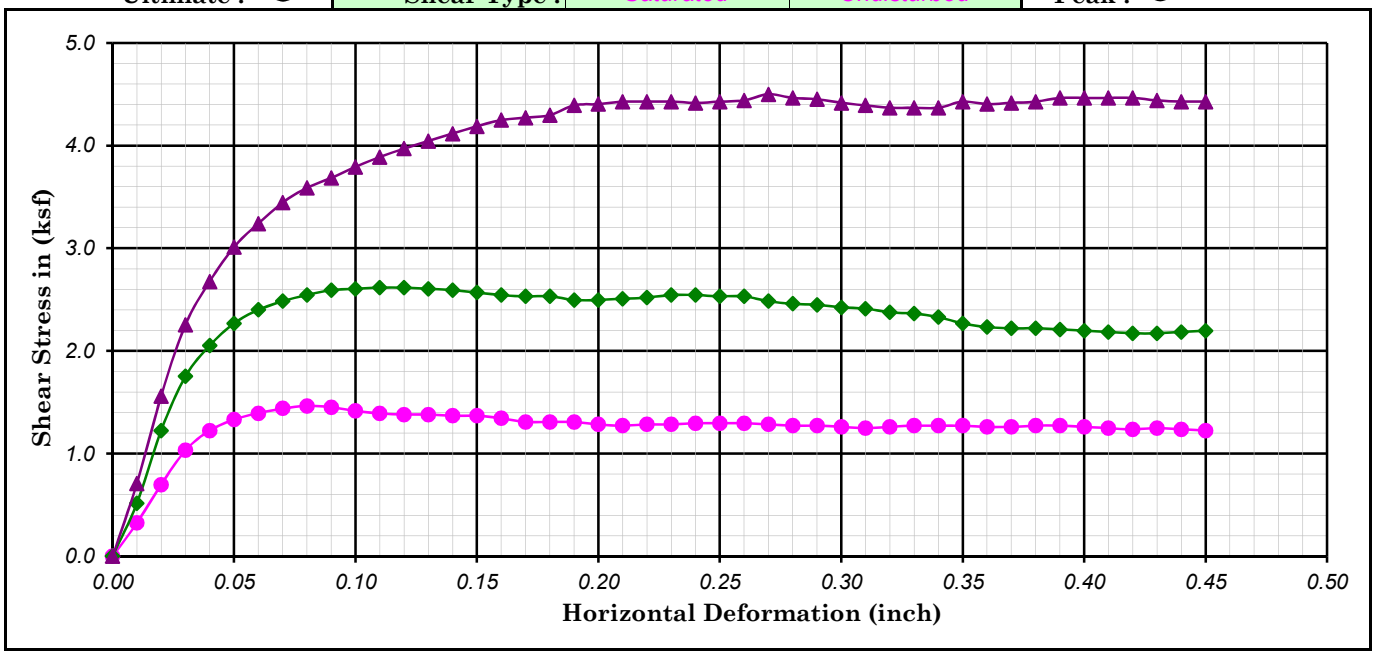
PROJECT NUMBER: LA-1148B

PROJECT NAME: Brookside Equstrian - American Multifamily, Lot 2

FIGURE NO. B-2H



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : B-1		Strength Intercept (C) :	0.52	(ksf)	Peak	0.22	(ksf)	Ultimate
Sample No. : R1			24.99	(kPa)		10.34	(kPa)	
Depth (ft/m) : 2.5	0.76	Friction Angle (ϕ) :	26.61	Degree		26.36	Degree	
Description : Brown Sandy Clay					Shear Rate (inch/minute) :		0.0025	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	23.63	104.12	16.39	0.62	2.00	95.76	1.46	70.10	1.22	58.61
◆	23.68	105.13	16.55	0.60	4.00	191.52	2.62	125.25	2.17	104.00
▲	21.45	105.74	16.64	0.59	8.00	383.04	4.50	215.46	4.19	200.52

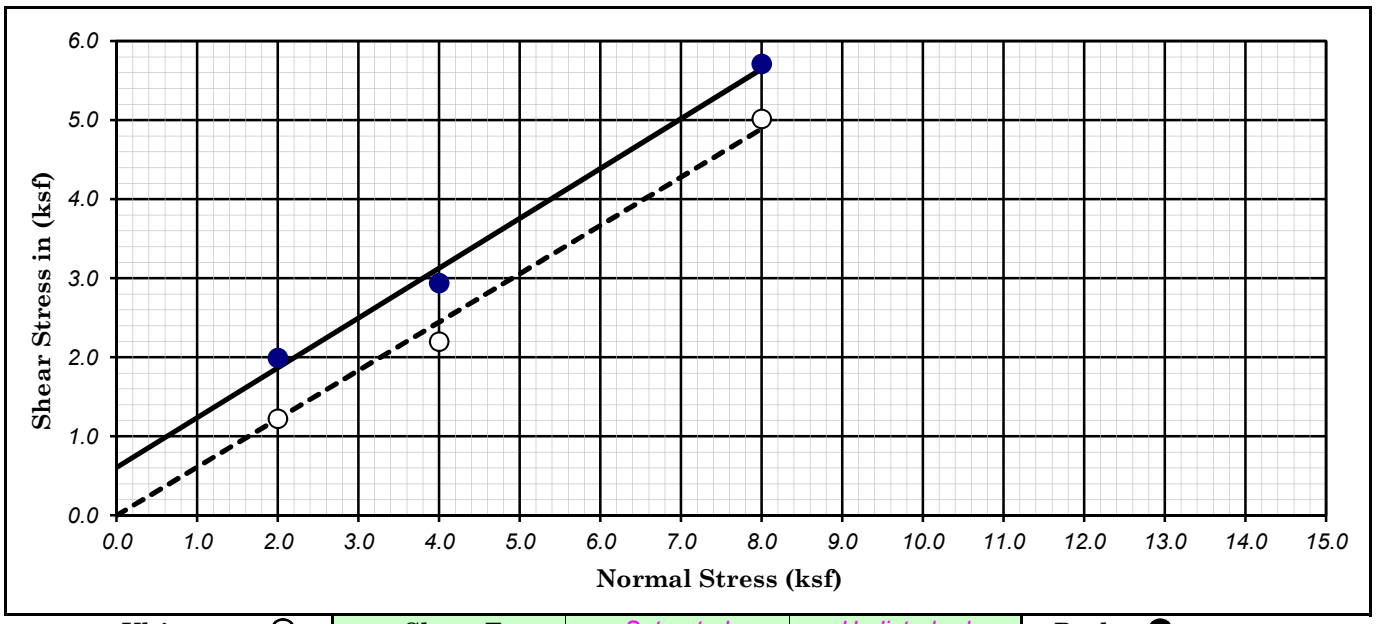
GROUP DELTA CONSULTANTS

Walnut - American Multifamily

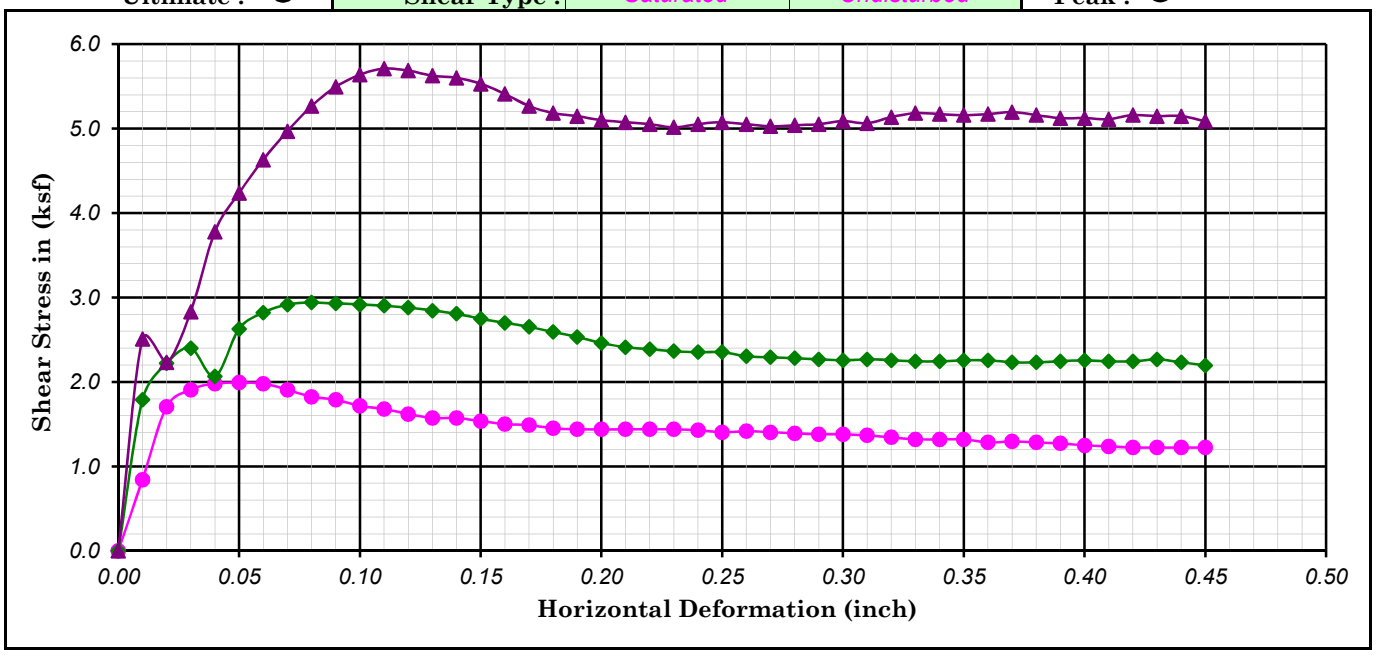
DIRECT SHEAR TEST
(ASTM D -3080)

Project No. : LA1148 | **Date :** 08/01/13

Figure No. B-3A



Ultimate : ○	Shear Type :	Saturated	Undisturbed	Peak : ●



Boring No. : B-3		Strength Intercept (C) :	0.61	(ksf)	Peak	0.00	(ksf)	Ultimate
Sample No. : R1			29.04	(kPa)		0.00	(kPa)	
Depth (ft/m) : 2.5	0.76	Friction Angle (ϕ) :	32.22	Degree		31.44	Degree	
Description : Very Dark Brown Sandy Clay with Traces of Siltstone,Shale					Shear Rate (inch/minute) :			0.0025

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	22.21	107.27	16.88	0.57	2.00	95.76	1.99	95.38	1.22	58.61
◆	20.44	111.36	17.53	0.51	4.00	191.52	2.94	140.77	2.20	105.14
▲	19.57	113.84	17.92	0.48	8.00	383.04	5.71	273.44	5.02	240.17

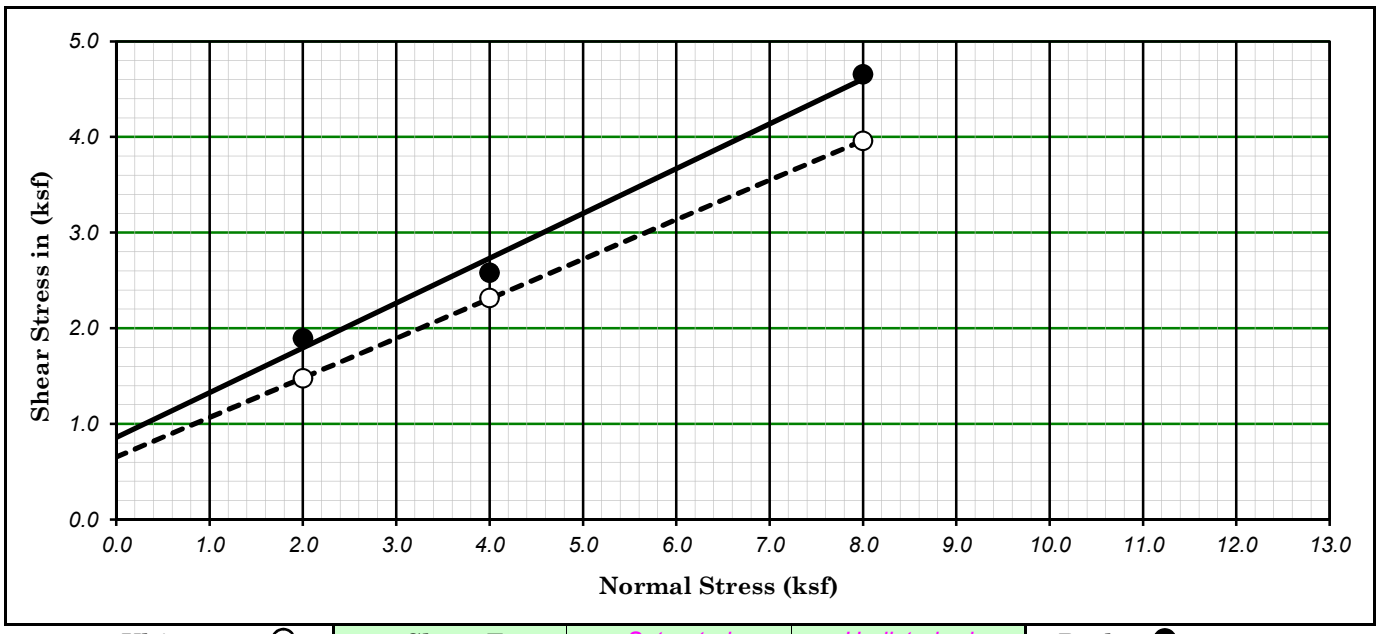
GROUP DELTA CONSULTANTS

Walnut - American Multifamily

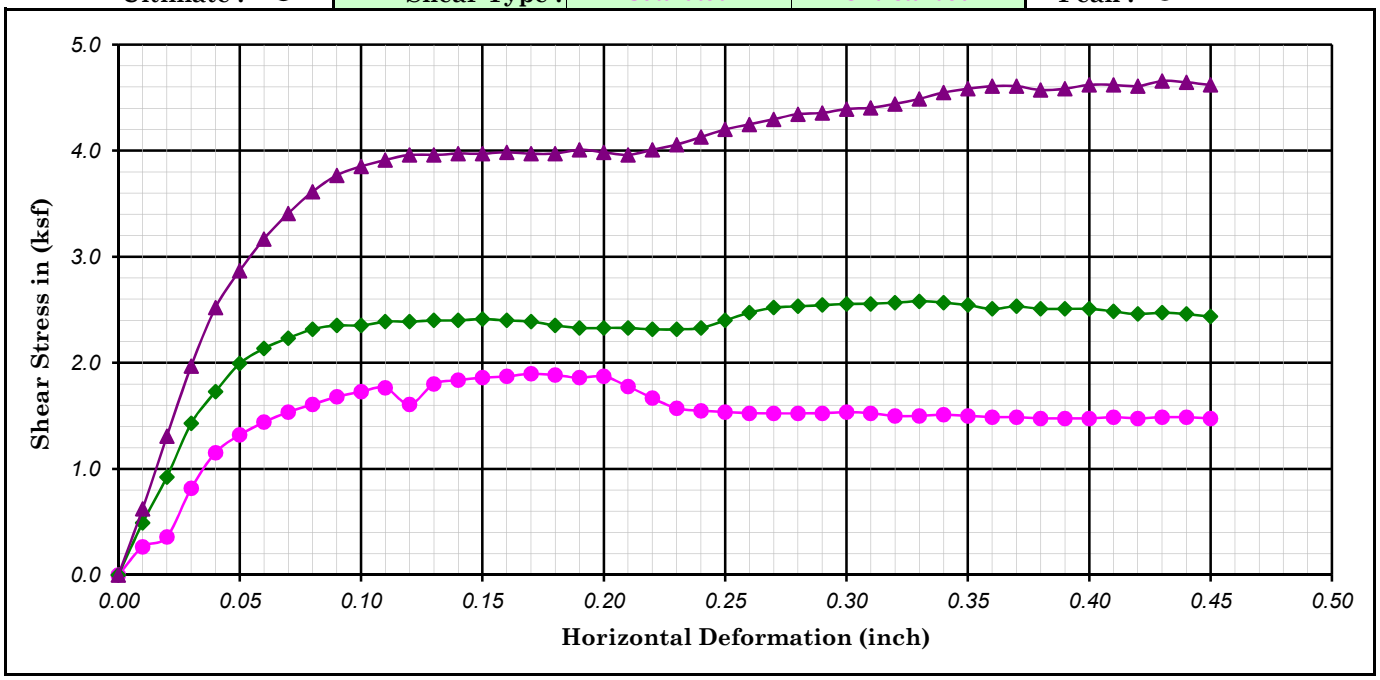
Project No. : LA1148 **Date :** 08/02/13

DIRECT SHEAR TEST
(ASTM D -3080)

Figure No. B-3B



Ultimate : ○	Shear Type :	Saturated	Undisturbed	Peak : ●



Boring No. : B-14		Strength Intercept (C) :	0.86	(ksf)	Peak	0.65	(ksf)	Ultimate
Sample No. : R2			41.1	(kPa)		31.3	(kPa)	
Depth (ft/m) : 3.5	1.07	Friction Angle (ϕ) :	25	Degree		22	Degree	

Description : Medium Brown Lean CLAY (CL) with few Claystone fragments — Shear Rate (inch/minute) : 0.0025

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	37.2	85	13.4	0.97	2.00	96	1.9	90.8	1.5	70.7
◆	35.5	87	13.7	0.94	4.00	192	2.6	123.5	2.3	110.9
▲	32.7	90	14.2	0.87	8.00	383	4.7	222.9	4.0	189.6

GROUP DELTA CONSULTANTS

Brookside Equestrian, American Multifamily, Lot 2

DIRECT SHEAR TEST
(ASTM D -3080)

Project No. : LA1148B

Date : 09/17/13

Figure No. : B-3C

APPENDIX D

LIQUEFACTION ALAYSES

APPENDIX D
LIQUEFACTION EVALUATION

D.1 GENERAL

Liquefaction involves a sudden loss in strength of a saturated, cohesionless soil (predominantly sand) caused by cyclic loading such as an earthquake. This phenomenon results in elevated pore-water pressures that temporarily transform the soil into a fluid mass resulting in vertical settlement and could include lateral deformations. Typically, liquefaction occurs in areas where groundwater is less than 50 feet from the surface and where the soils are comprised of predominantly poorly consolidated sands. Seismic ground motions can also induce settlement without liquefaction occurring, including within dry sands above the water table.

We have evaluated liquefaction potential in accordance with the 2022 CBC and CGS Special Publication 117A (2008).

Lateral spreading analyses have been performed for the cross-section across the Cross Section 9-9', where the encountered site soils are susceptible to liquefaction. This cross-section is shown in Figure 3.9.

D.2 PEAK GROUND ACCELERATION

Los Angeles County Document GS045.0 requires that liquefaction potential should be performed using probabilistic seismic hazard analysis utilizing at least a hazard level of 2 percent probability of exceedance in 50 years. We have used the peak ground acceleration (2% exceedance in 50 years, PGA_M) of 0.82g. We have used a mean magnitude of 6.71 estimated with the USGS Unified Hazard tool (https://earthquake.usgs.gov/hazards/interactive).

D.3 GROUNDWATER

The historical highest groundwater contours and borehole log data (San Dimas Quadrangle, CGS, 1998) does not have adequate coverage at the project site. The adjacent data indicates that the historical highest groundwater at this area is deeper than 20 feet below ground surface. Since shallowest groundwater encountered in the borings is 18 feet below existing grade, the design groundwater level was assumed to be at a depth of 18 feet.

The design groundwater level is deeper than the bottom of the existing Lemon Creek near CPT-2 location. Therefore, we have conservatively assumed a design groundwater level of 12 feet near CPT-2 location.

D.4 LIQUEFACTION POTENTIAL

D.4.1 ANALYSIS PROCEDURE

The liquefaction potential was analyzed using CPT data with the CLiq v.3.5.2.5 (computer program GeoLogismiki). The liquefaction potential was computed using the simplified procedures recommended by Robertson (2009) for CPT data. In addition, the liquefaction potential was also analyzed using SPT data in accordance procedures recommended by Youd (2001). A factor of safety of 1.3 was used in accordance with the Los Angeles County Document GS045.0.

Based on the results of the preliminary liquefaction potential evaluation, the loose young alluvial deposits and young fluvial debris adjacent to Lemon Creek are susceptible to liquefaction.

D.4.2 SEISMIC SETTLEMENT

Seismically-induced settlement is often caused by loose to medium-dense granular soils densified during ground shaking. Dry and partially saturated soils as well as saturated granular soils are subject to seismically-induced settlement. The seismically induced settlement was estimated using the procedures of Ishihara and Yoshimine (1992). The computation of liquefaction potential evaluation and seismically-induced settlement are presented in Figure D.1 through D.11. The total seismically-induced settlements are summarized in Table D.1.

TABLE D.1 SUMMARY OF SEISMICALLY-INDUCED SETTLEMENT

Boring No.	Seismically-Induced Settlement (Inches)		
	Saturated Soils	Unsaturated Soils	Total
B-1	-	-	-
CPT-2	***1.5***	***2.5***	***4***
B-3	-	-	-
CPT-4	0.1	0.1	0.2
B-5	-	-	-
CPT-6	-	-	-
CPT-7	-	-	-
B-8	0	0.2	0.2
B-9	-	-	-
CPT-10	0.2	0	0.2
CPT-11	0.15	0	0.15
B-11	-	-	-
B-12	-	-	-
B-13	-	-	-
B-14	0	<0.1	<0.1
CPT-15	<0.1	<0.1	<0.1
B-16	-	-	-
CPT-17	0.3	<0.1	0.3
B-18	-	-	-
B-19	-	-	-
B-20	**1.1**	**0.1**	**1.3**
B-21	-	-	-

Liquefaction-induced settlement of about 0.5 inches were estimated based on CPT data at depths of 45 to 48 feet at CPT-17. The materials near these elevations consist of claystone bedrock based on nearby borings. Claystone bedrock is not susceptible to liquefaction or seismically-induced settlement. Therefore, it is our opinion that the estimated settlement within these elevations is considered anomaly and we have ignored 0.5 inches of seismically-induced settlement within depths of 45 to 48 feet at CPT-17.

D.5 LATERAL SPREADING DISPLACEMENT

D.5.1 ANALYSIS PROCEDURE

According to "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction Hazards in California" (1999), Newmark's method was utilized for estimating liquefaction-induced lateral displacements.

The Newmark method involves two distinct steps:

1) A pseudo static slope stability analysis is first performed to evaluate the average horizontal acceleration required to cause slope movement (i.e., reach FS = 1.0). The horizontal acceleration that causes yielding of the slope or free face is referred to as the Yield Acceleration (k_y).
2) Once the yield acceleration is determined, the Newmark displacements are determined by integrating the seismic displacements that occur when the earthquake acceleration momentarily exceeds the yield acceleration of the slope.

D.5.2 GEOMETRY AND SOIL STRENGTH PARAMETERS

Lateral displacement analyses were performed based on information illustrated in Cross-Section 9-9'. The analyses considered the stratigraphy and empirically derived engineering properties of the subsurface materials as well as the variations in grade within the vicinity of the site including the presence of the nearby Lemon Creek.

Liquefiable soils were identified in all the CPTs at intermittent layers ranging from 12 to 34 feet below grade near CPT-2 location. Based on the available data, we understand that the materials that are susceptible to liquefaction do not extend to east of the building pad (B-1). However, we have conservatively assume that the liquifiable layer extend horizontally in our lateral spread model, as shown on Figure D.12.

Soil strength parameters of the material units implemented in our slope stability models are presented in Table D.2.

TABLE D.2 SOIL STRENGTH PARAMETERS

Layer No.	Material Unit	Layer			Soil Strength			
		Depth to Top of Layer (ft)	Depth to Bottom of Layer (ft)	CPT-Correlated (N60)	Estimated $(N1)_{60\text{-}SR}$	Cohesion (psf)	Internal Friction Angle (deg)	Residual Shear Strength (psf)
1	Non-Liquefiable Loose Silty Sand	0	12	10	-	0	30	-
2	Liquefiable Soil Silty Sand	12	15	10	15	-	-	600
3	Alluvium Stiff Clayey Soils	14	26	15	-	1000	0	-
4	Liquefiable Soil Silty Sand	26	30	20	22	-	-	1000
5	Alluvium Stiff Clayey Soils	30	31	30	-	1000	0	-
6	Liquefiable Silty Sand	31	34	30	29	-	-	1000
7	Alluvium Stiff Clayey Soils	34	50	40	-	-	-	-

Soil strength parameters for the non-liquefiable clay, silty sand, and sand layers were estimated based on empirical correlations from the CPT data and engineering judgement. For the potentially liquefiable layers, post-liquefaction residual strengths were computed using the methods from Idriss and Boulanger (2007), Seed and Harder (1990), and Stark and Mesri (1992).

D.5.3 PSEUDOSTATIC ANALYSES

To determine the yield acceleration of the site, pseudo-static slope stability analyses were performed using post-liquefaction residual strength of the liquefiable soils as well as the shear strength of the other material units as summarized in Table D.2 above. Yield accelerations (i.e. horizontal acceleration that causes the slope to have a FS of 1.0) were found to be on 0.32g. The pseudo static slope stability analysis models for determination of the yield accelerations are presented in Figure D.12.

D.5.4 LATERAL SPREADING ANALYSES

To estimate permanent seismic displacement, a deformation analysis using the Bray and Rathje procedure (1998) was performed. The input PGA value corresponded to the PGA at bedrock (Site Class B) for a design seismic event with a 2% probability of exceedance in 50 years. This PGA was determined to be to 0.7g. To estimate the site period (T_S), a shear wave velocity of 250 m/s was utilized for the liquefiable soils with a thickness of 3 meter (9 feet). The shear wave velocity was estimated based on data from the CPT-2. Distance to the controlling fault of 11 km was utilized

based on deaggregation of seismic hazards (USGS). The estimated permanent seismic lateral displacements is estimated to be about 3 inches.

D.6 CONCLUSION

The results indicate that the potential of liquefaction occurred at the site is considered low except at the locations near CPT-2, or within Lots 25 to 27, and B-20, or within Lots 20 to 24. Seismically-induced settlement of up to 4 inches was estimated at CPT-2 and up to 1.3 inches was estimated at B-20. According to the Los Angeles County guidelines for Liquefaction and Lateral Spread (GS 045.0, 2014), structural mitigation alone without ground improvement is acceptable if the total seismically induced settlement of up to 4 inches. Therefore, structures within Lots 21 through 28 should be designed to accommodate total/differential seismically-induced settlement.

In addition, the estimated permanent seismic lateral displacement is about 3 inches which is less than upper limit on permanent horizontal ground displacement, or 18 inches, per Table 12.13-2 of ASCE 7-22. Accordingly, ground improvement may not be required. However, permanent seismic lateral displacement of 3 inches should be considered for structural design for Lots 25 to 28.

The liquefaction analyses and lateral spread was estimated using soil profile developed from CPT-2. However, we understand that the materials that are susceptible to liquefaction do not extend to east of the building pad (B-1). Therefore, estimated lateral spread using CPT-2 only as shown on Figure D.12 is very conservative. We recommend that more comprehensive field program near CPT-2 should be performed during design phase of the project to estimate the limit of soils that are susceptible to liquefaction.

ESTIMATION OF PERMANENT SEISMIC DISPLACEMENT USING THE BRAY AND RATHJE (1998) PROCEDURE.

INPUT PARAMETERS:

Yield Acceleration, ky (g):	0.32		Normalized MHEA Sigma:	0.298	
Vertical Thickness, h (m):	3		Mean Period Sigma:	0.3	
Shear Wave Vel., Vs (m/s):	250		Significant Duration Sigma:	0.3	
Earthquake Magnitude, M:	6.70	*	Normalized Displacement Sigma:	0.35	
Earthquake Accel., Rock (g):	0.7	*			
Earthquake Distance, r (km):	11	*	Allowable screen displacement (cm):	10	*

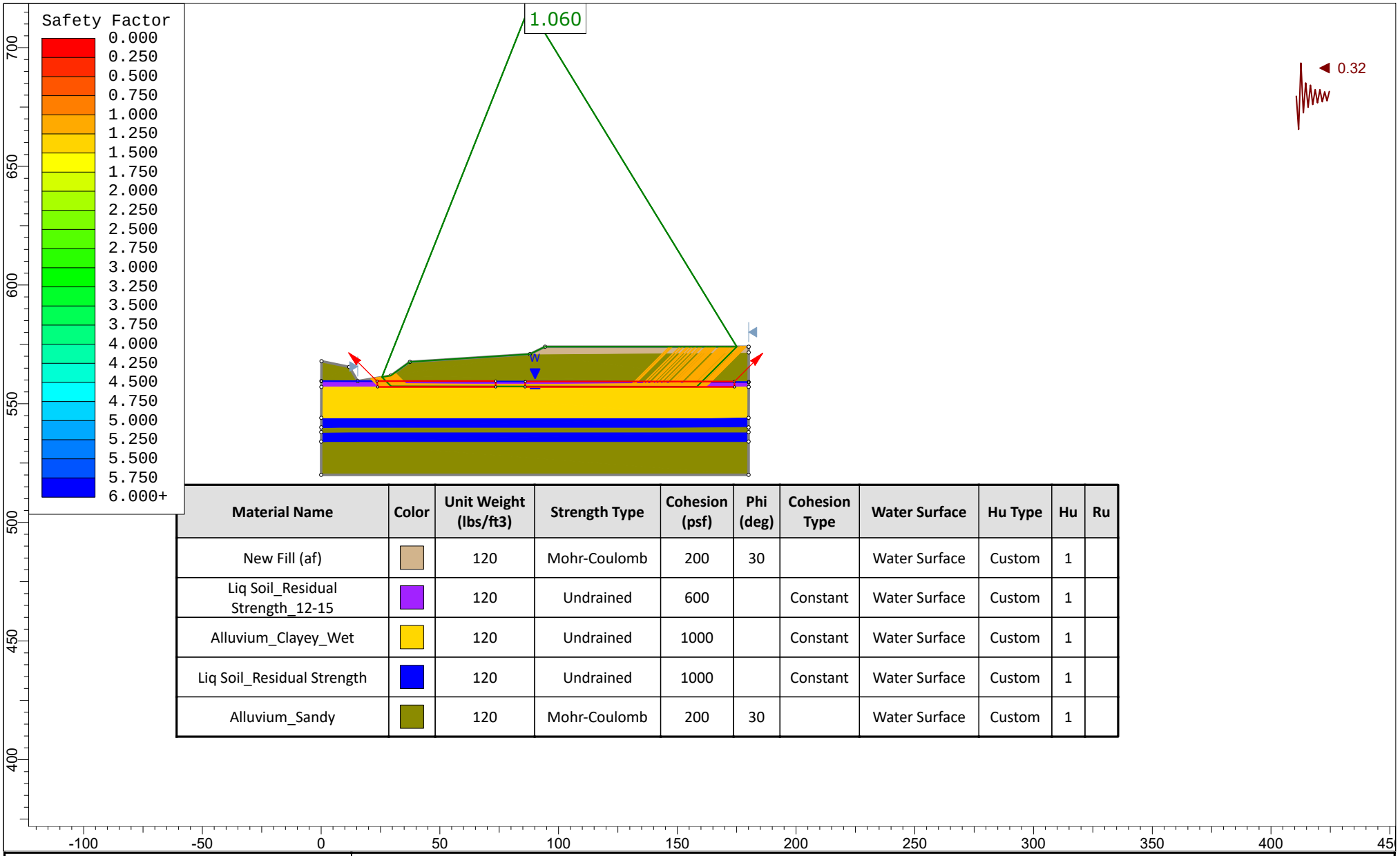
CALCULATIONS:

Site Period (s):	0.048
NRF Factor:	0.813
Mean Period (s):	0.561
Duration, D05-95 (s):	12.647
Ts/Tm:	0.0855
MHEA/MHA*NRF:	1.000
MHEA, kmax:	0.5692
ky/kmax:	0.5622
Normalized Disp. (cm/sec):	1.0908

(Input values marked with asterisks are used for calculation of seismic coefficient for screen)

Estimated Displacement (cm):	7.852	**Median f_{eq} for Screen Procedure:**	0.404 *
Estimated Displacement (in):	3.092	**Seismic Coefficient for Screen Procedure:**	0.283 *

GROUP DELTA

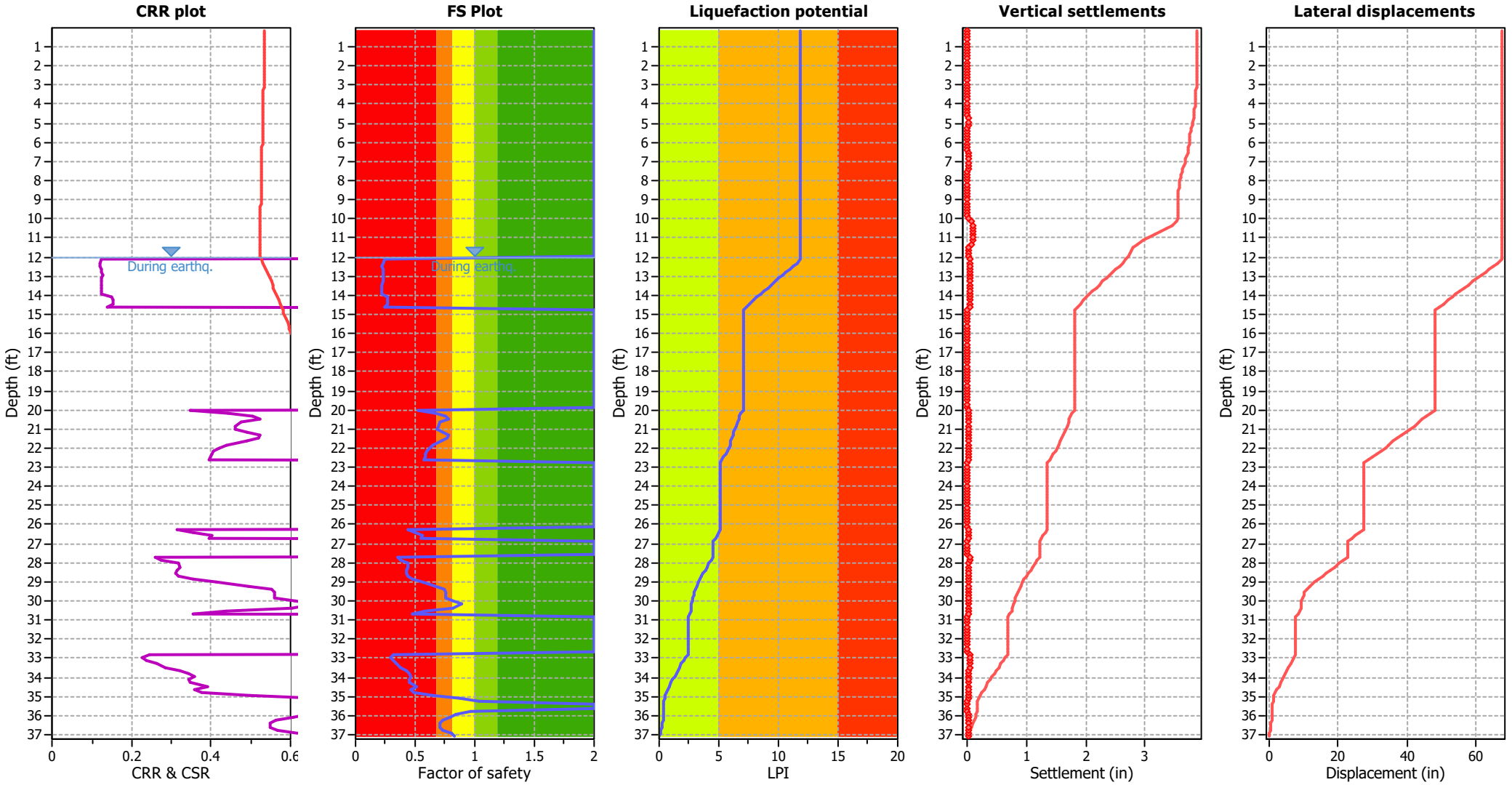


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
New Fill (af)		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Liq Soil_Residual Strength_12-15		120	Undrained	600		Constant	Water Surface	Custom	1	
Alluvium_Clayey_Wet		120	Undrained	1000		Constant	Water Surface	Custom	1	
Liq Soil_Residual Strength		120	Undrained	1000		Constant	Water Surface	Custom	1	
Alluvium_Sandy		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	

SLIDEINTERPRET 8.010

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:670	Company
Date	2/14/2023, 11:26:54 AM		File Name Lateral Spread Calculation.slmd

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	12.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

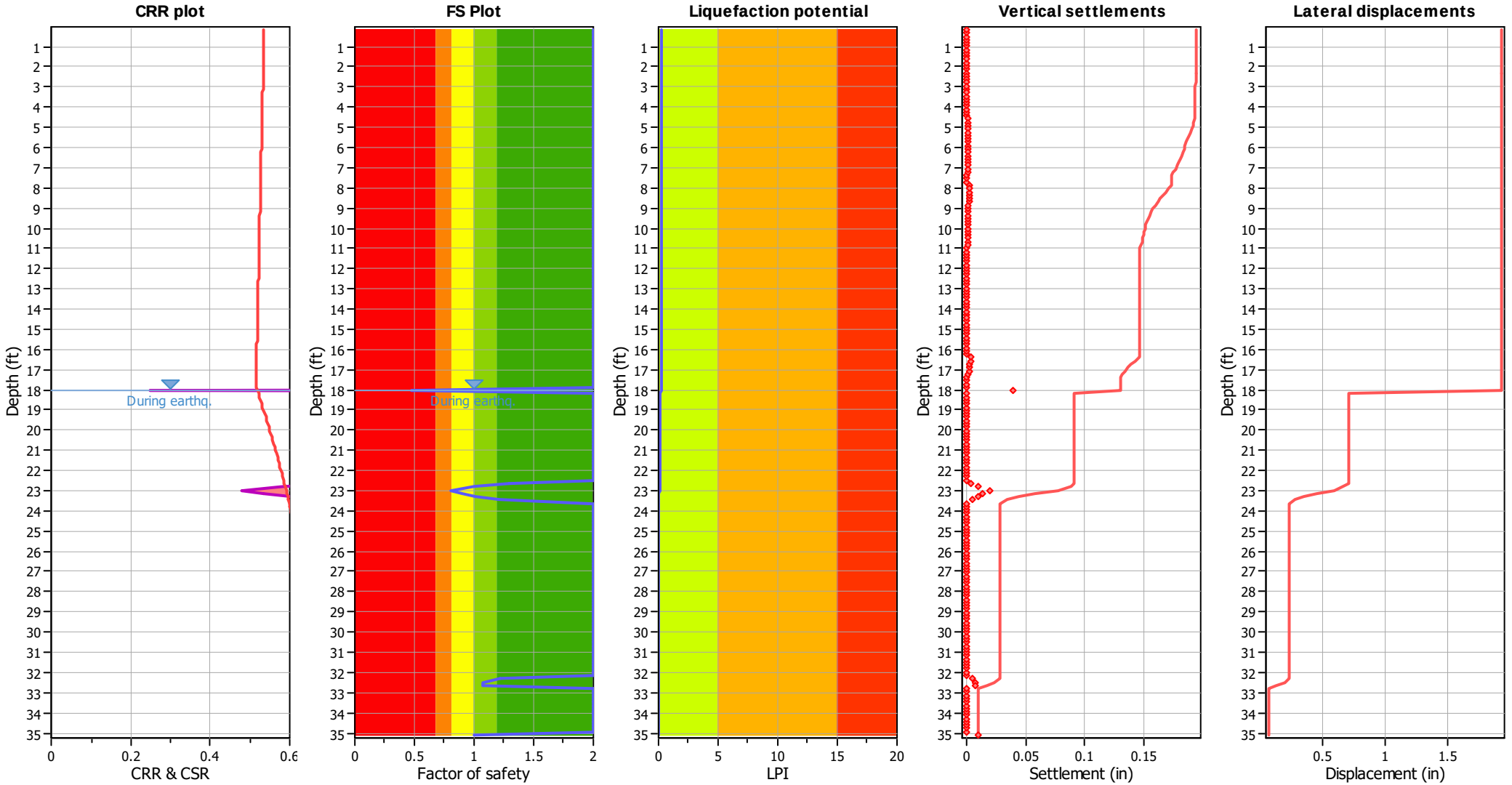
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.1

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

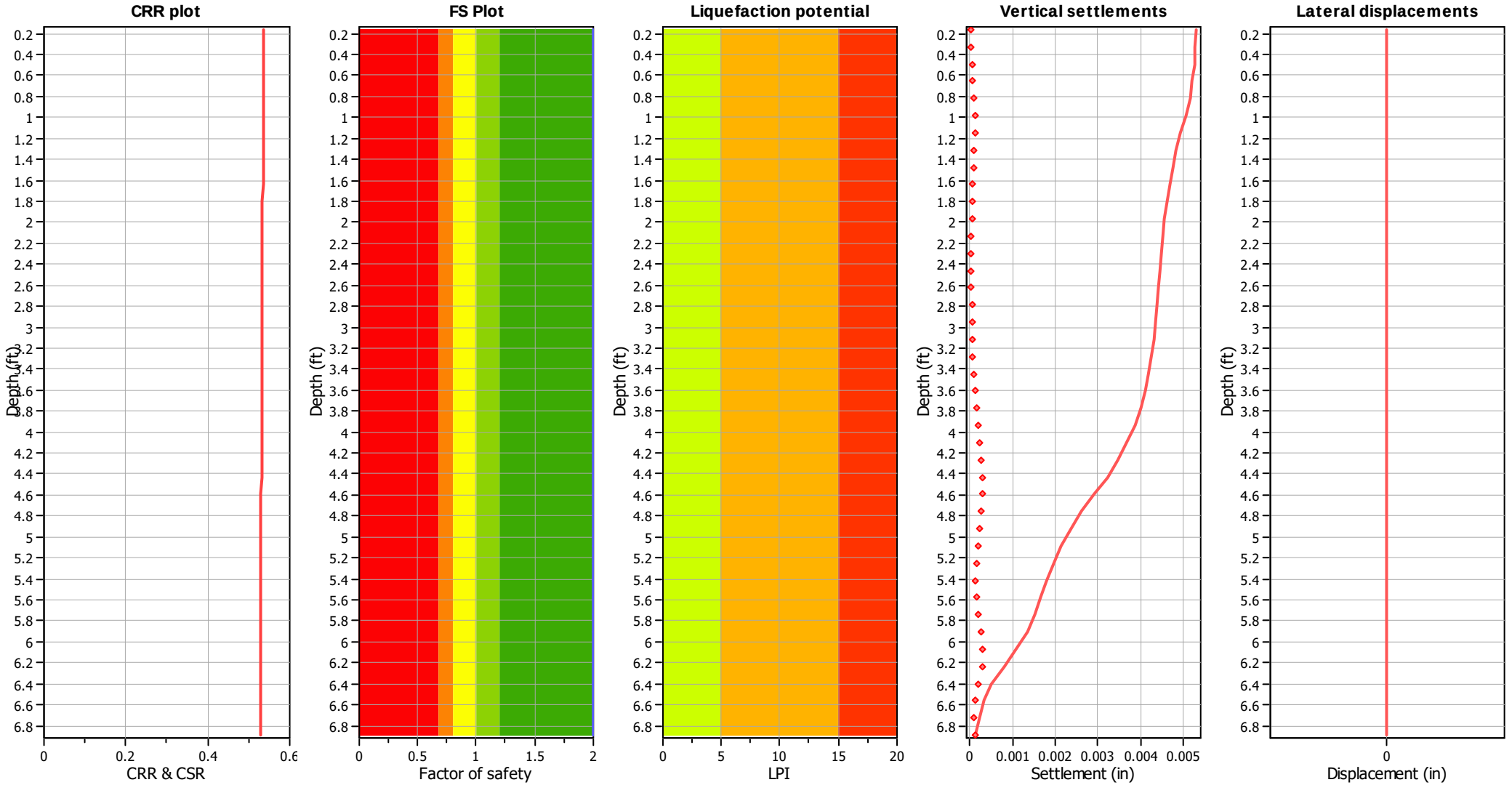
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.2

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

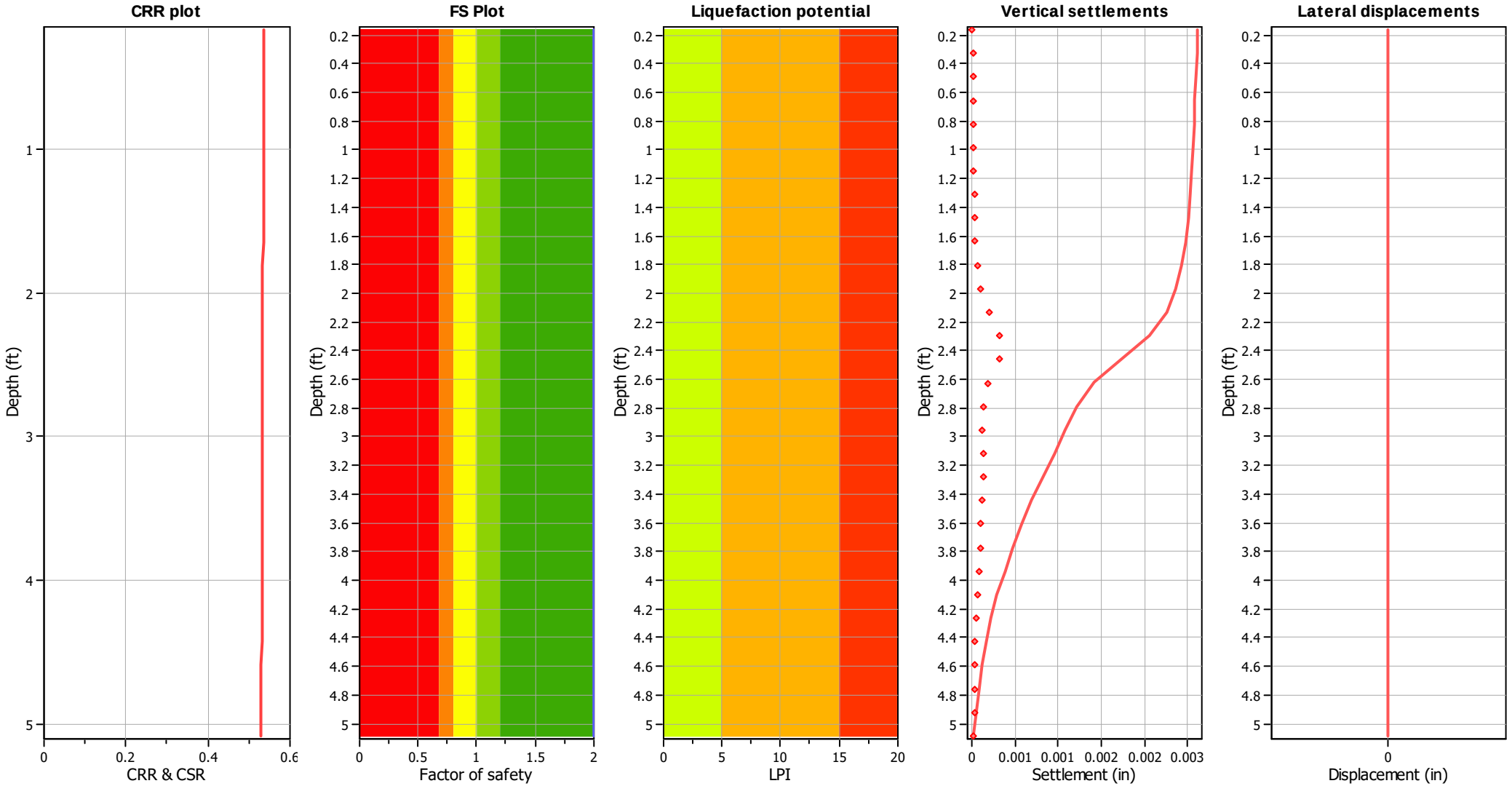
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.3

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

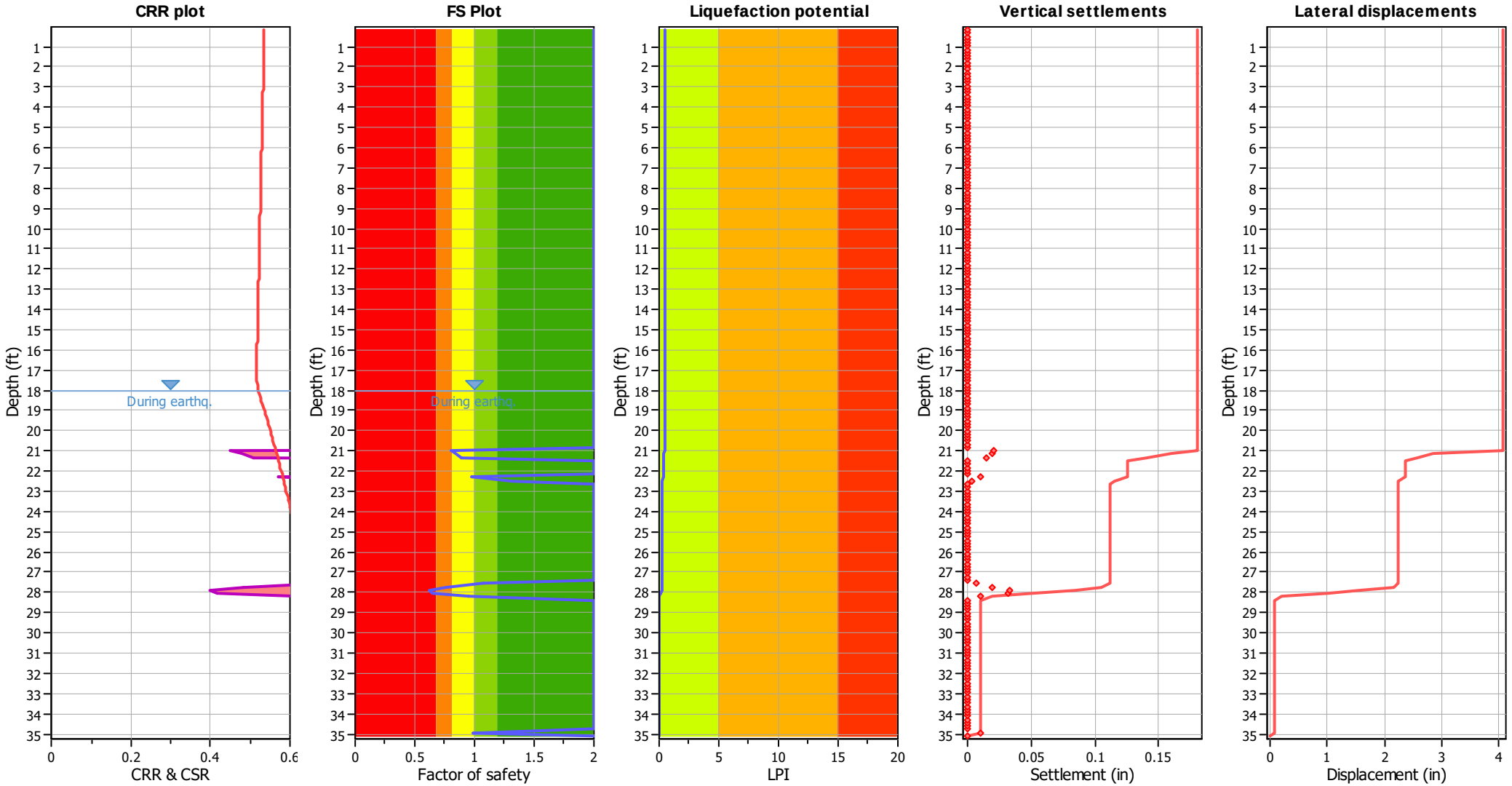
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.4

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

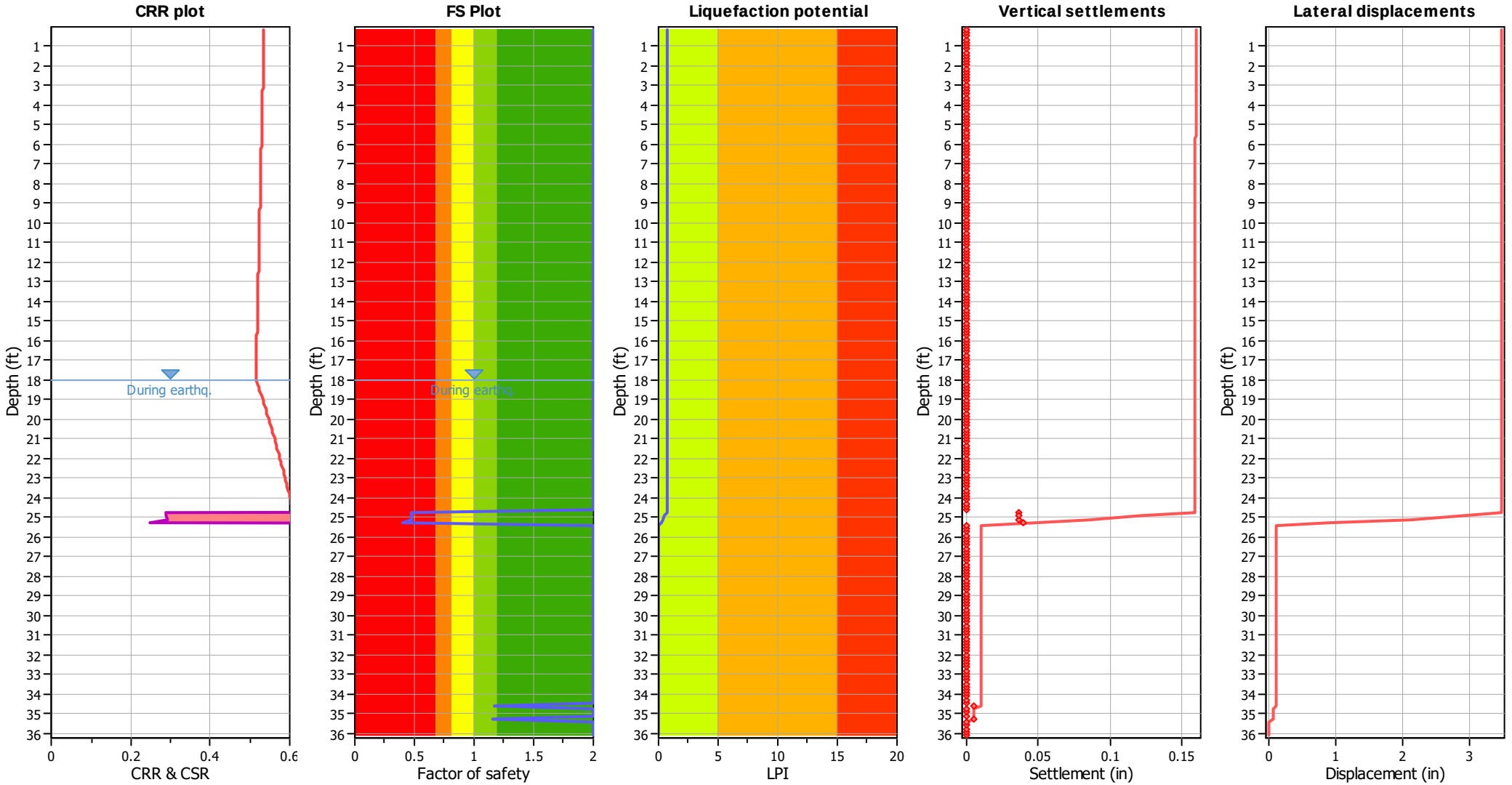
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.5

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

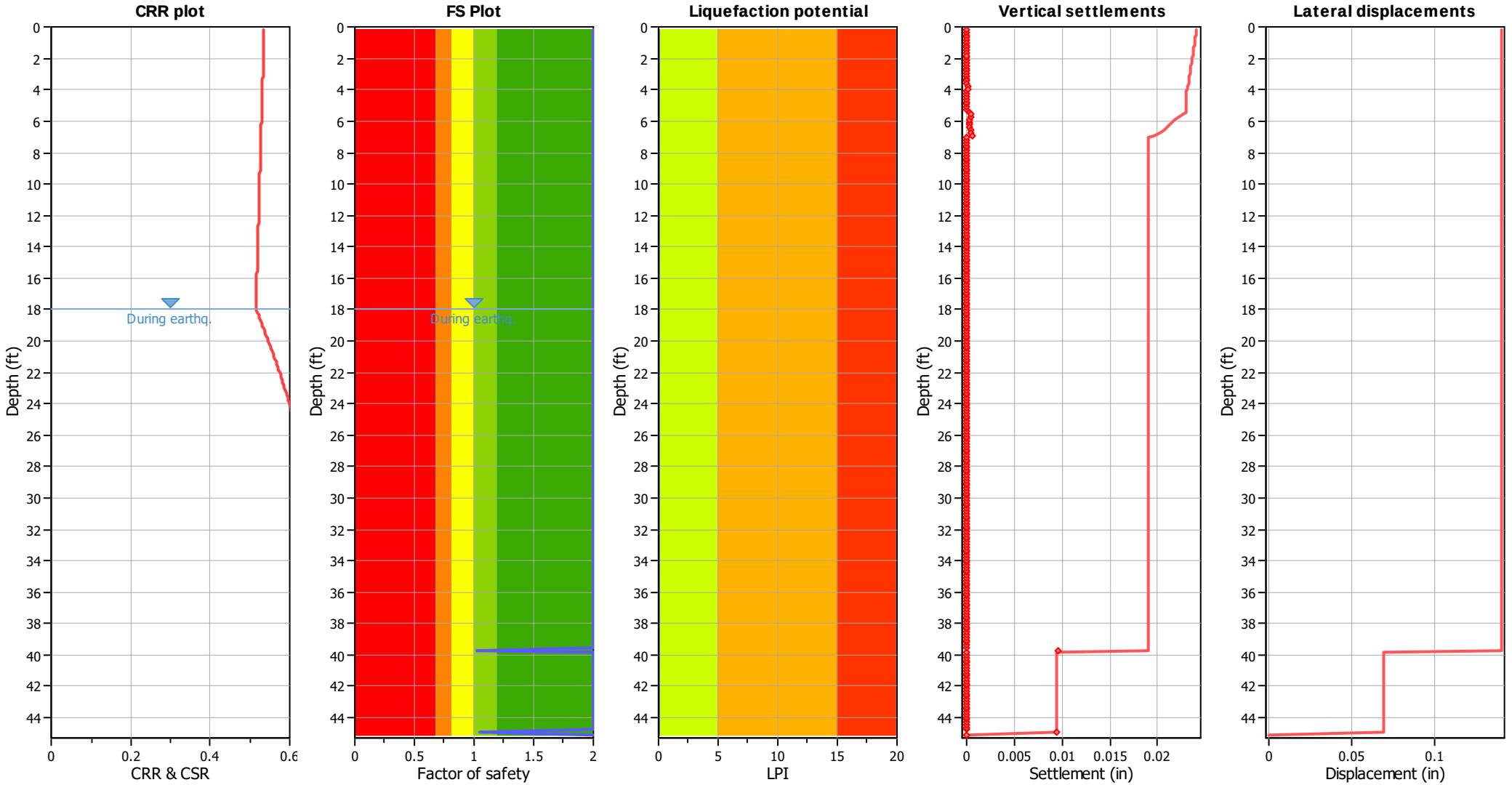
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.6

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

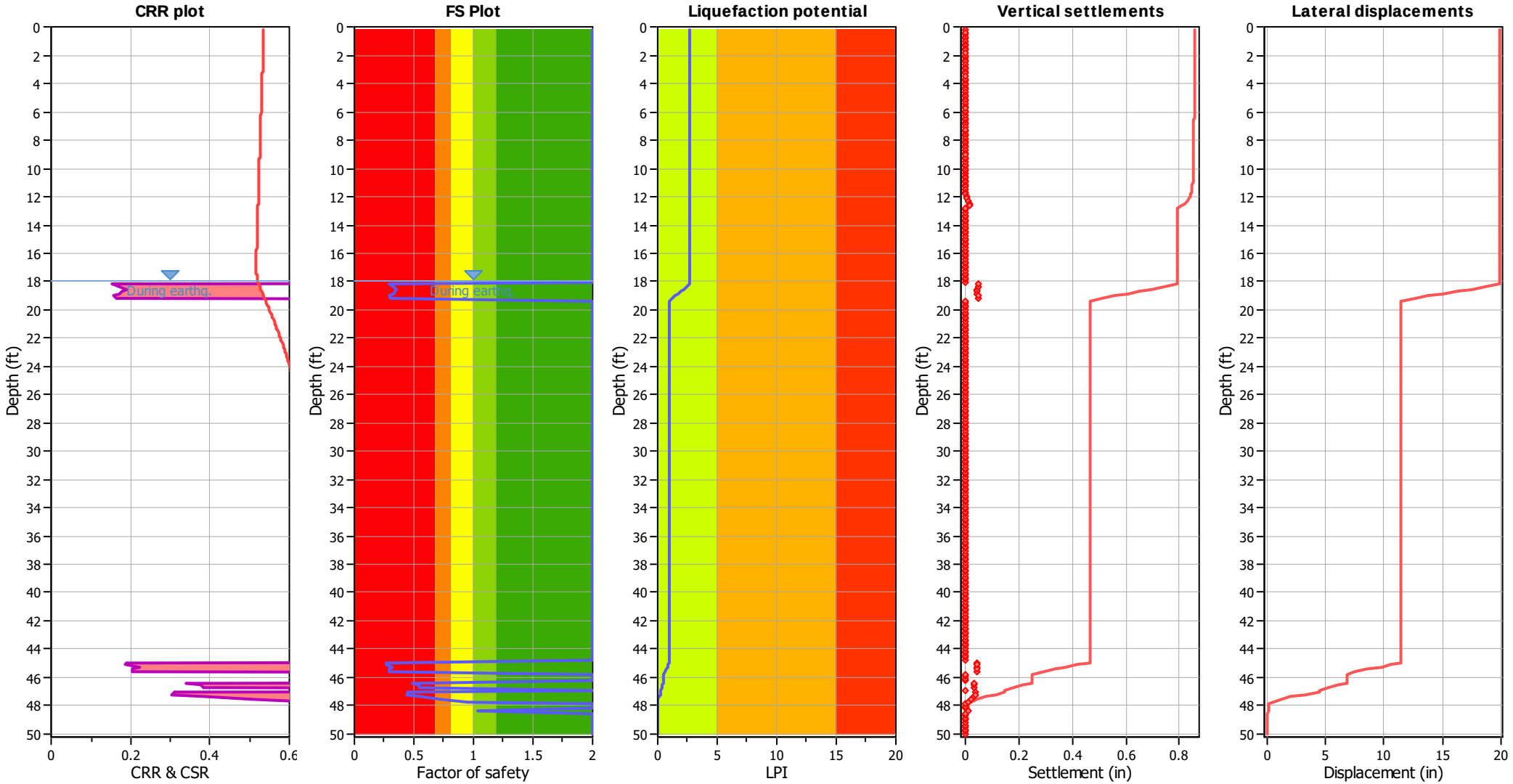
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.7

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.78	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.82	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Figure D.8

EVALUATION OF LIQUEFACTION POTENTIAL AND EARTHQUAKE-INDUCED GROUND SETTLEMENTS USING SPT DATA

<<---------- GENERAL INPUT DATA ---------- << ---------- REFERENCES ---------->

Project Name	Spring Meadow	
Location	Walnut, CA	
GDC Project Number	LA1579	
Exploration No.	B-8	
Ground Surf. Elevation	589.00	ft
GWT Depth During Testing, Z_w	30.00	ft
GWT Depth for Design, Z_{wd}	18.00	ft
Soil Unit Weight, γ_t	120.00	pcf
Earthquake Magnitude, M_{eq}	6.78	
Peak Ground Acceelration, A_{max}	0.82	g
Required FS	1.30	

+ Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 NCEER/NSF Workshops (Edited by: T.L. Youd and I.M. Idriss, 2001)

++ Combination of corrrection factors for hammer energy ratio (C_E), borehole diameter (C_B), rod length (C_R), and sampling method (C_S). Correction Factor = C_E C_B C_R C_S

+++ CSR = 0.65 A_{max} (σ_v/σ_v') r_d

*** FS = ($CRR_{7.5}$/CSR) MSF K_σ K_α where K_α =1.0 and MSF = 1.29**

**** S_r value based on extrapolated median curve and limited to a maximum value of 1,200 psf (Seed & Harder, 1990)**

***** Based on Tokimatsu and Seed (1987) and Pradel (1998).**

Note: This analysis asssumes level ground condition and depth of liquefiable soils does not change.

<<---------- SUMMARY OF RESULTS ---------->>

Total Thickness of Liquefiable Soils =	**0.00**	**feet**	
Earthquake-Induced Settlements:			
- Liquefaction-Induced Settlement =	**0.00**	**inches**	**<--- Saturated Sands**
- Seismic Compaction Settlement =	**0.18**	**inches**	**<--- Dry or Unsaturated Sands**
Total:	**0.18**	**inches**	

INPUT SOIL PROFILE						SOIL LIQUEFACTION POTENTIAL ANALYSIS (1996 NCEER & 1998 NCEER/NSF WORKSHOPS) +													RESIDUAL STRENGTH **			GROUND SETTLEMENT ***			
Soil Depth Z (ft)	Layer Thickness H (ft)	USCS Soil Type	Equivalent SPT Blow Count N (blows/ft)	Fines Content FC (%)	Combined SPT Correction Factor ++ C	Bottom of Layer Elevation (ft)	Total Vert. Stress (Design) σ_v (psf)	Effective Vert. Stress (Design) $\sigma_{v'}$ (psf)	Effective Vert. Stress (Testing) $\sigma_{v'}$ (psf)	SPT Stress Correction Factor+ C_N	Stress Corrected SPT Blow Count $(N_1)_{60}$	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Shear Stress Reduction Coeff.+ r_d	Correction for High Overburden Stress+ K_σ	Cyclic Stress Ratio++ CSR	Cyclic Res. Ratio $CRR_{7.5}$	Factor of Safety Against Liqefaction * FS	Liquefy ?	SPT Blow Count Correction $N_{corr.}$	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Residual Shear Strength S_r (psf)	Cyclic Shear Strain ** γ_c (%)	Vol. Strain ** ε_v (%)	Layer Settlement ** S_i (in.)	Cumulative Settlement
2.50	3	CL	38.0	50	1.33	585.0	300	300	300	1.700	85.9	108.1	0.994	1.000	0.530	N/A	N/A	NO	N/A	N/A	N/A	0.028	0.006	0.000	0.183
5.50	3	CL	52.0	50	1.33	582.0	660	660	660	1.700	117.6	146.1	0.987	1.000	0.526	N/A	N/A	NO	N/A	N/A	N/A	0.035	0.005	0.000	0.183
7.50	3	SM	12.0	30	1.33	580.0	900	900	900	1.491	23.8	32.2	0.983	1.000	0.524	N/A	N/A	NO	N/A	N/A	N/A	0.106	0.096	0.035	0.183
10.50	3	SM	23.0	30	1.33	577.0	1260	1260	1260	1.260	38.5	49.2	0.976	1.000	0.520	N/A	N/A	NO	N/A	N/A	N/A	0.088	0.048	0.017	0.148
15.50	4	SM	10.0	30	1.33	571.5	1860	1860	1860	1.037	13.8	20.6	0.964	1.000	0.514	N/A	N/A	NO	N/A	N/A	N/A	0.177	0.273	0.131	0.131
20.50	3	CL	27.0	50	1.33	567.0	2460	2304	2460	0.902	32.4	43.9	0.952	0.945	0.542	N/A	UNDEF.	NO	N/A	N/A	N/A	N/A	0.000	0.000	0.000

Figure D.9

EVALUATION OF LIQUEFACTION POTENTIAL AND EARTHQUAKE-INDUCED GROUND SETTLEMENTS USING SPT DATA

<<---------- GENERAL INPUT DATA ----------

Project Name	Spring Meadow
Location	Walnut, CA
GDC Project Number	LA1579
Exploration No.	B-14
Ground Surf. Elevation	589.00 ft
GWT Depth During Testing, Z_w	30.00 ft
GWT Depth for Design, Z_{wd}	18.00 ft
Soil Unit Weight, γ_t	120.00 pcf
Earthquake Magnitude, M_{eq}	6.78
Peak Ground Acceelration, A_{max}	0.82 g
Required FS	1.30

<< ---------- REFERENCES ---------->

+ Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 NCEER/NSF Workshops (Edited by: T.L. Youd and I.M. Idriss, 2001)

++ Combination of corrrection factors for hammer energy ratio (C_E), borehole diameter (C_B), rod length (C_R), and sampling method (C_S). Correction Factor = $C_E\ C_B\ C_R\ C_S$

+++ CSR = 0.65 A_{max} (σ_v/σ_v') r_d

* FS = ($CRR_{7.5}$/CSR) MSF K_σ K_α where K_α =1.0 and MSF = 1.29

** S_r value based on extrapolated median curve and limited to a maximum value of 1,200 psf (Seed & Harder, 1990)

*** Based on Tokimatsu and Seed (1987) and Pradel (1998).

Note: This analysis asssumes level ground condition and depth of liquefiable soils does not change.

<<---------- SUMMARY OF RESULTS ---------->>

Total Thickness of Liquefiable Soils = 0.00 feet

Earthquake-Induced Settlements:

- Liquefaction-Induced Settlement =	0.00 inches	<--- Saturated Sands
- Seismic Compaction Settlement =	0.06 inches	<--- Dry or Unsaturated Sands
Total:	0.06 inches	

INPUT SOIL PROFILE						SOIL LIQUEFACTION POTENTIAL ANALYSIS (1996 NCEER & 1998 NCEER/NSF WORKSHOPS) +													RESIDUAL STRENGTH **			GROUND SETTLEMENT ***			
Soil Depth Z (ft)	Layer Thickness H (ft)	USCS Soil Type	Equivalent SPT Blow Count N (blows/ft)	Fines Content FC (%)	Combined SPT Correction Factor ++ C	Bottom of Layer Elevation (ft)	Total Vert. Stress (Design) σ_v (psf)	Effective Vert. Stress (Design) $\sigma_{v'}$ (psf)	Effective Vert. Stress (Testing) $\sigma_{v'}$ (psf)	SPT Stress Correction Factor+ C_N	Stress Corrected SPT Blow Count $(N_1)_{60}$	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Shear Stress Reduction Coeff.+ r_d	Correction for High Overburden Stress+ K_σ	Cyclic Stress Ratio++ CSR	Cyclic Res. Ratio $CRR_{7.5}$	Factor of Safety Against Liqefaction * FS	Liquefy ?	SPT Blow Count Correction $N_{corr.}$	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Residual Shear Strength S_r (psf)	Cyclic Shear Strain ** γ_c (%)	Vol. Strain ** ε_v (%)	Layer Settlement ** S_i (in.)	Cumulative Settlement
2.50	3	CL	16.0	50	1.33	585.0	300	300	300	1.700	36.2	48.4	0.994	1.000	0.530	N/A	N/A	NO	N/A	N/A	N/A	0.049	0.027	0.010	0.061
5.50	2	CH	21.0	50	1.33	582.5	660	660	660	1.700	47.5	62.0	0.987	1.000	0.526	N/A	N/A	NO	N/A	N/A	N/A	0.060	0.025	0.000	0.051
7.50	3	CH	9.0	50	1.33	580.0	900	900	900	1.491	17.8	26.4	0.983	1.000	0.524	N/A	N/A	NO	N/A	N/A	N/A	0.123	0.141	0.051	0.051
10.50	4	CH	23.0	50	1.33	576.5	1260	1260	1260	1.260	38.5	51.2	0.976	1.000	0.520	N/A	N/A	NO	N/A	N/A	N/A	0.085	0.044	0.000	0.000
15.00	5	CL	32.0	50	1.33	571.5	1800	1800	1800	1.054	44.9	58.8	0.965	1.000	0.514	N/A	N/A	NO	N/A	N/A	N/A	0.087	0.038	0.000	0.000
20.00	5	SC	42.0	30	1.33	566.5	2400	2275	2400	0.913	51.0	63.6	0.953	0.950	0.536	N/A	UNDEF.	NO	N/A	N/A	N/A	N/A	0.000	0.000	0.000

Figure D.10

EVALUATION OF LIQUEFACTION POTENTIAL AND EARTHQUAKE-INDUCED GROUND SETTLEMENTS USING SPT DATA

<<---------- GENERAL INPUT DATA ----------

Project Name	Spring Meadow	
Location	Walnut, CA	
GDC Project Number	LA1579	
Exploration No.	B-20	
Ground Surf. Elevation	583.00	ft
GWT Depth During Testing, Z_w	30.00	ft
GWT Depth for Design, Z_{wd}	18.00	ft
Soil Unit Weight, γ_t	120.00	pcf
Earthquake Magnitude, M_{eq}	6.78	
Peak Ground Acceelration, A_{max}	0.82	g
Required FS	1.30	

<< ---------- REFERENCES ---------->

+ Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 NCEER/NSF Workshops (Edited by: T.L. Youd and I.M. Idriss, 2001)

++ Combination of corrrection factors for hammer energy ratio (C_E), borehole diameter (C_B), rod length (C_R), and sampling method (C_S). Correction Factor = C_E C_B C_R C_S

+++ CSR = 0.65 A_{max} (σ_v/σ_v') r_d

*** FS = ($CRR_{7.5}$/CSR) MSF K_σ K_α where K_α =1.0 and MSF = 1.29**

**** S_r value based on extrapolated median curve and limited to a maximum value of 1,200 psf (Seed & Harder, 1990)**

***** Based on Tokimatsu and Seed (1987) and Pradel (1998).**

Note: This analysis asssumes level ground condition and depth of liquefiable soils does not change.

<<---------- SUMMARY OF RESULTS ---------->>

Total Thickness of Liquefiable Soils = 5.00 feet

Earthquake-Induced Settlements:

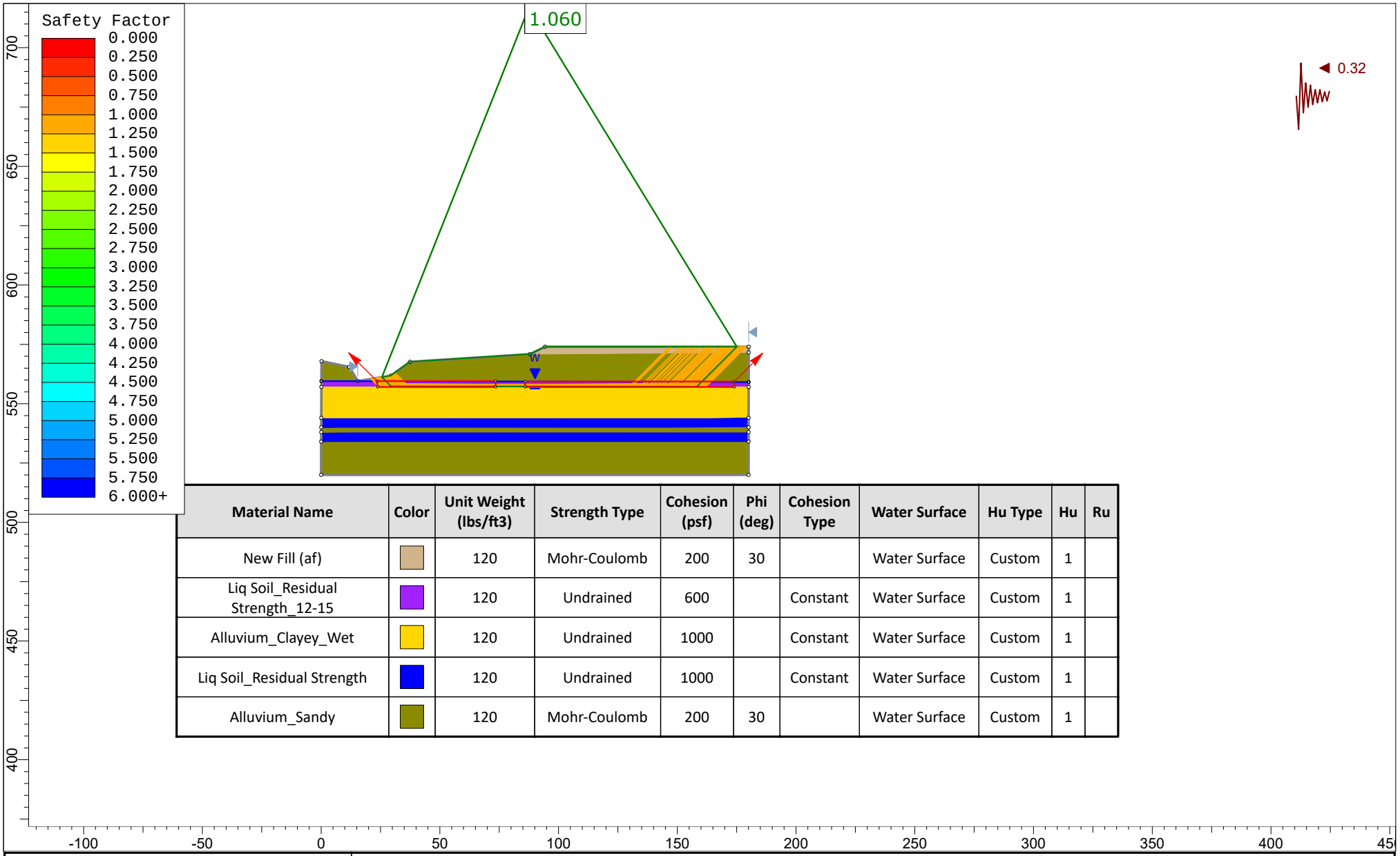
- Liquefaction-Induced Settlement = 1.13 inches <--- Saturated Sands

- Seismic Compaction Settlement = 0.13 inches <--- Dry or Unsaturated Sands

Total: 1.26 inches

INPUT SOIL PROFILE						SOIL LIQUEFACTION POTENTIAL ANALYSIS (1996 NCEER & 1998 NCEER/NSF WORKSHOPS) +													RESIDUAL STRENGTH **			GROUND SETTLEMENT ***			
Soil Depth Z (ft)	Layer Thickness H (ft)	USCS Soil Type	Equivalent SPT Blow Count N (blows/ft)	Fines Content FC (%)	Combined SPT Correction Factor ++ C	Bottom of Layer Elevation (ft)	Total Vert. Stress (Design) σ_v (psf)	Effective Vert. Stress (Design) $\sigma_{v'}$ (psf)	Effective Vert. Stress (Testing) $\sigma_{v'}$ (psf)	SPT Stress Correction Factor+ C_N	Stress Corrected SPT Blow Count $(N_1)_{60}$	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Shear Stress Reduction Coeff.+ r_d	Correction for High Overburden Stress+ K_σ	Cyclic Stress Ratio++ CSR	Cyclic Res. Ratio $CRR_{7.5}$	Factor of Safety Against Liqefaction * FS	Liquefy ?	SPT Blow Count Correction $N_{corr.}$	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Residual Shear Strength S_r (psf)	Cyclic Shear Strain ** γ_c (%)	Vol. Strain ** ε_v (%)	Layer Settlement ** S_1 (in.)	Cumulative Settlement
2.50	5	SM	30.0	15	1.33	578.0	300	300	300	1.700	67.8	73.6	0.994	1.000	0.530	N/A	N/A	NO	N/A	N/A	N/A	0.036	0.012	0.000	1.261
7.50	5	CL	30.0	50	1.33	573.0	900	900	900	1.491	59.5	76.4	0.983	1.000	0.524	N/A	N/A	NO	N/A	N/A	N/A	0.059	0.019	0.000	1.261
12.50	5	SC	15.0	30	1.33	568.0	1500	1500	1500	1.155	23.0	31.3	0.971	1.000	0.517	N/A	N/A	NO	N/A	N/A	N/A	0.125	0.117	0.070	1.261
17.50	5	SC	21.0	30	1.33	563.0	2100	2100	2100	0.976	27.3	36.2	0.959	0.981	0.511	N/A	N/A	NO	N/A	N/A	N/A	0.122	0.096	0.058	1.191
22.50	5	SM	12.0	15	1.33	558.0	2700	2419	2700	0.861	13.7	16.9	0.948	0.948	0.564	0.180	0.391	YES	1.3	15.1	707	N/A	1.778	1.067	1.134
27.50	5	CL	23.4	50	1.33	553.0	3300	2707	3300	0.778	24.2	34.1	0.936	0.894	0.608	N/A	UNDEF.	NO	N/A	N/A	N/A	N/A	0.111	0.067	0.067

Figure D.11



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
New Fill (af)		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Liq Soil_Residual Strength_12-15		120	Undrained	600		Constant	Water Surface	Custom	1	
Alluvium_Clayey_Wet		120	Undrained	1000		Constant	Water Surface	Custom	1	
Liq Soil_Residual Strength		120	Undrained	1000		Constant	Water Surface	Custom	1	
Alluvium_Sandy		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 8.010

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:670	Company
Date	2/14/2023, 11:26:54 AM		File Name Lateral Spread Calculation.slmd

Figure D.12

ESTIMATION OF PERMANENT SEISMIC DISPLACEMENT USING THE BRAY AND RATHJE (1998) PROCEDURE.

INPUT PARAMETERS:

Yield Acceleration, ky (g):	0.32		Normalized MHEA Sigma:	0.298	
Vertical Thickness, h (m):	3		Mean Period Sigma:	0.3	
Shear Wave Vel., Vs (m/s):	250		Significant Duration Sigma:	0.3	
Earthquake Magnitude, M:	6.70	*	Normalized Displacement Sigma:	0.35	
Earthquake Accel., Rock (g):	0.7	*			
Earthquake Distance, r (km):	11	*	Allowable screen displacement (cm):	10	*

CALCULATIONS:

Site Period (s):	0.048
NRF Factor:	0.813
Mean Period (s):	0.561
Duration, D05-95 (s):	12.647
Ts/Tm:	0.0855
MHEA/MHA*NRF:	1.000
MHEA, kmax:	0.5692
ky/kmax:	0.5622
Normalized Disp. (cm/sec):	1.0908

(Input values marked with asterisks are used for calculation of seismic coefficient for screen)

Estimated Displacement (cm):	7.852	**Median f_{eq} for Screen Procedure:**	0.404	*
Estimated Displacement (in):	3.092	**Seismic Coefficient for Screen Procedure:**	0.283	*

GROUP DELTA

Figure D.13

APPENDIX E

SLOPE STABILITY ANALYSES

APPENDIX E
SLOPE STABILITY ANALYSES

E.1 INTRODUCTION

Slope stabilities analyses were performed on selected critical sections on cross section 2-2', 3-3', 5-5', and 6-6'. The locations of these cross sections are shown on Figure 2. The cross section of each section are shown on Figure 3.4, 3.5, 3.6, and 3.7 for Section 2-2', 3-3', 5-5', and 6-6', respectively.

Analyses on Cross Section 2-2' was to evaluate the global stability of the cut slope at north of the property line. Analyses on Cross Section 3-3' was to evaluate the global stabilities of the existing south facing slope along Lemon Creek that might be impacted from the proposed new fills being planned near Lot 2 to Lot 5. Analyses on Cross Section 5-5' was to evaluate the global stabilities of the proposed cut slope east of the Street B. Analyses on Cross Section 6-6' was to evaluate the global stabilities of the existing west facing slope along Lemon Creek that might be impacted from the proposed new fills being planned near Lot 15 to Lot 20. Details of analyses procedures and results are discussed in the following sections.

E.2 SHEAR STRENGTH

Shear strengths of the materials onsite were selected based on the results of both field and laboratory tests. Conservative values were selected for a typical engineered fill. The undrained shear strength of clayey materials were estimated from pocket penetrometer tests and parameters interpolated from cone penetrometer tests. In addition, laboratory tests were performed to evaluate the shear strength values of the bedrock conditions. Cross bedding shear strengths were used for the bedrock based on limited test pit observation.

The results of this shear strength evaluation were utilized in our analysis and is presented in Table E.1.

Table E.1: Recommended Shear Strength Parameters for Stability Analyses

Materials	Unit Weight (pcf)	Friction Angle (deg)	Cohesion/UCS* (psf)
Fill	120	30	200
Alluvium (Clay)	120	-	1,000
Alluvium (Silty Sand)	120	24	200
Organic Soils	110	-	500
Canyon Wash Debris	110	-	200
Claystone Bedrock	120	30	800
Sandstone Bedrock	120	31	500
Ground Improvement Element	120	-	15,000**

*: UCS: Unconfined compressive strength of clayey soils.
**: Assume deep soil mixing columns have UCS of at least 100 psi

E.3 GLOBAL STABILITY ANALYSES

The global stability analyses were performed using Bishop simplified method. For seismic slope stability analyses, we have used horizontal seismic coefficient of 0.15g in accordance with the "Manual for Preparation of Geotechnical Reports (LACDPW, 2013)

E.3.1 Analyses for Cross Section 2-2'

Cross Section 2-2' was to evaluate the global stability of the proposed cut slope along north property line. The maximum height of the cut slope is about 30 feet and the cut slope will be no steeper than 2:1.

The underlying materials of the cut slope consists predominantly of existing fill soils underlain by alluvium and claystone bedrock. Bedrock is not anticipated to be exposed during excavation and therefore adverse bedding condition is not anticipated. Laboratory test was not performed to evaluate the existing fill soils. We have assumed a shear strength value based on the conditions observed in test pits excavated near the slope. The shear strength of the fill soils should be verified during design level geotechnical investigation.

The static and seismic stability analyses indicates that the factor of safety of the proposed cut slope against global instability are great than 1.5 and 1.1 for static case and seismic case, respectively (Figure E.1 and E. 2). Therefore, the potential of impacting the neighboring properties due to the proposed cut slopes are considered low.

The results of slope stability analyses are summarized in Table E.2.

Table E.2. Slope Stability Analyses Summary – Cross Section 2-2'

Cross Section	Case	Description	Factor of Safety	
			Static	Seismic
2-2'	2-1	Cut Slope along North Property Line	1.83	1.34

E.3.2 Analyses for Cross Section 3-3'

Analyses on Cross Section 3-3' was to evaluate the global stabilities of the existing south facing slope along Lemon Creek that might be impacted from the proposed new fills being planned near Lot 2 to Lot 5. Up to 13 feet of fill is planned in this area for the proposed building pads.

We first checked the static stability of the existing slope and both the static and seismic stability. The analysis assumed the existing canyon wall debris would continue to erode and be unstable. The analyses indicates that the factor of safety of the existing slope against global instability are great than 1.5 and 1.1 for static case and seismic case, respectively. The results of the analyses are shown on Figure E.3 and E.4 for static and seismic cases, respectively.

Then, we started to increase the thickness of the proposed fill on top of the existing slope. The results indicated that the slope having up to 1 foot of new fill will have the factor of safety against global instability greater than 1.5 and 1.1 for static case and seismic case, respectively (Figure E.5 and E.6). However, when the thickness of fill increases greater than 1 foot, the factor of safety against the global instability for seismic case becomes less than 1.1, which is lower than the County requirements. Therefore, we conclude that the existing south facing slope may support new fills up to 1 foot without special reinforcement.

For cases where new fills greater than 1 foot is being placed on top of the existing south facing slope, we recommend that ground improvement may be constructed near the toe of new fill slope to increase lateral resistance of the existing slope. Deep cement soil mixing (DCSM) may be an applicable improvement option.

We have assumed at least one row of DCSM columns extending into the top of bedrock may be installed. The typical shear strength of DCSM columns is on an order of 150 psi or greater. We have conservatively used an unconfined compressive strength of 100 psi (or 15,000 psf) for the DCSM columns. The stability analyses indicates that the south facing slope with recommended ground improvement may support new fills up to 15 feet and the factor of safety against global instability great than 1.5 and 1.1 for static case and seismic case, respectively. (Figure E.9 and E.10)

The results of slope stability analyses are summarized in Table E.3.

Table E.3. Slope Stability Analyses Summary – Cross Section 3-3'

Cross Section	Case	Description	Factor of Safety	
			Static	Seismic
3-3'	3-1	Existing Condition	1.60	1.13
	3-2	Thickness of New Fill = 1 feet	1.56	1.13
	3-3	Thickness of New Fill = 15 feet	0.94	0.65
	3-4	Thickness of New Fill = 15 feet with Deep Soil Mixing	1.85	1.13

E.3.3 Analyses for Cross Section 5-5'

Cross Section 5-5' was to evaluate the global stability of the cut slope east of the Street B. The maximum height of the cut slope is about 25 feet and the cut slope will be no steeper than 2:1.

The underlying materials of the cut slope consists predominantly of massive sandstone bedrock based on limited test pit observations. The static and seismic stability analyses indicates that the factor of safety of the existing slope against global instability are great than 1.5 and 1.1 for static case and seismic case, respectively (Figure E.11 and E. 12). Therefore, the potential of impacting the neighboring properties due to the proposed cut slopes are considered low.

The results of slope stability analyses are summarized in Table E.4.

Table E.4. Slope Stability Analyses Summary – Cross Section 5-5'

Cross Section	Case	Description	Factor of Safety	
			Static	Seismic
5-5'	5-1	Cut Slope East of Street B and Lot 16	3.33	2.33

E.3.4 Analyses for Cross Section 6-6'

Analyses on Cross Section 6-6' was to evaluate the global stabilities of the existing west facing slope along Lemon Creek that might be impacted from the proposed new fills being planned near Lot 15 to Lot 20. Up to 10 feet of fill is planned to be placed in this area for the proposed building pads.

We first checked the static stability of the existing slope and both the static and seismic stability analyses indicates that the factor of safety of the existing slope against global instability are greater than 1.5 and 1.1 for static case and seismic case, respectively (Figure E.13 and E.14). The static and seismic stability analyses indicates that the factor of safety of the proposed fill slope against global instability are greater than 1.5 and 1.1 for static case and seismic case, respectively (Figure E.15 and E.16).

The results of slope stability analyses are summarized in Table E.5.

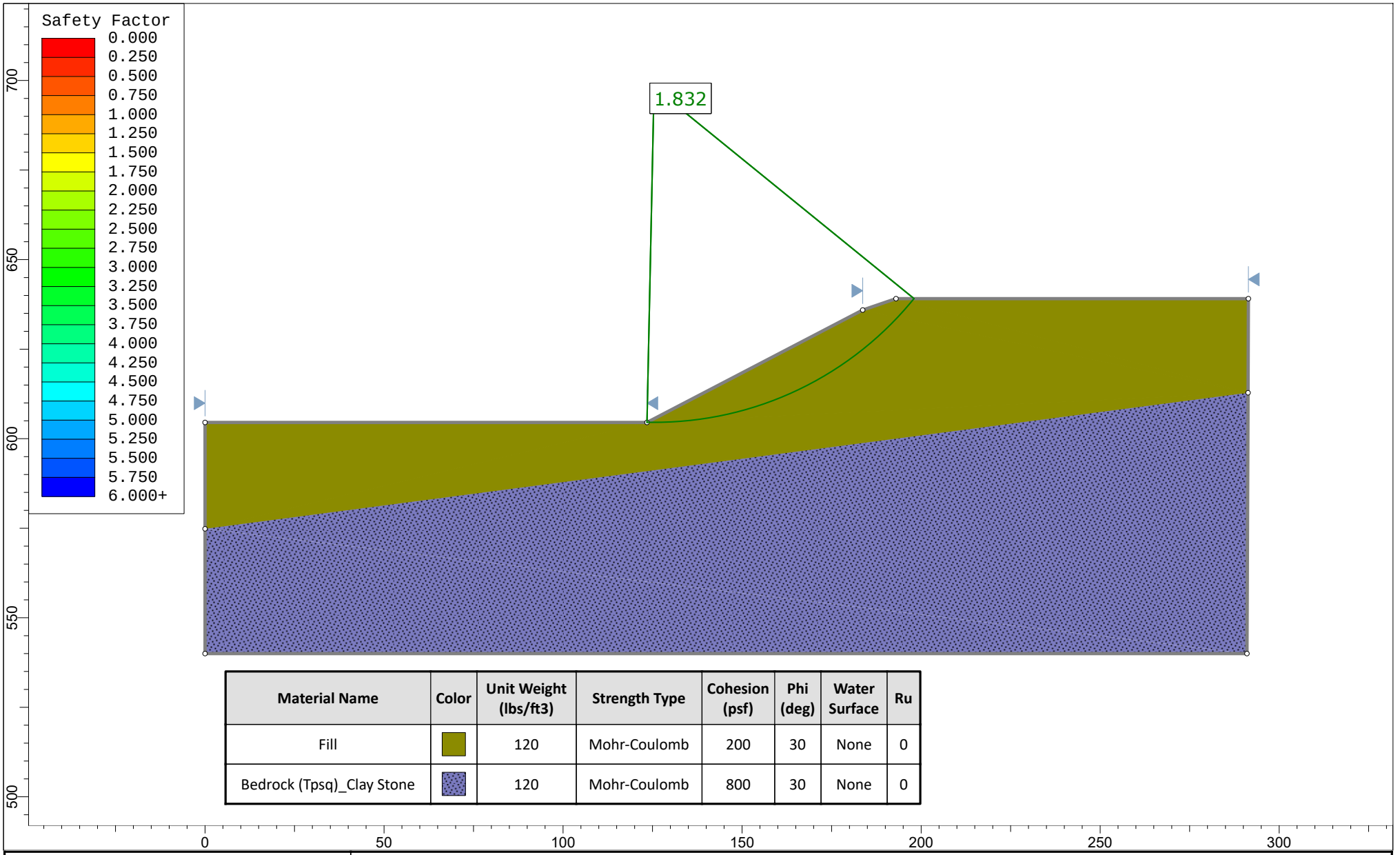
Table E.5. Slope Stability Analyses Summary – Cross Section 6-6'

Cross Section	Case	Description	Factor of Safety	
			Static	Seismic
6-6'	6-1	Existing Condition	1.70	1.29
	6-2	Proposed fill slope	1.76	1.34

E.5 Conclusion

Based on the results of the stability analyses discussed in this Appendix, it is our opinion that global stability is not an issue if the recommended mitigation measure can be followed. The proposed structures may be setback from adjacent slopes in accordance with Section 1808.7 of 2022 California Building Code. No other special structural setback is required.

An assumed shear strength was used in the analyses for the cut slope along north property line (Cross Section 2-2'). The shear strength should be verified during design-level geotechnical investigation and the slope stability analyses at this location should be updated. If the results of the updated slope stability analyses are below the County's requirement, the cut slope may need to be mitigated. Mitigation options would include, but not limit to, soil nails, retaining walls, or ground improvements to strengthen the shear strength of the existing fill soils. Details design recommendation can be provided in design-level geotechnical report.



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Fill		120	Mohr-Coulomb	200	30	None	0
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30	None	0

SLIDEINTERPRET 8.010

Project: Cross Section 2-2': Case 2-1: Cut Slope north Property Line, Static

Analysis Description:

Drawn By:

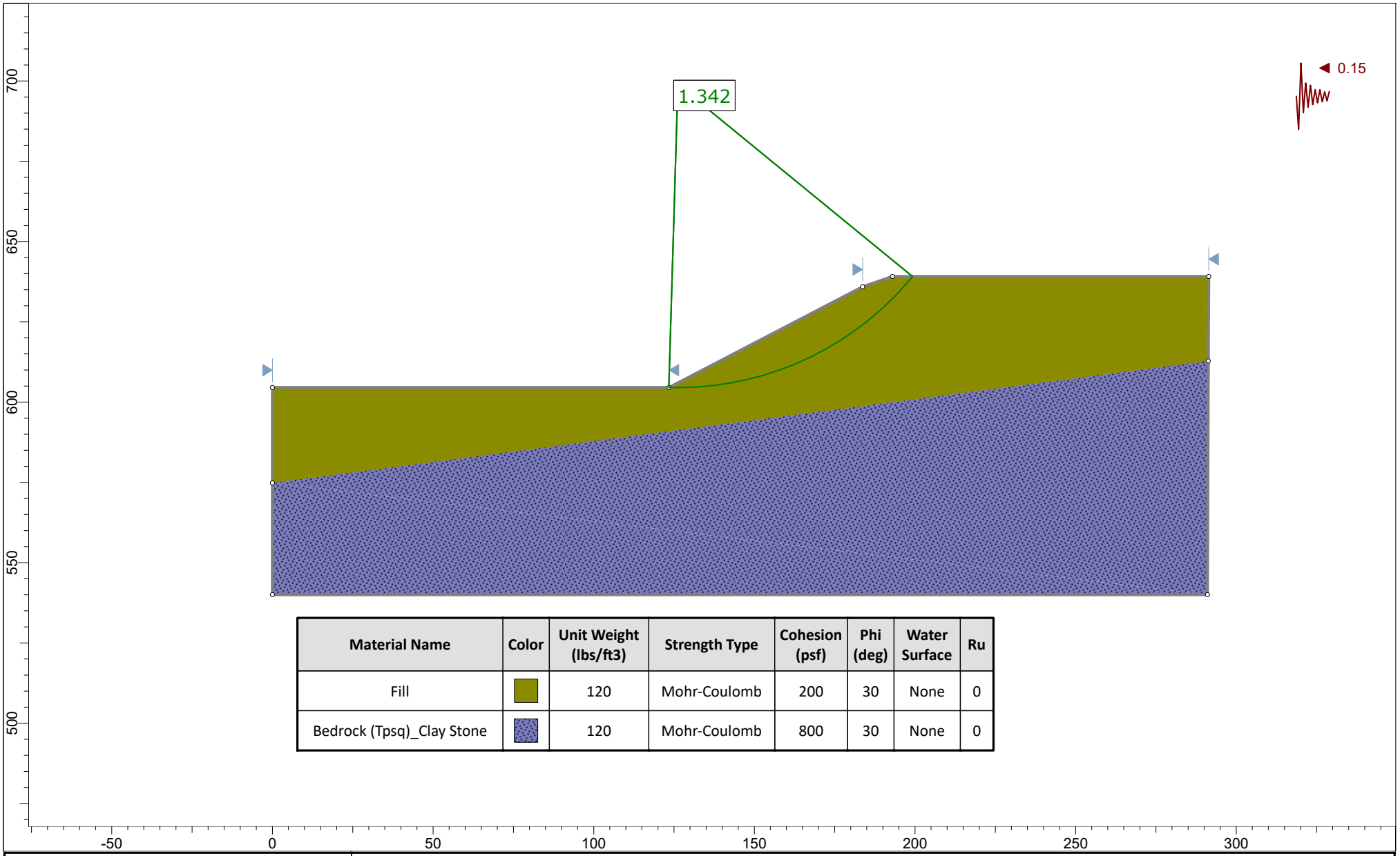
Scale: 1:444

Company:

Date:

File Name: Cross Section 2-2'.slmd

Figure E.1



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Fill		120	Mohr-Coulomb	200	30	None	0
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30	None	0

SLIDEINTERPRET 8.010

Project: Cross Section 2-2': Case 2-1: Cut Slope north Property Line, Seismic

Analysis Description:

Drawn By:

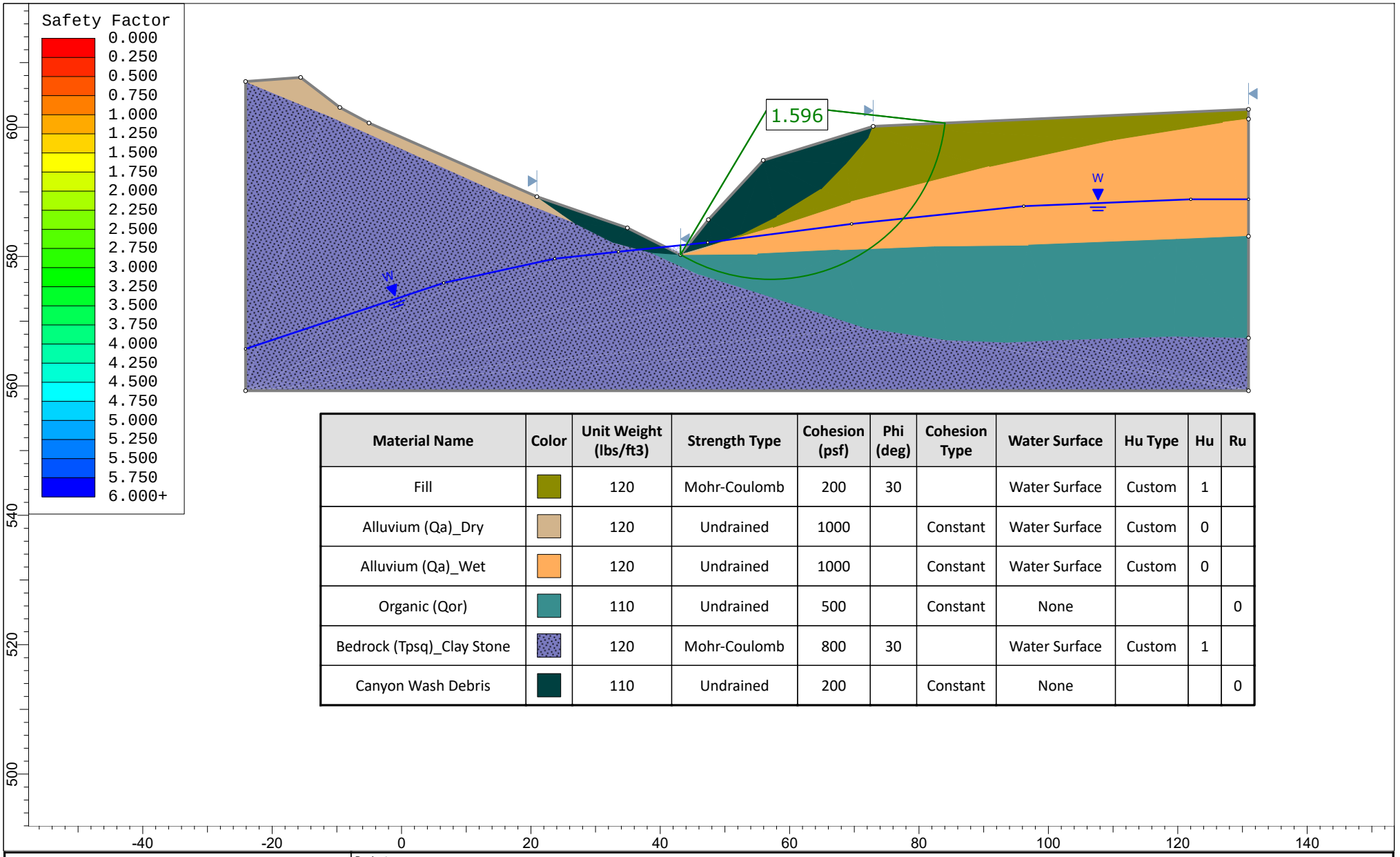
Scale: 1:495

Company:

Date:

File Name: Cross Section 2-2'.slmd

Figure E.2



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	None			0
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		Water Surface	Custom	1	
Canyon Wash Debris		110	Undrained	200		Constant	None			0

rocscience

SLIDEINTERPRET 8.010

Project: Cross Section 3-3': Case 3-1: Existing Condition, Static

Analysis Description:

Drawn By:

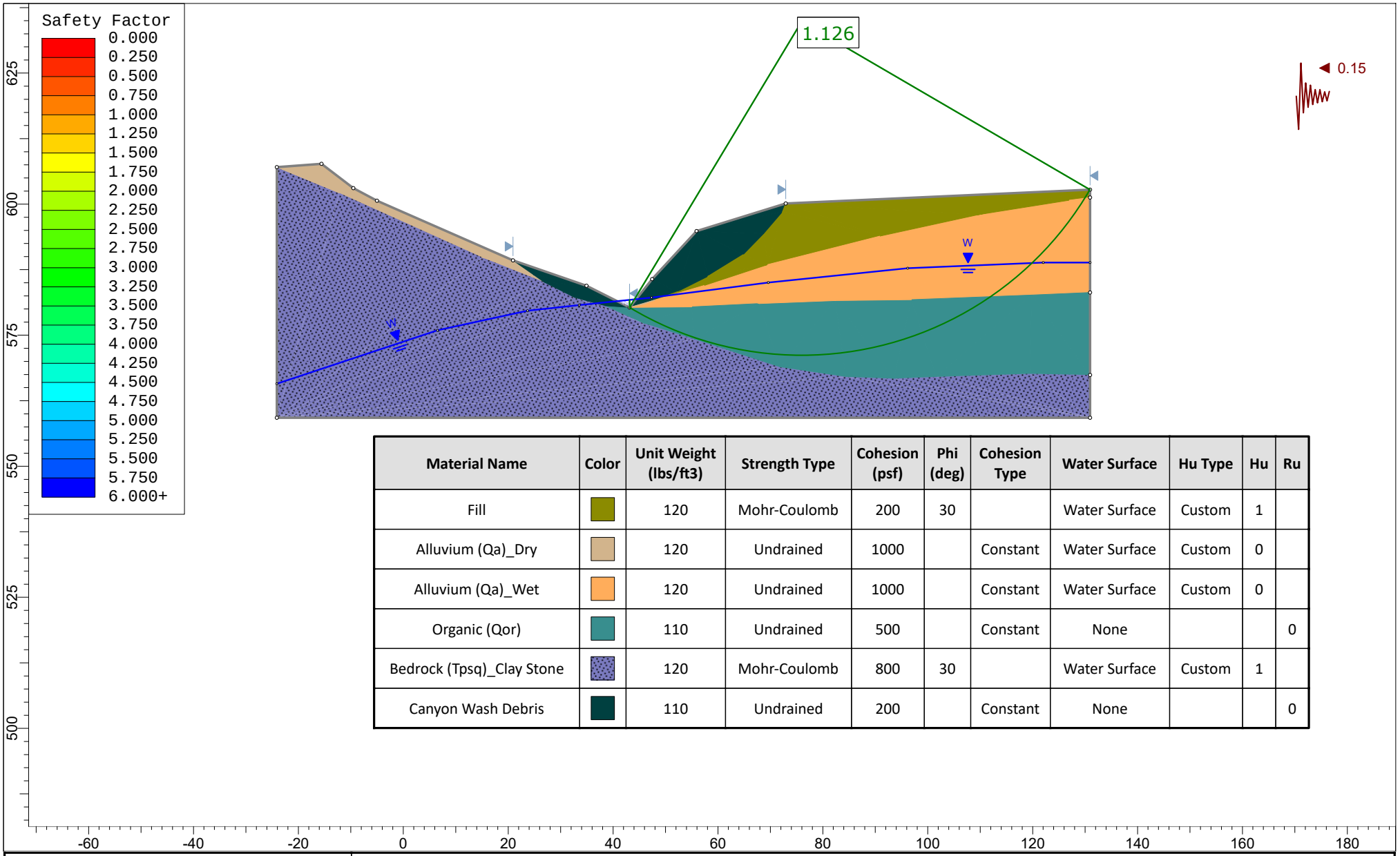
Scale: 1:246

Company:

Date:

File Name: Cross Section 3-3'.slmd

Figure E.3



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	None			0
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		Water Surface	Custom	1	
Canyon Wash Debris		110	Undrained	200		Constant	None			0

rocscience

SLIDEINTERPRET 8.010

Project: Cross Section 3-3': Case 3-1: Existing Condition, Seismic

Analysis Description:

Drawn By:

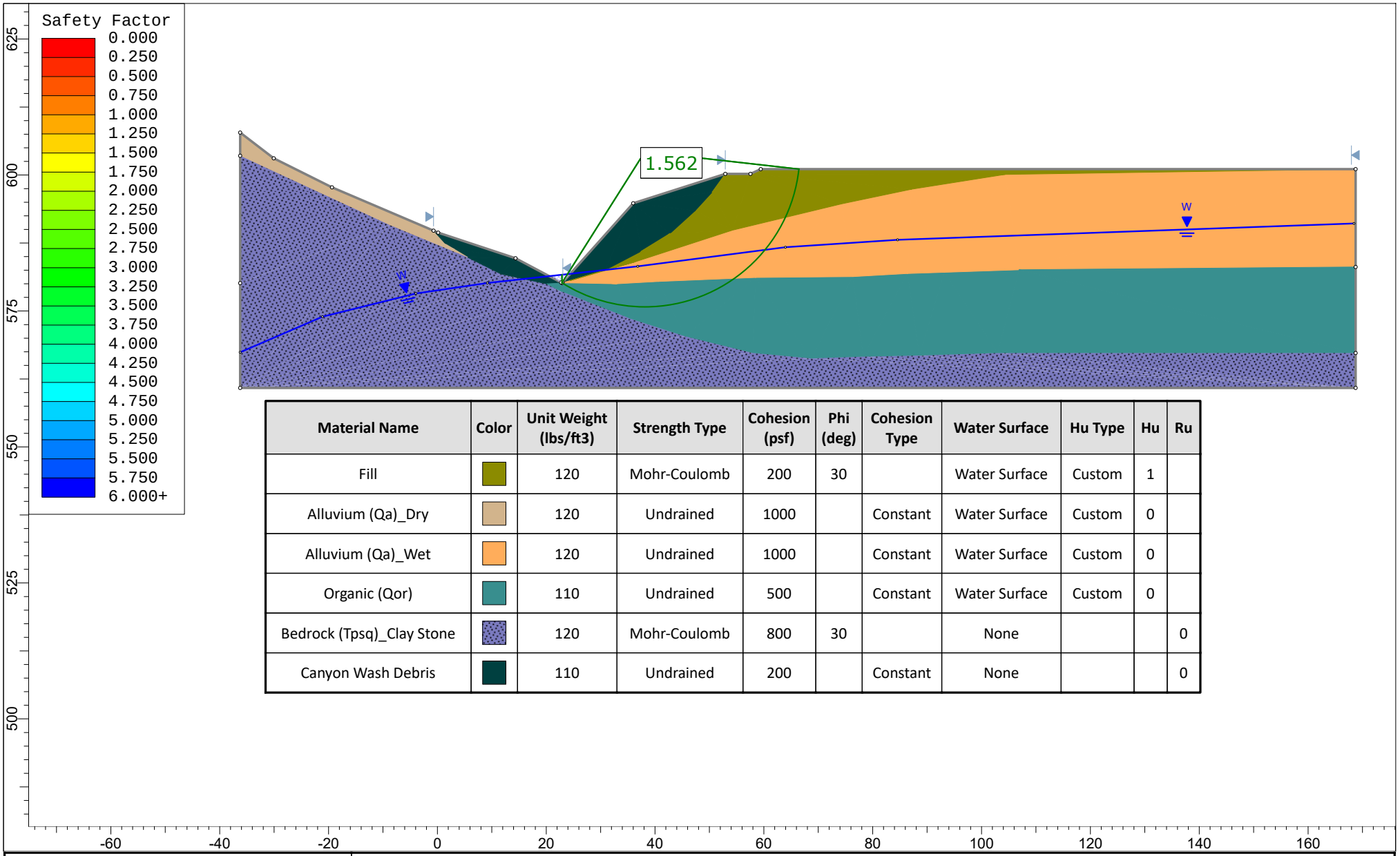
Scale: 1:303

Company:

Date:

File Name: Cross Section 3-3'.slmd

Figure E.4



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	Water Surface	Custom	0	
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		None			0
Canyon Wash Debris		110	Undrained	200		Constant	None			0

SLIDEINTERPRET 8.010

Project

Cross Section 3-3': Case 3-2: 1-foot thick new fill, Static

Analysis Description

Drawn By

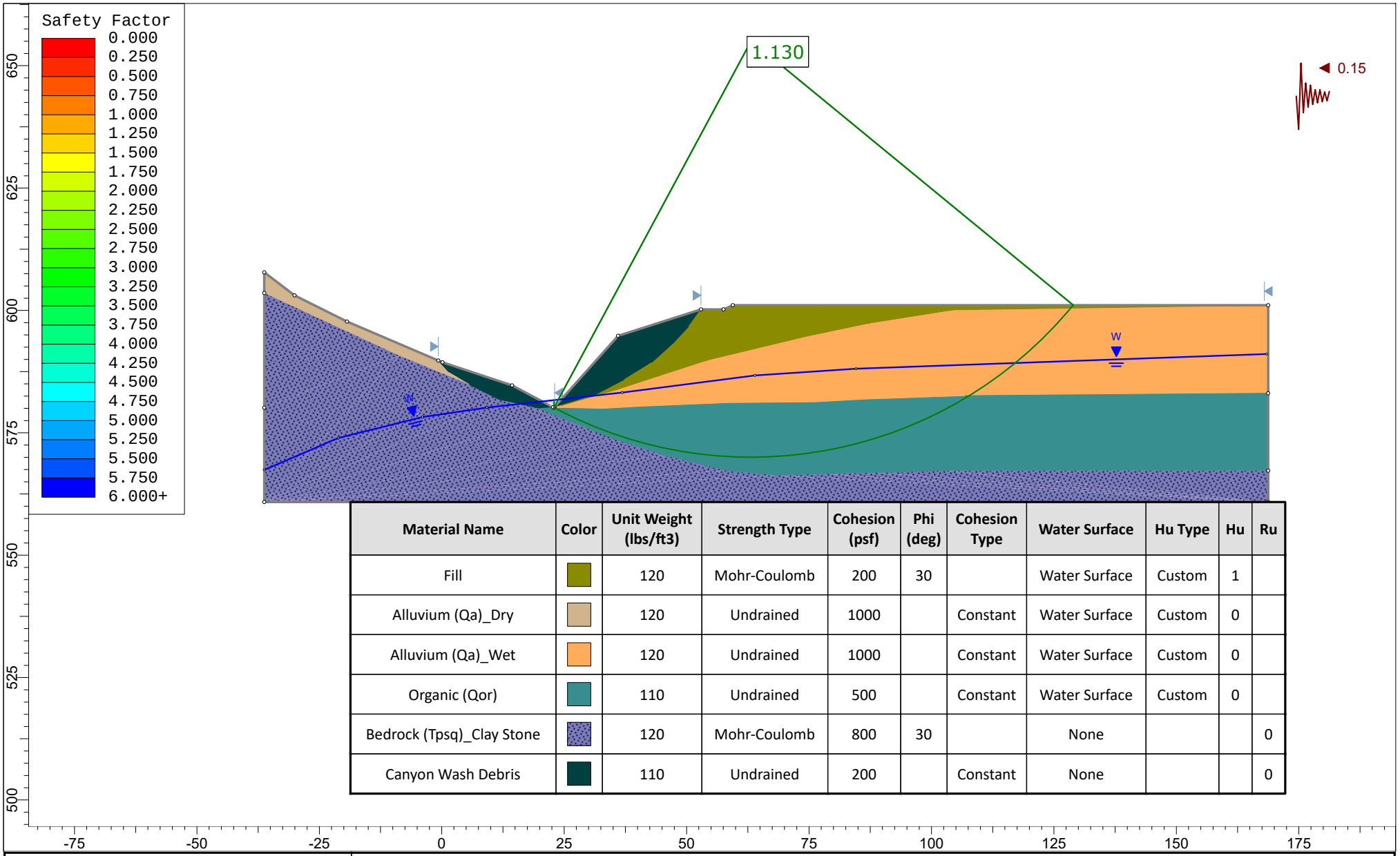
Scale 1:292

Company

Date

File Name Cross Section 3-3'.slmd

Figure E.5



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	Water Surface	Custom	0	
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		None			0
Canyon Wash Debris		110	Undrained	200		Constant	None			0

rocscience

SLIDEINTERPRET 8.010

Project: Cross Section 3-3': Case 3-2: 1-foot thick new fill, Seismic

Analysis Description:

Drawn By:

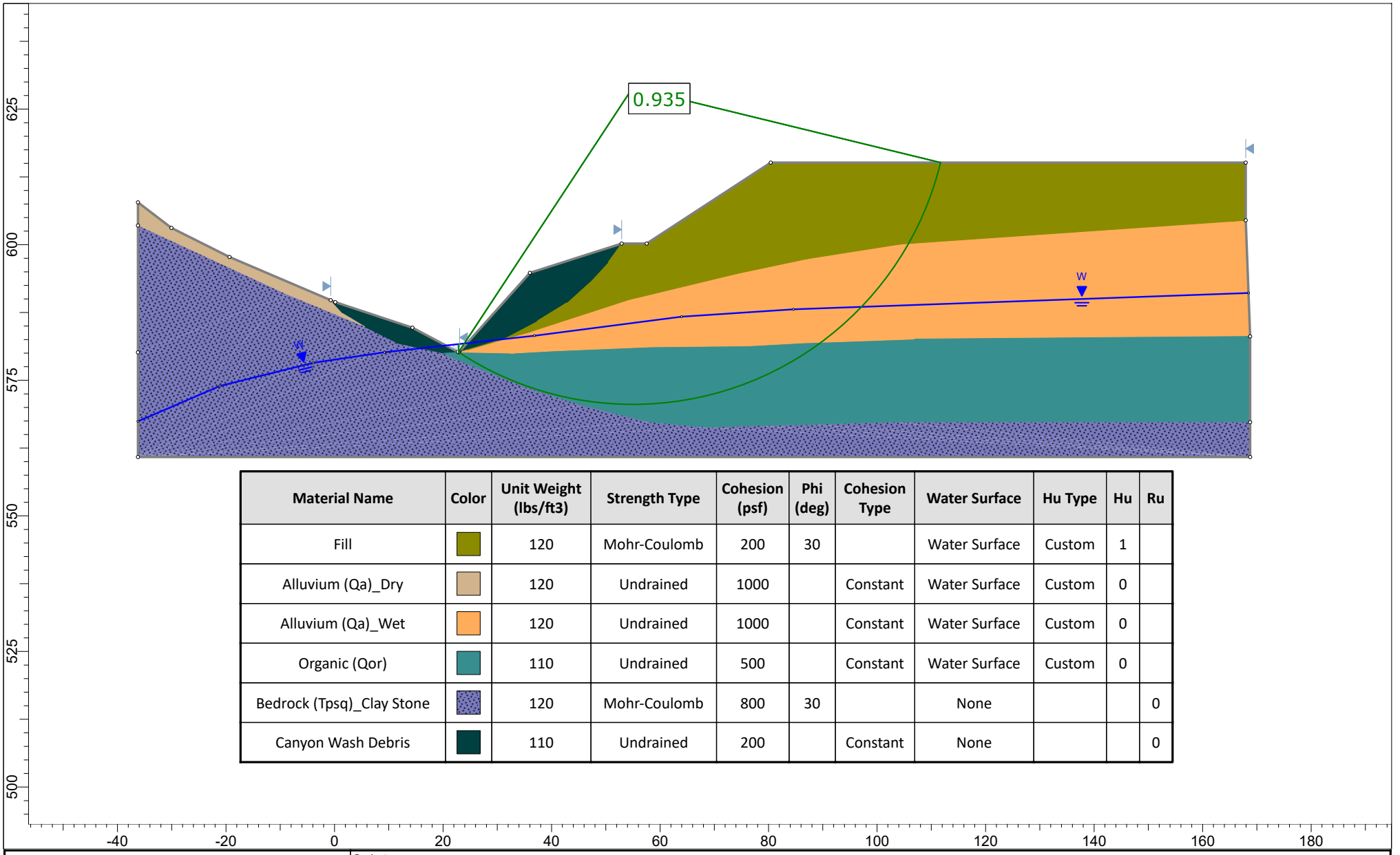
Scale: 1:325

Company:

Date:

File Name: Cross Section 3-3'.slmd

Figure E.6



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	Water Surface	Custom	0	
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		None			0
Canyon Wash Debris		110	Undrained	200		Constant	None			0

rocscience

SLIDEINTERPRET 8.010

Project: Cross Section 3-3': Case 3-3: 15-foot thick new fill, Static

Analysis Description:

Drawn By:

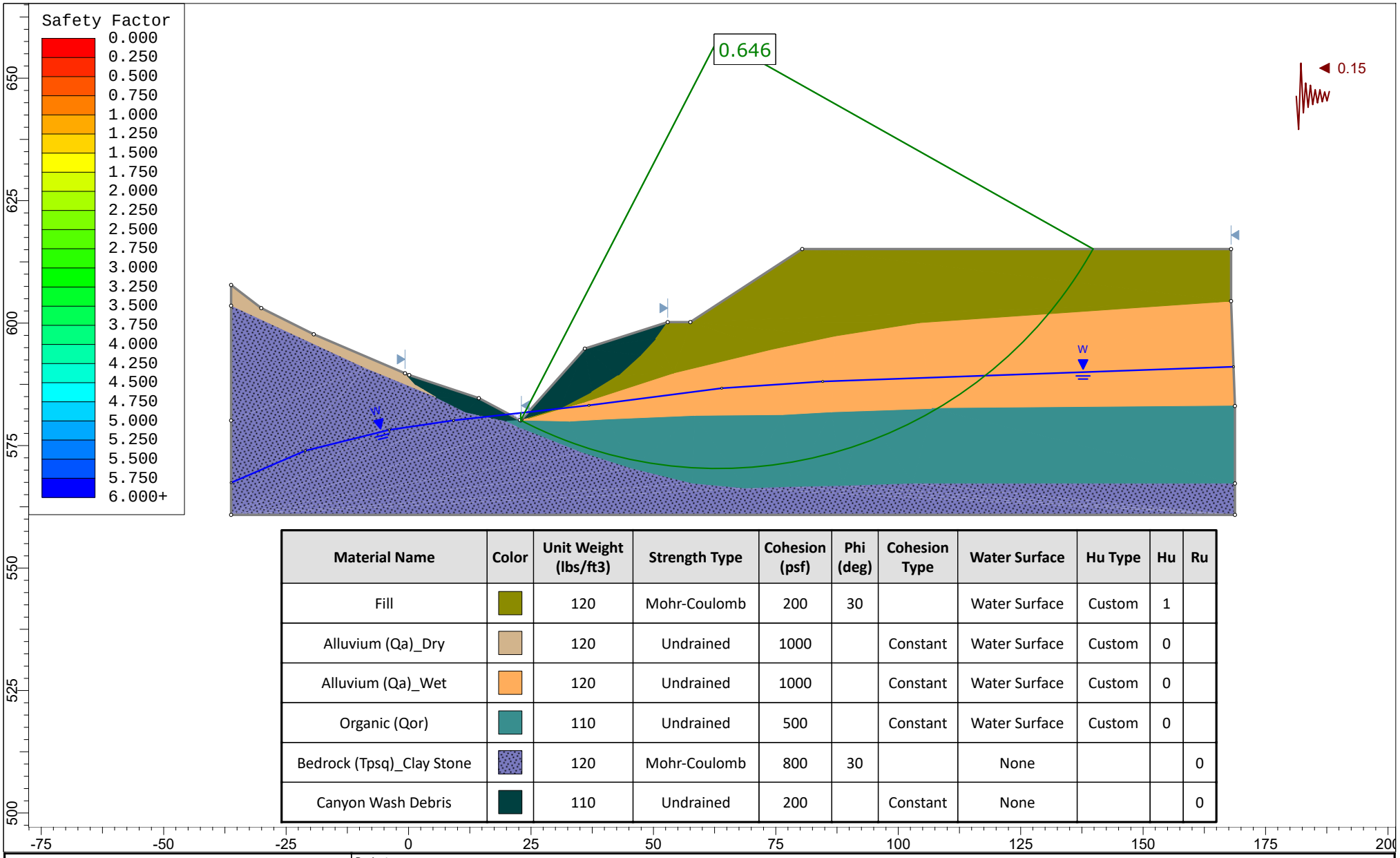
Scale: 1:292

Company:

Date:

File Name: Cross Section 3-3'.slmd

Figure E.7



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	Water Surface	Custom	0	
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		None			0
Canyon Wash Debris		110	Undrained	200		Constant	None			0

SLIDEINTERPRET 8.010

Project: Cross Section 3-3': Case 3-3: 15-foot thick new fill, Seismic

Analysis Description:

Drawn By:

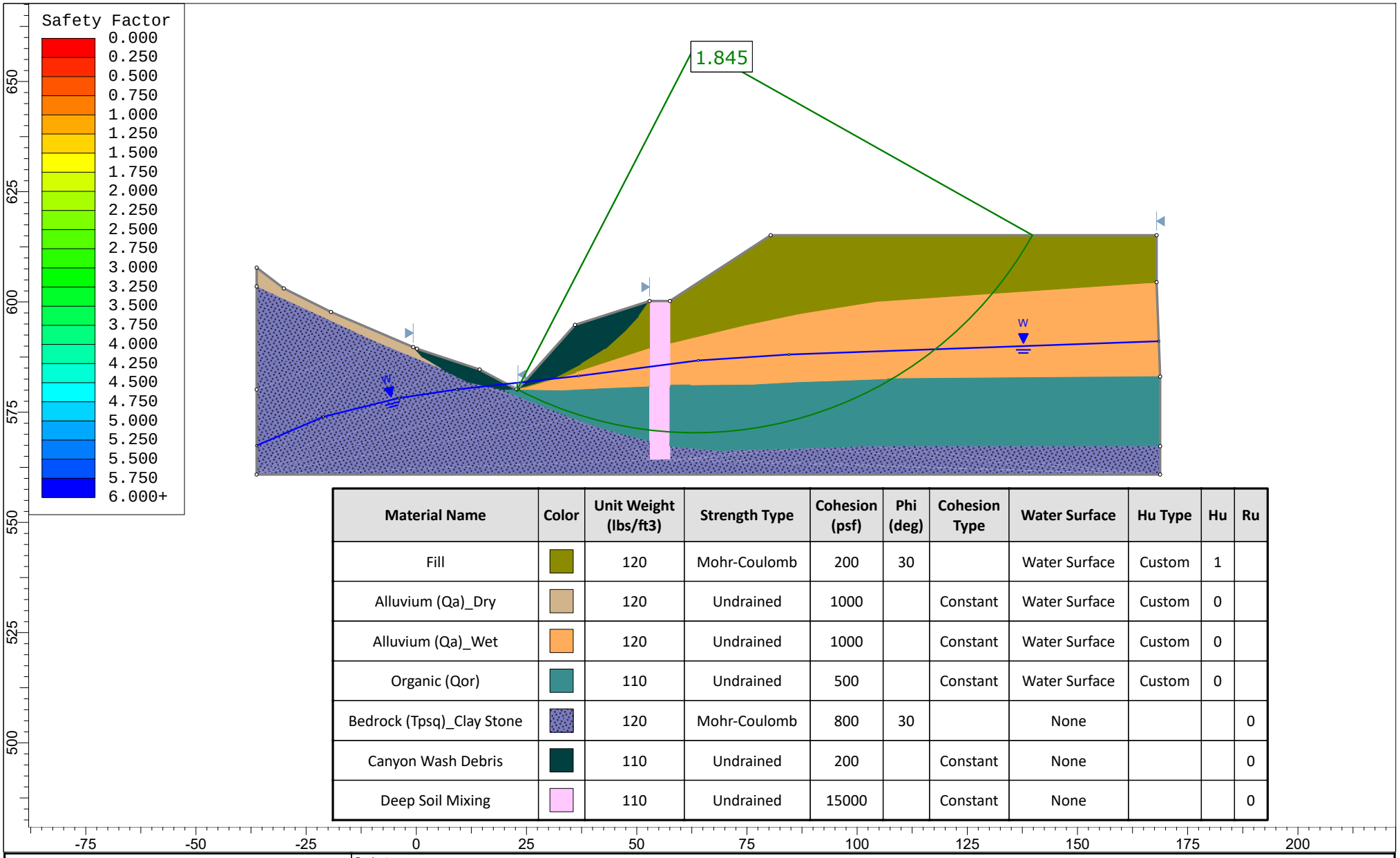
Scale: 1:325

Company:

Date:

File Name: Cross Section 3-3'.slmd

Figure E.8



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	Water Surface	Custom	0	
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		None			0
Canyon Wash Debris		110	Undrained	200		Constant	None			0
Deep Soil Mixing		110	Undrained	15000		Constant	None			0

rocscience

SLIDEINTERPRET 8.010

Project: Cross Section 3-3': Case 3-4: 15-foot thick new fill with Soil Mixing, Static

Analysis Description:

Drawn By:

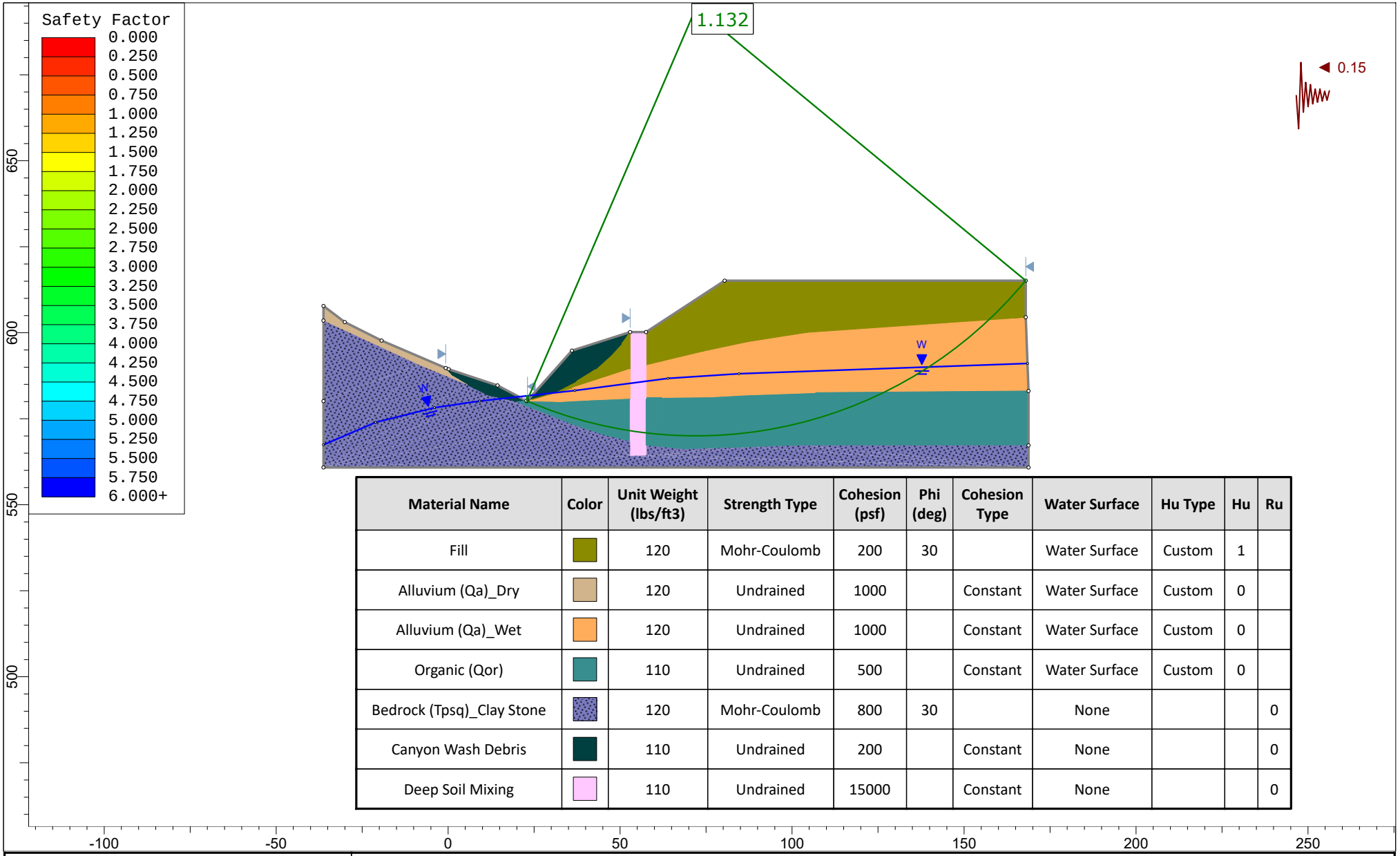
Scale: 1:361

Company:

Date:

File Name: Cross Section 3-3'.slmd

Figure E.9



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30		Water Surface	Custom	1	
Alluvium (Qa)_Dry		120	Undrained	1000		Constant	Water Surface	Custom	0	
Alluvium (Qa)_Wet		120	Undrained	1000		Constant	Water Surface	Custom	0	
Organic (Qor)		110	Undrained	500		Constant	Water Surface	Custom	0	
Bedrock (Tpsq)_Clay Stone		120	Mohr-Coulomb	800	30		None			0
Canyon Wash Debris		110	Undrained	200		Constant	None			0
Deep Soil Mixing		110	Undrained	15000		Constant	None			0

SLIDEINTERPRET 8.010

Project: Cross Section 3-3': Case 3-4: 15-foot thick new fill with Soil Mixing, Seismic

Analysis Description:

Drawn By:

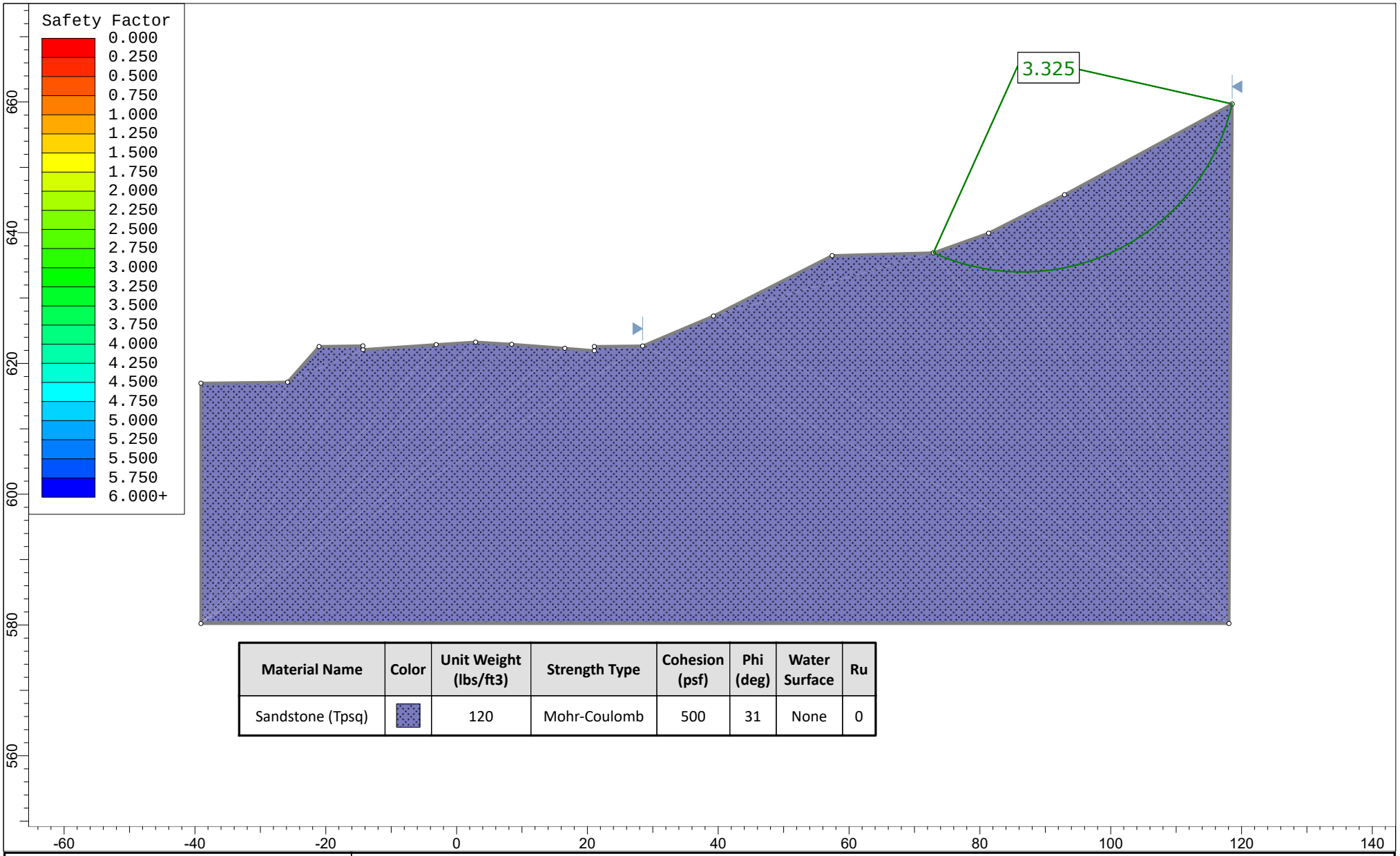
Scale: 1:463

Company:

Date:

File Name: Cross Section 3-3'.slmd

Figure E.10



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Sandstone (Tpsq)		120	Mohr-Coulomb	500	31	None	0

rocscience

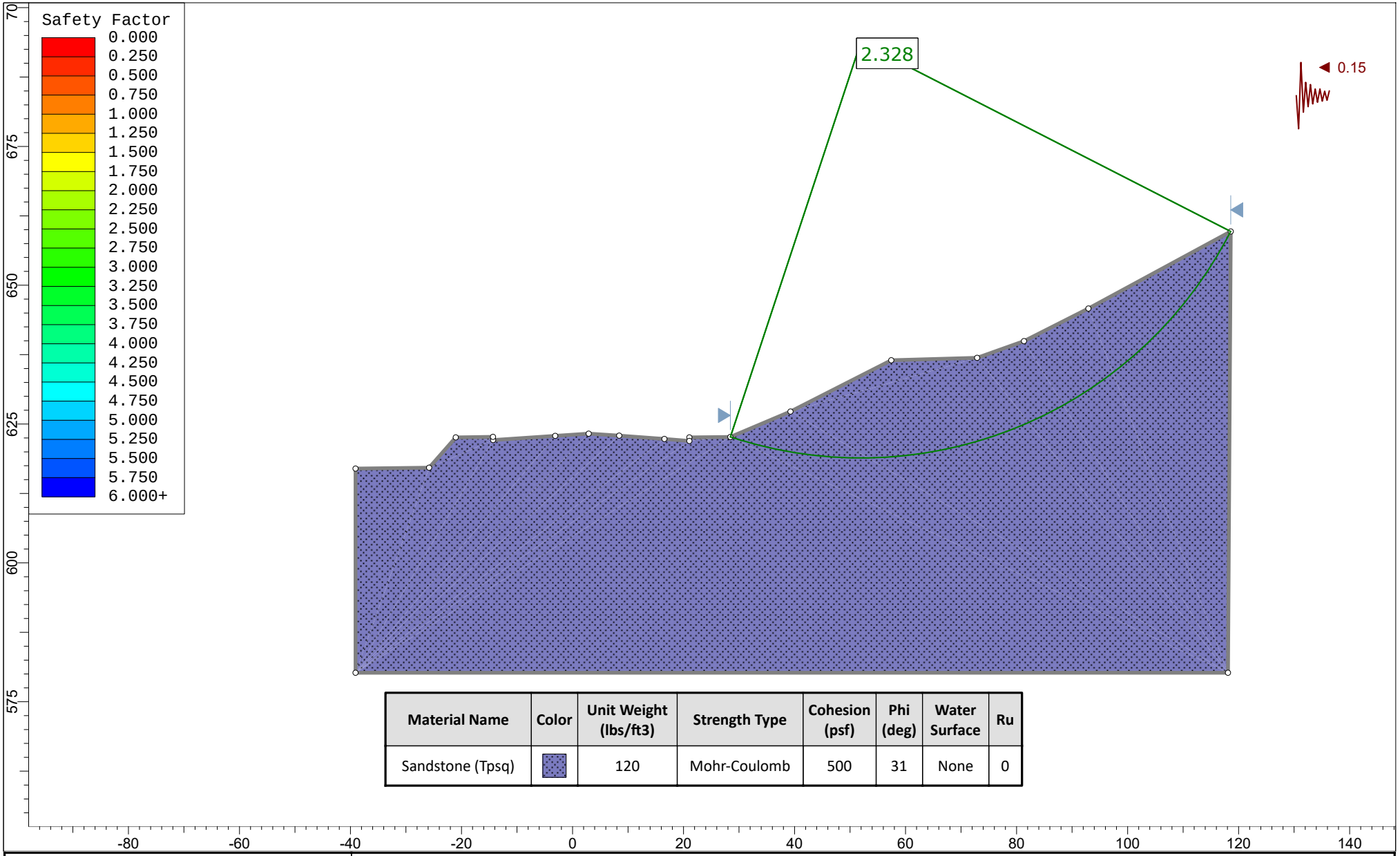
SLIDEINTERPRET 8.010

Project: Cross Section 5-5': Case 5-1: Cut Slope East of Street B, Static

Analysis Description:

Drawn By	Scale	Company
EVB	1:243	Group Delta
Date:		File Name: Cross Section 5-5'.slmd

Figure E.11



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Sandstone (Tpsq)		120	Mohr-Coulomb	500	31	None	0

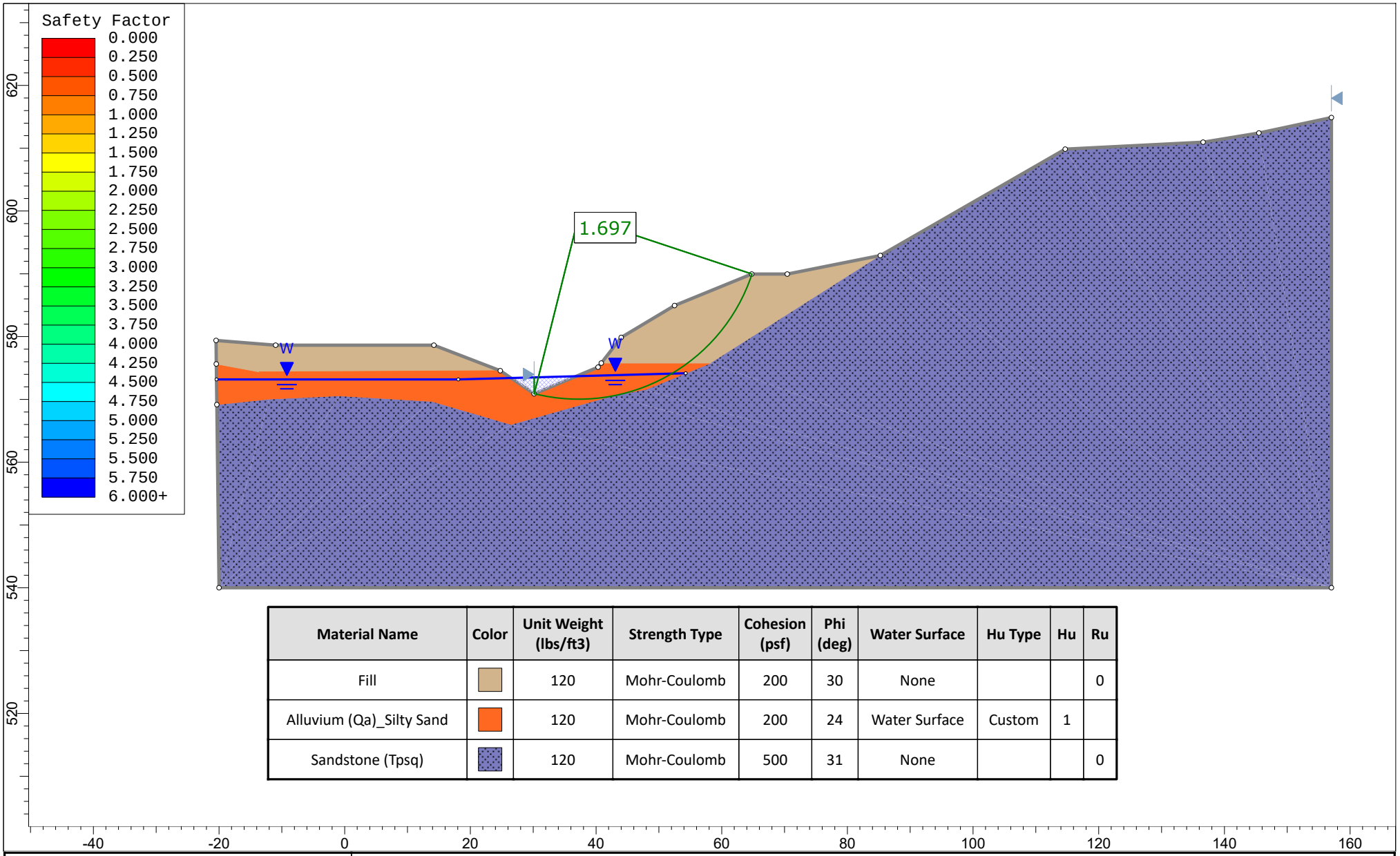
SLIDEINTERPRET 8.010

Project: Cross Section 5-5': Case 5-1: Cut Slope East of Street B, Seismic

Analysis Description:

Drawn By	EVB	Scale	1:287	Company	Group Delta
Date				File Name	Cross Section 5-5'.slmd

Figure E.12



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30	None			0
Alluvium (Qa)_Silty Sand		120	Mohr-Coulomb	200	24	Water Surface	Custom	1	
Sandstone (Tpsq)		120	Mohr-Coulomb	500	31	None			0

rocscience

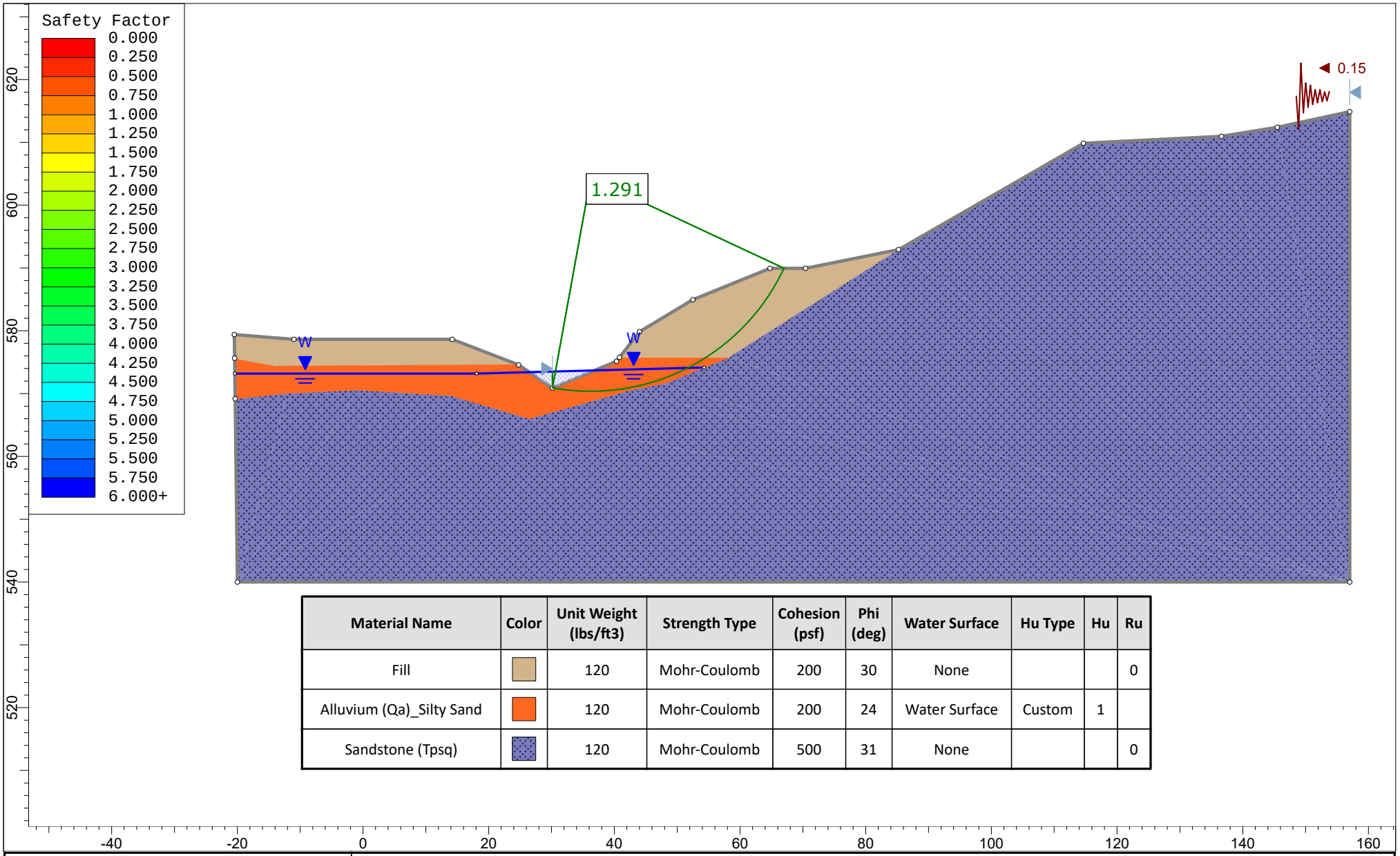
SLIDEINTERPRET 8.010

Project: Cross Section 6-6': Case 6-1: Existing Condition, Static

Analysis Description:

Drawn By	EVB	Scale	1:253	Company	Group Delta
Date				File Name	Cross Section 6-6'.slmd

Figure E.13



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30	None			0
Alluvium (Qa)_Silty Sand		120	Mohr-Coulomb	200	24	Water Surface	Custom	1	
Sandstone (Tpsq)		120	Mohr-Coulomb	500	31	None			0

rocscience

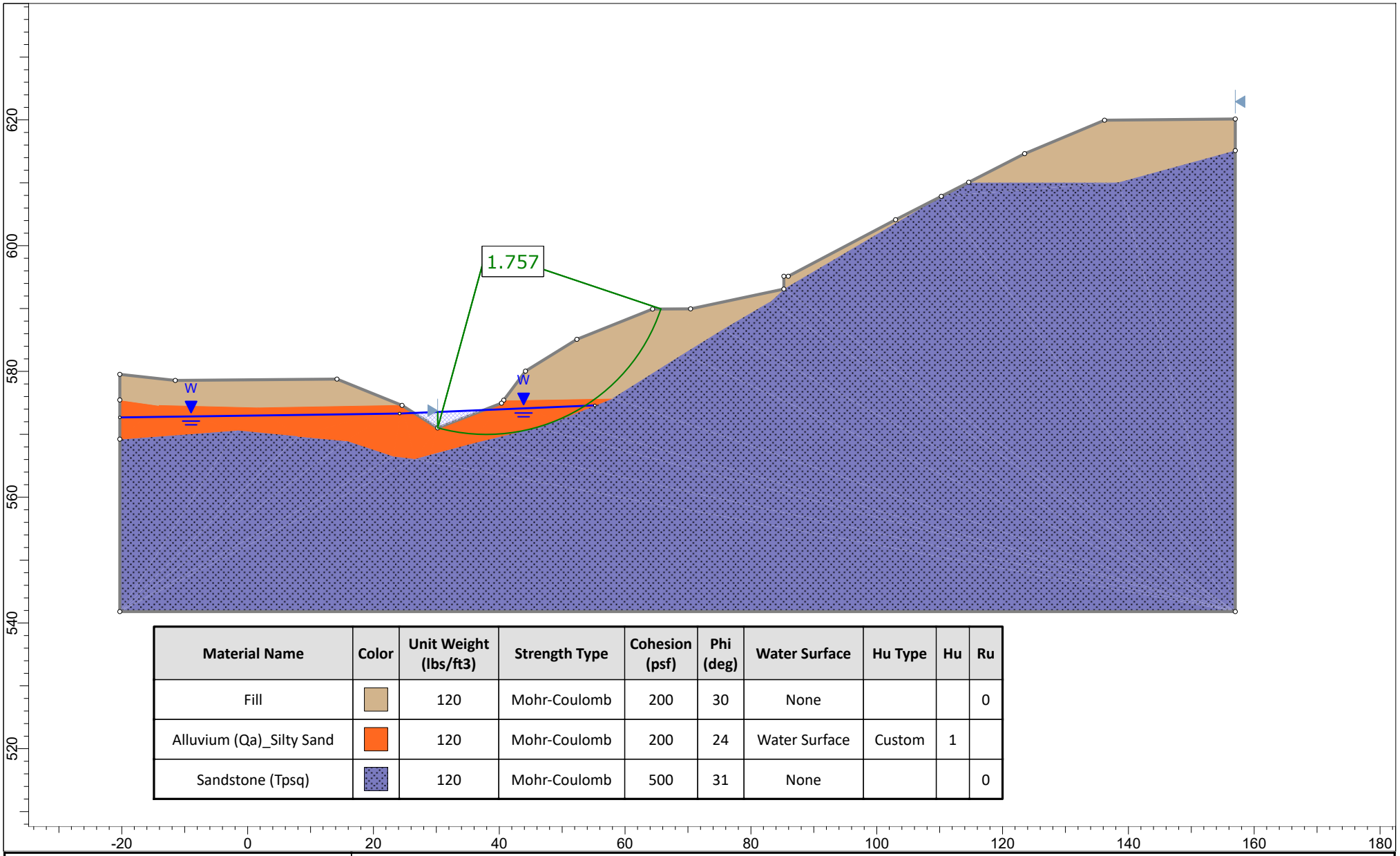
SLIDEINTERPRET 8.010

Project: Cross Section 6-6': Case 6-1: Existing Condition, Seismic

Analysis Description:

Drawn By	EVB	Scale	1:253	Company	Group Delta
Date				File Name	Cross Section 6-6'.slmd

Figure E.14



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30	None			0
Alluvium (Qa)_Silty Sand		120	Mohr-Coulomb	200	24	Water Surface	Custom	1	
Sandstone (Tpsq)		120	Mohr-Coulomb	500	31	None			0

rocscience

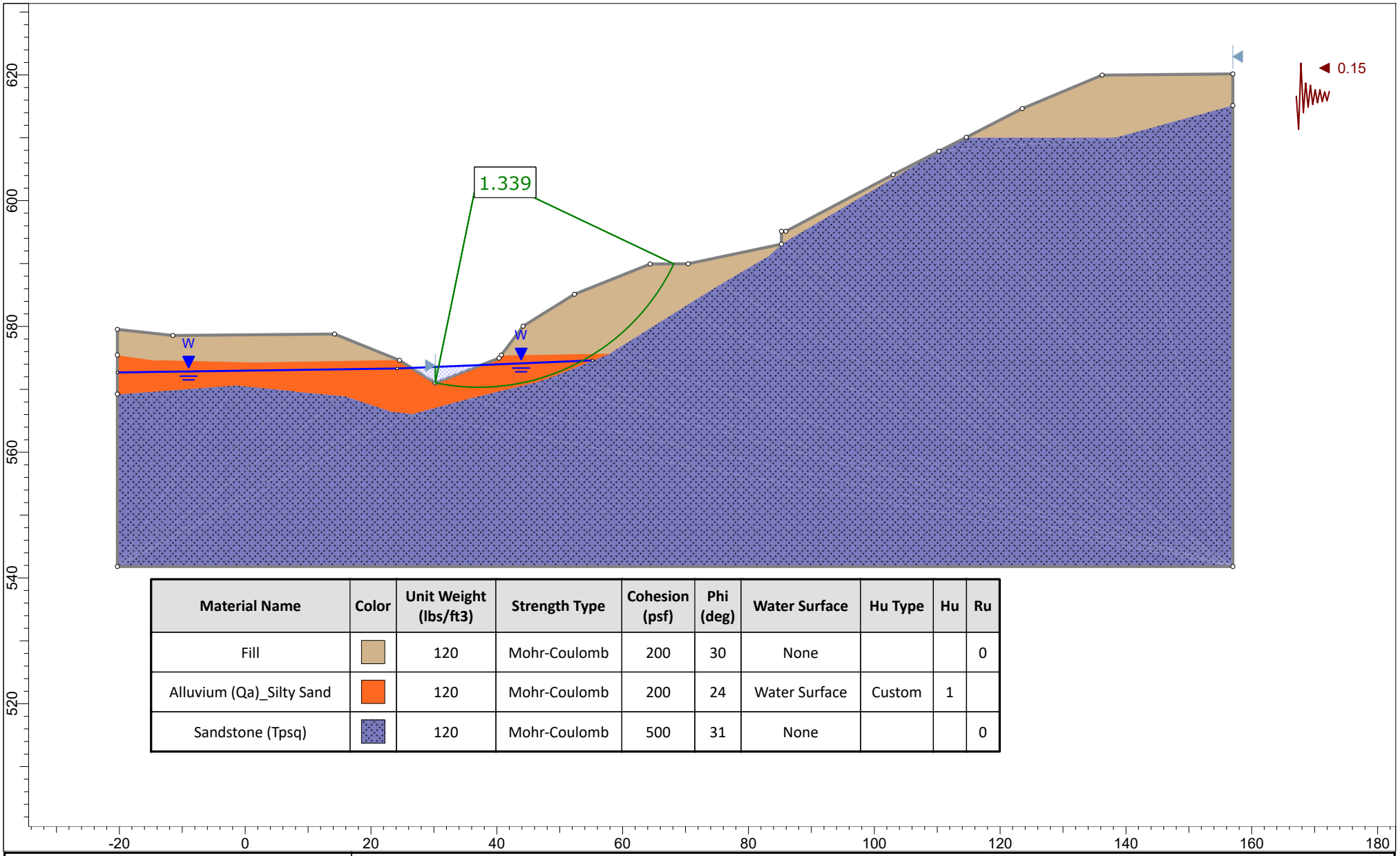
SLIDEINTERPRET 8.010

Project: Cross Section 6-6': Case 6-2: Proposed Fill Slope, Static

Analysis Description:

Drawn By	EVB	Scale	1:253	Company	Group Delta
Date				File Name	Cross Section 6-6'.slmd

Figure E.15



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Fill		120	Mohr-Coulomb	200	30	None			0
Alluvium (Qa)_Silty Sand		120	Mohr-Coulomb	200	24	Water Surface	Custom	1	
Sandstone (Tpsq)		120	Mohr-Coulomb	500	31	None			0

rocscience

SLIDEINTERPRET 8.010

Project: Cross Section 6-6': Case 6-2: Proposed Fill Slope, Seismic

Analysis Description:

Drawn By	EVB	Scale	1:253	Company	Group Delta
Date				File Name	Cross Section 6-6'.slmd

Figure E.16

Attachment C – Project Owner Certification

Project Owner's Certification

I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathered the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner's Name:			
Owner's Title:			
Company:			
Address:			
Email:			
Telephone No:			
Signature:		Date:	

Attachment D – Master Covenant Agreement

RECORDING REQUESTED BY
AND MAIL TO:

Space above this line is for Recorder's use

COVENANT AND AGREEMENT
REGARDING THE MAINTENANCE OF LOW IMPACT DEVELOPMENT (LID) & NATIONAL POLLUTANTS DISCHARGE ELIMINATION SYSTEM (NPDES) BMPs

The undersigned, xx ("Owner"), hereby certifies that it owns the real property described as follows ("Subject Property"), located in the County of Los Angeles, State of California:

LEGAL DESCRIPTION

ASSESSOR'S ID # 8709-093-001
8709-093-002
8709-093-003 TRACT NO. 45378 LOT NO. 1 & 2

ADDRESS: 800 Meadow Pass Lane, Walnut, CA, 91789

Owner is aware of the requirements of County of Los Angeles' Green Building Standards Code, Title 31 Section 4.106.5 (LID), and Title 12, Chapter 12.84 – Low Impact Development Standards. The following post-construction BMP features have been installed on the Subject Property:

- □ Porous pavement
- □ Cistern/rain barrel
- □ Infiltration trench/pit
- □ Bioretention or biofiltration
- □ Rain garden/planter box
- □ Disconnect impervious surfaces
- □ Dry Well
- □ Storage containers
- □ Landscape and landscape irrigation
- □ Green roof
- x Other Two Detention Basins

The location, including GPS x-y coordinates, and type of each post-construction BMP feature installed on the Subject Property is identified on the site diagram attached hereto as Exhibit 1.

Owner hereby covenants and agrees to maintain the above-described post-construction BMP features in a good and operable condition at all times, and in accordance with the LID/NPDES Maintenance Guidelines, attached hereto as Exhibit 2.

Owner further covenants and agrees that the above-described post-construction BMP features shall not be removed from the Subject Property unless and until they have been replaced with other post-construction BMP features in accordance with County of Los Angeles' Title 12, Chapter 12.84 – Low Impact Development Standards.

Owner further covenants and agrees to maintain all drainage devices located within his/her property in good condition and operable condition at all times.

Owner further covenants and agrees that if Owner hereafter sells the Subject Property, Owner shall provide printed educational materials to the buyer regarding the post-construction BMP features that are located on the Subject Property, including the type(s) and location(s) of all such features, and instructions for properly maintaining all such features.

Owner makes this Covenant and Agreement on behalf of itself and its successors and assigns. This Covenant and Agreement shall run with the Subject Property and shall inure to the benefit of the County of Los Angeles and be binding upon Owner, future owners, and their heirs, successors and assignees, and shall continue in effect until the release of this Covenant and Agreement by the County of Los Angeles, in its sole discretion.

Owner(s):

By:_____ Date:_____

By:_____ Date:_____

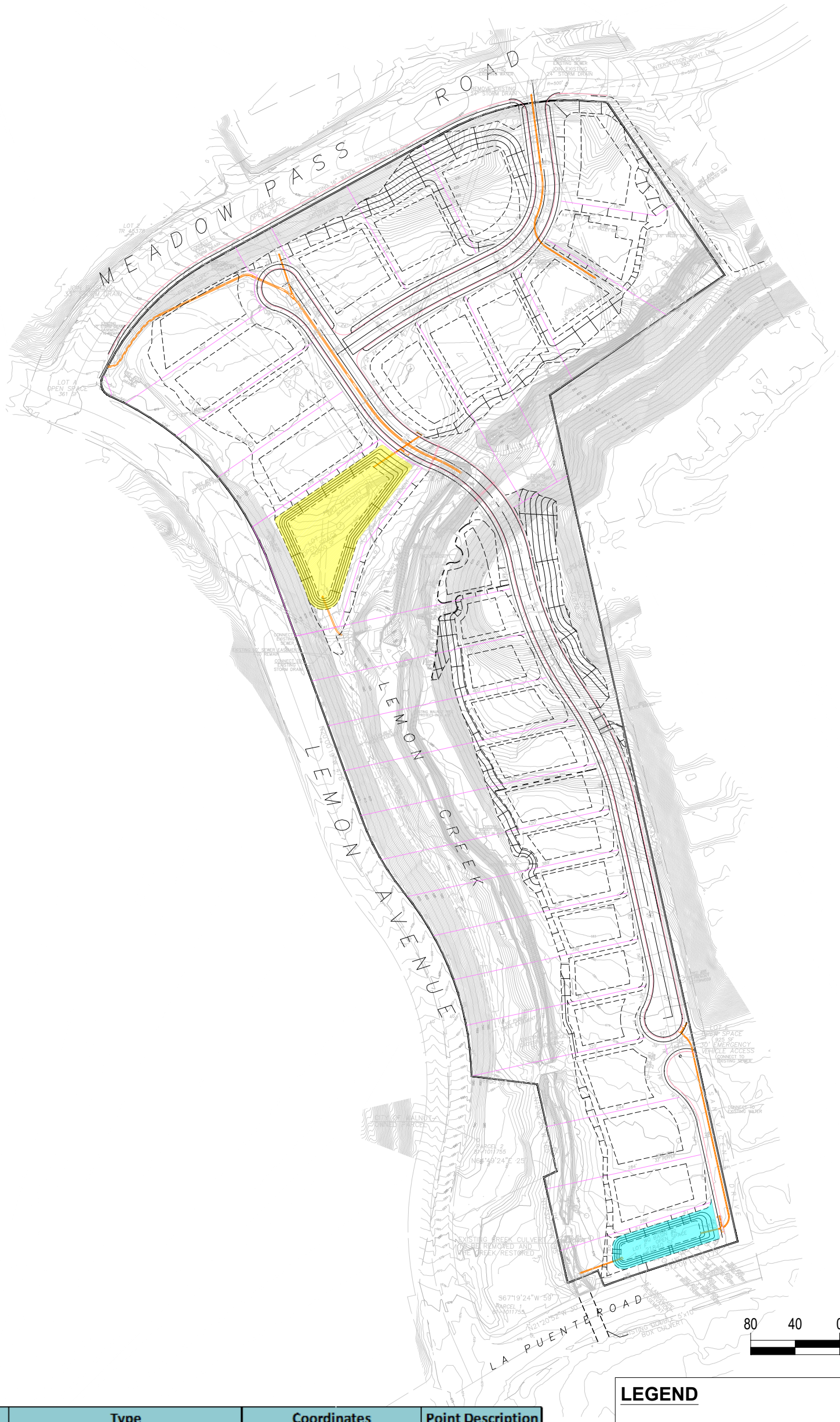
A notary public or other officer completing the attached certificate verifies only the identity of the individual who signed the document to which the certificate is attached, and not the truthfulness, accuracy, or validity of that document.

(PLEASE ATTACH NOTARY)

FOR DEPARTMENT USE ONLY:

MUST BE APPROVED BY COUNTY OF LOS ANGELES BUILDING AND SAFETY DIVISION PRIOR TO RECORDING.

APPROVED BY:_____ _____ Date _____ Permit No._____
(Print Name) (Signature)



No.	Type	Coordinates		Point Description
		Latitude	Longitude	
1	Biofiltration (Water Quality Basin)	-117.866799	34.024277	Centroid
2	Biofiltration (Water Quality Basin)	-117.864871	34.02097	Centroid

LEGEND

STORMWATER BASIN NO.1

STORMWATER BASIN NO.2

EXHIBIT **1**

PACE
Advanced Water Engineering
17520 Newhope Street, Suite 200 | Fountain Valley, CA 92708
P: (714) 481-7300 | www.pacewater.com

SCALE	1" = 200'
DESIGNED	MEK
DRAWN	CT
CHECKED	MEK
DATE	02-03-2023
JOB NO.	B852

JOB
BROOKSIDE DEVELOPMENT PROJECT
WALNUT CA

TITLE
STORMWATER FEATURES OF LID PLAN

P:\B852\Engineering\GlobalExhibits\B852 Report Figures.dwg - Tab: 09-22 LID Rpt Fig 8-1 - SW O&M Map - by cthompson on 02/03/23 at 3:02:56 PM

Maintenance Plan

Inspection and maintenance are key components in extending the life of water quality control measures, and it is important that they are considered and incorporated into the design process. The two proposed Detention Basins will either be owned / maintained by a public agency or the Homeowners Association (HOA), which will be set up by the Brookside developers. Regardless of the entity that will own the infrastructure, the Maintenance Plan presented in this section will be implemented. The Maintenance Plan addresses the following items:

- Operation plan and schedule, including a site map
- Maintenance and cleaning activities and schedule
- Equipment and resource requirements necessary to operate and maintain stormwater quality control measures
- Responsible party for operation and maintenance

1.1 Description of the Facilities

The stormwater facilities to be maintained include two Detention Basins. The Detention Basins are designed to detain / treat runoff from the developed areas of the project site before it reaches Lemon Creek. Approximate locations for each of the facilities discussed are shown on **Figure 8-1**.

Detention Basin No.1 is located just south of Lot 13, occupying an area approximately 32,480 sq. ft. in size, with a depth of 5 ft. and side slopes of 4(H) : 1(V). The basin will intercept flows from sub-watershed areas 2A, 2B, 4A, and 5B, which includes Lot numbers 1 through 15. The basin will be configured as a detention basin, with vegetated slopes and bottoms, which will provide natural treatment processes for the captured runoff as it infiltrates into the underlying media. An underdrain system will be installed below the invert of the facility, which will transport the infiltrated water to an existing outlet point in Lemon Creek, where the Lemon Ave. storm drain outlets into Lemon Creek. A buried impermeable liner will be installed along the side slopes and invert of the basin (below the underdrain), in order to prevent saturated soils from creating unstable slopes in the vicinity of the basin, per recommendations from the geotechnical engineer (Group Delta). The Detention Basin will be designed to hold 2.67 ac-ft of runoff from the developed areas of the site, and will be completely drained within 96 hrs in order to avoid vector breeding. Flows in excess of the design volume of the Detention Basin will outlet over a spillway into Lemon Creek. The slopes at the spillway will be lined/armored in order to protect against erosion.

Detention Basin No.2 is located just south of Lot 27, occupying an area approximately 11,380 sq. ft. in size, with a depth of 4 ft. and side slopes of 4(H) : 1(V). The basin will intercept flows from sub-watershed areas 5A and 11A, which includes Lot numbers 16 through 27. The basin will be configured as a detention basin, similar to Basin No.1, with vegetation, an underdrain, and buried liners. Basin No.2 will be designed to hold 0.66 ac-ft of runoff from the developed areas of the site (0.31 ac-ft of which constitutes the SWQDv), completely draining within 96hrs. Flows in excess of the design volume will outlet over a spillway into Lemon Creek. The slopes at the spillway will be lined/armored to protect against erosion.

1.2 Maintenance / Inspection Access

The Detention Basins can be accessed by vehicle through the use of the trail network on-site. The trail network that exists currently will be modified to ensure adequate widths for maintenance vehicle access. Detention Basin No.1 can be accessed by the trail that borders the west edge of the property. Detention Basin No.2 can be accessed by either of the two streets at the southeast corner of the property, namely, San Vicente Drive or La Puente Road.

The Detention Basins will need to be regularly inspected, in order to identify issues that should be addressed with maintenance. Those inspecting the facilities should keep a log of observations for each visit and schedule a time for any problems observed to be addressed. Different inspection activities will require different levels of frequency. During the first two years after construction, the results of the inspections will

be the basis of a more appropriate frequency for maintenance activities to take place. **Table 8-1** is a guideline for how frequent the various inspection actives should take place. The associated maintenance required for these issues may be more or less frequent than the inspection frequency, and should only take place if an issue is observed.

Table 1: Schedule of Inspections

Inspect For	Frequency
Overgrown vegetation	1x per month
Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds	1x per month
Trash, plant litter, and dead leaves present	1x per month
Irrigation not functioning properly	1x per month
Inlet / outlet areas clogged with sediment and/or debris	Inspect quarterly; one inspection shall occur 30 days prior of October 1st. During the first two years, inspection should occur after every storm event.
Erosion/Sediment accumulation	Inspect quarterly; one inspection shall occur 30 days prior of October 1st. During the first two years, inspection should occur after every storm event.
Standing water	Inspect quarterly; one inspection shall occur 30 days prior of October 1st. During the first two years, inspection should occur after every storm event.
Any evidence of oil, gasoline, contaminants, or other pollutants	1x per year
Mulch layer thinning / absent	1x per year

1.3 General Maintenance Activities

1.3.1 Routine Maintenance Activities

The following maintenance activities will take place on a more regular basis and will require minimal effort to implement. These activities will, in general, occur once per month.

1.3.1.1 Facilities Inspection

Inspect the Detention Basins' flow entrances, ponding area, and surface overflow areas for signs that soil, plant material, and/or mulch layer needs to be replaced. Soil may need to be replaced/re-graded if the biofiltration area has standing water and/or if sediment accumulation is observed in the inlet/overflow areas. Plant material should be inspected for signs of overgrowth, death, or the presence of invasive, poisonous, nuisance, or noxious vegetation or weeds.

Inspect for sediment deposited in the Detention Basin areas, which could reduce the infiltration rate of the facility. If a buildup of sediment is observed, the source should be identified. Additionally, identify if the outlet pipe or weir spillway of the Detention Basins have obstructions or debris that might prevent them from draining. Underdrains should also be inspected for signs of clogging.

The Detention Basins should be inspected for signs of trash, plant litter, dead leaves, and any evidence of contaminants/pollution, such as oil and gasoline. If contaminants/pollution are observed, the source should be identified.

1.3.1.2 Trash & Debris Removal

Any accumulated trash or debris (i.e. plant litter, dead leaves) should be removed from the Detention Basins, in order to maintain the visual aesthetics of the facility and to ensure adequate infiltration, inflow, and outflow. If obstructions or debris are observed at the outlet pipe or weir spillway, it should be removed immediately. All collected trash/debris should be disposed of properly.

1.3.1.3 Minor Vegetation Upkeep

Irrigate plants as needed during prolonged dry periods. In general, the plants selected will be drought-tolerant and will not require irrigation after an establishment period of 2-3 years.

Prune and remove dead plant material as needed. Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and mulch is replaced on an annual basis. Do not apply nutrients and pesticides to the plants, as these may contribute pollutant loads to receiving waters.

Standing water should be immediately eliminated, in order to prevent vector breeding. Standing water in the detention basins should drain within 96 hours of a rain event. If the drain time is longer than 96 hours, this may indicate an issue with the outlets or clogging in the soil media / underdrain layer.

1.3.1.4 Minor Sediment operations

If a small amount of sediment is deposited in the facilities, remove excess surface deposits and stabilize the eroded areas as needed through regrading or addition of gravel.

1.3.2 Major Maintenance Activities

The following maintenance activities will take place on a less regular basis and will require greater effort to implement. These activities will, in general, occur once per year or less.

1.3.2.1 Major Vegetation Upkeep

Replace all dead plants, and if specific plants have a high mortality rate, asses the cause and, if necessary, replace with more appropriate species.

A two to three-inch mulch layer should be maintained, in the facilities. Thinning/removal of the mulch layer should be inspected for at least once per year and the mulch replaced/added to as necessary.

1.3.2.2 Major Sediment Removal

If large amounts of sediment are deposited in the facilities, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits. Eroded areas may be re-graded or repaired with gravel. The collected sediment should be properly disposed of.

1.3.2.3 Vector Control

Standing water should be immediately eliminated, in order to prevent vector breeding. Standing water in the detention basins should drain within 96 hours of a rain event. If the drain time is longer than 96 hours, this may indicate an issue with the outlets or clogging in the soil media / underdrain layer.

If burrowing of pests is observed in the facilities, traps or other rodent elimination methods should be implemented.

1.3.2.4 Spillway / Outlet Repair

If the inlet pipe, or weir spillway is damaged, it should be repaired upon discovery. If the underdrain shows signs of clogging, it should be replaced or the media should be cleaned as necessary.

1.5 Inspection and Maintenance Checklist

Oftentimes, inspection and maintenance will go hand in hand, and the inspection checklist can be reviewed during more frequent maintenance activities, such as monthly pruning and clearing of the facilities. However, inspection may take place without triggering some less frequent, major types of maintenance activities. **Table 8-2** lists the conditions that would be observed during an inspection that would trigger a maintenance activity, and also describes what the maintenance activities should entail.

Table 2: Inspection & Maintenance Checklist

Problem	Conditions When Maintenance is Needed	Maintenance Required
Vegetation	Overgrown vegetation	Mow and prune vegetation as appropriate
	Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds	Remove this vegetation and plant native species as needed
Mulch	Mulch is thin / removed throughout the facility surface	Replace / supplement mulch as needed to maintain a 2-3 inch layer depth
Trash & debris	Trash, plant litter, and dead leaves present	Remove and properly dispose of trash and debris
Irrigation	Not functioning properly	Check irrigation system for clogs or broken lines and repair as needed
Inlet / outlet	Inlet / underdrain areas clogged with sediment and/or debris	Remove material
	Overflow weir blocked or broken	Repair as needed
Erosion / sediment accumulation	Splash pads or spreader incorrectly placed Presence of erosion or sediment accumulation	Check inlet structure to ensure proper function. Repair, or replace if necessary, the inlet device. Repair eroded areas with gravel as needed. Re-grade the Detention Basin / biofiltration area as needed
Contaminants & pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove any evidence of visual contamination from floatables such as oil and grease
Standing water	Standing water is observed more than 96 hours after storm event	Inspect, and clean as needed, the underdrain to ensure proper function. Clear clogs as needed. Remove and replace planter media (sand, gravel, topsoil, mulch) and vegetation.

Attachment D – Engineer's Certification

Preparer (Engineer) Certification

Engineer's Name:	**Mark Krebs**		
Engineer's Title:	**P.E., President**		
Company:	**Pacific Advanced Civil Engineering, Inc. (PACE)**		
Address:	**17520 Newhope St., Fountain Valley, CA, 92708**		
Email:	**mkrebs@pacewater.com**		
Telephone No:	**(714) 481-7201**		
I hereby certify that this Low Impact Development Plan is in compliance with, and meets the requirements set forth in, Order No. R4-2012-0175, of the Los Angeles Regional Water Quality Control Board.			
Engineer's Signature		Date	
Place Stamp Here			