MOJAVE RIVER WATERSHED
Preliminary
Water Quality Management Plan

For:

Mojave 68

TPM NO. _____

Prepared for:

Industrial Property Group, Inc.

10515 20th Street Southeast

Lake Stevens, WA 98258

(314) 713-9516

Prepared by:

Kier & Wright

163 Technology Drive, #150

Irvine, CA 92832

(949) 508-0202

Submittal Date: January 2023

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: ___

Revision No. and Date: _____

Final Approval Date:______________________

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Industrial Property Group, Inc. by Kier & Wright. The WQMP is intended to comply with the requirements of the City of Victorville and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	PSUB22-00074	Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3128-621-02 & 3128-621-06

Owner's Signature			
Owner Name: Craig J Wilde			
Title	Development Manager		
Company	Industrial Property Group, Inc.		
Address	10515 20th Street Southeast		
Email	craig@industrialpg.com		
Telephone #	(314) 713-9516		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	PSUB22-00074	Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3128-621-02 & 3128-621-06

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: Garrett Readler		PE Stamp Below
Title	Principal	
Company	Kier & Wright	
Address	163 Technology Drive, #150	
Email	greadler@kierwright.com	
Telephone #	(949) 508-0202	
Signature		
Date		

Table of Contents

Forms

Section I – Introduction

This WQMP template has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB). This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: http://cms.sbcounty.gov/dpw/Land/NPDES.aspx to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">Mojave 68</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4">Craig J Wilde</td></tr>
<tr><td>Mailing Address:</td><td>10515 20th Street Southeast</td><td>E-mail Address:</td><td>craig@industrialpg.com</td><td>Telephone:</td><td>314-713-9516</td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td>PSUB22-00074</td><td>Tract/Parcel Map Number(s):</td><td colspan="2">TBD</td></tr>
<tr><td colspan="2">Additional Information/
Comments:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">This project is located within the City of Victorville between Mojave Drive, Mesa Linda Ave, Cactus Rd and Onyx Rd. This is a proposed 1.057 million square foot warehouse and 40,000 sf office and a parking lot with 458 auto stalls and 726 truck trailer stalls. This is a "Priority Project" which requires a WQMP.</td></tr>
<tr><td colspan="2">Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</td><td colspan="4">Existing Condition:
This is a 64.92 acre site that is currently undeveloped with an elevation ranging from 3020 to 2993 feet above sea level. Existing vegetation includes native desert scrub brush and sparse grasses. The site drains from the southwest to the northeast. Mojave Drive is an existing arterial street to the south of the site.
Proposed Condition:
The site will include a warehouse with four 2-story office areas at each corner of the building. The sute will include auto and truck trailer parking, two loading docks with 187 dock doors total. Landscaping will surround the site and an infiltration/detention basin is proposed at the northeast corner at the lowpoint of the site. Curb & gutter will direct stormwater into catch basins throughout the site. Storm drain will direct stormwater into the proposed basin where it will infiltrate. This basin will capture and treat the entire stormwater design capture volume.</td></tr>
</table>

Section 2 Project Description

2.1 Project Information

The WQMP shall provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

<table>
<tr><th colspan="8">Form 2.1-1 Description of Proposed Project</th></tr>
<tr><td colspan="8">1 Regulated Development Project Category (Select all that apply):</td></tr>
<tr><td colspan="2">☒ #1 New development involving the creation of 5,000 ft² or more of impervious surface collectively over entire site</td><td colspan="2">☐ #2 Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site</td><td colspan="2">☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface</td><td colspan="2">☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface</td></tr>
<tr><td colspan="8">☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) Will require source control Site Design Measures. Use the “PCMP” Template. Do not use this WQMP Template.</td></tr>
<tr><td>2 Project Area (ft2):</td><td>2,827,918</td><td colspan="2">3 Number of Dwelling Units:</td><td>0</td><td>4 SIC Code:</td><td colspan="2"></td></tr>
<tr><td colspan="8">5 Is Project going to be phased? Yes ☐ No ☒ If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</td></tr>
</table>

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management
Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
To be provided in the final WQMP.

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	
Nutrients - Phosphorous	E ☒	N ☐	
Nutrients - Nitrogen	E ☒	N ☐	
Noxious Aquatic Plants	E ☐	N ☒	
Sediment	E ☒	N ☐	
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☒	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.***

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34° 31' 57" N	Longitude 117°23'18"W	Thomas Bros Map page
1 San Bernardino County climatic region: ☒ Desert			
2 Does the site have more than one drainage area (DA): Yes☐ No☒ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*			

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	Surface runoff will be directed into catch basins with inlet filters. Stormwater will then travel through storm drain to outlet into the infiltration/retention basin.
DA1 DMA B to Outlet 1	
DA2 to Outlet 2	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	2,827,918			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	C			
5 Longest flowpath length (ft)	1000			
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Natural Cover: Barren			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	Poor			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)				
2 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*				
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*				

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Mojave River: Fluoride
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	Southwestern Willow Flycatcher Desert Tortise Habitat Cat Mojave Ground Squirrel
Hydromodification Assessment	☒ Yes *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal* ☐ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control BMPs and Site Design BMP Measures are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

The identified list of source control BMPs correspond to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	To be provided in final WQMP
N2	Activity Restrictions	☒	☐	To be provided in final WQMP
N3	Landscape Management BMPs	☒	☐	To be provided in final WQMP
N4	BMP Maintenance	☒	☐	To be provided in final WQMP
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	To be provided in final WQMP
N6	Local Water Quality Ordinances	☒	☐	To be provided in final WQMP
N7	Spill Contingency Plan	☒	☐	To be provided in final WQMP
N8	Underground Storage Tank Compliance	☐	☒	N/A
N9	Hazardous Materials Disclosure Compliance	☐	☐	N/A

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Litter/Debris Control Program	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☒	☐	
N14	Catch Basin Inspection Program	☒	☐	
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	
N17	Comply with all other applicable NPDES permits	☐	☒	

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☒	☐	
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☒	☐	
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☒	☐	

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	
S14	Wash water control for food preparation areas	☐	☒	
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Site Design Practices Checklist
Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation:
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation:
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation:
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes ☒ No ☐ Explanation:
Use of Porous Pavement.: Yes ☐ No ☒ Explanation:
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation:
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☐ No ☒ Explanation:

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation:
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation:
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☐ No ☒ Explanation:
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation:
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation:

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping -
http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795

Recommended High-Desert Plants -
http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553

Mojave Water Agency:

Desert Ranch: http://www.mojavewater.org/files/desertranchgardenprototype.pdf

Summertree: http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf

Thornless Garden: http://www.mojavewater.org/files/thornlessgardenprototype.pdf

Mediterranean Garden: http://www.mojavewater.org/files/mediterraneangardenprototype.pdf

Lush and Efficient Garden: http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – http://hdawac.org/save-outdoors.html

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evaportranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P_6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for hydromodification performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft^2): 2,827,918	2 Imperviousness after applying preventative site design practices (Imp%): 85%	3 Runoff Coefficient (Rc): _0.661 *R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.359 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.444 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 135,766 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-2 Summary of Hydromodification Assessment (DA 1)

Is the change in post- and pre- condition flows captured on-site? : Yes ☒ No ☐

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*

If "No," then proceed to Section 4.3 BMP Selection and Sizing

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 248,501 *Form 4.2-3 Item 12*	2 42.19 *Form 4.2-4 Item 13*	3 16.99 *Form 4.2-5 Item 10*
Post-developed	4 458,987 *Form 4.2-3 Item 13*	5 13.12 *Form 4.2-4 Item 14*	6 98.88 *Form 4.2-5 Item 14*
Difference	7 *210,486* *Item 4 – Item 1*	8 *29.07* *Item 2 – Item 5*	9 *81.89* *Item 6 – Item 3*
Difference (as % of pre-developed)	10 *84.7%* *Item 7 / Item 1*	11 *68.9%* *Item 8 / Item 2*	12 *482%* *Item 9 / Item 3*

SEE APPENDIX B

Form 4.2-3 Hydromodification Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: <u>Pre</u>-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								
Weighted Curve Number Determination for: <u>Post</u>-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

5 Pre-Developed area-weighted CN:	**7** Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	**8** Post-developed soil storage capacity, S (in): *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): *I_a = 0.2 * Item 8*

11 Precipitation for 10 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet hydromodification requirement, (ft^3):
*Vhydro = (Item 13 * 0.95) – Item 12*

SEE APPENDIX B

Form 4.2-4 Hydromodification Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o *= Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7}/\text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								

13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet hydromodification requirement (min): $T_{C\text{-}Hydro} = (\text{Item 13} * 0.95) - \text{Item 14}$

SEE APPENDIX B

Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.7 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B		*n/a*			*n/a*	
	DMA C			*n/a*			*n/a*

8 Pre-developed Q_p at T_c for DMA A: *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	9 Pre-developed Q_p at T_c for DMA B: *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	10 Pre-developed Q_p at T_c for DMA C: *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	12 Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	13 Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): $Q_{p\text{-}hydro}$ = *(Item 14 * 0.95) – Item 10*		

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design Measures (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

> Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is “Yes,” provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable Site Design BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;

2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and

3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)
Feasibility Criterion – Complete evaluation for each DA on the Project Site
1 Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒ *Refer to Section 5.3.2.1 of the TGD for WQMP*
If Yes, Provide basis: (attach)
2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒ (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than ten feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.
If Yes, Provide basis: (attach)
3 Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒
If Yes, Provide basis: (attach)
4 Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒
If Yes, Provide basis: (attach)
5 Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒
If Yes, Provide basis: (attach)
6 Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒ *See Section 3.5 of the TGD for WQMP and WAP*
If Yes, Provide basis: (attach)
7 Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒ *If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP.* *If no, then proceed to Item 8 below.* 8 Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒ *If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Site Design BMP.* *If no, then proceed to Item 9, below.* 9 All answers to Item 1 through Item 6 are "No": *Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Site Design BMPs.*

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA 1 DMA A BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): *$V_{retention}$ =Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): *$V_{retention}$ =Sum of Item 12 for all BMPs*			

Form 4.3-2 Site Design BMPs (DA 1)

Form 4.3-2 cont. Site Design BMPs (DA 1)

14 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 14-18. If no, proceed to Item 19*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches*			
18 Runoff volume retention from street tree BMPs (ft^3): *$V_{retention}$ = Sum of Item 17 for all BMPs*			
19 Total Retention Volume from Site Design BMPs: 0 *Sum of Items 5, 13 and 18*			

4.3.3 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix C of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.

2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).

3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

[1] Remaining LID DCV not met by site design BMP (ft^3): 135,766 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA A BMP Type INFILTRATION BASIN	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
[2] Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	4.5		
[3] Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3		
[4] Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.5		
[5] Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
[6] Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	9		
[7] Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	6		
[8] Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	22,628		
[9] Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
[10] Amended soil porosity	0		
[11] Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0		
[12] Gravel porosity	0		
[13] Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
[14] Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	135,766		
[15] Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A		

[16] Total Retention Volume from LID Infiltration BMPs: 135,766 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

[17] Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*

[18] Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐
If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)		
1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume* ☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow* ☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) *$V_{biotreated}$ = Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} *= Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ *=(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V *=Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) Q_{BMP} *= (Item* $8_{forebay}$ *+ Item* 8_{basin}*) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ *= (Item* $8_{forebay}$ *+ Item* 8_{basin}*) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Flow Based Biotreatment (DA 1)

Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w *= (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2*$^{\wedge 1.67}$ ** Item 3*$^{\wedge 0.5}$*)*			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item 2*$^{\wedge 2}$*)*			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) SA_{top} *= (Item 5 + (2 * Item 2 * Item 6)) * Item 10*			

4.3.5 Conformance Summary

Complete Form 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)
1 Total LID DCV for the Project DA-1 (ft^3): *Copy Item 7 in Form 4.2-1*
2 On-site retention with site design BMP (ft^3): *Copy Item18 in Form 4.3-2*
3 On-site retention with LID infiltration BMP (ft^3): *Copy Item 16 in Form 4.3-3*
4 On-site biotreatment with volume based biotreatment BMP (ft^3): *Copy Item 3 in Form 4.3-4*
5 Flow capacity provided by flow based biotreatment BMP (cfs): *Copy Item 6 in Form 4.3-4*
6 LID BMP performance criteria are achieved if answer to any of the following is "Yes": • Full retention of LID DCV with site design or infiltration BMP: Yes ☐ No ☐ *If yes, sum of Items 2, 3, and 4 is greater than Item 1* • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐ *If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized* ▪ On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐ *If yes, Form 4.3-1 Items 7 and 8 were both checked yes*
7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: • Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐ *Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%* • Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated: 1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐ 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐ 3) Equal or greater protection against shock loadings and spills; ☐ 4) Equal or greater accessibility and ease of inspection and maintenance. ☐

4.3.6 Hydromodification Control BMP

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-9 Hydromodification Control BMPs (DA 1)	
1 Volume reduction needed for hydromodification performance criteria (ft^3): *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3):
5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐ *If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☐ • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐	
6 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐ *If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐	

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance.

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

1) Equal or greater amount of runoff infiltrated or evapotranspired;

2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;

3) Equal or greater protection against shock loadings and spills;

4) Equal or greater accessibility and ease of inspection and maintenance.

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMPs included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and a Maintenance Agreement. The Maintenance Agreement must also be attached to the WQMP.

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Stormwater Department

Form 5-1 BMP Inspection and Maintenance
(use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

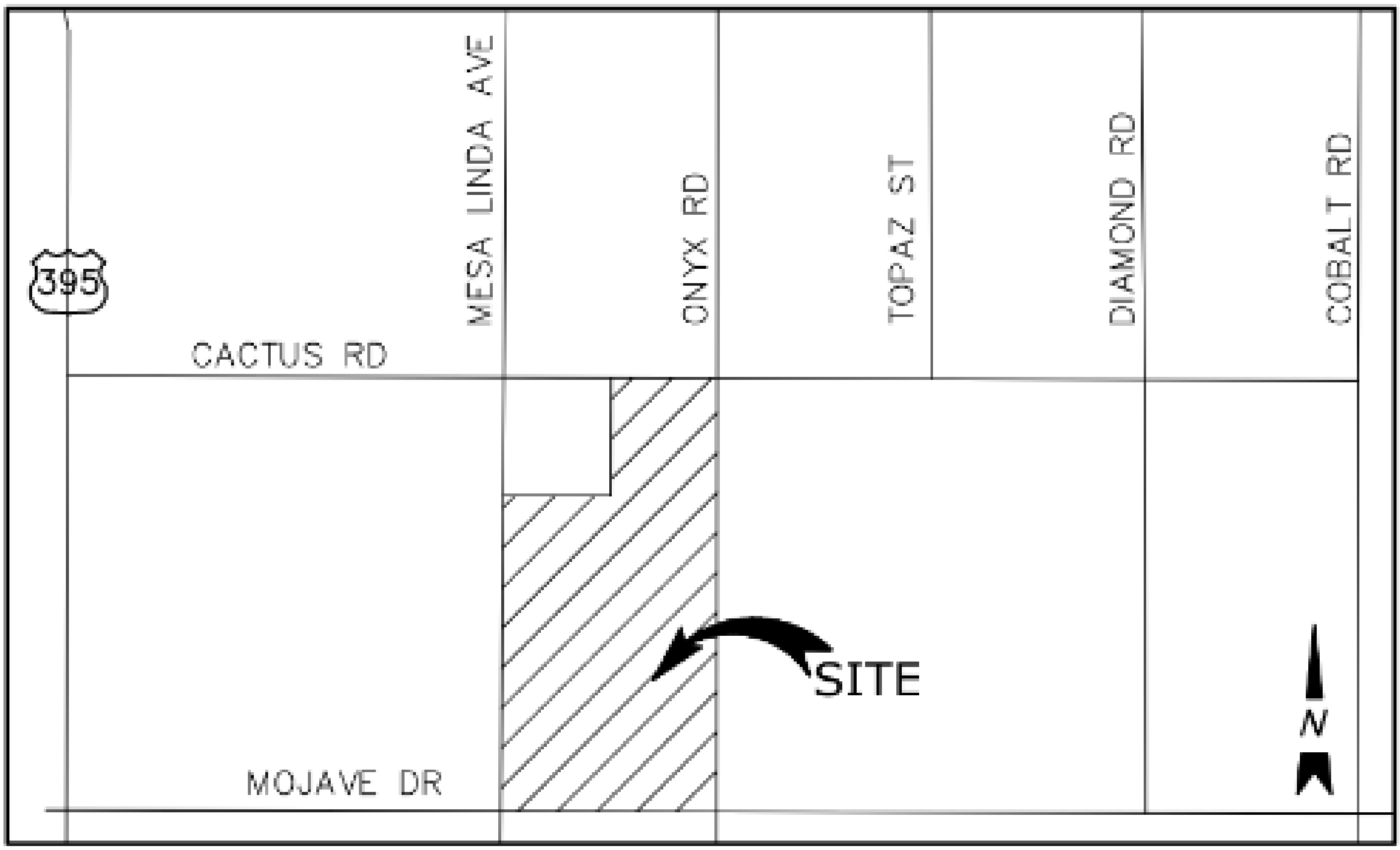
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C,C&R's & Lease Agreements

APPENDIX A:

VICINITY MAP



Vicinity Map

APPENDIX B:

HYDROMODIFICATION ASSESSMENT CALCULATIONS

(USING CIVIL DESIGN COMPUTER SOFTWARE)

```
               San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
        Rational Hydrology Study        Date: 10/26/22
------------------------------------------------------------------------
MOJAVE 68
A22221 10 YEAR EXISTING
SUBAREA A

------------------------------------------------------------------------


Program License Serial Number 6509

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.619 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  3020.000(Ft.)
Bottom (of initial area) elevation =  3007.000(Ft.)
Difference in elevation =    13.000(Ft.)
Slope =    0.01300  s(%)=       1.30
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.832 min.
Rainfall intensity =      1.203(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff =      6.232(CFS)
Total initial stream area =        9.960(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.507(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      12.000 to Point/Station      13.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
```

```
Top of street segment elevation =  3007.000(Ft.)
End of street segment elevation =  2999.000(Ft.)
Length of street segment  =   515.000(Ft.)
Height of curb above gutter flowline  =    2.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  15.000(Ft.)
Slope from gutter to grade break (v/hz) =  -0.010
Slope from grade break to crown (v/hz)  =  -0.010
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.5000
 Manning's N from gutter to grade break =  0.5000
 Manning's N from grade break to crown =  0.5000
Estimated mean flow rate at midpoint of street =      6.297(CFS)
Depth of flow =   0.625(Ft.), Average velocity =   0.199(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  30.000(Ft.)
Flow velocity =   0.20(Ft/s)
Travel time =   43.13 min.     TC =   62.96  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      1.404(CFS)
therefore the upstream flow rate of Q =      6.232(CFS) is being used
Rainfall intensity =      0.601(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.141
Subarea runoff =      0.000(CFS) for    6.650(Ac.)
Total runoff =      6.232(CFS)
Effective area this stream =       16.61(Ac.)
Total Study Area (Main Stream No. 1) =       16.61(Ac.)
Area averaged Fm value =    0.507(In/Hr)
Street flow at end of street =      6.232(CFS)
Half street flow at end of street =      3.116(CFS)
Depth of flow =   0.622(Ft.), Average velocity =   0.198(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  30.000(Ft.)
```

```
End of computations, Total Study Area =          16.61 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  86.0
```

```
              San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
        Rational Hydrology Study        Date: 10/26/22
------------------------------------------------------------------------
MOJAVE 68
A22221 10 YEAR EXISTING
SUBAREA B


------------------------------------------------------------------------


Program License Serial Number 6509

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.619 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  3019.000(Ft.)
Bottom (of initial area) elevation =  3007.000(Ft.)
Difference in elevation =    12.000(Ft.)
Slope =    0.01200  s(%)=       1.20
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   20.152 min.
Rainfall intensity =      1.191(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.517
Subarea runoff =      6.098(CFS)
Total initial stream area =        9.910(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.507(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      22.000 to Point/Station      23.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  3007.000(Ft.)
End of street segment elevation =  2997.000(Ft.)
Length of street segment  =  1040.000(Ft.)
Height of curb above gutter flowline  =    2.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  15.000(Ft.)
Slope from gutter to grade break (v/hz) =  -0.010
Slope from grade break to crown (v/hz)  =  -0.010
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.0500
 Manning's N from gutter to grade break =  0.0500
 Manning's N from grade break to crown =  0.0500
Estimated mean flow rate at midpoint of street =      6.183(CFS)
Depth of flow =   0.280(Ft.), Average velocity =   0.786(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  30.000(Ft.)
Flow velocity =   0.79(Ft/s)
Travel time =   22.04 min.     TC =   42.19  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      5.830(CFS)
therefore the upstream flow rate of Q =      6.098(CFS) is being used
Rainfall intensity =      0.765(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.303
Subarea runoff =      0.000(CFS) for   15.280(Ac.)
Total runoff =      6.098(CFS)
Effective area this stream =       25.19(Ac.)
Total Study Area (Main Stream No. 1) =       25.19(Ac.)
Area averaged Fm value =    0.507(In/Hr)
Street flow at end of street =      6.098(CFS)
Half street flow at end of street =      3.049(CFS)
Depth of flow =   0.279(Ft.), Average velocity =   0.784(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  30.000(Ft.)
End of computations, Total Study Area =          25.19 (Ac.)
```

```
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  86.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/26/22

MOJAVE 68
A22221 10 YEAR EXISTING
SUBAREA C

Program License Serial Number 6509

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.619 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 1

++
Process from Point/Station 31.000 to Point/Station 32.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.507(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 3016.000(Ft.)
Bottom (of initial area) elevation = 3012.500(Ft.)
Difference in elevation = 3.500(Ft.)
Slope = 0.00350 s(%)= 0.35
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 25.784 min.
Rainfall intensity = 1.027(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.456
Subarea runoff = 4.666(CFS)
Total initial stream area = 9.970(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.507(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      32.000 to Point/Station      33.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  3012.500(Ft.)
End of street segment elevation =  2993.000(Ft.)
Length of street segment  =  1090.000(Ft.)
Height of curb above gutter flowline  =    2.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  15.000(Ft.)
Slope from gutter to grade break (v/hz) =  -0.010
Slope from grade break to crown (v/hz)  =  -0.010
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.0500
 Manning's N from gutter to grade break =  0.0500
 Manning's N from grade break to crown =  0.0500
Estimated mean flow rate at midpoint of street =      4.756(CFS)
Depth of flow =   0.226(Ft.), Average velocity =   0.930(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  30.000(Ft.)
Flow velocity =   0.93(Ft/s)
Travel time =   19.54 min.     TC =   45.33  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      4.427(CFS)
therefore the upstream flow rate of Q =      4.666(CFS) is being used
Rainfall intensity =      0.732(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.276
Subarea runoff =      0.000(CFS) for   11.890(Ac.)
Total runoff =      4.666(CFS)
Effective area this stream =      21.86(Ac.)
Total Study Area (Main Stream No. 1) =      21.86(Ac.)
Area averaged Fm value =    0.507(In/Hr)
Street flow at end of street =      4.666(CFS)
Half street flow at end of street =      2.333(CFS)
Depth of flow =   0.225(Ft.), Average velocity =   0.925(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  30.000(Ft.)
End of computations, Total Study Area =          21.86 (Ac.)
```

```
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  86.0
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 01/05/23

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6509

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
63.66	1	0.62
Rainfall data for year 10		
63.66	6	1.27
Rainfall data for year 10		
63.66	24	2.34

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
82.8	82.8	63.66	1.000	0.322	1.000	0.322

Area-averaged adjusted loss rate Fm (In/Hr) = 0.322

```
********* Area-Averaged low loss rate fraction, Yb **********

Area        Area          SCS CN    SCS CN      S     Pervious
 (Ac.)       Fract          (AMC2)    (AMC2)            Yield Fr
    63.66   1.000          82.8      82.8       2.08     0.396

Area-averaged catchment yield fraction, Y =  0.396
Area-averaged low loss fraction, Yb =  0.604
User entry of time of concentration  =   0.703 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      63.66(Ac.)
Catchment Lag time =   0.562 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 14.8174
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.322(In/Hr)
Average low loss rate fraction (Yb) = 0.604 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.294(In)
Computed peak 30-minute rainfall =  0.504(In)
Specified peak 1-hour rainfall =  0.620(In)
Computed peak 3-hour rainfall =  0.962(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.340(In)


Rainfall depth area reduction factors:
Using a total area of      63.66(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997     Adjusted rainfall =  0.293(In)
30-minute factor = 0.997    Adjusted rainfall =  0.502(In)
1-hour factor = 0.997       Adjusted rainfall =  0.618(In)
3-hour factor = 1.000       Adjusted rainfall =  0.962(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.340(In)
---------------------------------------------------------------------

                        U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =       769.89 (CFS))

  1                0.666                  5.131
  2                2.792                 16.364
  3                6.330                 27.241
  4               12.007                 43.702
  5               22.914                 83.973
  6               36.841                107.226
  7               47.584                 82.709
  8               55.621                 61.869
  9               61.494                 45.222
 10               66.034                 34.952
 11               69.837                 29.276
 12               73.074                 24.920
```

13	75.791	20.922
14	78.239	18.842
15	80.261	15.567
16	82.098	14.149
17	83.703	12.356
18	85.193	11.472
19	86.593	10.774
20	87.815	9.412
21	88.916	8.478
22	89.814	6.913
23	90.670	6.587
24	91.491	6.323
25	92.225	5.652
26	92.922	5.366
27	93.577	5.041
28	94.154	4.444
29	94.658	3.879
30	95.162	3.879
31	95.642	3.697
32	96.035	3.028
33	96.421	2.966
34	96.802	2.936
35	97.102	2.306
36	97.368	2.053
37	97.635	2.053
38	97.856	1.699
39	98.005	1.147
40	98.153	1.141
41	98.305	1.170
42	98.479	1.341
43	98.657	1.369
44	98.835	1.369
45	99.013	1.369
46	99.190	1.369
47	99.368	1.369
48	99.521	1.180
49	99.617	0.732
50	99.709	0.713
51	99.802	0.713
52	99.894	0.713
53	100.000	0.356

Total soil rain loss = 1.25(In)
Total effective rainfall = 1.09(In)
Peak flow rate in flood hydrograph = 37.74(CFS)

24 - H O U R   S T O R M
R u n o f f   H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m) Volume Ac.Ft   Q(CFS) 0   10.0   20.0   30.0   40.0

```
-----------------------------------------------------------------------
  0+ 5        0.0001      0.01  Q         |         |         |         |
  0+10        0.0003      0.03  Q         |         |         |         |
  0+15        0.0007      0.07  Q         |         |         |         |
  0+20        0.0016      0.13  Q         |         |         |         |
  0+25        0.0034      0.25  Q         |         |         |         |
  0+30        0.0061      0.40  Q         |         |         |         |
  0+35        0.0097      0.52  Q         |         |         |         |
  0+40        0.0140      0.61  Q         |         |         |         |
  0+45        0.0186      0.68  Q         |         |         |         |
  0+50        0.0236      0.73  Q         |         |         |         |
  0+55        0.0290      0.77  Q         |         |         |         |
  1+ 0        0.0345      0.81  Q         |         |         |         |
  1+ 5        0.0403      0.84  Q         |         |         |         |
  1+10        0.0463      0.87  Q         |         |         |         |
  1+15        0.0525      0.90  Q         |         |         |         |
  1+20        0.0588      0.92  Q         |         |         |         |
  1+25        0.0653      0.94  Q         |         |         |         |
  1+30        0.0719      0.96  Q         |         |         |         |
  1+35        0.0786      0.98  Q         |         |         |         |
  1+40        0.0855      0.99  Q         |         |         |         |
  1+45        0.0924      1.01  VQ        |         |         |         |
  1+50        0.0994      1.02  VQ        |         |         |         |
  1+55        0.1066      1.03  VQ        |         |         |         |
  2+ 0        0.1138      1.05  VQ        |         |         |         |
  2+ 5        0.1210      1.06  VQ        |         |         |         |
  2+10        0.1284      1.07  VQ        |         |         |         |
  2+15        0.1358      1.08  VQ        |         |         |         |
  2+20        0.1433      1.09  VQ        |         |         |         |
  2+25        0.1509      1.10  |Q        |         |         |         |
  2+30        0.1585      1.11  |Q        |         |         |         |
  2+35        0.1662      1.12  |Q        |         |         |         |
  2+40        0.1739      1.12  |Q        |         |         |         |
  2+45        0.1817      1.13  |Q        |         |         |         |
  2+50        0.1896      1.14  |Q        |         |         |         |
  2+55        0.1975      1.15  |Q        |         |         |         |
  3+ 0        0.2054      1.15  |Q        |         |         |         |
  3+ 5        0.2134      1.16  |Q        |         |         |         |
  3+10        0.2214      1.17  |Q        |         |         |         |
  3+15        0.2295      1.17  |Q        |         |         |         |
  3+20        0.2376      1.18  |Q        |         |         |         |
  3+25        0.2458      1.18  |Q        |         |         |         |
  3+30        0.2539      1.19  |Q        |         |         |         |
  3+35        0.2622      1.20  |Q        |         |         |         |
  3+40        0.2705      1.20  |Q        |         |         |         |
  3+45        0.2788      1.21  |Q        |         |         |         |
  3+50        0.2871      1.21  |Q        |         |         |         |
  3+55        0.2955      1.22  |QV       |         |         |         |
  4+ 0        0.3040      1.23  |QV       |         |         |         |
  4+ 5        0.3125      1.23  |QV       |         |         |         |
  4+10        0.3210      1.24  |QV       |         |         |         |
  4+15        0.3296      1.24  |QV       |         |         |         |
  4+20        0.3382      1.25  |QV       |         |         |         |
  4+25        0.3468      1.25  |QV       |         |         |         |
  4+30        0.3555      1.26  |QV       |         |         |         |
  4+35        0.3642      1.26  |QV       |         |         |         |
```

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  4+40       0.3729      1.27  |QV        |         |         |         |
  4+45       0.3817      1.27  |QV        |         |         |         |
  4+50       0.3905      1.28  |QV        |         |         |         |
  4+55       0.3993      1.28  |QV        |         |         |         |
  5+ 0       0.4082      1.29  |QV        |         |         |         |
  5+ 5       0.4171      1.29  |QV        |         |         |         |
  5+10       0.4260      1.30  |QV        |         |         |         |
  5+15       0.4350      1.30  |Q V       |         |         |         |
  5+20       0.4440      1.31  |Q V       |         |         |         |
  5+25       0.4531      1.31  |Q V       |         |         |         |
  5+30       0.4622      1.32  |Q V       |         |         |         |
  5+35       0.4713      1.33  |Q V       |         |         |         |
  5+40       0.4805      1.33  |Q V       |         |         |         |
  5+45       0.4897      1.34  |Q V       |         |         |         |
  5+50       0.4989      1.34  |Q V       |         |         |         |
  5+55       0.5082      1.35  |Q V       |         |         |         |
  6+ 0       0.5175      1.35  |Q V       |         |         |         |
  6+ 5       0.5269      1.36  |Q V       |         |         |         |
  6+10       0.5363      1.37  |Q V       |         |         |         |
  6+15       0.5457      1.37  |Q V       |         |         |         |
  6+20       0.5552      1.38  |Q V       |         |         |         |
  6+25       0.5647      1.38  |Q V       |         |         |         |
  6+30       0.5743      1.39  |Q V       |         |         |         |
  6+35       0.5839      1.40  |Q  V      |         |         |         |
  6+40       0.5936      1.40  |Q  V      |         |         |         |
  6+45       0.6033      1.41  |Q  V      |         |         |         |
  6+50       0.6130      1.42  |Q  V      |         |         |         |
  6+55       0.6228      1.42  |Q  V      |         |         |         |
  7+ 0       0.6327      1.43  |Q  V      |         |         |         |
  7+ 5       0.6425      1.44  |Q  V      |         |         |         |
  7+10       0.6525      1.44  |Q  V      |         |         |         |
  7+15       0.6625      1.45  |Q  V      |         |         |         |
  7+20       0.6725      1.46  |Q  V      |         |         |         |
  7+25       0.6826      1.46  |Q  V      |         |         |         |
  7+30       0.6927      1.47  |Q  V      |         |         |         |
  7+35       0.7029      1.48  |Q  V      |         |         |         |
  7+40       0.7131      1.49  |Q  V      |         |         |         |
  7+45       0.7234      1.49  |Q   V     |         |         |         |
  7+50       0.7338      1.50  |Q   V     |         |         |         |
  7+55       0.7441      1.51  |Q   V     |         |         |         |
  8+ 0       0.7546      1.52  |Q   V     |         |         |         |
  8+ 5       0.7651      1.53  |Q   V     |         |         |         |
  8+10       0.7757      1.53  |Q   V     |         |         |         |
  8+15       0.7863      1.54  |Q   V     |         |         |         |
  8+20       0.7969      1.55  |Q   V     |         |         |         |
  8+25       0.8077      1.56  |Q   V     |         |         |         |
  8+30       0.8185      1.57  |Q   V     |         |         |         |
  8+35       0.8293      1.58  |Q   V     |         |         |         |
  8+40       0.8403      1.59  |Q   V     |         |         |         |
  8+45       0.8512      1.59  |Q   V     |         |         |         |
  8+50       0.8623      1.60  |Q   V     |         |         |         |
  8+55       0.8734      1.61  |Q    V    |         |         |         |
  9+ 0       0.8846      1.62  |Q    V    |         |         |         |
  9+ 5       0.8958      1.63  |Q    V    |         |         |         |
  9+10       0.9071      1.64  |Q    V    |         |         |         |
  9+15       0.9185      1.65  |Q    V    |         |         |         |
```

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 9+20       0.9299      1.66  |Q    V   |         |         |         |
 9+25       0.9415      1.67  |Q    V   |         |         |         |
 9+30       0.9531      1.68  |Q    V   |         |         |         |
 9+35       0.9647      1.69  |Q    V   |         |         |         |
 9+40       0.9765      1.71  |Q    V   |         |         |         |
 9+45       0.9883      1.72  |Q    V   |         |         |         |
 9+50       1.0002      1.73  |Q    V   |         |         |         |
 9+55       1.0122      1.74  |Q    V   |         |         |         |
10+ 0       1.0243      1.75  |Q     V  |         |         |         |
10+ 5       1.0364      1.76  |Q     V  |         |         |         |
10+10       1.0486      1.78  |Q     V  |         |         |         |
10+15       1.0610      1.79  |Q     V  |         |         |         |
10+20       1.0734      1.80  |Q     V  |         |         |         |
10+25       1.0859      1.81  |Q     V  |         |         |         |
10+30       1.0985      1.83  |Q     V  |         |         |         |
10+35       1.1111      1.84  |Q     V  |         |         |         |
10+40       1.1239      1.86  |Q     V  |         |         |         |
10+45       1.1368      1.87  |Q     V  |         |         |         |
10+50       1.1498      1.88  |Q     V  |         |         |         |
10+55       1.1629      1.90  |Q      V |         |         |         |
11+ 0       1.1760      1.91  |Q      V |         |         |         |
11+ 5       1.1893      1.93  |Q      V |         |         |         |
11+10       1.2027      1.95  |Q      V |         |         |         |
11+15       1.2163      1.96  |Q      V |         |         |         |
11+20       1.2299      1.98  |Q      V |         |         |         |
11+25       1.2436      2.00  |Q      V |         |         |         |
11+30       1.2575      2.01  | Q     V |         |         |         |
11+35       1.2715      2.03  | Q     V |         |         |         |
11+40       1.2856      2.05  | Q     V |         |         |         |
11+45       1.2999      2.07  | Q     V |         |         |         |
11+50       1.3143      2.09  | Q      V|         |         |         |
11+55       1.3288      2.11  | Q      V|         |         |         |
12+ 0       1.3434      2.13  | Q      V|         |         |         |
12+ 5       1.3582      2.15  | Q      V|         |         |         |
12+10       1.3732      2.17  | Q      V|         |         |         |
12+15       1.3882      2.18  | Q      V|         |         |         |
12+20       1.4033      2.19  | Q      V|         |         |         |
12+25       1.4184      2.19  | Q      V|         |         |         |
12+30       1.4334      2.18  | Q      V|         |         |         |
12+35       1.4485      2.19  | Q       V         |         |         |
12+40       1.4636      2.19  | Q       V         |         |         |
12+45       1.4788      2.21  | Q       V         |         |         |
12+50       1.4941      2.23  | Q       V         |         |         |
12+55       1.5096      2.25  | Q       V         |         |         |
13+ 0       1.5252      2.27  | Q       V         |         |         |
13+ 5       1.5410      2.29  | Q       V         |         |         |
13+10       1.5569      2.32  | Q       V         |         |         |
13+15       1.5731      2.35  | Q       V         |         |         |
13+20       1.5894      2.38  | Q       V         |         |         |
13+25       1.6060      2.41  | Q       |V        |         |         |
13+30       1.6228      2.44  | Q       |V        |         |         |
13+35       1.6399      2.48  | Q       |V        |         |         |
13+40       1.6572      2.51  | Q       |V        |         |         |
13+45       1.6747      2.55  | Q       |V        |         |         |
13+50       1.6926      2.59  | Q       |V        |         |         |
13+55       1.7108      2.64  | Q       |V        |         |         |
```

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14+ 0       1.7292      2.68  | Q       |V        |         |         |
14+ 5       1.7480      2.73  | Q       | V       |         |         |
14+10       1.7672      2.78  | Q       | V       |         |         |
14+15       1.7868      2.84  | Q       | V       |         |         |
14+20       1.8067      2.90  | Q       | V       |         |         |
14+25       1.8271      2.96  | Q       | V       |         |         |
14+30       1.8480      3.03  |  Q      | V       |         |         |
14+35       1.8694      3.10  |  Q      | V       |         |         |
14+40       1.8913      3.18  |  Q      |  V      |         |         |
14+45       1.9137      3.26  |  Q      |  V      |         |         |
14+50       1.9368      3.35  |  Q      |  V      |         |         |
14+55       1.9605      3.44  |  Q      |  V      |         |         |
15+ 0       1.9849      3.55  |  Q      |  V      |         |         |
15+ 5       2.0101      3.66  |  Q      |  V      |         |         |
15+10       2.0361      3.78  |  Q      |   V     |         |         |
15+15       2.0631      3.91  |  Q      |   V     |         |         |
15+20       2.0911      4.06  |   Q     |   V     |         |         |
15+25       2.1201      4.22  |   Q     |   V     |         |         |
15+30       2.1502      4.37  |   Q     |   V     |         |         |
15+35       2.1815      4.53  |   Q     |    V    |         |         |
15+40       2.2137      4.69  |   Q     |    V    |         |         |
15+45       2.2468      4.80  |   Q     |    V    |         |         |
15+50       2.2807      4.92  |   Q     |    V    |         |         |
15+55       2.3165      5.20  |    Q    |     V   |         |         |
16+ 0       2.3562      5.77  |    Q    |     V   |         |         |
16+ 5       2.4108      7.93  |      Q  |     V   |         |         |
16+10       2.4917     11.75  |         |Q     V  |         |         |
16+15       2.6004     15.78  |         |    Q V  |         |         |
16+20       2.7493     21.63  |         |        V|Q        |         |
16+25       2.9735     32.56  |         |         V         | Q       |
16+30       3.2334     37.74  |         |         | V       |      Q  |
16+35       3.4447     30.68  |         |         |  V      Q         |
16+40       3.6129     24.42  |         |         |   Q     |         |
16+45       3.7469     19.46  |         |        Q|    V    |         |
16+50       3.8593     16.32  |         |     Q   |     V   |         |
16+55       3.9584     14.39  |         |   Q     |      V  |         |
17+ 0       4.0469     12.84  |         | Q       |      V  |         |
17+ 5       4.1257     11.45  |         |Q        |       V |         |
17+10       4.1983     10.54  |         Q         |        V|         |
17+15       4.2630      9.40  |        Q|         |        V|         |
17+20       4.3232      8.75  |       Q |         |        V|         |
17+25       4.3786      8.05  |       Q |         |         V         |
17+30       4.4309      7.59  |      Q  |         |         V         |
17+35       4.4804      7.19  |      Q  |         |         V         |
17+40       4.5261      6.63  |     Q   |         |         |V        |
17+45       4.5687      6.19  |     Q   |         |         |V        |
17+50       4.6075      5.63  |    Q    |         |         |V        |
17+55       4.6447      5.40  |    Q    |         |         | V       |
18+ 0       4.6804      5.19  |    Q    |         |         | V       |
18+ 5       4.7141      4.89  |   Q     |         |         | V       |
18+10       4.7465      4.70  |   Q     |         |         | V       |
18+15       4.7775      4.50  |   Q     |         |         |  V      |
18+20       4.8068      4.25  |   Q     |         |         |  V      |
18+25       4.8345      4.03  |   Q     |         |         |  V      |
18+30       4.8618      3.96  |  Q      |         |         |  V      |
18+35       4.8883      3.84  |  Q      |         |         |  V      |
```

18+40	4.9131	3.61	Q			V
18+45	4.9374	3.52	Q			V
18+50	4.9611	3.43	Q			V
18+55	4.9831	3.21	Q			V
19+ 0	5.0043	3.08	Q			V
19+ 5	5.0250	3.01	Q			V
19+10	5.0447	2.85	Q			V
19+15	5.0630	2.66	Q			V
19+20	5.0810	2.61	Q			V
19+25	5.0987	2.58	Q			V
19+30	5.1165	2.58	Q			V
19+35	5.1341	2.55	Q			V
19+40	5.1514	2.51	Q			V
19+45	5.1685	2.47	Q			V
19+50	5.1852	2.44	Q			V
19+55	5.2017	2.39	Q			V
20+ 0	5.2175	2.29	Q			V
20+ 5	5.2322	2.14	Q			V
20+10	5.2467	2.10	Q			V
20+15	5.2609	2.06	Q			V
20+20	5.2748	2.02	Q			V
20+25	5.2878	1.89	Q			V
20+30	5.2999	1.76	Q			V
20+35	5.3119	1.73	Q			V
20+40	5.3236	1.71	Q			V
20+45	5.3352	1.68	Q			V
20+50	5.3467	1.66	Q			V
20+55	5.3579	1.64	Q			V
21+ 0	5.3691	1.62	Q			V
21+ 5	5.3801	1.60	Q			V
21+10	5.3910	1.58	Q			V
21+15	5.4017	1.56	Q			V
21+20	5.4123	1.54	Q			V
21+25	5.4228	1.52	Q			V
21+30	5.4332	1.51	Q			V
21+35	5.4435	1.49	Q			V
21+40	5.4536	1.48	Q			V
21+45	5.4637	1.46	Q			V
21+50	5.4737	1.45	Q			V
21+55	5.4836	1.43	Q			V
22+ 0	5.4933	1.42	Q			V
22+ 5	5.5030	1.41	Q			V
22+10	5.5126	1.39	Q			V
22+15	5.5221	1.38	Q			V
22+20	5.5315	1.37	Q			V
22+25	5.5409	1.36	Q			V
22+30	5.5501	1.34	Q			V
22+35	5.5593	1.33	Q			V
22+40	5.5684	1.32	Q			V
22+45	5.5774	1.31	Q			V
22+50	5.5864	1.30	Q			V
22+55	5.5953	1.29	Q			V
23+ 0	5.6041	1.28	Q			V
23+ 5	5.6128	1.27	Q			V
23+10	5.6215	1.26	Q			V
23+15	5.6301	1.25	Q			V

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    23+20        5.6387       1.24   |Q         |         |         |      V |
    23+25        5.6471       1.23   |Q         |         |         |       V|
    23+30        5.6556       1.22   |Q         |         |         |       V|
    23+35        5.6639       1.21   |Q         |         |         |       V|
    23+40        5.6722       1.20   |Q         |         |         |       V|
    23+45        5.6804       1.20   |Q         |         |         |       V|
    23+50        5.6886       1.19   |Q         |         |         |       V|
    23+55        5.6968       1.18   |Q         |         |         |       V|
    24+ 0        5.7048       1.17   |Q         |         |         |       V|
-----------------------------------------------------------------------
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                    San Bernardino County Rational Hydrology Program

                        (Hydrology Manual Date - August 1986)

  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
         Rational Hydrology Study        Date: 10/26/22
------------------------------------------------------------------------
MOJAVE 68
A22221 10 YEAR PROPOSED
SUBAREA A


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Program License Serial Number 6509

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.619 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      11.000 to Point/Station      12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Initial subarea data:
Initial area flow distance =   380.000(Ft.)
Top (of initial area) elevation =  3017.500(Ft.)
Bottom (of initial area) elevation =  3005.900(Ft.)
Difference in elevation =    11.600(Ft.)
Slope =    0.03053  s(%)=       3.05
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.574 min.
Rainfall intensity =      2.910(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =      3.284(CFS)
Total initial stream area =        1.290(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.081(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station      13.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  3002.900(Ft.)
Downstream point/station elevation =  2997.800(Ft.)
Pipe length  =   730.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.284(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.284(CFS)
Normal flow depth in pipe =    8.45(In.)
Flow top width inside pipe =   14.88(In.)
Critical Depth =    8.75(In.)
Pipe flow velocity =      4.61(Ft/s)
Travel time through pipe =    2.64 min.
Time of concentration (TC) =     9.21 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station      13.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Time of concentration =     9.21 min.
Rainfall intensity =      2.298(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.868
Subarea runoff =     21.776(CFS) for   11.270(Ac.)
Total runoff =     25.060(CFS)
Effective area this stream =       12.56(Ac.)
Total Study Area (Main Stream No. 1) =       12.56(Ac.)
Area averaged Fm value =    0.081(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station      14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2997.800(Ft.)
Downstream point/station elevation =  2992.700(Ft.)
Pipe length  =   730.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    25.060(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    25.060(CFS)
Normal flow depth in pipe =   21.38(In.)
Flow top width inside pipe =   21.93(In.)
```

```
Critical Depth =   20.99(In.)
Pipe flow velocity =      7.42(Ft/s)
Travel time through pipe =    1.64 min.
Time of concentration (TC) =    10.85 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station      14.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Time of concentration =    10.85 min.
Rainfall intensity =      2.049(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.864
Subarea runoff =     16.666(CFS) for   11.000(Ac.)
Total runoff =     41.727(CFS)
Effective area this stream =       23.56(Ac.)
Total Study Area (Main Stream No. 1) =       23.56(Ac.)
Area averaged Fm value =    0.081(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station      15.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2992.700(Ft.)
Downstream point/station elevation =  2984.500(Ft.)
Pipe length  =  1160.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    41.727(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    41.727(CFS)
Normal flow depth in pipe =   25.41(In.)
Flow top width inside pipe =   27.78(In.)
Critical Depth =   25.76(In.)
Pipe flow velocity =      8.51(Ft/s)
Travel time through pipe =    2.27 min.
Time of concentration (TC) =    13.12 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station      15.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
```

```
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Time of concentration =    13.12 min.
Rainfall intensity =      1.794(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.859
Subarea runoff =      1.524(CFS) for    4.500(Ac.)
Total runoff =     43.250(CFS)
Effective area this stream =       28.06(Ac.)
Total Study Area (Main Stream No. 1) =       28.06(Ac.)
Area averaged Fm value =    0.081(In/Hr)
End of computations, Total Study Area =           28.06 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  69.0
```

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                  San Bernardino County Rational Hydrology Program

                     (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
        Rational Hydrology Study        Date: 10/26/22
------------------------------------------------------------------------
MOJAVE 68
A22221 10 YEAR PROPOSED
SUBAREA B


------------------------------------------------------------------------


Program License Serial Number 6509

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.619 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Initial subarea data:
Initial area flow distance =   195.000(Ft.)
Top (of initial area) elevation =  3012.300(Ft.)
Bottom (of initial area) elevation =  3009.300(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.01538  s(%)=       1.54
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.774 min.
Rainfall intensity =      3.187(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =      1.202(CFS)
Total initial stream area =        0.430(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.081(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  3006.300(Ft.)
Downstream point/station elevation =  3001.400(Ft.)
Pipe length  =   700.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.202(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.202(CFS)
Normal flow depth in pipe =    6.48(In.)
Flow top width inside pipe =    8.08(In.)
Critical Depth =    6.05(In.)
Pipe flow velocity =      3.53(Ft/s)
Travel time through pipe =    3.31 min.
Time of concentration (TC) =     9.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Time of concentration =     9.08 min.
Rainfall intensity =      2.321(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.869
Subarea runoff =      6.741(CFS) for    3.510(Ac.)
Total runoff =      7.943(CFS)
Effective area this stream =        3.94(Ac.)
Total Study Area (Main Stream No. 1) =        3.94(Ac.)
Area averaged Fm value =    0.081(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  3001.400(Ft.)
Downstream point/station elevation =  2995.200(Ft.)
Pipe length  =   890.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.943(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.943(CFS)
Normal flow depth in pipe =   13.43(In.)
Flow top width inside pipe =   15.67(In.)
```

```
Critical Depth =   13.09(In.)
Pipe flow velocity =      5.62(Ft/s)
Travel time through pipe =    2.64 min.
Time of concentration (TC) =    11.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       24.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Time of concentration =    11.72 min.
Rainfall intensity =      1.942(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.862
Subarea runoff =     20.118(CFS) for   12.820(Ac.)
Total runoff =     28.061(CFS)
Effective area this stream =       16.76(Ac.)
Total Study Area (Main Stream No. 1) =       16.76(Ac.)
Area averaged Fm value =    0.081(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       25.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2995.200(Ft.)
Downstream point/station elevation =  2988.800(Ft.)
Pipe length   =   915.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    28.061(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    28.061(CFS)
Normal flow depth in pipe =   20.63(In.)
Flow top width inside pipe =   27.81(In.)
Critical Depth =   21.68(In.)
Pipe flow velocity =      7.79(Ft/s)
Travel time through pipe =    1.96 min.
Time of concentration (TC) =    13.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       25.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
```

```
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Time of concentration =    13.68 min.
Rainfall intensity =      1.743(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.858
Subarea runoff =     15.243(CFS) for   12.200(Ac.)
Total runoff =     43.304(CFS)
Effective area this stream =       28.96(Ac.)
Total Study Area (Main Stream No. 1) =       28.96(Ac.)
Area averaged Fm value =    0.081(In/Hr)
End of computations, Total Study Area =           28.96 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  69.0
```

```
               San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2019 Version 9.1
        Rational Hydrology Study        Date: 10/26/22
------------------------------------------------------------------------
MOJAVE 68
A22221 10 YEAR PROPOSED
SUBAREA C


------------------------------------------------------------------------


Program License Serial Number 6509

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.619 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       31.000 to Point/Station      32.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 1 = 49.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.081(In/Hr)
Initial subarea data:
Initial area flow distance =   370.000(Ft.)
Top (of initial area) elevation =  3006.500(Ft.)
Bottom (of initial area) elevation =  2994.400(Ft.)
Difference in elevation =    12.100(Ft.)
Slope =    0.03270  s(%)=       3.27
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.416 min.
Rainfall intensity =      2.960(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =     12.334(CFS)
Total initial stream area =        4.760(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.081(In/Hr)
```

```
End of computations, Total Study Area =            4.76 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  69.0
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 01/05/23

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6509

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
63.66	1	0.62
Rainfall data for year 10		
63.66	6	1.27
Rainfall data for year 10		
63.66	24	2.34

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
82.8	82.8	63.66	1.000	0.322	0.150	0.048

Area-averaged adjusted loss rate Fm (In/Hr) = 0.048

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
9.55	0.150	82.8	82.8	2.08	0.396
54.11	0.850	98.0	98.0	0.20	0.902

Area-averaged catchment yield fraction, Y = 0.826
Area-averaged low loss fraction, Yb = 0.174
User entry of time of concentration = 0.219 (hours)
++
Watershed area = 63.66(Ac.)
Catchment Lag time = 0.175 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 47.5647
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.048(In/Hr)
Average low loss rate fraction (Yb) = 0.174 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.294(In)
Computed peak 30-minute rainfall = 0.503(In)
Specified peak 1-hour rainfall = 0.619(In)
Computed peak 3-hour rainfall = 0.962(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.340(In)

Rainfall depth area reduction factors:
Using a total area of 63.66(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997 Adjusted rainfall = 0.293(In)
30-minute factor = 0.997 Adjusted rainfall = 0.501(In)
1-hour factor = 0.997 Adjusted rainfall = 0.617(In)
3-hour factor = 1.000 Adjusted rainfall = 0.961(In)
6-hour factor = 1.000 Adjusted rainfall = 1.270(In)
24-hour factor = 1.000 Adjusted rainfall = 2.340(In)

U n i t H y d r o g r a p h
+++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

```
                    (K =       769.89 (CFS))

          1                3.649                  28.091
          2               27.631                 184.637
          3               58.250                 235.734
          4               72.057                 106.300
          5               80.076                  61.734
          6               85.377                  40.814
          7               89.203                  29.451
          8               91.898                  20.748
          9               94.006                  16.235
         10               95.608                  12.332
         11               96.840                   9.483
         12               97.710                   6.696
         13               98.253                   4.181
         14               98.805                   4.256
         15               99.365                   4.310
         16               99.733                   2.830
         17              100.000                   2.057
         ---------------------------------------------------------------------
         --------------------------------------------------------------------
         --------------------------------------------------------------------
         Total soil rain loss =      0.34(In)
         Total effective rainfall =      2.00(In)
         Peak flow rate in flood hydrograph =     87.11(CFS)
         ---------------------------------------------------------------------
         ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                              24 - H O U R   S T O R M
                         R u n o f f     H y d r o g r a p h
         --------------------------------------------------------------------
                      Hydrograph in   5   Minute intervals ((CFS))

         --------------------------------------------------------------------
   Time(h+m) Volume Ac.Ft   Q(CFS)  0       22.5      45.0      67.5      90.0
   -----------------------------------------------------------------------
     0+ 5       0.0006      0.08  Q         |         |         |         |
     0+10       0.0049      0.63  Q         |         |         |         |
     0+15       0.0141      1.33  Q         |         |         |         |
     0+20       0.0254      1.65  Q         |         |         |         |
     0+25       0.0381      1.84  Q         |         |         |         |
     0+30       0.0516      1.96  Q         |         |         |         |
     0+35       0.0658      2.06  Q         |         |         |         |
     0+40       0.0804      2.12  Q         |         |         |         |
     0+45       0.0954      2.18  Q         |         |         |         |
     0+50       0.1107      2.22  Q         |         |         |         |
     0+55       0.1262      2.26  VQ        |         |         |         |
     1+ 0       0.1420      2.28  VQ        |         |         |         |
     1+ 5       0.1578      2.30  VQ        |         |         |         |
     1+10       0.1738      2.32  VQ        |         |         |         |
     1+15       0.1899      2.34  VQ        |         |         |         |
     1+20       0.2062      2.36  VQ        |         |         |         |
     1+25       0.2225      2.37  VQ        |         |         |         |
     1+30       0.2389      2.38  VQ        |         |         |         |
```

1+35	0.2553	2.39	VQ
1+40	0.2718	2.39	Q
1+45	0.2883	2.40	Q
1+50	0.3049	2.41	Q
1+55	0.3216	2.42	Q
2+ 0	0.3383	2.42	Q
2+ 5	0.3550	2.43	Q
2+10	0.3718	2.44	Q
2+15	0.3887	2.45	Q
2+20	0.4056	2.46	Q
2+25	0.4226	2.46	Q
2+30	0.4396	2.47	Q
2+35	0.4567	2.48	Q
2+40	0.4738	2.49	Q
2+45	0.4910	2.50	Q
2+50	0.5083	2.51	Q
2+55	0.5256	2.52	Q
3+ 0	0.5430	2.52	QV
3+ 5	0.5605	2.53	QV
3+10	0.5780	2.54	QV
3+15	0.5956	2.55	QV
3+20	0.6132	2.56	QV
3+25	0.6309	2.57	QV
3+30	0.6487	2.58	QV
3+35	0.6665	2.59	QV
3+40	0.6844	2.60	QV
3+45	0.7023	2.61	QV
3+50	0.7204	2.62	QV
3+55	0.7384	2.63	QV
4+ 0	0.7566	2.64	QV
4+ 5	0.7748	2.65	QV
4+10	0.7931	2.66	QV
4+15	0.8115	2.67	Q V
4+20	0.8300	2.68	Q V
4+25	0.8485	2.69	Q V
4+30	0.8671	2.70	Q V
4+35	0.8857	2.71	Q V
4+40	0.9045	2.72	Q V
4+45	0.9233	2.73	Q V
4+50	0.9422	2.74	Q V
4+55	0.9611	2.75	Q V
5+ 0	0.9802	2.76	Q V
5+ 5	0.9993	2.78	Q V
5+10	1.0185	2.79	Q V
5+15	1.0378	2.80	Q V
5+20	1.0571	2.81	Q V
5+25	1.0766	2.82	Q V
5+30	1.0961	2.84	Q V
5+35	1.1157	2.85	Q V
5+40	1.1354	2.86	Q V
5+45	1.1552	2.87	Q V
5+50	1.1751	2.89	Q V
5+55	1.1950	2.90	Q V

6+ 0	1.2151	2.91	Q V			
6+ 5	1.2352	2.92	Q V			
6+10	1.2555	2.94	Q V			
6+15	1.2758	2.95	Q V			
6+20	1.2962	2.97	Q V			
6+25	1.3167	2.98	Q V			
6+30	1.3373	2.99	Q V			
6+35	1.3581	3.01	Q V			
6+40	1.3789	3.02	Q V			
6+45	1.3998	3.04	Q V			
6+50	1.4208	3.05	Q V			
6+55	1.4419	3.07	Q V			
7+ 0	1.4632	3.08	Q V			
7+ 5	1.4845	3.10	Q V			
7+10	1.5059	3.11	Q V			
7+15	1.5275	3.13	Q V			
7+20	1.5492	3.15	Q V			
7+25	1.5709	3.16	Q V			
7+30	1.5928	3.18	Q V			
7+35	1.6148	3.20	Q V			
7+40	1.6370	3.21	Q V			
7+45	1.6592	3.23	Q V			
7+50	1.6816	3.25	Q V			
7+55	1.7041	3.27	Q V			
8+ 0	1.7267	3.28	Q V			
8+ 5	1.7494	3.30	Q V			
8+10	1.7723	3.32	Q V			
8+15	1.7953	3.34	Q V			
8+20	1.8185	3.36	Q V			
8+25	1.8417	3.38	Q V			
8+30	1.8652	3.40	Q V			
8+35	1.8887	3.42	Q V			
8+40	1.9124	3.44	Q V			
8+45	1.9363	3.46	Q V			
8+50	1.9603	3.48	Q V			
8+55	1.9844	3.51	Q V			
9+ 0	2.0087	3.53	Q V			
9+ 5	2.0331	3.55	Q V			
9+10	2.0578	3.57	Q V			
9+15	2.0825	3.60	Q V			
9+20	2.1075	3.62	Q V			
9+25	2.1326	3.65	Q V			
9+30	2.1579	3.67	Q V			
9+35	2.1833	3.70	Q V			
9+40	2.2089	3.72	Q V			
9+45	2.2348	3.75	Q V			
9+50	2.2607	3.77	Q V			
9+55	2.2869	3.80	Q V			
10+ 0	2.3133	3.83	Q V			
10+ 5	2.3399	3.86	Q V			
10+10	2.3667	3.89	Q V			
10+15	2.3936	3.92	Q V			
10+20	2.4208	3.95	Q V			

```
10+25       2.4482      3.98  |Q       V|         |         |         |
10+30       2.4759      4.01  |Q       V|         |         |         |
10+35       2.5037      4.04  |Q       V|         |         |         |
10+40       2.5318      4.08  |Q       V|         |         |         |
10+45       2.5601      4.11  |Q       V|         |         |         |
10+50       2.5886      4.15  |Q       V|         |         |         |
10+55       2.6174      4.18  |Q       V|         |         |         |
11+ 0       2.6465      4.22  |Q       V|         |         |         |
11+ 5       2.6758      4.25  |Q        V         |         |         |
11+10       2.7053      4.29  |Q        V         |         |         |
11+15       2.7352      4.33  |Q        V         |         |         |
11+20       2.7653      4.37  |Q        V         |         |         |
11+25       2.7957      4.41  |Q        V         |         |         |
11+30       2.8264      4.46  |Q        V         |         |         |
11+35       2.8574      4.50  | Q       V         |         |         |
11+40       2.8887      4.55  | Q       V         |         |         |
11+45       2.9203      4.59  | Q       |V        |         |         |
11+50       2.9523      4.64  | Q       |V        |         |         |
11+55       2.9846      4.69  | Q       |V        |         |         |
12+ 0       3.0172      4.74  | Q       |V        |         |         |
12+ 5       3.0501      4.77  | Q       |V        |         |         |
12+10       3.0826      4.72  | Q       |V        |         |         |
12+15       3.1146      4.64  | Q       |V        |         |         |
12+20       3.1465      4.64  | Q       |V        |         |         |
12+25       3.1786      4.66  | Q       | V       |         |         |
12+30       3.2109      4.69  | Q       | V       |         |         |
12+35       3.2435      4.74  | Q       | V       |         |         |
12+40       3.2765      4.79  | Q       | V       |         |         |
12+45       3.3099      4.85  | Q       | V       |         |         |
12+50       3.3437      4.91  | Q       | V       |         |         |
12+55       3.3780      4.98  | Q       | V       |         |         |
13+ 0       3.4128      5.05  | Q       | V       |         |         |
13+ 5       3.4481      5.12  | Q       |  V      |         |         |
13+10       3.4839      5.20  | Q       |  V      |         |         |
13+15       3.5202      5.28  | Q       |  V      |         |         |
13+20       3.5572      5.37  | Q       |  V      |         |         |
13+25       3.5948      5.46  | Q       |  V      |         |         |
13+30       3.6331      5.56  | Q       |  V      |         |         |
13+35       3.6721      5.66  | Q       |  V      |         |         |
13+40       3.7118      5.76  | Q       |   V     |         |         |
13+45       3.7522      5.88  | Q       |   V     |         |         |
13+50       3.7935      5.99  | Q       |   V     |         |         |
13+55       3.8357      6.12  | Q       |   V     |         |         |
14+ 0       3.8787      6.25  | Q       |   V     |         |         |
14+ 5       3.9227      6.39  | Q       |   V     |         |         |
14+10       3.9678      6.55  | Q       |   V     |         |         |
14+15       4.0141      6.72  | Q       |    V    |         |         |
14+20       4.0616      6.89  |  Q      |    V    |         |         |
14+25       4.1103      7.08  |  Q      |    V    |         |         |
14+30       4.1604      7.27  |  Q      |    V    |         |         |
14+35       4.2119      7.48  |  Q      |    V    |         |         |
14+40       4.2650      7.71  |  Q      |     V   |         |         |
14+45       4.3198      7.96  |  Q      |     V   |         |         |
```

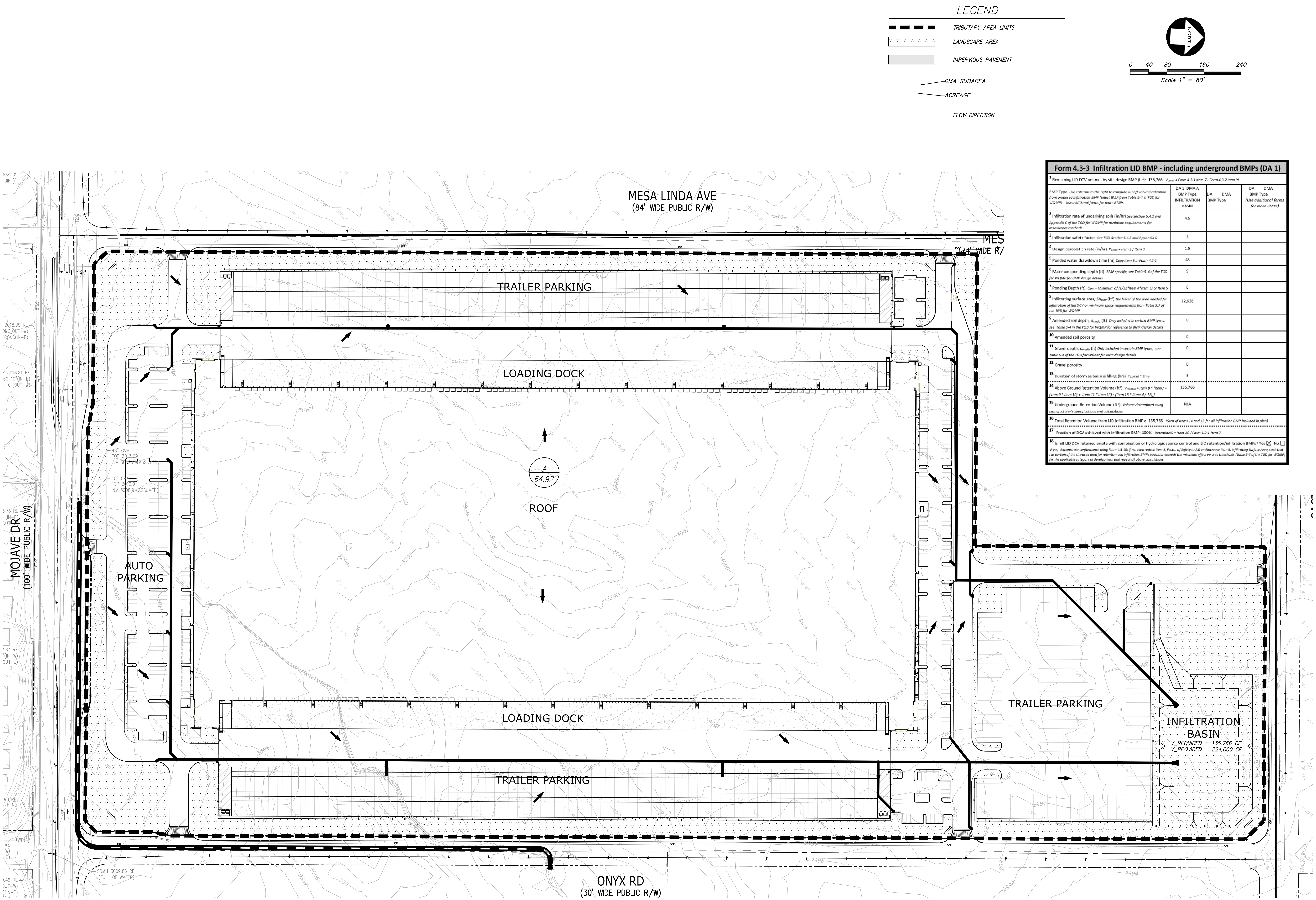
```
14+50       4.3765      8.23  |  Q      |     V   |         |         |
14+55       4.4352      8.52  |  Q      |     V   |         |         |
15+ 0       4.4961      8.85  |  Q      |     V   |         |         |
15+ 5       4.5596      9.21  |   Q     |      V  |         |         |
15+10       4.6258      9.62  |   Q     |      V  |         |         |
15+15       4.6952     10.08  |   Q     |      V  |         |         |
15+20       4.7682     10.60  |   Q     |       V |         |         |
15+25       4.8445     11.08  |   Q     |       V |         |         |
15+30       4.9201     10.97  |   Q     |       V |         |         |
15+35       4.9940     10.74  |   Q     |       V |         |         |
15+40       5.0715     11.24  |   Q     |        V|         |         |
15+45       5.1555     12.21  |    Q    |        V|         |         |
15+50       5.2508     13.83  |     Q   |        V|         |         |
15+55       5.3644     16.49  |      Q  |         V         |         |
16+ 0       5.5138     21.69  |        Q|         V         |         |
16+ 5       5.7653     36.52  |         |     Q   |V        |         |
16+10       6.3031     78.09  |         |         | V       |   Q     |
16+15       6.9031     87.11  |         |         |    V    |       Q |
16+20       7.2499     50.36  |         |         | Q    V  |         |
16+25       7.4889     34.69  |         |    Q    |       V |         |
16+30       7.6745     26.95  |         |Q        |       V |         |
16+35       7.8303     22.63  |         Q         |        V|         |
16+40       7.9609     18.96  |       Q |         |         V         |
16+45       8.0746     16.51  |      Q  |         |         V         |
16+50       8.1738     14.41  |     Q   |         |         V         |
16+55       8.2614     12.72  |    Q    |         |         |V        |
17+ 0       8.3385     11.20  |   Q     |         |         |V        |
17+ 5       8.4069      9.92  |   Q     |         |         |V        |
17+10       8.4714      9.36  |   Q     |         |         | V       |
17+15       8.5322      8.84  |  Q      |         |         | V       |
17+20       8.5871      7.97  |  Q      |         |         | V       |
17+25       8.6374      7.30  |  Q      |         |         | V       |
17+30       8.6816      6.42  | Q       |         |         | V       |
17+35       8.7237      6.12  | Q       |         |         | V       |
17+40       8.7641      5.86  | Q       |         |         |  V      |
17+45       8.8030      5.64  | Q       |         |         |  V      |
17+50       8.8404      5.43  | Q       |         |         |  V      |
17+55       8.8765      5.25  | Q       |         |         |  V      |
18+ 0       8.9115      5.08  | Q       |         |         |  V      |
18+ 5       8.9456      4.94  | Q       |         |         |  V      |
18+10       8.9794      4.91  | Q       |         |         |  V      |
18+15       9.0132      4.91  | Q       |         |         |   V     |
18+20       9.0466      4.85  | Q       |         |         |   V     |
18+25       9.0795      4.77  | Q       |         |         |   V     |
18+30       9.1118      4.69  | Q       |         |         |   V     |
18+35       9.1435      4.60  | Q       |         |         |   V     |
18+40       9.1747      4.52  | Q       |         |         |   V     |
18+45       9.2052      4.44  |Q        |         |         |   V     |
18+50       9.2353      4.36  |Q        |         |         |   V     |
18+55       9.2648      4.29  |Q        |         |         |    V    |
19+ 0       9.2938      4.21  |Q        |         |         |    V    |
19+ 5       9.3224      4.14  |Q        |         |         |    V    |
19+10       9.3505      4.08  |Q        |         |         |    V    |
```

19+15	9.3781	4.01	Q			V
19+20	9.4053	3.95	Q			V
19+25	9.4321	3.89	Q			V
19+30	9.4585	3.83	Q			V
19+35	9.4845	3.78	Q			V
19+40	9.5102	3.72	Q			V
19+45	9.5355	3.67	Q			V
19+50	9.5604	3.62	Q			V
19+55	9.5851	3.58	Q			V
20+ 0	9.6094	3.53	Q			V
20+ 5	9.6334	3.49	Q			V
20+10	9.6571	3.44	Q			V
20+15	9.6805	3.40	Q			V
20+20	9.7037	3.36	Q			V
20+25	9.7265	3.32	Q			V
20+30	9.7492	3.29	Q			V
20+35	9.7715	3.25	Q			V
20+40	9.7937	3.21	Q			V
20+45	9.8156	3.18	Q			V
20+50	9.8372	3.15	Q			V
20+55	9.8587	3.11	Q			V
21+ 0	9.8799	3.08	Q			V
21+ 5	9.9009	3.05	Q			V
21+10	9.9218	3.02	Q			V
21+15	9.9424	2.99	Q			V
21+20	9.9628	2.97	Q			V
21+25	9.9830	2.94	Q			V
21+30	10.0031	2.91	Q			V
21+35	10.0230	2.89	Q			V
21+40	10.0427	2.86	Q			V
21+45	10.0622	2.84	Q			V
21+50	10.0816	2.81	Q			V
21+55	10.1008	2.79	Q			V
22+ 0	10.1198	2.76	Q			V
22+ 5	10.1387	2.74	Q			V
22+10	10.1574	2.72	Q			V
22+15	10.1760	2.70	Q			V
22+20	10.1944	2.68	Q			V
22+25	10.2127	2.66	Q			V
22+30	10.2309	2.64	Q			V
22+35	10.2489	2.62	Q			V
22+40	10.2668	2.60	Q			V
22+45	10.2846	2.58	Q			V
22+50	10.3022	2.56	Q			V
22+55	10.3197	2.54	Q			V
23+ 0	10.3371	2.52	Q			V
23+ 5	10.3544	2.51	Q			V
23+10	10.3715	2.49	Q			V
23+15	10.3885	2.47	Q			V
23+20	10.4055	2.46	Q			V
23+25	10.4223	2.44	Q			V
23+30	10.4390	2.42	Q			V
23+35	10.4555	2.41	Q			V

```
     23+40        10.4720      2.39   |Q       |       |       |      V|
     23+45        10.4884      2.38   |Q       |       |       |      V|
     23+50        10.5047      2.36   |Q       |       |       |      V|
     23+55        10.5209      2.35   |Q       |       |       |      V|
     24+ 0        10.5369      2.33   |Q       |       |       |      V|
-----------------------------------------------------------------------
```

APPENDIX C:

P-WQMP EXHIBIT



Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)			
1 Remaining LID DCV not met by site design BMP (ft³): 135,766 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA A BMP Type INFILTRATION BASIN	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	4.5		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.5		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	9		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	6		
8 Infiltrating surface area, SA_{BMP} (ft²) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	22,628		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft³) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	135,766		
15 Underground Retention Volume (ft³) *Volume determined using manufacturer's specifications and calculations*	N/A		
16 Total Retention Volume from LID Infiltration BMPs: 135,766 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

NO.	REVISION	BY

KIER+WRIGHT
163 Technology Drive
Irvine, CA 92620
Phone: (949) 508-0202
www.kierwright.com

PRELIMINARY SWQCP
OF
MOJAVE DRIVE AT MESA LINDA AVENUE
FOR
INDUSTRIAL PROPERTY GROUP, INC.
VICTORVILLE, CALIFORNIA

DATE	JANUARY 2023
SCALE	AS SHOWN
DESIGNER	LB
DRAWN BY	JP
JOB NO.	A22221
SHEET	C7.0
OF	9 SHEETS

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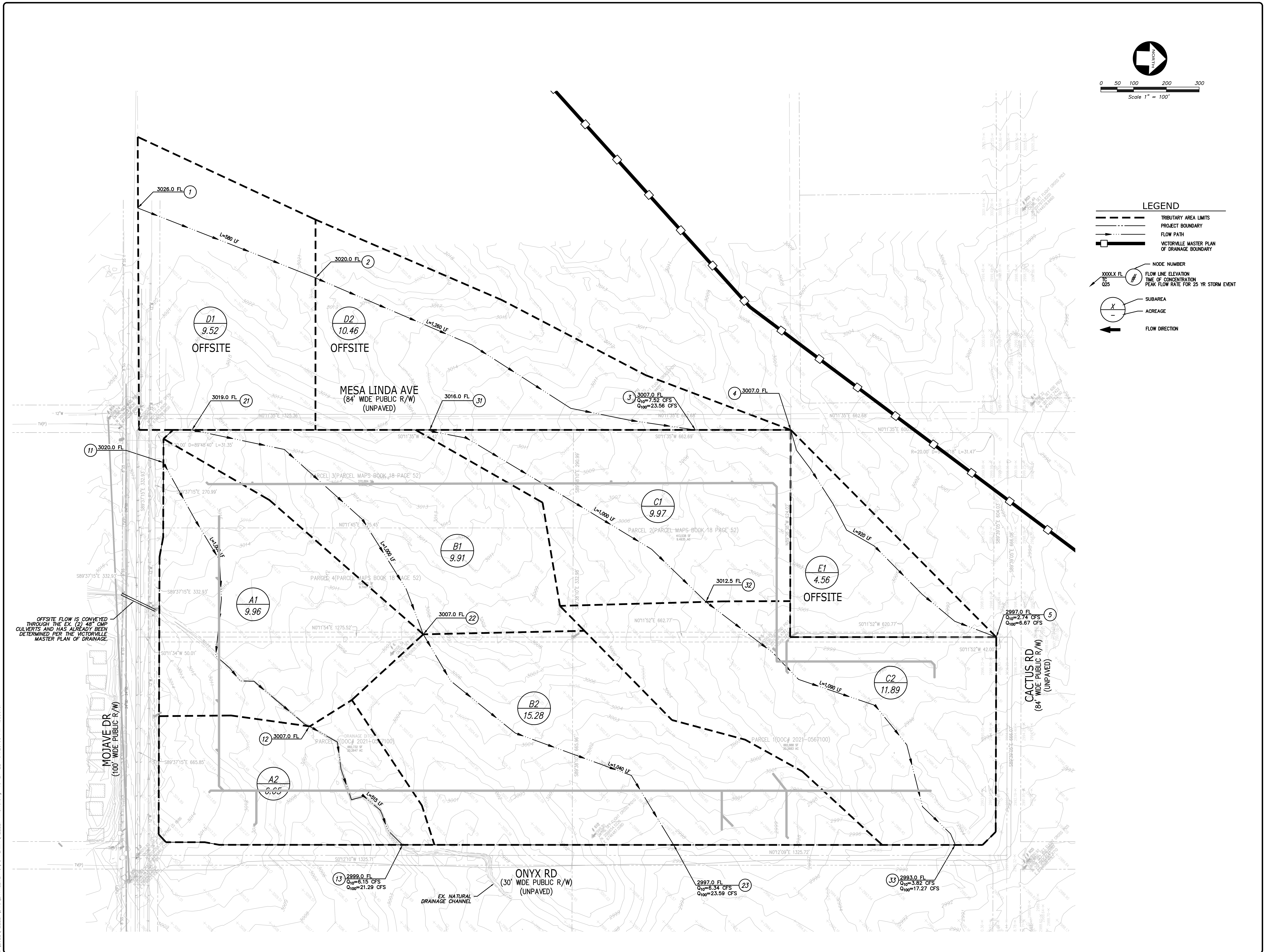
APPENDIX D:

HYDROLOGY EXHIBITS

EXISTING HYDROLOGY MAP

PROPOSED HYDROLOGY MAP



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PRELIMINARY EXISTING HYDROLOGY MAP
OF
MOJAVE DRIVE AT MESA LINDA AVENUE
FOR
INDUSTRIAL PROPERTY GROUP, INC.

VICTORVILLE, CALIFORNIA

DATE	OCTOBER, 2022
SCALE	AS SHOWN
DESIGNER	LB
DRAWN BY	LB
JOB NO.	A22221
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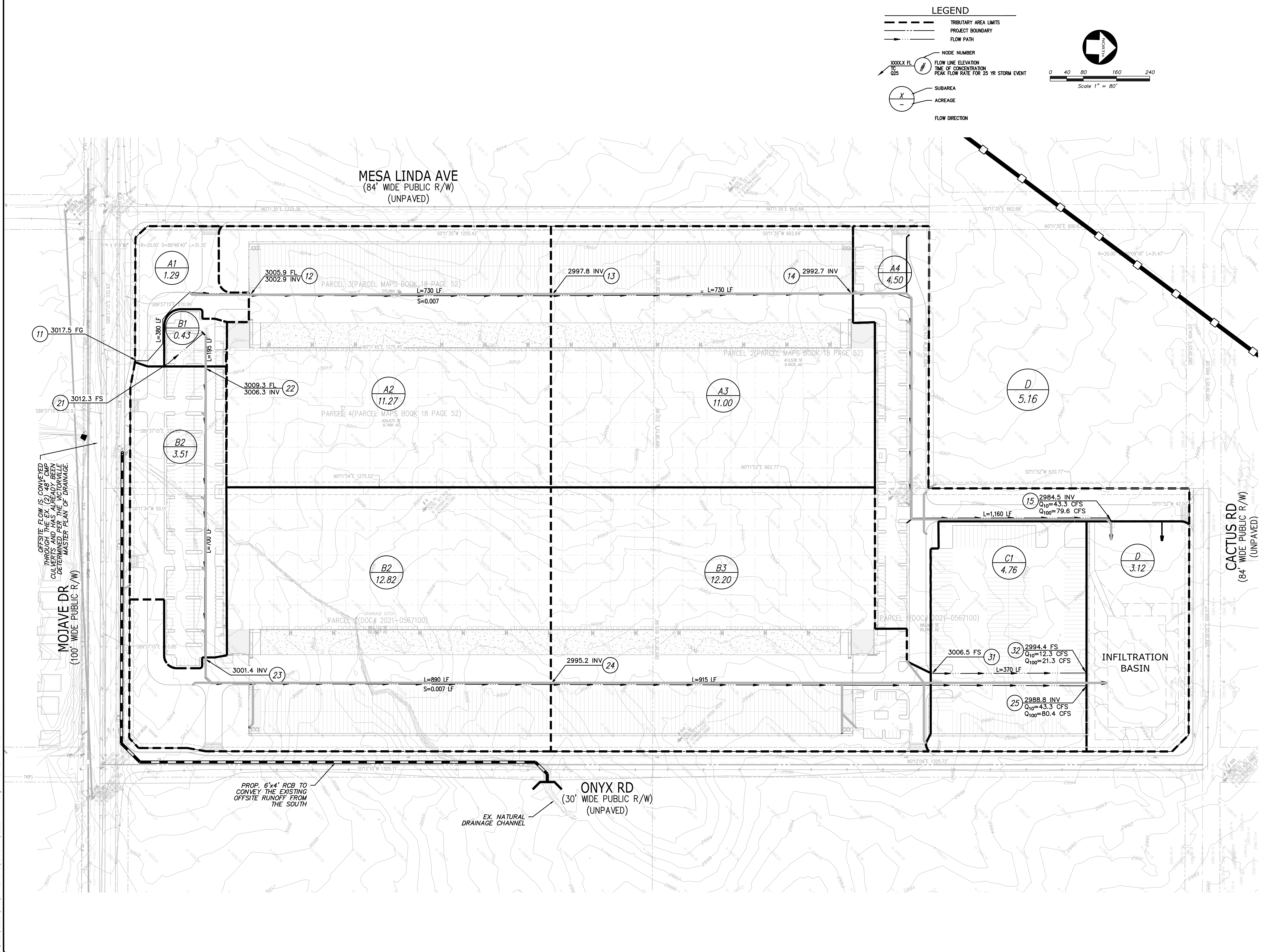
OF 2	SHEETS



PRELIMINARY PROPOSED HYDROLOGY MAP
OF
MOJAVE DRIVE AT MESA LINDA AVENUE
FOR
INDUSTRIAL PROPERTY GROUP, INC.

VICTORVILLE, CALIFORNIA

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163 Technology Drive
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DATE	OCTOBER, 2022
SCALE	AS SHOWN
DESIGNER	LB
DRAWN BY	LB
JOB NO.	A22221
SHEET	2
OF 2	SHEETS

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APPENDIX E:

GEOTECHNICAL AND INFILTRATION REPORT

October 19, 2022 Project No. 22124-01

Mr. Craig Wilde
Industrial Property Group, Inc.
10515 20th Street Southeast
Lake Stevens, Washington 98258

Subject: ***Preliminary Geotechnical Evaluation, Proposed Industrial Development, Northwest of the Intersection of Mojave Drive & Onyx Road, Victorville, California***

In accordance with your request, LGC Geotechnical, Inc. has performed a preliminary geotechnical evaluation for the proposed industrial development to be located northwest of the intersection of Mojave Drive and Onyx Road in the City of Victorville, California. The purpose of our study was to evaluate the existing onsite geotechnical conditions and to provide preliminary geotechnical recommendations relative to the proposed development.

Should you have any questions regarding this report, please do not hesitate to contact our office. We appreciate this opportunity to be of service.

Respectfully,

LGC Geotechnical, Inc.

Brad Zellmer, GE 2618
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
BRAD ZELLMER
No. 2618
GEOTECHNICAL
STATE OF CALIFORNIA

Kevin B. Colson, CEG 2210
Vice President

CERTIFIED ENGINEERING GEOLOGIST
KEVIN BONIFACE COLSON
No. 2210
STATE OF CALIFORNIA

KBC/BTZ/CPM/amm

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131 Calle Iglesia, Suite 200, San Clemente, CA 92672 (949) 369-6141 www.lgcgeotechnical.com

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1.0 INTRODUCTION

LGC Geotechnical has performed a geotechnical evaluation for the proposed industrial development to be located northwest of the intersection of Mojave Drive and Onyx Road, in the City of Victorville, San Bernardino County, California. (Figure 1). This report summarizes our findings, conclusions, and preliminary geotechnical recommendations relative to the proposed development.

1.1 Project Description and Background

The approximately 65-acre, generally rectangular-shaped site is bound on the south by Mojave Drive, on the north by Cactus Road, on the east by Onyx Road, and on the west by Mesa Linda Avenue. During our site review Mojave Drive was a paved road, while the other roads were unimproved dirt roads. At the time of our field visit the site consisted of vacant land with a few man-made dirt trails. Vegetation generally consisted of low scrub and weeds scattered across the site. The majority of the site is relatively flat with topographic relief on the order of approximately 25 to 30 feet. Drainage is toward the northeast generally via sheet flow.

We understand that the proposed site will include one approximately 1,078,880 square foot industrial building, a stormwater quality detention basin in the northeastern portion of the site, and associated parking (HPA Architecture, 2022). Grading plans were not available. It is anticipated that relatively minor cuts and fills are proposed for the building pad. Preliminary building (dead plus live) loads were not provided at the time of this report. The assumed maximum column and wall structural (dead plus live) loads are 125 kips and 10 kips per lineal foot, respectively.

The recommendations given in this report are based on assumptions as indicated above. LGC Geotechnical should be provided with any updated project information, plans and/or any structural loads when they become available, in order to either confirm or modify the recommendations provided herein.

1.2 Subsurface Exploration

In September of 2022, LGC Geotechnical performed a subsurface geotechnical evaluation of the subject site consisting of the excavation of fourteen hollow-stem auger borings in order to evaluate onsite geotechnical conditions.

Fourteen borings (HS-1 through HS-12 and I-1 through I-2) were excavated using a truck-mounted drill rig equipped with 6-inch and 8-inch-diameter hollow-stem augers to depths ranging from approximately 10 to 50 feet below existing grade. An LGC Geotechnical representative observed the drilling operations, logged the borings, and collected soil samples for laboratory testing. Driven soil samples were collected by means of the Standard Penetration Test (SPT) and Modified California Drive (MCD) sampler. The SPT sampler (1.4-inch ID) and MCD sampler (2.4-inch ID, 3.0-inch OD) were driven using a 140-pound hammer falling 30 inches to advance the sampler a total depth of 18 inches or until refusal. The raw blow counts for each 6-inch increment of penetration were recorded on the boring logs. Bulk samples were also collected and logged for laboratory testing at select depths. In select borings, after removal of the augers the depth of the boring due to caving was measured and is noted on the boring logs. The borings were backfilled with cuttings. The approximate locations of our subsurface explorations are provided on our Geotechnical Map (Figure 2). The boring logs are provided in Appendix B.

At the completion of excavation of Infiltration Borings, I-1 through I-2, an infiltration well was constructed within each boring for testing as outlined in the "Field Percolation Testing" Section below. At the completion of infiltration testing, the installed pipe was removed, and the resulting void backfilled with native soils.

Please note that some settlement of the backfill may occur over time and the excavations should be topped off as needed.

1.3 <u>Field Percolation Testing</u>

Two field percolation tests (I-1 through I-2) were performed in the approximate locations indicated on our Geotechnical Map (Figure 2). Estimation of infiltration rates was accomplished in general accordance with the guidelines set forth by the County of San Bernardino (2013). A 3-inch diameter perforated PVC pipe was placed in the borehole, and the annulus was backfilled with gravel, including placement of approximately 2 inches of gravel at the bottom of the borehole. The infiltration wells were pre-soaked the day prior to testing. During the pre-test, if the water level drops more than 6 inches in 25 minutes for two consecutive readings, the test procedure for coarse-grained soils should be followed. If the water level does not meet that criterion, the procedure for fine-grained soils should be followed. The procedure for coarse-grained soils requires performing the test for one hour and taking one reading every 10 minutes from a fixed reference point. The procedure for fine-grained soils requires performing the test for six hours and taking one reading every 30 minutes from a fixed reference point. The pre-tests indicated the procedure for coarse-grained soils should be followed. The calculated (observed) infiltration is normalized relative to the three-dimensional flow that occurs within the field test to a one-dimensional flow out of the bottom of the boring only (i.e., "Porchet Method"). The observed infiltration rates are provided in Table 1 below and do not include any factors of safety.

<u>TABLE 1</u>

<u>Summary of Field Infiltration Testing</u>

Infiltration Test Location	Infiltration Test Approximate Depth (ft)	Observed Infiltration Rate (inch/hr.) *
I-1	10	6.9
I-2	10	4.5

*Does not include a factor of safety

It should also be emphasized that infiltration test results are only representative of the location and depth where they are performed. Varying subsurface conditions may exist outside of the test locations which could alter the calculated infiltration rates indicated above. The percolation tests were performed using relatively clean water free of particulates, silt, etc. Field percolation test data is attached. Infiltration test data is presented in Appendix D. Refer to further discussion in Section 4.9.

1.4 *Laboratory Testing*

Representative bulk and driven samples were obtained for laboratory testing during our field evaluation. Laboratory testing included in-situ moisture content and dry density, Atterberg Limits, gradation/fines content, consolidation, expansion index, laboratory compaction, R-Value, and corrosion characteristics (sulfate, chloride, pH and minimum resistivity).

- Dry density of the samples collected ranged from approximately 102 pounds per cubic foot (pcf) to 130 pcf, with an average of approximately 115 pcf. Field moisture contents ranged from approximately 1 percent to 17 percent, with an average of approximately 4 percent.
- One Atterberg Limit (liquid limit and plastic limit) test was performed. Results indicated a Plasticity Index of 7.
- Five sieve analysis and four fines content tests indicated a fines content (passing No. 200 sieve) ranging from approximately 24 to 49 percent. Based on the Unified Soils Classification System (USCS), the tested samples are classified as "coarse-grained."
- Two Expansion Index (EI) tests indicated EI values of 0 to 18, corresponding to "Very Low" expansion potential.
- Four Consolidation tests were performed. The deformation versus vertical stress plots is provided in Appendix C.
- One laboratory compaction curve resulted in a maximum dry density value of 129.5 pcf with an optimum moisture content value of 9.0 percent.
- One R-Value test was performed and indicated a result of 27.
- Corrosion testing indicated soluble sulfate contents less than approximately 0.02 percent, a chloride content of 21 parts per million (ppm), pH of 8.6, and a minimum resistivity of 2,590 ohm-centimeters.

A summary of the results is presented in Appendix C. The moisture and dry density test results are presented on the boring logs in Appendix B.

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional and Local Geology

Regionally the site is located in the southwestern portion of the Mojave Desert Geomorphic Province of California. The following discussion regarding the Geomorphic Province is from the California Geological Survey Note 36 (CGS, 2002). The Mojave Desert is a broad interior region of isolated mountain ranges separated by expanses of desert plains. It has an interior enclosed drainage and many playas. There are two important fault trends that control topography: a prominent northwest-southeast trend and a secondary east-west trend, which is in apparent alignment with the Transverse Ranges Geomorphic Province on the southwestern side of the Mojave Desert. The Mojave Province is wedged in a sharp angle between the Garlock Fault which is the southern boundary of the Sierra Nevada Province, and the San Andreas Fault where it bends east from its northwest trend. The northern boundary of the Mojave is separated from the prominent Basin and Range Province by the eastern extension of the Garlock Fault. The site is located southeast of the Garlock Fault and north of the San Andreas Fault.

Locally, the site is located on a broad, nearly flat alluvial plain. The alluvium is derived from the nearby hills and mountains. The northward-flowing Mojave River is located approximately 4 miles northeast of the site and drainage in the vicinity of the site is generally via sheet flow towards the northeast. Old alluvial deposits are located in the upper reaches of incised drainages along the banks of the river. The alluvial plain is underlain at depth by granitic and metasedimentary rocks of the San Bernardino Mountain assemblage, and steep rugged hillsides that expose these rocks are located approximately 5 to 8 miles northeast and northwest of the site, respectively (Dibblee, 2008). A large playa (dry lakebed), known as El Mirage Dry Lake, is located adjacent to the hillsides northwest of the site.

2.2 Site-Specific Geology & Generalized Subsurface Conditions

Based on our review of regional geologic mapping in the vicinity of the site (Dibblee, 2008) and our site visit, the project area is underlain by Quaternary alluvial deposits. A brief description of the geologic unit encountered is presented below.

As encountered in our subsurface evaluation (borings), site materials primarily consist of medium dense to very dense silty sands and very stiff to hard sandy silts to the maximum explored depth of approximately 50 feet below existing grade. Moisture contents in the upper approximate 5 feet are generally well below optimum.

It should be noted that our excavations are only representative of the location and time where/when they are performed, and varying subsurface conditions may exist outside of the performed location. In addition, subsurface conditions can change over time. The soil descriptions provided above should not be construed to mean that the subsurface profile is uniform, and that soil is homogeneous within the project area. For details on the stratigraphy at the exploration locations, refer to Appendix B.

2.2.1 ***Quaternary Alluvium (Map Symbol - Qa)***

Quaternary alluvial deposits were exposed at the surface and were encountered to the maximum depth explored, approximately 50 feet below the ground surface. The alluvium was found to consist mostly of silty sand and sandy silt with scattered discontinuous beds of sandy clay and clayey sand, and scattered carbonate (caliche) deposits in the upper approximately 10 feet.

2.3 ***Geologic Structure***

Geologic structure was not identified in the subject site geotechnical evaluation. The alluvial materials encountered are generally massive, and bedding (if present) is assumed to be nearly horizontal.

2.4 ***Landslides***

The topography of the site and surrounding area is generally flat. Our research and field observations do not indicate the presence of landslides on the site or in the immediate vicinity. Review of regional geologic maps of the area do not indicate the presence of known or suspected landslides in the vicinity of the site. Therefore, the possibility of landslides at the site is considered nil.

2.5 ***Groundwater***

Groundwater was not encountered during our subsurface field evaluation to the maximum explored depth of approximately 50 feet below existing ground surface. Historic high groundwater is anticipated to be greater than 50 feet below existing grade. The California Department of Water Resources Water Data Library (CDWR, 2022) indicates several wells existed within approximately 2-miles of the site; however, the wells were not frequently monitored. Based on the data, it appears that groundwater between the 1950's and 1990's has lowered from between approximately 160 to approximately 300 feet deep, and since the 2000's it has been deeper than 300 feet deep.

Seasonal fluctuations of groundwater elevations should be expected over time. In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present within the near-surface deposits due to local seepage or during rainy seasons. Groundwater conditions below the site may be variable, depending on numerous factors including seasonal rainfall, local irrigation and groundwater pumping, among others.

2.6 ***Faulting***

California is located on the boundary between the Pacific and North American Lithospheric Plates. The average motion along this boundary is on the order of 50-mm/yr. in a right-lateral sense. The majority of the motion is expressed at the surface along the northwest trending San Andreas Fault Zone with lesser amounts of motion accommodated by sub-parallel faults located predominantly west of the San Andreas including the San Jacinto, Elsinore, Newport-Inglewood, Rose Canyon, and Coronado Bank Faults. Within Southern California, a large bend in the San Andreas Fault north of the San Gabriel Mountains has resulted in a transfer of a portion of the right-lateral motion between the plates into left-lateral displacement and vertical uplift. Compression south and west of the bend has resulted in folding, left-lateral, reverse thrust faulting, and regional uplift creating the east-west trending Transverse Ranges and several east-west trending faults. Further south within the Los Angeles Basin, "blind thrust" faults are believed to have developed below the surface also as a result of this compression, which have resulted in earthquakes such as the 1994 Northridge event along faults with little to no surface expression.

Prompted by damaging earthquakes in Northern and Southern California, State legislation and policies concerning the classification and land-use criteria associated with faults have been developed. The Alquist-Priolo Earthquake Fault Zoning Act was implemented in 1972 to prevent the construction of urban developments across the trace of active faults. California Geologic Survey Special Publication 42 was created to provide guidance for following and implementing the law requirements. Special Publication 42 was most recently revised in 2018 (CGS, 2018). According to the State Geologist, a "Holocene-active" fault is defined as one which has had surface displacement within Holocene time (roughly the last 11,700 years). Regulatory Earthquake Fault Zones have been delineated to encompass traces of known, Holocene-active faults to address hazards associated with surface fault rupture within California. Where developments for human occupation are proposed within these zones, the state requires detailed fault evaluations be performed so that engineering-geologists can identify the locations of active faults and recommend setbacks from locations of possible surface fault rupture.

The subject site is not located within a State of California Fault Rupture Hazard Zone (CGS, 2018 and 2022). The nearest Holocene-active faults identified by CGS are the Helendale Fault, located approximately 14.5 miles northeast of the site and the San Andreas Fault Zone located approximately 18 miles to the southwest of the site. These faults trend northwest-southeast, oblique to the site and not toward the site. Therefore, the possibility of damage due to ground rupture is considered low since no active faults are known to cross the site.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site, include ground lurching and shallow ground rupture, soil liquefaction, dynamic settlement, seiches and tsunamis. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and causative fault, and the onsite geology. A discussion of these secondary effects is provided in the following sections.

2.6.1 Lurching and Shallow Ground Rupture

Soil lurching refers to the rolling motion on the ground surface by the passage of seismic surface waves. Effects of this nature are not likely to be significant where the thickness of soft sediments do not vary appreciably under structures. Ground rupture due to active faulting is not likely to occur onsite due to the absence of known active fault traces. Ground cracking due to shaking from distant seismic events is not considered a significant hazard, although it is a possibility at any site.

2.6.2 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose near-surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction, depending on their plasticity and moisture content. Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures. Dynamic settlement of dry loose sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

Due to the depth of groundwater greater than 50 feet, the generally dense/hard nature of underlying soils, the potential for liquefaction and liquefaction-induced settlement is considered very low.

2.6.3 Lateral Spreading

Lateral spreading is a type of liquefaction-induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move down-slope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures.

Due to the very low potential for liquefaction, the potential for lateral spreading is also considered very low.

2.6.4 Tsunamis and Seiches

Based on the elevation of the site, with respect to sea level, the possibility of damage to the site during a large tsunami event is considered nil. There are no nearby large, enclosed bodies of water, therefore the possibility of damage due to a seiche is nil.

2.7 Seismic Design Parameters

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2019 California Building Code (CBC) and applicable portions of ASCE 7-16 which has been adopted by the CBC. Please note that the following seismic parameters are only applicable for code-based acceleration response spectra and are not applicable for where site-specific ground motion procedures are required by ASCE 7-16. Representative site coordinates of latitude 34.5289 degrees north and longitude -117.3905 degrees west were utilized in our analyses. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and

S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class C are provided in Table 2 below. The structural designer should contact the geotechnical consultant if structural conditions (e.g., number of stories, seismically isolated structures, etc.) require site-specific ground motions.

TABLE 2

Seismic Design Parameters

Selected Parameters from 2019 CBC, Section 1613 - Earthquake Loads	Seismic Design Values	Notes/Exceptions
Distance to applicable faults classifies the site as a "Near-Fault" site.		Section 11.4.1 of ASCE 7
Site Class	C	Chapter 20 of ASCE 7
Ss (Risk-Targeted Spectral Acceleration for Short Periods)	1.191g	From SEAOC, 2021
S_1 (Risk-Targeted Spectral Accelerations for 1-Second Periods)	0.463g	From SEAOC, 2021
F_a (per Table 1613.2.3(1))	1.2	For Simplified Design Procedure of Section 12.14 of ASCE 7, F_a shall be taken as 1.4 (Section 12.14.8.1)
F_v (per Table 1613.2.3(2))	1.5	-
S_{MS} for Site Class C [Note: $S_{MS} = F_aS_S$]	1.429g	-
S_{M1} for Site Class C [Note: $S_{M1} = F_vS_1$]	0.695g	-
S_{DS} for Site Class C [Note: $S_{DS} = (^2/_3)\ S_{MS}$]	0.953g	-
S_{D1} for Site Class C [Note: $S_{D1} = (^2/_3)\ S_{M1}$]	0.463g	-
C_{RS} (Mapped Risk Coefficient at 0.2 sec)	0.935	ASCE 7 Chapter 22
C_{R1}(Mapped Risk Coefficient at 1 sec)	0.918	ASCE 7 Chapter 22

A deaggregation of the PGA based on a 2,475-year average return period (MCE) indicates that an earthquake magnitude of 7.1 at a distance of approximately 21 km from the site would contribute the most to this ground motion. A deaggregation of the PGA based on a 475-year average return period (Design Earthquake) indicates that an earthquake magnitude of 7.1 at a distance of approximately 24 km from the site would contribute the most to this ground motion (USGS, 2014).

Section 1803.5.12 of the 2019 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for liquefaction potential. The PGA_M for the site is equal to 0.60g (SEAOC, 2022). The design PGA is equal to 0.40g (2/3 of PGA_M).

2.8 Subsidence

Subsidence is the settlement of the ground surface over large areas (typically on the order of square miles) typically due to the lowering of the groundwater table. Mitigation against such a large-scale groundwater drawdown cannot be performed on a site-specific level, but instead "requires regional cooperation among numerous agencies" and therefore is not a site-specific geotechnical consideration. The soils encountered in our field evaluation did not indicate the presence of soils susceptible to collapse or excessive settlement. Based on the local site geologic conditions, the potential for subsidence in the site development area is considered low.

2.9 Rippability

In general, excavation for foundations and underground improvements should be achievable with the appropriate earthwork equipment.

2.10 Oversized Material

Encountering significant quantities of oversized material (material larger than 8 inches in maximum dimension) is not anticipated during grading. Recommendations are provided for appropriate handling of oversized materials, if encountered, in Appendix E. If feasible, crushing oversized materials or exporting to an offsite location may be considered.

2.11 Expansion Potential

Based on the results of laboratory testing, site soils are anticipated to have a "Very Low" expansion potential. Final expansion potential of site soils should be determined at the completion of grading. Results of expansion testing at finish grades will be utilized to confirm final foundation design.

3.0 FINDINGS AND CONCLUSIONS

Based on the results of our geotechnical evaluation, it is our opinion that the proposed site development is feasible from a geotechnical standpoint, provided the following conclusions and recommendations are incorporated into the site design, grading, and construction.

The following is a summary of the primary geotechnical factors, which may affect future development of the site.

- In general, our subsurface evaluation primarily indicates that the site contains medium dense to very dense silty sands and medium stiff to hard sandy silts to the maximum explored depth of approximately 50 feet below existing grade. Moisture content of soils in the upper approximate 5 feet are generally well below optimum. The near-surface compressible soils are not suitable for the planned improvements in their present condition (refer to Section 4.1).
- From a geotechnical perspective, onsite soils are anticipated to be suitable for use as general compacted fill, provided they are screened of construction debris and any oversized material (8 inches in greatest dimension). Significant moisture conditioning of site soils should be anticipated to achieve adequate compaction.
- Groundwater was not encountered to the maximum explored depth of approximately 50 feet below existing ground surface. Historic high groundwater is anticipated to be greater than 50 feet below existing ground surface (CDWR, 2022).
- The subject site is not located within an Alquist-Priolo Earthquake Fault Zone. No active faults are mapped on the site. No faults were identified on the site during our site evaluation. The proposed development will likely be subjected to strong seismic ground shaking during its design life from one of the regional faults.
- Due to a lack of groundwater in the upper 50 feet and the generally dense/hard on underlying native soils, the potential for liquefaction and liquefaction-induced settlement is considered very low.
- Based on laboratory testing, soils exposed at the proposed foundation level are anticipated to have a "Very Low" expansion potential (EI not exceeding 20). This shall be confirmed at the completion of site earthwork.
- Excavation for foundations and underground improvements should be achievable with the appropriate earthwork equipment.
- The field infiltration tests indicated observed infiltration rates of 6.9 inch/hour and 4.5 inch/hour for I-1 and I-2, respectively. These values do not include any factor of safety. Recommendations are provided in Section 4.9.
- The site contains soils with high fines content (i.e., silts and clay) that are not suitable for backfill of retaining walls. Therefore, select grading and stockpiling of native suitable sandy soils and/or import of select sandy soils meeting project recommendations will be required for retaining wall backfill.

4.0 RECOMMENDATIONS

The following recommendations are to be considered preliminary and should be confirmed upon completion of earthwork operations. In addition, they should be considered minimal from a geotechnical viewpoint, as there may be more restrictive requirements from the architect, structural engineer, building codes, governing agencies, or the City. It is the responsibility of the builder to ensure these recommendations are provided to the appropriate parties.

It should be noted that the following geotechnical recommendations are intended to provide sufficient information to develop the site in general accordance with the 2019 California Building Code (CBC) requirements. With regard to the potential occurrence of potentially catastrophic geotechnical hazards such as fault rupture, earthquake-induced landslides, liquefaction, etc. the following geotechnical recommendations should provide adequate protection for the proposed development to the extent required to reduce seismic risk to an "acceptable level." The "acceptable level" of risk is defined by the California Code of Regulations as "the level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project" [Section 3721(a)]. Therefore, repair and remedial work of the proposed improvement may be required after a significant seismic event. With regards to the potential for less significant geologic hazards to the proposed development, the recommendations contained herein are intended as a reasonable protection against the potential damaging effects of geotechnical phenomena such as expansive soils, fill settlement, groundwater seepage, etc. It should be understood, however, that although our recommendations are intended to maintain the structural integrity of the proposed development and structures given the site geotechnical conditions, they cannot preclude the potential for some cosmetic distress or nuisance issues to develop as a result of the site geotechnical conditions.

The geotechnical recommendations contained herein must be confirmed to be suitable or modified based on the actual exposed conditions.

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of required earthwork removals, foundation construction and utility line construction and backfill. We recommend that earthwork onsite be performed in accordance with the following recommendations, the City of Victorville, 2019 CBC and the General Earthwork and Grading Specifications included in Appendix E. In case of conflict, the following recommendations shall supersede previous recommendations and those included as part of Appendix E.

4.1.1 Site Preparation

Prior to grading of areas to receive structural fill, engineered structures or improvements should be demolished and the area should be cleared of existing vegetation (shrubs, trees, grass, etc.), surface obstructions, existing debris and potentially compressible or otherwise unsuitable material. Debris should be removed and properly disposed of off-site. Holes resulting from the removal of buried obstructions, which extend below proposed removal bottoms, should be replaced with suitable compacted fill material. Any abandoned utility lines should be completely removed and replaced with properly compacted fill.

If cesspools or septic systems are encountered, they should be removed in their entirety. The resulting excavation should be backfilled with properly compacted fill soils. As an alternative, cesspools can be backfilled with lean sand-cement slurry. Any encountered wells should be properly abandoned in accordance with regulatory requirements. At the conclusion of the clearing operations, a representative of LGC Geotechnical should observe and accept the site prior to further grading.

4.1.2 Removal Depths and Limits

In order to provide a relatively uniform bearing condition for the planned improvements, upper loose/compressible native soils are to be removed and replaced as properly compacted fills. For preliminary planning purposes, the depth of required removals may be estimated as indicated below.

Building Structure: Removals should extend a minimum depth of 5 feet below existing grade or 2 feet below the proposed footings, whichever is greater. In general, the envelope for removals should extend laterally a minimum horizontal distance equal to the fill thickness so that a 1:1 plane may be projected from the footing to the edge of the removal, with a minimum lateral extent of 5 feet beyond the edges of the proposed building footprint. The removals for loading dock areas, which act as retaining walls, should extend a minimum of 2 feet below the bottom of the proposed footings, which is likely deeper than 5 feet below existing grade, depending upon the design of the loading docks.

Retaining/Free-Standing Wall Structures: Removals should extend a minimum of 3 feet below existing grade, or 1-foot below proposed footings, whichever is greater.

Pavement and Hardscape Areas: Removals should extend to a depth of at least 2 feet below the existing grade. Removals in any design cut areas of the pavement may be reduced by the depth of the design cut but should not be less than 1-foot below the finished subgrade (i.e., below planned aggregate base/asphalt concrete). In general, the envelope for removals should extend laterally a minimum lateral distance of 2 feet beyond the edges of the proposed improvements.

Local conditions may be encountered during excavation that could require additional over-excavation beyond the above-noted minimum in order to obtain an acceptable subgrade including localized areas of undocumented fill. The actual depths and lateral extents of grading will be determined by the geotechnical consultant, based on subsurface conditions encountered during grading. Removal areas should be accurately staked in the field by the Project Surveyor.

4.1.3 Temporary Excavations

Temporary excavations should be performed in accordance with project plans, specifications, and applicable Occupational Safety and Health Administration (OSHA) requirements. Excavations should be laid back or shored in accordance with OSHA requirements before personnel or equipment are allowed to enter. Based on our field investigation, the majority of site soils are anticipated to be OSHA Type "C" soils (refer to the attached boring logs). Sandy soils are present and should be considered susceptible to caving. Soil conditions should be regularly evaluated during construction to verify conditions are as anticipated. The contractor shall be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination with the geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Excavation safety is the sole responsibility of the contractor.

Vehicular traffic, stockpiles, and equipment storage should be set back from the perimeter of excavations a minimum distance equivalent to a 1:1 projection from the bottom of the excavation or 5 feet, whichever is greater. Once an excavation has been initiated, it should be backfilled as soon as practical. Prolonged exposure of temporary excavations may result in some localized instability. Excavations should be planned so that they are not initiated without sufficient time to shore/fill them prior to weekends, holidays, or forecasted rain.

It should be noted that any excavation that extends below a 1:1 (horizontal to vertical) projection of an existing foundation will remove existing support of the structure foundation. If requested, temporary shoring parameters can be provided.

4.1.4 __Removal Bottoms and Subgrade Preparation__

In general, removal bottom areas and any areas to receive compacted fill should be scarified to a minimum depth of 6 inches, brought to a near-optimum moisture condition, and re-compacted per project recommendations.

Removal bottoms and areas to receive fill should be observed and accepted by the geotechnical consultant prior to subsequent fill placement.

4.1.5 __Material for Fill__

From a geotechnical perspective, the onsite soils are generally considered suitable for use as general compacted fill (i.e., non-retaining wall backfill), provided they are screened of organic materials, construction debris and any oversized material (8 inches in greatest dimension). Significant moisture conditioning of site soils should be anticipated as outlined in the section below.

From a geotechnical viewpoint, any required import soils should consist of clean, relatively granular soils of Low expansion potential (expansion index 50 or less based on ASTM D4829) and no particles larger than 3 inches in greatest dimension. Source samples of planned importation should be provided to the geotechnical consultant for laboratory testing a minimum of 3 working days prior to any planned importation for required laboratory testing.

Any required retaining wall backfill should consist of sandy soils with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) Test Method D1140 (or ASTM D6913/D422) and a Very Low expansion potential (EI of 20 or less per ASTM D4829). Soils should also be screened of organic materials, construction debris and any material greater than 3 inches in maximum dimension. The site contains soils that are not suitable for retaining wall backfill due to their fines content; therefore, select grading and stockpiling and/or import of select sandy soils will be required by the contractor to obtain suitable retaining wall backfill soil.

Aggregate base (crushed aggregate base or crushed miscellaneous base) should conform to the requirements of Section 200-2 of the Standard Specifications for Public Works Construction ("Greenbook") for untreated base materials (except processed miscellaneous base) or Caltrans Class 2 aggregate base.

4.1.6 Fill Placement and Compaction

Material to be placed as fill should be brought to near-optimum moisture content (generally at about 2 percent above optimum moisture content) and recompacted to at least 90 percent relative compaction (per ASTM D1557). Significant moisture conditioning of site soils should be anticipated in order to achieve the required degree of compaction. In general, soils will require additional moisture conditioning in order to achieve the required compaction are present. Soils may also be present that will require drying and/or mixing the very moist soils prior to reusing the materials in compacted fills. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in loose thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances and with observation and testing by the geotechnical consultant. Oversized material as previously defined should be removed from site fills.

Fill placed on any slopes greater than 5:1 (horizontal to vertical) should be properly keyed and benched into firm and competent soils as it is placed in lifts. During backfill of excavations, the fill should be properly benched into firm and competent soils of temporary backcut slopes as it is placed in lifts.

Aggregate base material should be compacted to a minimum of 95 percent relative compaction at or slightly above-optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction per ASTM D1557 at or slightly above-optimum moisture content.

If gap-graded ¾-inch rock is used for backfill (around storm drain storage chambers, retaining wall backfill, etc.) it will require compaction. Rock shall be placed in thin lifts (typically not exceeding 6 inches) and mechanically compacted with observation by the geotechnical consultant. Backfill rock shall meet the requirements of ASTM D2321. Gap-graded rock is required to be wrapped in filter fabric to prevent the migration of fines into the rock backfill.

4.1.7 ***Trench and Retaining Wall Backfill and Compaction***

Bedding material used within the pipe zone should conform to the requirements of the current Greenbook and the pipe manufacturer. Where applicable, sand having a sand equivalent (SE) of 30 or greater (per Caltrans Test Method [CTM] 217) may be used to bed and shade the pipes within the bedding zone. Sand backfill should be densified by jetting or flooding and then tamped to ensure adequate compaction. Bedding sand should be from a natural source, manufactured sand from recycled material is not suitable for jetting. The onsite soils may generally be considered suitable as trench backfill (zone defined as 12 inches above the pipe to subgrade), provided the soils are screened of rocks greater than 6 inches in maximum dimension, construction debris and organic material. Trench backfill should be compacted in uniform lifts (as outlined above in Section 4.1.5 "Material for Fill") by mechanical means to at least 90 percent relative compaction (per ASTM D1557). If gap-graded rock is used for trench backfill, refer to Section 4.1.6.

In backfill areas where mechanical compaction of soil backfill is impractical due to space constraints, flowable fill such as sand-cement slurry may be substituted for compacted backfill. The slurry should contain about one sack of cement per cubic yard. When set, such a mix typically has the consistency of compacted soil. Sand cement slurry placed near the surface within landscape areas should be evaluated for potential impacts on planned improvements.

Any required retaining wall backfill should consist of predominately granular, sandy soils outlined in Section 4.1.5. The limits of select sandy backfill should extend at minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater (Refer to Figure 3). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to a minimum of 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted. If gap-graded rock is used for retaining wall backfill, refer to Section 4.1.6.

A representative from LGC Geotechnical should observe, probe, and test the backfill to verify compliance with the project recommendations.

4.1.8 ***Shrinkage and Subsidence***

Allowance in the earthwork volumes budget should be made for an estimated 5 to 10 percent reduction in volume of near-surface (upper approximate 5 feet) soils. It should be stressed that these values are only estimates and that an actual shrinkage factor would be extremely difficult to predetermine. Subsidence, due to earthwork operations, is expected to be on the order of 0.1-foot. These values are estimates only and exclude losses due to removal of any vegetation or debris. The above shrinkage estimate is intended as an aid for others in determining preliminary earthwork quantities. However, these estimates should be used with some caution since they are not absolute values. The effective shrinkage of onsite soils will depend primarily on the type of compaction equipment and method of compaction used onsite by the contractor and accuracy of the topographic survey.

4.2 Preliminary Foundation Recommendations

The following foundation recommendations are preliminary and must be confirmed by LGC Geotechnical at the completion of project plans (i.e., foundation, grading, etc.) as well as completion of earthwork. Please note that foundation recommendations are based on estimated structural loads. Increase of structural loads may require revision of the provided foundation recommendations and parameters and/or revised remedial recommendations.

Based on preliminary laboratory testing, site soils are anticipated to be of Very Low expansion potential (EI of 20 or less per ASTM D4829). However, this must be verified based on as-graded conditions. Recommended soil bearing and estimated static settlement are provided in Section 4.3. Since site soils are anticipated to be of "Very Low" expansion potential special design considerations from a geotechnical perspective are not anticipated to be required.

4.2.1 Slab Design and Construction

From a geotechnical perspective, minimum slab thicknesses of 6 inches and 4 inches are recommended for new slabs in the warehouse areas and office areas, respectively. Slabs are to be supported on compacted fill soils properly prepared in accordance with the recommendations provided in this report. Actual slab reinforcement and thickness should be determined by the structural engineer based on the imposed loading. Additional slab-on-grade recommendations can be provided for alternative building types upon request.

The foundation designer may use a modulus of vertical subgrade reaction (k) of 150 pounds per cubic inch (pounds per square inch per inch of deflection). This value is for a 1-foot by 1-foot square loaded area and should be adjusted by the structural designer for the area of the proposed footing using the following formula:

$$k = 150 \times [(B+1)/2B]^2$$

k = modulus of vertical subgrade reaction, pounds per cubic inch (pci)
B = foundation width (feet)

It is recommended that subgrade soils below slabs be moisture conditioned in order to maintain the recommended moisture content up to the time of concrete placement. The recommended moisture content of the slab subgrade soils should be between optimum moisture content and approximately 2 percent above optimum moisture content to a minimum depth of 12 inches. The moisture content of the slab subgrade should be verified by the geotechnical consultant within 1 to 2 days prior to concrete placement. In addition, this moisture content should be maintained around the immediate perimeter of the slab during construction and up to occupancy of the building structures.

The following recommendations are for informational purposes only, as they are unrelated to the geotechnical performance of the foundation. The following recommendations may be superseded by the foundation engineer and/or owner. Some post-construction moisture migration should be expected below the foundation. In general, interior floor slabs with moisture sensitive floor coverings should be underlain by a minimum 10 mil thick polyolefin material vapor retarder, which has a water vapor transmission rate (permeance) of less than 0.03 perms. The need for sand and/or the sand thickness (above and/or below the vapor retarder) should be specified by the structural engineer, architect or concrete contactor. The selection and thickness of sand is not a geotechnical engineering issue and is therefore outside our purview.

4.2.2 Shallow Foundation Maintenance

The geotechnical parameters provided herein assume that if the areas adjacent to the foundation are planted and irrigated, these areas will be designed with proper drainage and adequately maintained so that ponding, which causes significant moisture changes below the foundation, does not occur. Our recommendations do not account for excessive irrigation and/or incorrect landscape design. Plants should only be provided with sufficient irrigation for life and not overwatered to saturate subgrade soils. Sunken planters placed adjacent to the foundation, should either be designed with an efficient drainage system or liners to prevent moisture infiltration below the foundation. Some lifting of the perimeter foundation beam should be expected even with properly constructed planters.

In addition to the factors mentioned above, future owners/property management personnel should be made aware of the potential negative influences of trees and/or other large vegetation. Roots that extend near the vicinity of foundations can cause distress to foundations. Future owners (and the owner's landscape architect) should not plant trees/large shrubs closer to the foundations than a distance equal to half the mature height of the tree or 20 feet, whichever is more conservative unless specifically provided with root barriers to prevent root growth below the building foundation.
It is the owner's responsibility to perform periodic maintenance during hot and dry periods to ensure that adequate watering has been provided to keep soil from separating or pulling back from the foundation. Future owners and property management personnel should be informed and educated regarding the importance of maintaining a constant level of soil-moisture. The owners should be made aware of the potential negative consequences of both excessive watering, as well as allowing potentially expansive soils to become too dry. Expansive soils can undergo shrinkage during drying, and swelling during the rainy winter season, or when irrigation is resumed. This can result in distress to building structures and hardscape improvements. These recommendations should be provided to future owners and property management personnel.

4.3 Soil Bearing and Lateral Resistance

Provided our earthwork recommendations are implemented, the following minimum footing widths and embedments for isolated spread and continuous wall footings are recommended for the corresponding allowable bearing pressures.

TABLE 3

Allowable Soil Bearing Pressures

Allowable Static Bearing Pressure (psf)	Minimum Footing Width (feet)	Minimum Footing Embedment* (feet)
3,000	4	2
2,500	3	2
2,000	2	1.5
1,500	1	1

*Refers to minimum depth to the bottom of the footing below lowest adjacent finish grade.

These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5 horizontal feet to 1-foot vertical) conditions only. Bearing values indicated above are for total dead loads and live loads. The above vertical bearing may be increased by one-third for short durations of loading which will include the effect of wind or seismic loading. The increase is based on a reduced factor of safety (seismic factor of safety equal to three-fourths of the static factor of safety) for short duration loading.

Soil settlement is a function of footing dimensions and applied soil bearing pressure. In utilizing the above-mentioned allowable bearing capacity and provided our earthwork recommendations are implemented, foundation settlement due to structural loads is anticipated to be on the order of 1-inch or less. Differential static settlement may be taken as half of the static settlement (i.e., ½-inch over a horizontal span of 40 feet). Additionally, differential settlement should be anticipated between nearby columns or walls where a large differential loading condition exists. Settlement estimates should be updated by LGC Geotechnical when the final foundation plans are available.

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. For concrete/soil frictional resistance, an allowable coefficient of friction of 0.30 may be assumed with dead-load forces. An allowable passive lateral earth pressure of 250 psf per foot of depth (or pcf) to a maximum of 2,500 psf may be used for lateral resistance. Allowable passive pressure may be increased to 340 pcf (maximum of 3,400 psf) for short duration seismic loading. This passive pressure is applicable for level (ground slope equal to or flatter than 5 horizontal feet to 1-foot vertical) conditions only. Frictional resistance and passive pressure may be used in combination without reduction. We recommend that the upper foot of passive resistance be neglected if finished grade will not be covered with concrete or asphalt concrete. The provided allowable passive pressures are based on a factor of safety of 1.5 and 1.1 for static and seismic loading conditions, respectively.

4.4 Lateral Earth Pressures for Retaining Walls

The following preliminary lateral earth pressures may be used for any site retaining walls 10 feet or less. Lateral earth pressures are provided as equivalent fluid unit weights, in pound per square foot (psf) per foot of depth or pcf. These values do not contain an appreciable factor of safety, so the retaining wall designer should apply the applicable factors of safety and/or load factors during design.

The following lateral earth pressures are presented on Table 4 below for approved select granular soils with a maximum of 35 percent fines (passing the No. 200 sieve per ASTM D-421/422) and Very Low expansion potential (EI of 20 or less per ASTM D4829). The wall designer should clearly indicate on the retaining wall plans the required sandy soil backfill criteria.

TABLE 4

Lateral Earth Pressures – Select Sandy Backfill

Conditions	Equivalent Fluid Unit Weight (pcf)
	Level Backfill
	Approved Soils
Active	35
At-Rest	55

If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the earth pressure will be higher. This would include 90-degree corners of retaining walls. Such walls should be designed for "at-rest." The equivalent fluid pressure values assume free-draining conditions. Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed (Figure 3). Please note that waterproofing and outlet systems are not the purview of the geotechnical consultant. If conditions other than those assumed above are anticipated, the equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical consultant.

Surcharge loading effects from any adjacent structures should be evaluated by the basement/retaining wall designer. The amount of surcharge loading on a proposed retaining wall structure is primarily a function of the distance, magnitude and lateral extents of the surcharge loading and should be evaluated on a case-by-case basis. In addition to the recommended lateral earth pressure, basement/retaining walls adjacent to streets should be designed to resist vehicular traffic if applicable. Uniform surcharges may be estimated using the applicable coefficient of lateral earth pressure using a rectangular distribution. A factor of 0.5 and 0.3 may be used for at-rest and active conditions, respectively for a level backfill. The vertical traffic surcharge may be determined by the structural designer. The structural designer should contact the geotechnical consultant for any required geotechnical input in estimating any applicable surcharge loads.

If required, the retaining wall designer may use a seismic lateral earth pressure increment of 5 pcf for a level backfill condition. This increment should be applied in addition to the provided static lateral earth pressure using a triangular distribution with the resultant acting at H/3 in relation to the base of the retaining structure (where H is the retained height). For the restrained, at-rest condition, the seismic increment may be added to the applicable active lateral earth pressure (in lieu of the at-rest lateral earth pressure) when analyzing short duration seismic loading. Per Section 1803.5.12 of the 2019 CBC, the seismic lateral earth pressure is applicable to structures assigned to Seismic Design Category D through F for retaining wall structures supporting more than 6 feet of backfill height. The provided seismic lateral earth pressure should not be used for retaining walls exceeding 10 feet in height. If a retaining wall greater than 10 feet in height is proposed or a retaining wall with a sloping backfill condition, the retaining wall designer should contact the geotechnical consultant for specific seismic lateral earth pressure increments based on the configuration of the planned retaining wall structures. Seismic lateral earth pressures are estimated using the procedure outlined by the Structural Engineers Association of California (Lew, et al, 2010).

Soil bearing and lateral resistance (friction coefficient and passive resistance) are provided in Section 4.3. Earthwork considerations (temporary backcuts, backfill, compaction, etc.) for retaining walls are provided in Section 4.1 (Site Earthwork) and the subsequent earthwork related sub-sections.

4.5 Preliminary Pavement Sections

The following preliminary minimum asphalt concrete (AC) pavement sections are provided in Table 5 based on an R-value of 20 and for requested on-site Traffic Indices (TI) up to 10.0. These recommendations should be confirmed with R-value testing of representative near-surface soils at the completion of earthwork. Determination of the Traffic Index is not the purview of the geotechnical consultant. Final asphalt concrete pavement sections should be confirmed by the project civil engineer based upon the projected design Traffic Index. If requested, LGC Geotechnical will provide sections for alternate TI values.

TABLE 5

Preliminary Asphalt Concrete Paving Section Options

Traffic Index	8.0	9.0	10.0
R -Value Subgrade	20	20	20
AC Thickness	5.0 inches	5.5 inches	6.5 inches
Aggregate Base Thickness	13.5 inches	16.0 inches	17.5 inches

The following provided preliminary Portland Cement Concrete (PCC) pavement section is based on the guidelines of the American Concrete Institute (ACI 330R-08 & ACI 330.2R-17). For the final design section, we recommend a traffic study be performed as LGC Geotechnical does not perform traffic engineering. Traffic study should include the design vehicle (number of axles and load per axle) and estimated number of daily repetitions/trips. Based on an assumed Traffic Category C with an Average Daily Truck Traffic (ADTT) of 575 (Approximate TI of 10), we recommend a preliminary section of a minimum of 6.5 inches of concrete over 4 inches of compacted aggregate base over compacted subgrade. The concrete should have a minimum compressive strength of 4,000 psi and a minimum flexural strength of 550 psi at the time the pavement is subjected to traffic. Steel reinforcement is not required (ACI, 2013 & 2017). This pavement section assumes that edge restraints like a curb and gutter will be provided. To reduce the potential (but not eliminate) for cracking, paving should provide control joints at regular intervals not exceeding 12 feet in each direction. Decreasing the spacing of these joints will further reduce, but not eliminate the potential for unsightly cracking. Preliminary pavement section is based on a 20-year design. Truck loading is defined one 16-kip axle and two 32-kip tandem axles (80 kips). Alternate section(s) may be provided based on anticipated specific traffic loadings and repetitions provided by others. LGC Geotechnical does not perform traffic engineering and determination of traffic loading is not the purview of the geotechnical consultant.

The thicknesses shown are for minimum thicknesses. Increasing the thickness of any or all of the above layers will reduce the likelihood of the pavement experiencing distress during its service life. The above recommendations are based on the assumption that proper maintenance and irrigation of the areas adjacent to the roadway will occur through the design life of the pavement. Failure to maintain a proper maintenance and/or irrigation program may jeopardize the integrity of the pavement.

Earthwork recommendations regarding aggregate base and subgrade are provided in the previous section "Site Earthwork" and the related sub-sections of this report.

4.6 Soil Corrosivity

Although not corrosion engineers (LGC Geotechnical is not a corrosion consultant), several governing agencies in Southern California require the geotechnical consultant to determine the corrosion potential of soils to buried concrete and metal facilities. We therefore present the results of our testing with regard to corrosion for the use of the client and other consultants, as they determine necessary.

Corrosion testing indicated soluble sulfate contents less than approximately 0.02 percent, a chloride content of 21 ppm, pH of 8.6, and a minimum resistivity of 2,590 ohm-centimeters. Based on Caltrans Corrosion Guidelines (2021), soils are considered corrosive if the pH is 5.5 or less, or the chloride concentration is 500 ppm or greater, or the sulfate concentration is 1,500 ppm (0.15 percent) or greater.

Based on laboratory sulfate test results, the near surface soils are designated to a class "S0" per ACI 318, Table 19.3.1.1 with respect to sulfates.

4.7 Nonstructural Concrete Flatwork

Nonstructural concrete (such as flatwork, sidewalks, etc.) has a potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed in accordance with the minimum guidelines outlined in Table 6 on the following page. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 6

Nonstructural Concrete Flatwork for Very Low/Low Expansion Potential

	Flatwork	City Sidewalk Curb and Gutters
Minimum Thickness (in.)	4 (full)	City/Agency Standard
Presoaking	Wet down prior to placing	City/Agency Standard
Reinforcement	No. 3 at 24 inches on centers	City/Agency Standard
Crack Control Joints	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	City/Agency Standard
Maximum Joint Spacing	6 feet or quarter cut whichever is closer	City/Agency Standard
Aggregate Base Thickness (in.)	---	City/Agency Standard

To reduce the potential for nonstructural concrete flatwork to separate from entryways and doorways, the owner may elect to install dowels to tie these two elements together.

4.8 Surface Drainage and Landscaping

Landscape design should limit the potential for surface water to penetrate the soils adjacent to the proposed structures and improvements.

4.8.1 General

Surface drainage should be carefully taken into consideration during precise grading, building construction, future landscaping, and throughout the design life of the industrial structure. Positive drainage should be provided to direct surface water away from improvements and towards either the street or other suitable drainage devices. Ponding of water, adjacent to any structural improvement foundation, must be avoided. The performance of structural foundations is dependent upon maintaining adequate surface drainage away from them, thereby reducing excessive moisture fluctuations. From a geotechnical perspective, area drains, drainage swales, and finished grade soils should be aligned so as to transport surface water to a minimum distance of 5 feet away from the proposed foundations. Roof gutters and downspout systems should be discharged directly to a pipe or to a paved surface with a positive gradient away from the building and should not outlet directly into unpaved landscape areas.

Decorative gravel tends to act as a reservoir trapping surface water; therefore, we do not recommend it be used adjacent to buildings unless the system is designed with a subsurface drainage system and is properly lined.

4.8.2 Precise Grading

From a geotechnical perspective, we recommend that compacted finished grade soils adjacent to the proposed industrial structures be sloped away from the proposed structures and towards an approved drainage device or unobstructed swale. Drainage swales, wherever feasible, should not be constructed within 5 feet of buildings. Where lot and building geometry necessitates that the drainage swales be routed closer than 5 feet to structural foundations, we recommend the use of area drains together with drainage swales. Drainage swales used in conjunction with area drains should be designed by the project civil engineer so that a properly constructed and maintained system will prevent ponding within 5 feet of the foundation. Code compliance of grades is not the purview of the geotechnical consultant. We do not recommend that area drains be connected to basement/retaining subdrains.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Overwatering must be avoided.

4.8.3 Landscaping

Planters adjacent to a building or structure should be avoided wherever possible or be properly designed (e.g., lined with a membrane and properly outlet), to reduce the penetration of water into the adjacent footing subgrades and thereby reduce moisture related damage to the foundation. Planting areas at grade should be provided with appropriate positive drainage. Wherever possible, exposed soil areas should be above adjacent paved grades to facilitate drainage. Planters should not be depressed below adjacent paved grades unless provisions for drainage, such as multiple depressed area drains, are constructed. Adequate drainage gradients, devices, and curbing should be provided to prevent runoff from adjacent pavement or walks into the planting areas. Irrigation methods should promote uniformity of moisture in planters and beneath adjacent concrete flatwork. Overwatering and underwatering of landscape areas must be avoided. Irrigation levels should be kept to the absolute minimum level necessary to maintain healthy plant life.

Area drain inlets should be maintained and kept clear of debris in order to properly function. The building owner should also be made aware that excessive irrigation of neighboring properties can cause seepage and moisture conditions on adjacent lots.

The impact of heavy irrigation or inadequate runoff gradients can create perched water conditions. This may result in seepage or shallow groundwater conditions where previously none existed. Maintaining adequate surface drainage and controlled irrigation will significantly reduce the potential for nuisance-type moisture problems. To reduce differential earth movements such as heaving and shrinkage due to the change in moisture content of foundation soils, which may cause distress to a structure and associated improvements, moisture content of the soils surrounding the structure should be kept as relatively constant as possible.

4.9 ***Subsurface Water Infiltration***

Recent regulatory changes have occurred that mandate that storm water be infiltrated below grade rather than collected in a conventional storm drain system. It should be noted that collecting and concentrating surface water for the purpose of intentionally infiltrating it below grade, conflicts with the geotechnical engineering objective of directing surface water away from slopes, structures and other improvements. The geotechnical stability and integrity of a site is reliant upon appropriately handling surface water. In general, we do not recommend that surface water be intentionally infiltrated into the subsurface soils.

If it is determined that water must be infiltrated due to regulatory requirements, we recommend the absolute minimum amount of water be infiltrated and that the infiltration areas not be located near slopes or near settlement sensitive existing/proposed improvements. Contamination and environmental suitability of the site for infiltration is not the purview of the geotechnical consultant and should be evaluated by others. LGC Geotechnical only addressed the geotechnical issues associated with stormwater infiltration.

As with all systems that are designed to concentrate surface flow and direct the water into the subsurface soils, some minor settlement, nuisance type localized saturation and/or other water related issues should be expected. Due to variability in geologic and hydraulic conductivity characteristics, these effects may be experienced at the onsite location and/or potentially at other locations well beyond the physical limits of the subject site. Infiltrated water may enter underground utility pipe zones or flow along heterogeneous soil layers or geologic structure and migrate laterally impacting other improvements which may be located far away or at an elevation much different than the infiltration source.

Based on the results of our field infiltration testing the observed (no factor of safety) infiltration rates were 4.5 and 6.9 inches per hour (refer to Table 1). The design infiltration rate shall be determined by dividing the observed infiltration rate by a series of safety factors for site suitability and design considerations that are the purview of both the geotechnical consultant and designer of the infiltration system (County of San Bernardino, 2013). The recommended geotechnical factors of safety that are to be used to determine the design infiltration rate are provided in Table 7.

TABLE 7

Geotechnical Factors of Safety for Design Infiltration Rate

A: Site Suitability Considerations (From Table VII.3)	
Consideration	**Factor of Safety (F.S.)**
Soil Assessment Methods	2
Texture Class	1
Site Soil Variability	2
Depth to Groundwater/Impervious Layer	1
Calculated Suitability Assessment Factor of Safety	**1.5**
B: Design Related Considerations (From Table VII.4)	
Consideration	**Factor of Safety (F.S.)**
Tributary Size Area	Per Infiltration Designer
Level of Pretreatment	Per Infiltration Designer
Redundancy of Treatment	Per Infiltration Designer
Compaction during Construction	2
Calculated Design Factor of Safety	Per Infiltration Designer
Combined F.S.= Suitability F.S x Design F.S.	**TBD**

Per the requirements of the San Bernardino County testing guidelines (2013), subsurface materials should have a design infiltration rate equal to or greater than 0.3 inches per hour. The factor of safety used to determine the design infiltration rate is determined by multiplying the calculated suitability assessment factor of safety of 1.5 by the design factor of safety which is to be determined by the infiltration system designer. The design infiltration rate is thereby equal to the Measured Infiltration Rate provided in Table 1 (inches per hour) divided by the product of 1.5 times the calculated design factor of safety. The combined factor of safety must be a minimum of 2.0 but need not exceed 9.0. Results of field infiltration testing are provided in Appendix D.

Please note that the infiltration values reported herein are for native materials only and are not for compacted fill. Water discharge from any infiltration systems should not occur within the zone of influence of foundation footings (column and load bearing wall locations). For preliminary purposes we recommend a minimum setback of 15 feet from the structural improvements. Infiltration shall not be permitted directly on or into compacted fill soils. The infiltration values provided are based on clean water and this requires the removal of trash, debris, soil particles, etc., and on-going maintenance. Over time, siltation, plugging and clogging of the system may reduce the infiltration rate and subsequently reduce the effectiveness of the infiltration system. Any designed infiltration system will require routine periodic maintenance. It should be noted that methods to prevent this shall be the sole responsibility of the infiltration designer and are not the purview of the geotechnical consultant. If adequate measures cannot be incorporated into the design and maintenance of the system, then the infiltration rates may need to be further reduced. These and other factors should be considered in selecting a design infiltration rate.

We recommend the design of any infiltration system include at least one redundancy or overflow system. It may be prudent to provide an overflow system connected directly to a storm drain system in order to prevent failure of the infiltration system, either as a result of lower than anticipated infiltration with time and/or very high flow volumes.

LGC Geotechnical should be provided with details for any planned required infiltration system early in the design process for geotechnical input.

4.10 ***Pre-Construction Documentation and Construction Monitoring***

A program of documentation and monitoring should be devised and put into practice before the onset of any groundwork. LGC Geotechnical can perform these services at your request. This should include, but not necessarily be limited to, detailed documentation of the existing improvements, buildings, and utilities around the area of proposed excavation, with particular attention to any distress that is already present prior to the start of work. At the completion of construction, we recommend that the adjacent properties be re-documented to confirm their condition after potentially damaging activities are completed. In the event of future claims, any post-construction damage may be attributed to other causes.

4.11 ***Geotechnical Plan Review***

Project plans (e.g., grading, foundation, retaining wall, etc.) and any other improvement plans, and final project drawings should be reviewed by this office prior to construction to verify that our geotechnical recommendations, provided herein, have been appropriately incorporated. Additional or modified geotechnical recommendations may be required based on the proposed design.

4.12 ***Geotechnical Observation and Testing During Construction***

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC Geotechnical. Geotechnical observation and testing is required per Section 1705 of the 2019 California Building Code (CBC).

Geotechnical observation and/or testing should be performed by LGC Geotechnical at the following stages:

- During grading (removal bottoms, fill placement, etc.);
- During retaining wall backfill and compaction;
- During utility trench backfill and compaction;
- During drilling and backfilling of holes in bottom of infiltration system;
- During precise grading;
- Preparation of building pads and other concrete-flatwork subgrades, and prior to placement of aggregate base or concrete;

- After building and wall footing excavation and prior to placement of steel reinforcement and/or concrete;
- Preparation of pavement subgrade and placement of aggregate base; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

5.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. The samples taken and submitted for laboratory testing, the observations made, and the in-situ field testing performed are believed representative of the entire project; however, soil and geologic conditions revealed by excavation may be different than our preliminary findings. If this occurs, the changed conditions must be evaluated by the project soils engineer and geologist and design(s) adjusted as required or alternate design(s) recommended.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and/or project engineer and incorporated into the plans, and the necessary steps are taken to see that the contractor and/or subcontractor properly implements the recommendations in the field. The contractor and/or subcontractor should notify the owner if they consider any of the recommendations presented herein to be unsafe.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. Therefore, the findings, conclusions, and recommendations presented in this report can be relied upon only if LGC Geotechnical has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification, and should not be relied upon after a period of 3 years.

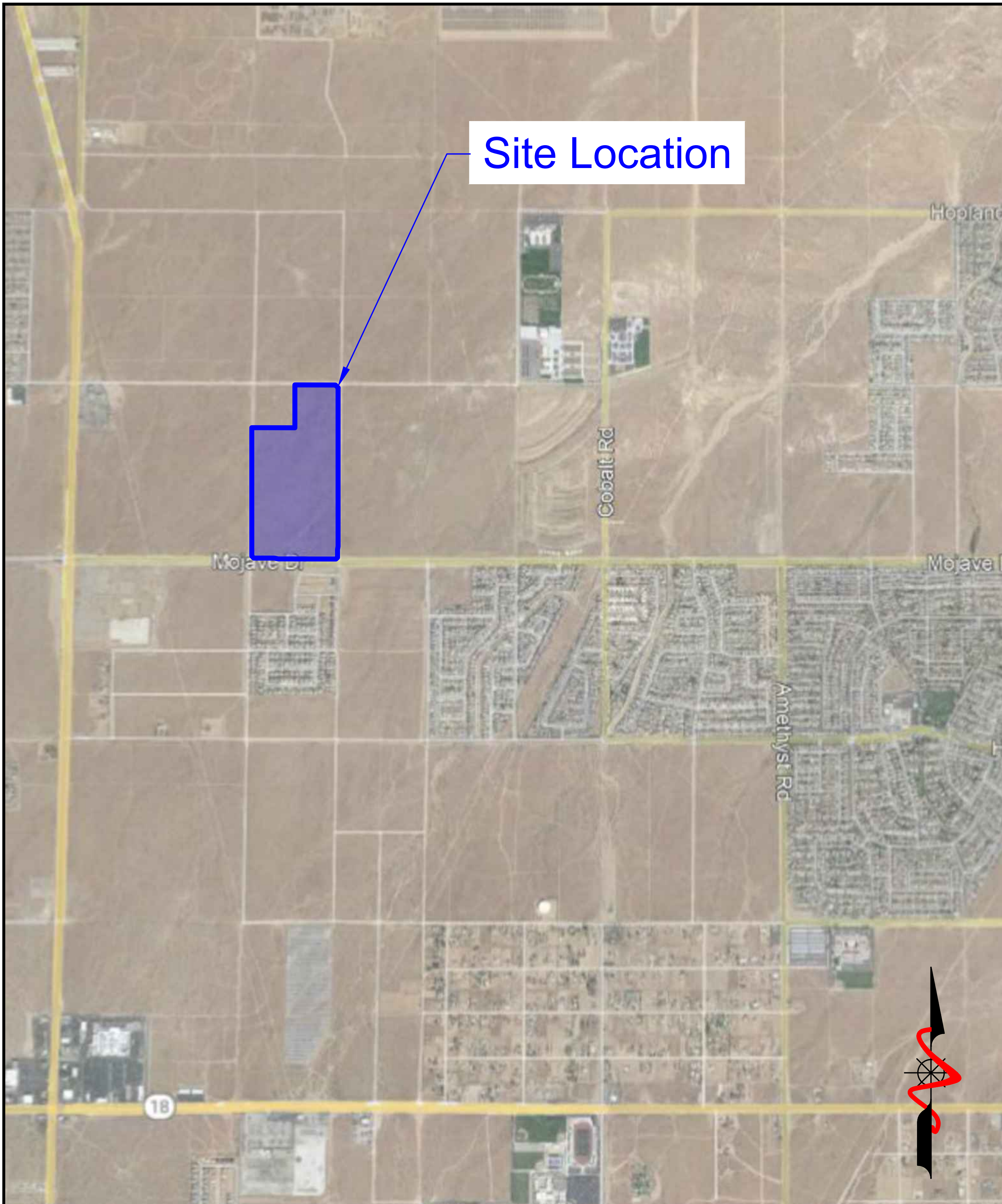
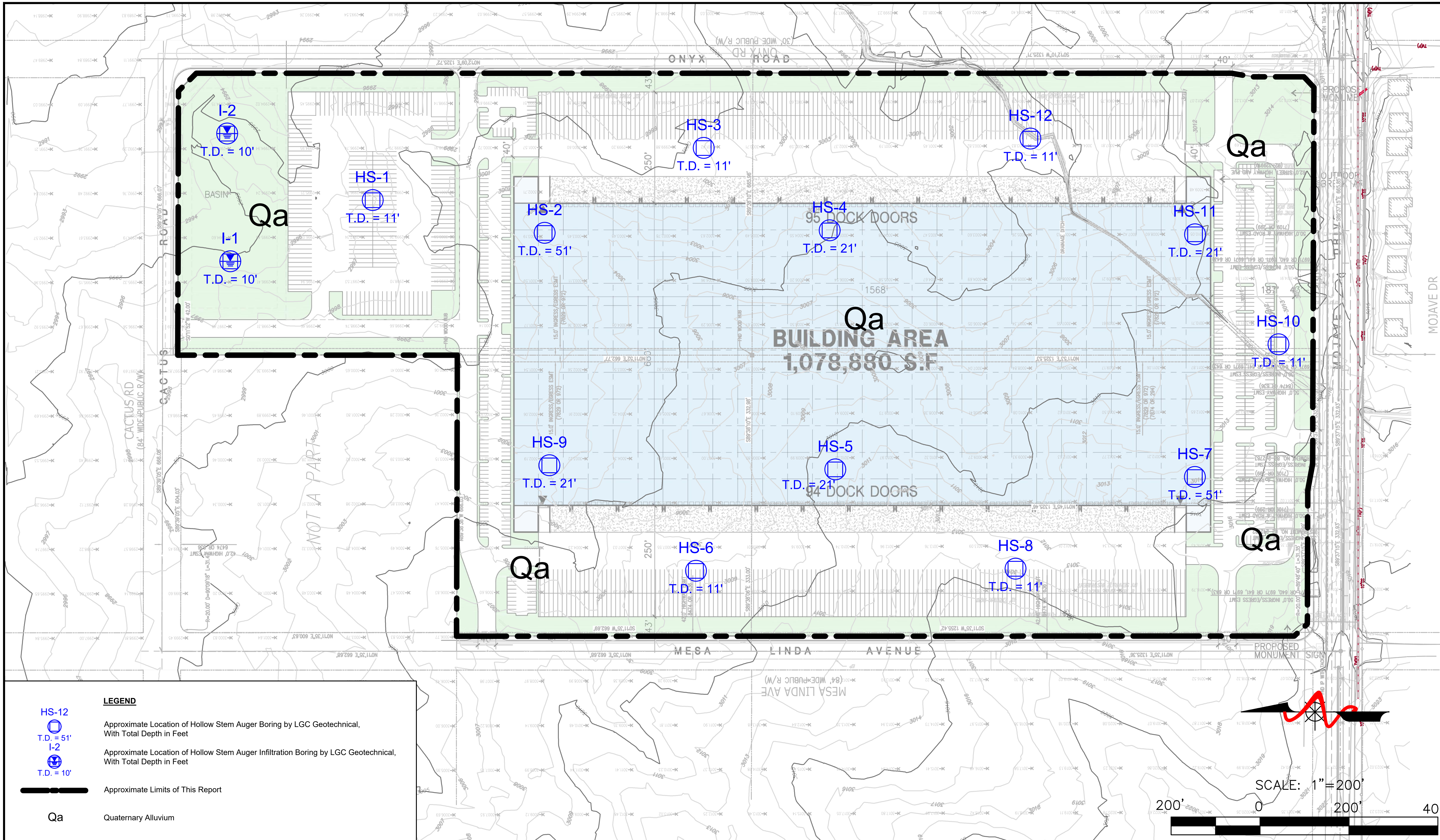


FIGURE 1 **Site Location Map**	PROJECT NAME	IPG - Mojave 68, Victorville
	PROJECT NO.	22124-01
	ENG. / GEOL.	BTZ/KBC
	SCALE	Not to Scale
	DATE	October 2022

LGC Geotechnical, Inc.

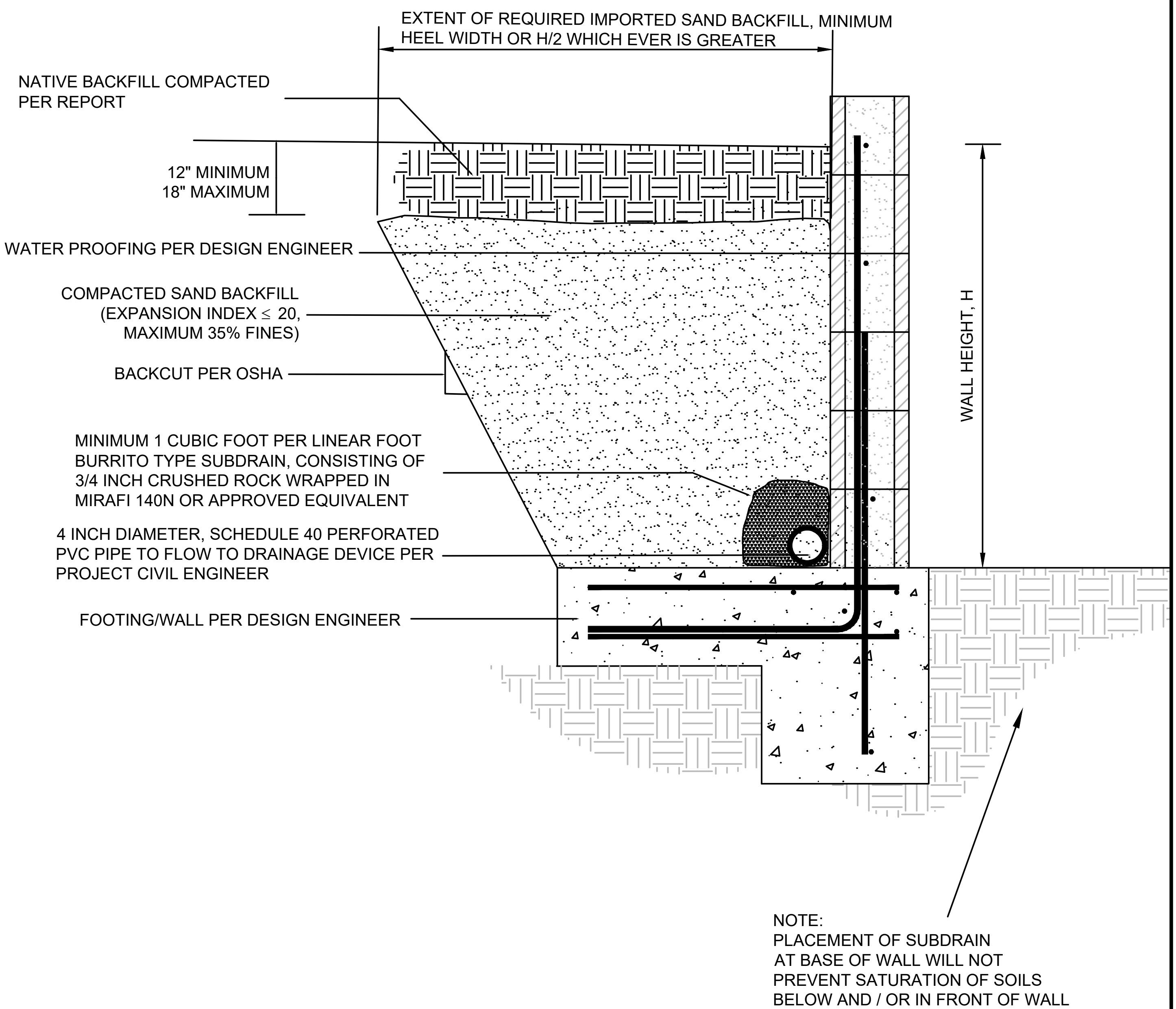


LGC Geotechnical, Inc.

LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

Figure 2
Geotechnical Site Map

PROJECT NAME	IPG - Mojave 68, Victorville
PROJECT NO.	22124-01
ENG. / GEOL.	BTZ/KBC
SCALE	1" = 200'
DATE	October 2022



LGC Geotechnical, Inc.

FIGURE 3
Retaining Wall Backfill Detail

PROJECT NAME	IPG - Mojave 68, Victorville
PROJECT NO.	22124-01
ENG. / GEOL.	BTZ/KBC
SCALE	Not to Scale
DATE	October 2022

Appendix A
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APPENDIX A

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Appendix B
Boring Logs

Geotechnical Boring Log Borehole HS-1

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~2997' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1					ML	@ 0' - Sandy SILT: light brown, dry	
2995			R-1	19 32 40	119.8	4.9		@ 2.5' - Sandy SILT: light brown, slightly moist, hard, with caliche	
	5		SPT-1	5 6 6		1.8	SM	@ 5' - Silty SAND: light yellowish gray, dry, medium dense	
2990			R-2	18 30 39	107.3	3.6	ML	@ 7.5' - Sandy SILT: light brown, slightly moist, hard	
	10		SPT-2	6 8 10		4.6	SM	@ 10' - Silty SAND: light brown, slightly moist, medium dense	SA
2985								Total Depth = 11' Groundwater Not Encountered Backfilled with Cuttings on 9/12/2022	
	15								
-20									
	20								
-25									
	25								
	30								

LGC Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-2

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3003' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 2

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1 (0–5')					SC	@ 0' - Clayey SAND: light brown, slightly moist	EI CR
3000			SPT-1	7 13 18		4.4		@ 2.5' - Silty SAND: light brown, slightly moist, dense	
	5		R-1	17 22 35	121.0	2.5	SP-SM	@ 5' - SAND with Silt: light reddish brown, dry, dense	
2995			SPT-2	11 13 16		4.9	SM	@ 7.5' - Silty SAND: light brown, slightly moist, dense	SA
	10		R-2	20 32 50	112.3	2.1		@ 10' - Silty SAND: light olive brown, dry, very dense	CN
2990									
	15		SPT-3	7 10 12		4.1	SC	@ 15' - Clayey SAND: yellowish brown, slightly moist, medium dense	SA
2985									
	20		R-3	25 45 50/5"	119.9	4.4	ML	@ 20' - Sandy SILT: light brown, slightly moist, hard	
2980									
	25		SPT-4	9 10 13		4.0	CL-ML	@ 25' - Sandy SILT to CLAY: grayish brown, slightly moist, very stiff	AL -#200
2975									
	30								

LGC Geotechnical, Inc.

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SAMPLE TYPES:
B BULK SAMPLE
R RING SAMPLE (CA Modified Sampler)
G GRAB SAMPLE
SPT STANDARD PENETRATION TEST SAMPLE
GROUNDWATER TABLE

TEST TYPES:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
SA SIEVE ANALYSIS
S&H SIEVE AND HYDROMETER
EI EXPANSION INDEX
CN CONSOLIDATION
CR CORROSION
AL ATTERBERG LIMITS
CO COLLAPSE/SWELL
RV R-VALUE
-#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-2

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3003' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 2 of 2

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	30		R-4	25 40 50/4"	118.8	5.8	ML	@ 30' - Sandy SILT: dark olive gray, slightly moist, hard	
2970									
	35		SPT-5	16 22 28		4.4	SM	@ 35' - Silty SAND: olive gray, slightly moist, very dense	
2965									
	40		R-5	42 50/4"	107.7	8.2	ML	@ 40' - SILT: light grayish brown, slightly moist, hard	
2960									
	45		SPT-6	14 19 28		16.7	CL	@ 45' - CLAY: light grayish brown, moist, hard, with caliche	
2955									
	50		R-6	45 50/3"	116.6	8.6	ML	@ 50' - Sandy SILT: yellowish brown, slightly moist, hard	
2950								Total Depth = 51' Groundwater Not Encountered Caving: Hole Measured Approximately 50' After Removal of Augers Backfilled with Cuttings on 9/12/2022	
	55								
2945									
	60								

Geotechnical Boring Log Borehole HS-3

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3001' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
3000	0	B-1					ML	@ 0' - Sandy SILT: dark yellowish brown, dry	RV
			R-1	25 40 50/5"	120.5	3.8	SM	@ 2.5' - Silty SAND: light brown, slightly moist, very dense	
2995	5		SPT-1	8 11 14		2.9	ML	@ 5' - Sandy SILT: light grayish brown, slightly moist, hard	
			R-2	16 24 32	110.1	6.0	SM	@ 7.5' - Silty SAND: light brown, slightly moist, dense	
2990	10		SPT-1	6 7 9		3.0		@ 10' - Silty SAND: light brownish gray, slightly moist, medium dense	
								Total Depth = 11' Groundwater Not Encountered Backfilled with Cuttings on 9/12/2022	
2985	15								
2980	20								
2975	25								
	30								

LGC Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-4

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3005' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0						SM	@ 0' - Silty SAND: light reddish brown, dry	MD
			SPT-1	7 11 14		3.7		@ 2.5' - Silty SAND: light reddish brown, slightly moist, dense	
3000	5	B-1	R-1	17 24 29	121.3	1.9		@ 5' - Silty SAND: light olive gray, dry, dense	CN
			SPT-2	15 24 19		4.6	ML	@ 7.5' - Sandy SILT: light grayish brown, slight moist, hard	
2995	10		R-2	38 50/2"	105.7	5.1	SM	@ 10' - Silty SAND: light olive brown, slightly moist, very dense	
2990	15		SPT-3	5 6 10		2.4	ML	@ 15' - Sandy SILT: gray, slightly moist, very stiff	
2985	20		R-3	40 50/5"	104.3	3.1	SM	@ 20' - Silty SAND: gray, slightly moist, very dense	
								Total Depth = 21' Groundwater Not Encountered Caving: Hole Measured Approximately 16' After Removal of Augers Backfilled with Cuttings on 9/12/2022	
2980	25								
2975	30								

LGC Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-5

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3010' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1					SM	@ 0' - Silty SAND: reddish brown, dry	
			R-1	9 25 38	129.5	2.1		@ 2.5' - Silty SAND: reddish brown, slightly moist, dense	
3005	5		SPT-1	6 9 10		1.3	SP-SM	@ 5' - SAND with Silt: yellowish gray, dry, medium dense	
			R-2	28 40 45	113.0	1.7	SM	@ 7.5' - Silty SAND: pale brown, dry, very dense	
3000	10		SPT-2	13 16 20		4.3	ML	@ 10' - Sandy SILT: light brown, slightly moist, hard	
2995	15		R-3	39 50/6"	109.2	2.0	SM	@ 15' - Silty SAND: light brown, dry, very dense	
2990	20		SPT-3	8 10 13		2.7	ML	@ 20' - Sandy SILT: light brownish gray, slightly moist, very stiff	
2985	25							Total Depth = 21' Groundwater Not Encountered Caving: Hole Measured Approximately 18.6' After Removal of Augers Backfilled with Cuttings on 9/12/2022	
	30								

LGC Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-6

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3008' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1					SM	@ 0' - Silty SAND: light reddish brown, dry	
3005			SPT-1	5 6 8		3.8		@ 2.5' - Silty SAND: light reddish brown, slightly moist, medium dense	
	5		R-1	40 50/3"	117.3	3.3		@ 5' - Silty SAND: light brown, slightly moist, very dense	
3000			SPT-2	6 8 9		3.3		@ 7.5' - Silty SAND: light olive brown, slightly moist, medium dense	
	10		R-2	35 50/5"	109.0	2.4		@ 10' - Silty SAND: light grayish brown, slightly moist, very dense	
2995	15							Total Depth = 11' Groundwater Not Encountered Caving: Hole Measured Approximately 7' After Removal of Augers Backfilled with Cuttings on 9/12/2022	
2990	20								
2985	25								
2980	30								

LGC Geotechnical, Inc.

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SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- ▽ GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-7

Date: 9/13/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3014' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 2

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
3015	0	B-1 (0–5')					SM	@ 0' - Silty SAND: light brown, dry	EI
			R-1	12 18 39	120.1	2.3		@ 2.5' - Silty SAND: light brown, slightly moist, dense	
3010	5		SPT-1	7 9 12		3.1		@ 5' - Silty SAND: grayish brown, slightly moist, medium dense	SA
			R-2	28 45 50/5"	121.1	4.1		@ 7.5' - Silty SAND: grayish brown, slightly moist, very dense	
3005	10		SPT-2	7 10 13		3.7		@ 10' - Silty SAND: light brown, slightly moist, medium dense	SA
3000	15		R-3	26 40 50/5"	117.4	1.0	SP-SM	@ 15' - SAND with Silt: olive gray, dry, very dense	
2995	20		SPT-3	15 18 30		9.0	SM	@ 20' - Silty SAND: olive brown, moist, very dense	
2990	25		R-4	38 50/5"	120.8	3.6		@ 25' - Silty SAND: light olive, slightly moist, very dense	
	30								

LGC Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-7

Date: 9/13/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3014' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
2985	30		SPT-4	13 16 20		8.8	ML	@ 30' - Sandy SILT: light brown, moist, dense	
2980	35		R-5	29 44 50/3"	105.2	4.2		@ 35' - Sandy SILT: light yellowish brown, slightly moist, hard	
2975	40		SPT-5	20 32 40		12.3		@ 40' - SILT: grayish brown, moist, hard	
2970	45		R-6	50/5"	101.7	3.8	SM	@ 45' - Silty SAND: pale brown, slightly moist, very dense	
2965	50		SPT-6	20 38 50/5"		12.6	ML	@ 50' - SILT: grayish brown, moist, hard	
2960	55							Total Depth = 51' Groundwater Not Encountered Caving: Hole Measured Approximately 48' After Removal of Augers Backfilled with Cuttings on 9/13/2022	
	60								

LGC Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
B BULK SAMPLE
R RING SAMPLE (CA Modified Sampler)
G GRAB SAMPLE
SPT STANDARD PENETRATION TEST SAMPLE

GROUNDWATER TABLE

TEST TYPES:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
SA SIEVE ANALYSIS
S&H SIEVE AND HYDROMETER
EI EXPANSION INDEX
CN CONSOLIDATION
CR CORROSION
AL ATTERBERG LIMITS
CO COLLAPSE/SWELL
RV R-VALUE
-#200 % PASSING # 200 SIEVE

Geotechnical Boring Log Borehole HS-8

Date: 9/13/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3014' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0						SM	@ 0' - Silty SAND: yellowish brown, dry	
			SPT-1	7 9 10		2.5		@ 2.5' - Silty SAND: yellowish brown, slightly moist, medium dense	
3010	5	B-1	R-1	32 50/5"	119.8	2.1		@ 5' - Silty SAND: light brown, slightly moist, very dense	
			SPT-2	14 19 29		4.6		@ 7.5' - Silty SAND: light olive gray, slightly moist, very dense	
3005	10		R-2	39 50/6"	117.4	2.5		@ 10' - Silty SAND: light yellowish brown, slightly moist, very dense	
								Total Depth = 11' Groundwater Not Encountered Caving: Hole Measured Approximately 8.8' After Removal of Augers Backfilled with Cuttings on 9/13/2022	
3000	15								
2995	20								
2990	25								
2985	30								

Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-9

Date: 9/13/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3003' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1					ML	@ 0' - Sandy SILT: light brown, dry	
3000			R-1	28 40 50/5"	105.0	6.4		@ 2.5' - Sandy SILT: light brown, moist, hard	
	5		SPT-1	5 6 9		3.4	SM	@ 5' - Silty SAND: gray, slightly moist, medium dense	-#200
2995			R-2	18 26 38	113.3	2.7		@ 7.5' - Silty SAND: olive gray, dry, very dense	CN
	10		SPT-2	7 9 12		2.7		@ 10' - Silty SAND: light yellowish brown, slightly moist, medium dense	-#200
2990									
	15		R-3	30 39 50	117.7	10.0	ML	@ 15' - Silty SAND: light grayish brown, moist to very moist, hard	
2985									
	20		SPT-3	8 9 15		1.5	SP-SM	@ 20' - SAND with Silt: gray, dry, dense	
2980								Total Depth = 21' Groundwater Not Encountered Caving: Hole Measured Approximately 18.3' After Removal of Augers Backfilled with Cuttings on 9/13/2022	
	25								
2975									
	30								

LGC Geotechnical, Inc.

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SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-10

Date: 9/13/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3013' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0						SM	@ 0' - Silty SAND: light brown, dry	
3010			SPT-1	5 6 7		1.8		@ 2.5' - Silty SAND: light brown, dry, medium dense	
	5	B-1	R-1	20 29 40	112.5	1.8		@ 5' - Silty SAND: light yellowish brown, dry, very dense	
3000			SPT-2	20 32 40		4.5		@ 7.5' - Silty SAND: light brown, slightly moist, very dense	
	10		R-2	48 50/3"	116.2	6.8		@ 10' - Silty SAND: light brown, moist, very dense	
2995	15							Total Depth = 11' Groundwater Not Encountered Backfilled with Cuttings on 9/13/2022	
2990	20								
2985	25								
2980	30								

Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-11

Date: 9/13/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3010' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0						ML	@ 0' - Sandy SILT: light yellowish brown, slightly moist	
			R-1	12 15 21	101.5	7.5		@ 2.5' - Sandy SILT: light yellowish brown, slightly moist, very stiff	
3005	5	B-1	SPT-1	5 6 9		2.0	SM	@ 5' - Silty SAND: light olive gray, dry, medium dense	
			R-2	33 50/6"	124.6	6.4		@ 7.5' - Silty SAND: brown, slightly moist, very dense	
3000	10		SPT-2	15 19 30		6.1	ML	@ 10' - Sandy SILT: light brown, slightly moist, hard	
2995	15		R-3	40 50/5"	124.2	1.2	SP-SM	@ 15' - SAND with Silt: light brown, dry, very dense	CN
2990	20		SPT-3	10 11 15		2.9	SM	@ 20' - Silty SAND: gray, slightly moist, dense	-#200
								Total Depth = 21' Groundwater Not Encountered Caving: Hole Measured Approximately 18.3' After Removal of Augers Backfilled with Cuttings on 9/13/2022	
2985	25								
	30								

LGC Geotechnical, Inc.

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SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole HS-12

Date: 9/13/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~3003' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0						ML	@ 0' - Sandy SILT: light brown, dry	
3000			SPT-1	12 15 21		4.3		@ 2.5' - Sandy SILT: light brown, slightly moist, hard	
	5	B-1	R-1	28 40 50/6"	114.4	3.8	SM	@ 5' - Silty SAND: light yellowish brown, slightly moist, very dense	
2995			SPT-2	10 12 16		2.7		@ 7.5' - Silty SAND: light yellowish brown, slightly moist, dense	
	10		R-2	39 50/5"	126.1	3.2		@ 10' - Silty SAND: brown, slightly moist, very dense	
2990								Total Depth = 11' Groundwater Not Encountered Caving: Hole Measured Approximately 7' After Removal of Augers Backfilled with Cuttings on 9/13/2022	
	15								
2985									
	20								
2980									
	25								
2975									
	30								

LGC Geotechnical, Inc.

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SAMPLE TYPES:
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- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- ▽ GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
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- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole I-1

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~2995' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0						SM	@ 0' - Silty SAND: light reddish brown, dry	
			SPT-1	4 5 5		1.4		@ 2.5' - Silty SAND: light reddish brown, dry, medium dense	
2990	5		SPT-2	7 9 12		1.0	SP-SM	@ 5' - SAND with Silt: light brown, dry, medium dense	
2985	10								
								Total Depth = 11' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Sand, and Presoaked on 9/12/22 Pipe Removed and Boring Backfilled with Cuttings on 9/13/2022	
2980	15								
2975	20								
2970	25								
2965	30								

LGC Geotechnical, Inc.

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- ▽ GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Last Edited: 9/19/2022

Geotechnical Boring Log Borehole I-2

Date: 9/12/2022	**Drilling Company:** Choice Drilling
Project Name: Mojave 68 - Victorville	**Type of Rig:** Truck Mounted
Project Number: 22124-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~2995' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By KBC

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							@ 0' - Sandy CLAY: reddish brown, dry	
			SPT-1	6 8 15		6.6	CL	@ 2.5' - Sandy CLAY, reddish brown, slightly moist, very stiff	
2990	5		SPT-2	6 8 12		2.8	SM	@ 5' - Silty SAND: yellowish brown, slightly moist, medium dense	
			SPT-3	8 12 15		3.6	SM-ML	@ 7.5' - Silty SAND/Sandy SILT: light brown, slightly moist, dense/hard	
2985	10								
								Total Depth = 11' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Sand, and Presoaked on 9/12/22 Pipe Removed and Boring Backfilled with Cuttings on 9/13/2022	
2980	15								
2975	20								
2970	25								
2965	30								

Last Edited: 9/19/2022

LGC Geotechnical, Inc.

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. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE (CA Modified Sampler)
- G GRAB SAMPLE
- SPT STANDARD PENETRATION TEST SAMPLE
- ∇ GROUNDWATER TABLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
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- RV R-VALUE
- -#200 % PASSING # 200 SIEVE

Appendix C
Laboratory Test Results

APPENDIX C

Laboratory Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on driven samples obtained from the test borings. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from undisturbed or disturbed samples.

Grain Size Distribution/Fines Content: Representative samples were dried, weighed, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve (ASTM D1140). Where applicable, the portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D6913 (sieve).

Sample Location	Description	% Passing # 200 Sieve
HS-1 @ 10 ft	Silty Sand	48
HS-2 @ 7.5 ft	Silty Sand	24
HS-2 @ 15 ft	Clayey Sand	24
HS-2 @ 25 ft	Silty, Clayey Sand	45
HS-7 @ 5 ft	Silty Sand	25
HS-7 @ 10 ft	Silty Sand	25
HS-9 @ 5 ft	Silty Sand	34
HS-9 @ 10 ft	Silty Sand	28
HS-11 @ 20 ft	Silty Sand	49

Laboratory Test Results

ASTM D4318 for engineering classification of fine-grained material and presented in the table below. The USCS soil classification indicated in the table below is based on the portion of sample passing the No. 40 sieve and may not necessarily be representative of the entire sample. The plot is provided in this Appendix.

Sample Location	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Soil Classification (Passing No. 40 Sieve Only)
HS-2 @ 25 ft	24	17	7	CL-ML

Expansion Index: The expansion potential of selected representative samples was evaluated by the Expansion Index Test per ASTM D4829. The results are presented in the table below.

Sample Location	Expansion Index	Expansion Potential*
HS-2 @ 0-5 ft	18	Very Low
HS-7 @ 0-5 ft	1	Very Low

* Per ASTM D4829

Consolidation: Consolidation tests were performed per ASTM D2435. Samples (2.4 inches in diameter and 1 inch in height) were placed in a consolidometer and increasing loads were applied. The samples were allowed to consolidate under "double drainage" and total deformation for each loading step was recorded. The percent consolidation for each load step was recorded as the ratio of the amount of vertical compression to the original sample height. The consolidation pressure curves are provided in this Appendix.

Laboratory Compaction: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results are presented in the table below.

Sample Location	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
HS-4 @ 0-5 ft	Light Brown Silty Sand	129.5	9.0

Laboratory Test Results

<u>R-value Test</u>: R-value test was performed in general accordance with California Test Method 301. The plot is attached.

Sample No.	R-Value
HS-3 @ 0-5 ft	27

<u>Soluble Sulfates</u>: The soluble sulfate contents of selected samples were determined by standard geochemical methods (CTM 417). The test results are presented in the table below.

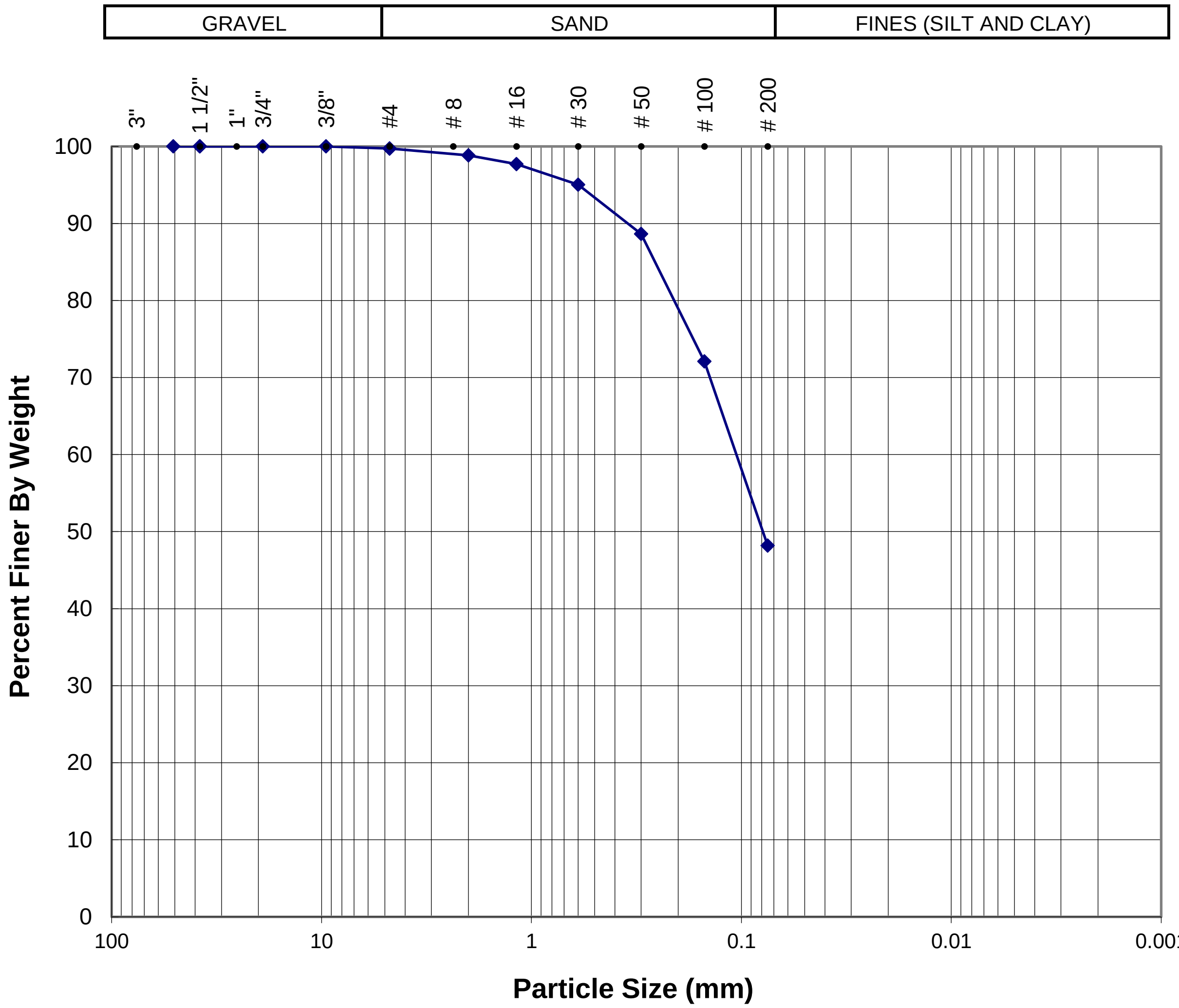
Sample Location	Sulfate Content (ppm)	Sulfate Content (%)
HS-2 @ 0-5 ft	112	< 0.02
HS-7 @ 0-5 ft	129	< 0.02

<u>Chloride Content</u>: Chloride content was tested per CTM 422. The results are presented below.

Sample Location	Chloride Content (ppm)
HS-2 @ 0-5 ft	21

<u>Minimum Resistivity and pH Tests</u>: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The results are presented in the table below.

Sample Location	pH	Minimum Resistivity (ohms-cm)
HS-2 @ 0-5 ft	8.6	2,950



Location:	Sample No.:	Depth (ft.)	Soil Type	Gravel (%)	Sand (%)	Fines (%)
HS-1	**SPT-2**	**10'**	**SM**	**0**	**52**	**48**

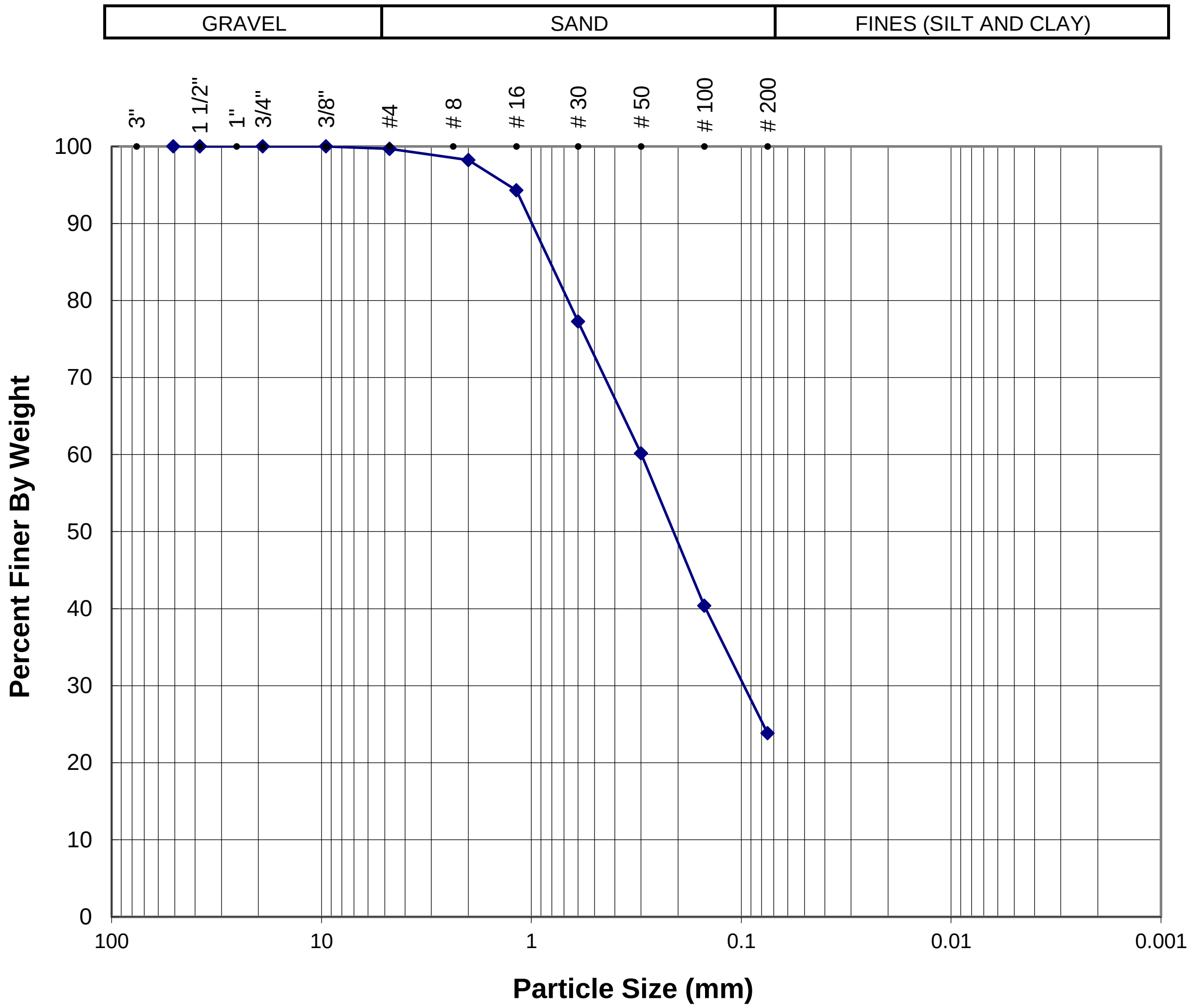
Sample Description: Light brown silty SAND

LGC Geotechnical, Inc.

PARTICLE SIZE ANALYSIS
(ASTM D 422)

Project Number: 22124-01
Date: Sep-22

Mojave 68, Victorville



Location:	Sample No.:	Depth (ft.)	Soil Type	Gravel (%)	Sand (%)	Fines (%)
HS-2	**SPT-2**	**7.5'**	**SM**	**0**	**76**	**24**

Sample Description: Light brown silty SAND

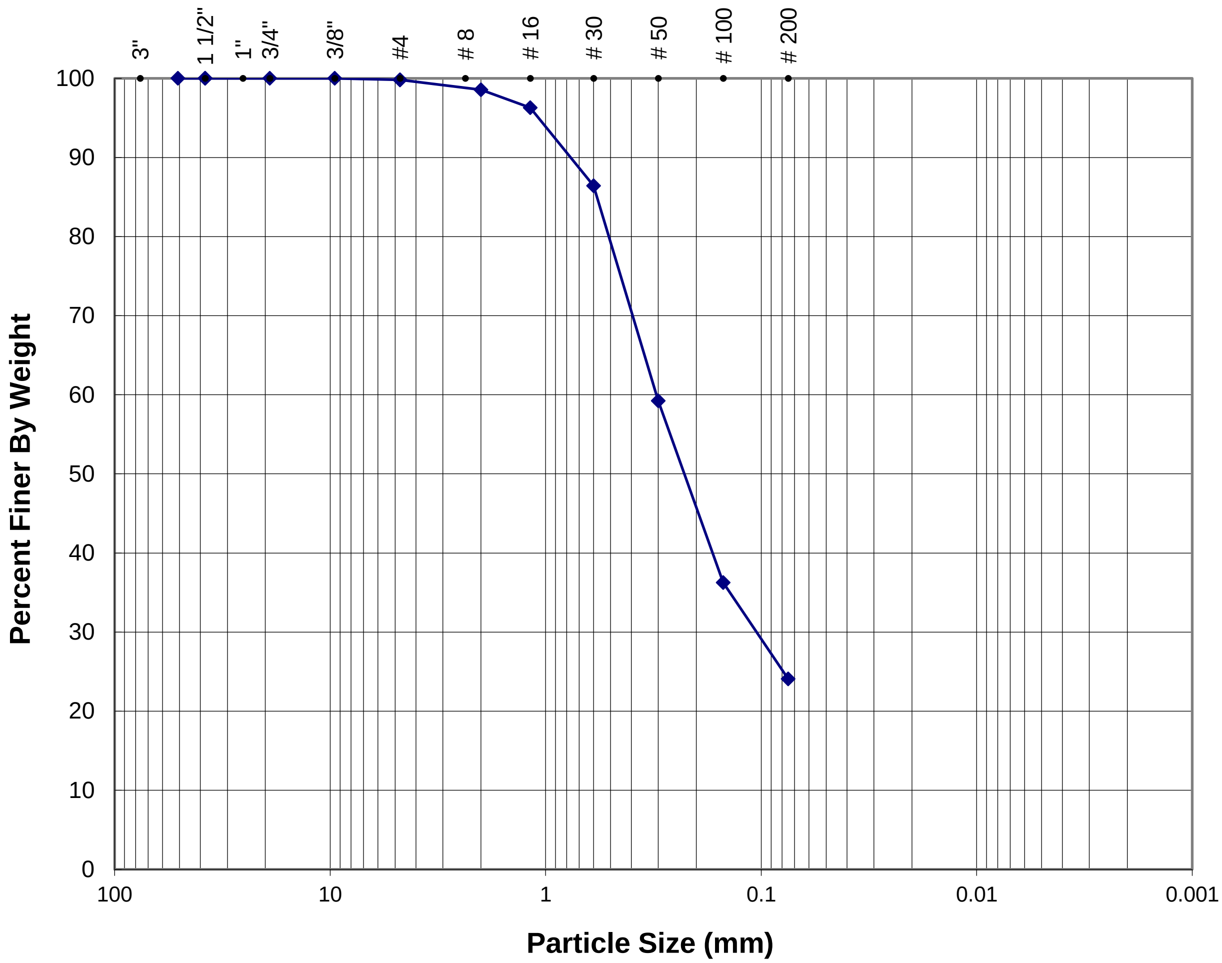
LGC Geotechnical, Inc.

PARTICLE SIZE ANALYSIS
(ASTM D 422)

Project Number: 22124-01
Date: Sep-22

Mojave 68, Victorville

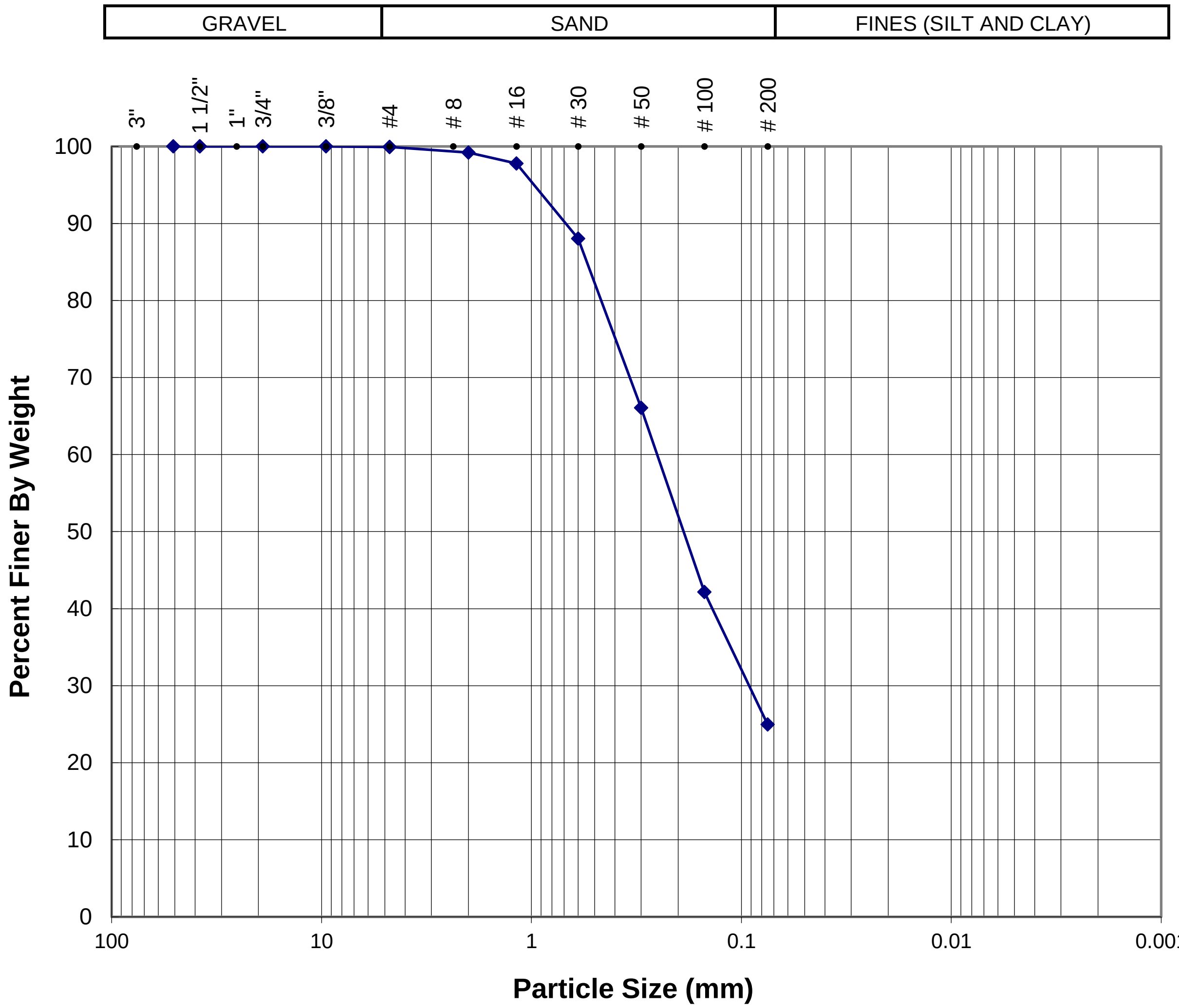
GRAVEL	SAND	FINES (SILT AND CLAY)



Location:	Sample No.:	Depth (ft.)	Soil Type	Gravel (%)	Sand (%)	Fines (%)
HS-2	**SPT-3**	**15'**	**SC**	**0**	**76**	**24**

Sample Description: Yellowish brown clayey SAND

LGC Geotechnical, Inc.	**PARTICLE SIZE ANALYSIS** (ASTM D 422)	**Project Number:** 22124-01 **Date:** Sep-22 **Mojave 68, Victorville**



Location:	Sample No.:	Depth (ft.)	Soil Type	Gravel (%)	Sand (%)	Fines (%)
HS-7	**SPT-1**	**5'**	**SM**	**0**	**75**	**25**

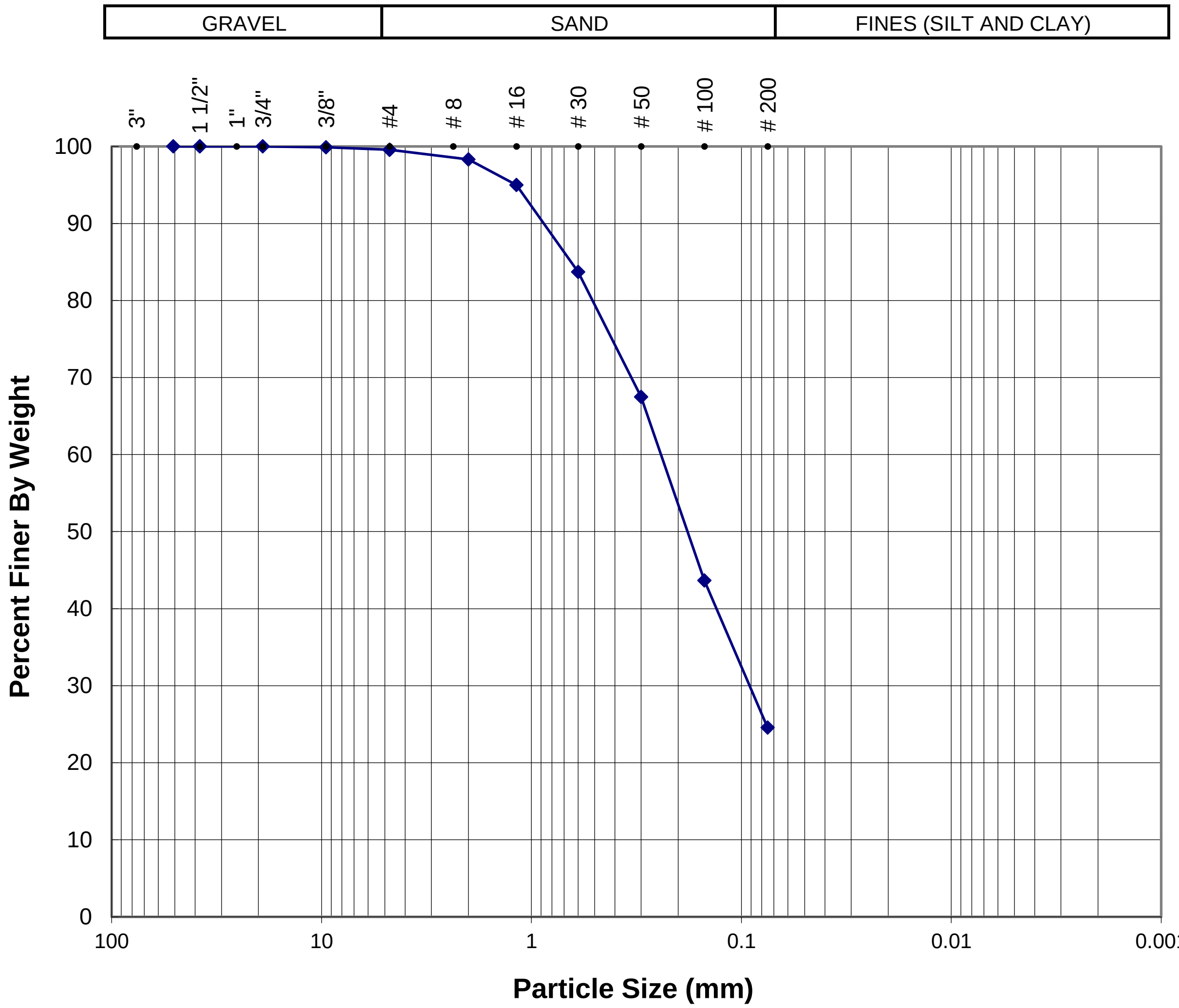
Sample Description: Grayish brown silty SAND

LGC Geotechnical, Inc.

PARTICLE SIZE ANALYSIS
(ASTM D 422)

Project Number: 22124-01
Date: Sep-22

Mojave 68, Victorville



Location:	Sample No.:	Depth (ft.)	Soil Type	Gravel (%)	Sand (%)	Fines (%)
HS-7	**SPT-2**	**10'**	**SM**	**0**	**75**	**25**

Sample Description: Pale brown silty SAND

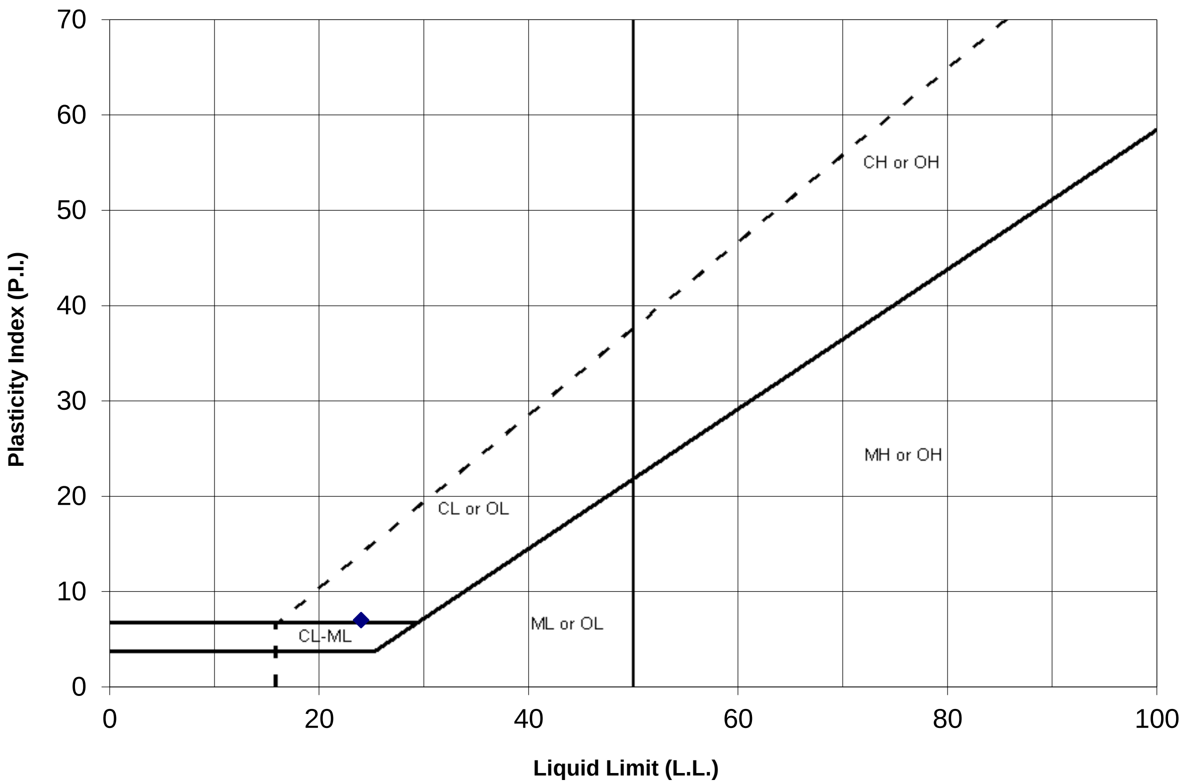
LGC Geotechnical, Inc.

PARTICLE SIZE ANALYSIS
(ASTM D 422)

Project Number: 22124-01
Date: Sep-22

Mojave 68, Victorville

PLASTICITY CHART - CLASSIFICATION OF FINE-GRAINED SOILS



Symbol	Location.:	Sample No.:	Depth (ft)	Passing No. 200 Sieve (%)	Liquid Limit (%) LL	Plastic Limit (%) PL	Plasticity Index (%) PI	USCS
◆	**HS-2**	**SPT-4**	**25'**	**45**	**24**	**17**	**7**	**CL-ML**

LGC Geotechnical, Inc.

ATTERBERG LIMITS
(ASTM D 4318)

Project Number: 22124-01
Date: Sep-22

Mojave 68, Victorville

Location	Sample No.	Depth (ft)	Molding Moisture Content (%)	Initial Dry Density (pcf)	Final Moisture Content (%)	Expansion Index	Expansion Classification[1]
HS-2	B-1	0-5'	8.0	116.7	15.1	18	Very Low
HS-7	B-1	0-5'	8.1	117.6	12.2	0	Very Low

LGC Geotechnical, Inc.

EXPANSION INDEX
(ASTM D 4829)

Project Number: 22124-01
Date: Sep-22

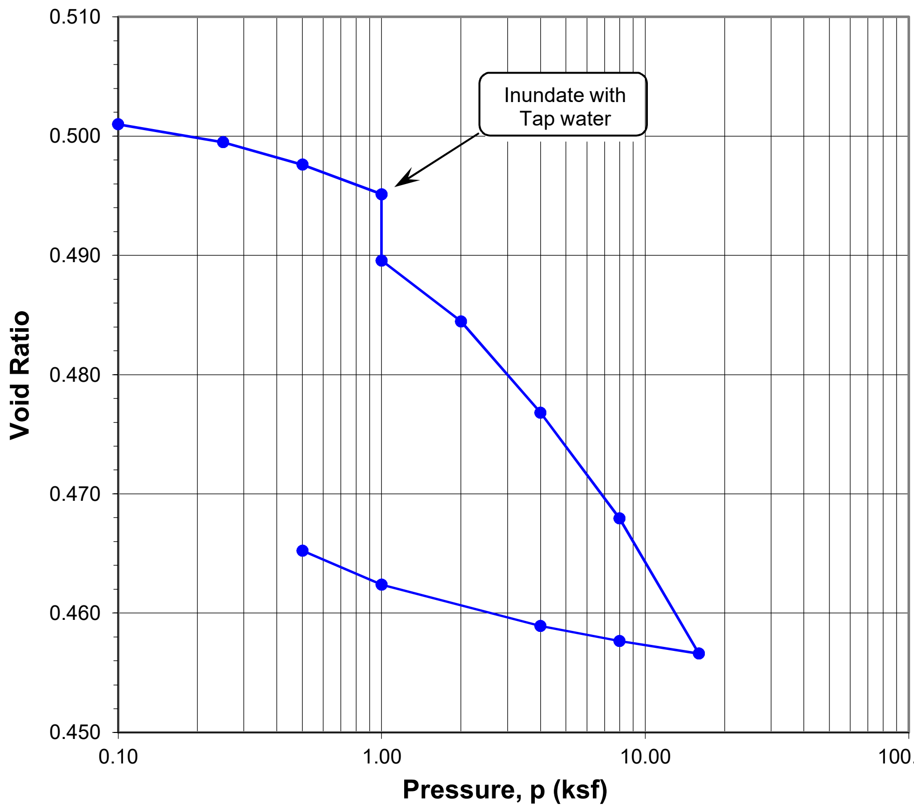
Mojave 68, Victorville

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	Mojave 68, Victorville	Tested By:	GB/JD	Date:	09/22/22
Project No.:	22124-01	Checked By:	J. Ward	Date:	10/06/22
Boring No.:	HS-2	Depth (ft.):	10.0		
Sample No.:	R-2	Sample Type:	Ring		
Soil Identification:	Light olive brown silty sand (SM)				

Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	179.70
Weight of Ring (g):	41.84
Height after consol. (in.):	0.9760
Before Test	
Wt. of Wet Sample+Cont. (g):	179.82
Wt. of Dry Sample+Cont. (g):	176.89
Weight of Container (g):	38.36
Initial Moisture Content (%)	2.1
Initial Dry Density (pcf)	112.3
Initial Saturation (%):	11
Initial Vertical Reading (in.)	0.0981
After Test	
Wt. of Wet Sample+Cont. (g):	252.10
Wt. of Dry Sample+Cont. (g):	231.52
Weight of Container (g):	56.60
Final Moisture Content (%)	15.46
Final Dry Density (pcf):	113.4
Final Saturation (%):	86
Final Vertical Reading (in.)	0.1257
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

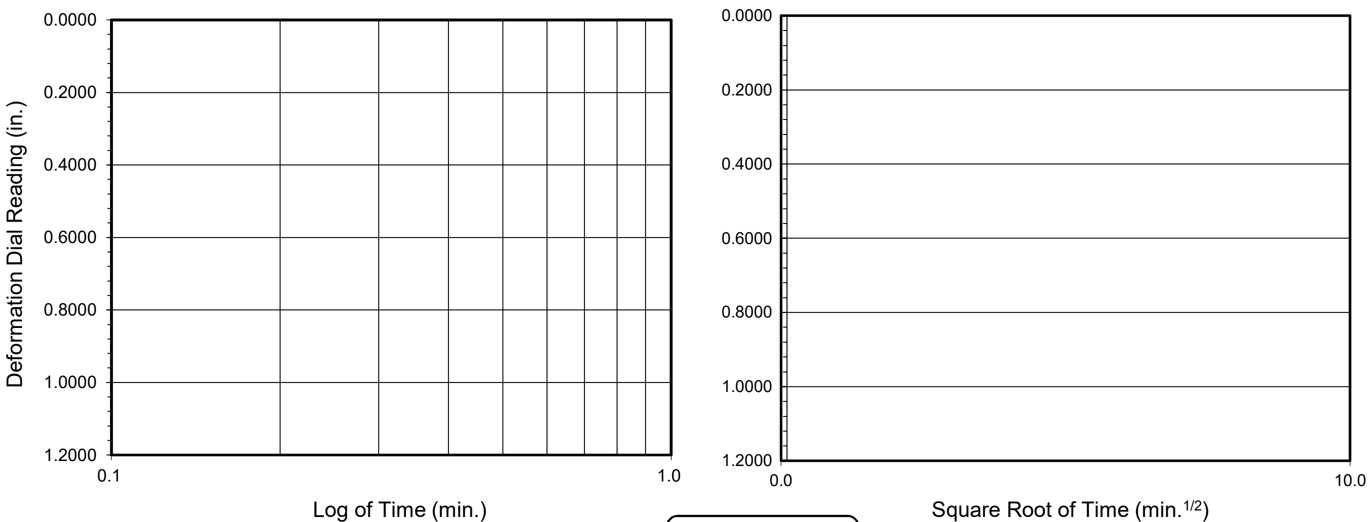


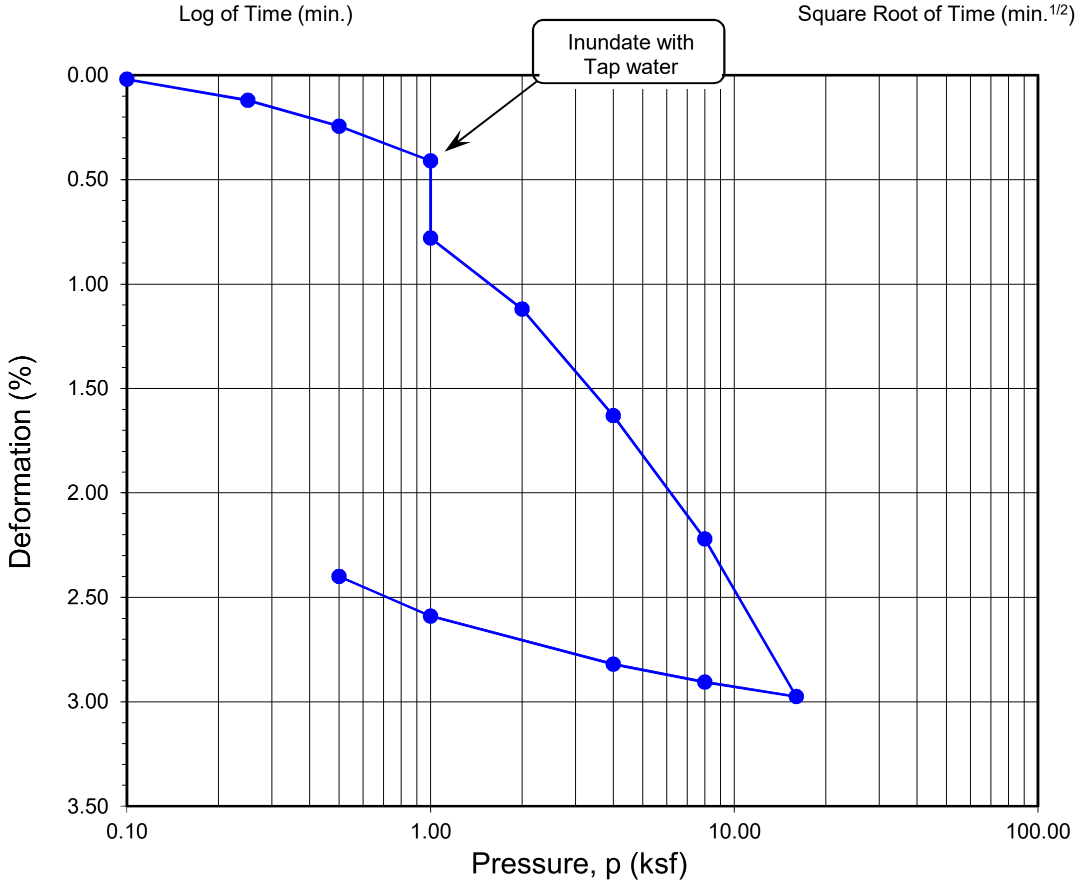
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.0983	0.9998	0.00	0.02	0.501	0.02
0.25	0.0998	0.9983	0.05	0.17	0.499	0.12
0.50	0.1017	0.9965	0.11	0.35	0.498	0.24
1.00	0.1041	0.9940	0.19	0.60	0.495	0.41
1.00	0.1078	0.9903	0.19	0.97	0.490	0.78
2.00	0.1122	0.9859	0.29	1.41	0.484	1.12
4.00	0.1186	0.9795	0.42	2.05	0.477	1.63
8.00	0.1258	0.9723	0.55	2.77	0.468	2.22
16.00	0.1348	0.9634	0.69	3.67	0.457	2.98
8.00	0.1334	0.9648	0.62	3.53	0.458	2.91
4.00	0.1318	0.9663	0.55	3.37	0.459	2.82
1.00	0.1281	0.9700	0.41	3.00	0.462	2.59
0.50	0.1257	0.9724	0.36	2.76	0.465	2.40

Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

Time Readings





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-2	**R-2**	**10**	**2.1**	**15.5**	**112.3**	**113.4**	**0.501**	**0.465**	**11**	**86**

Soil Identification: Light olive brown silty sand (SM)

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 22124-01

Mojave 68, Victorville

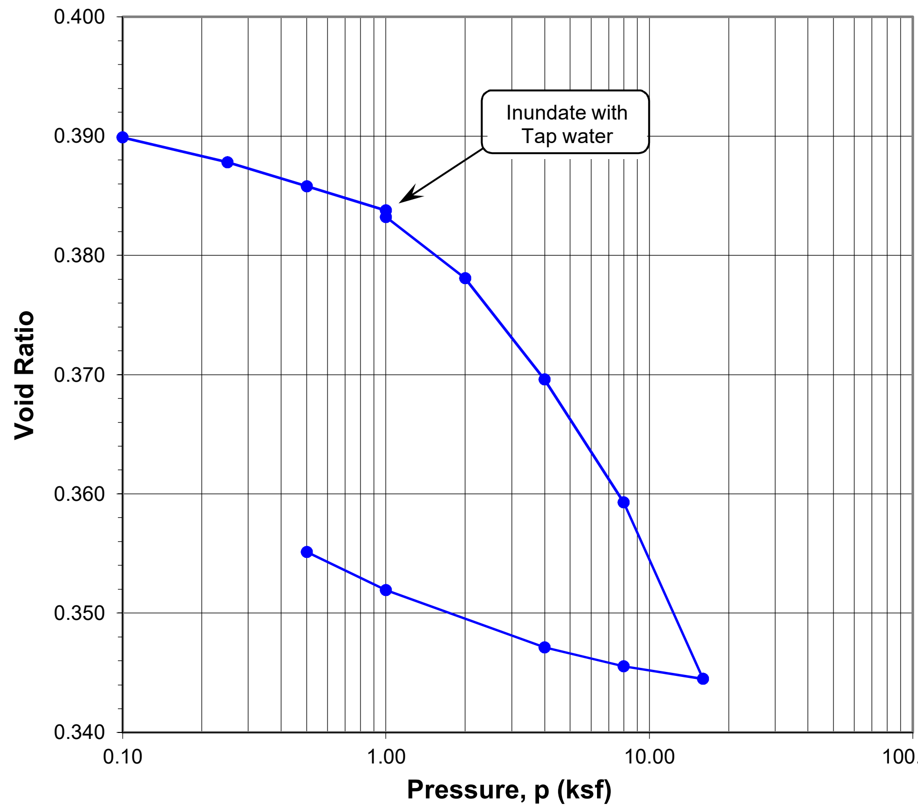
10-22

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	Mojave 68, Victorville	Tested By: GB/JD	Date: 09/22/22
Project No.:	22124-01	Checked By: J. Ward	Date: 10/06/22
Boring No.:	HS-4	Depth (ft.): 5.0	
Sample No.:	R-1	Sample Type: Ring	
Soil Identification:	Light olive gray silty sand (SM)		

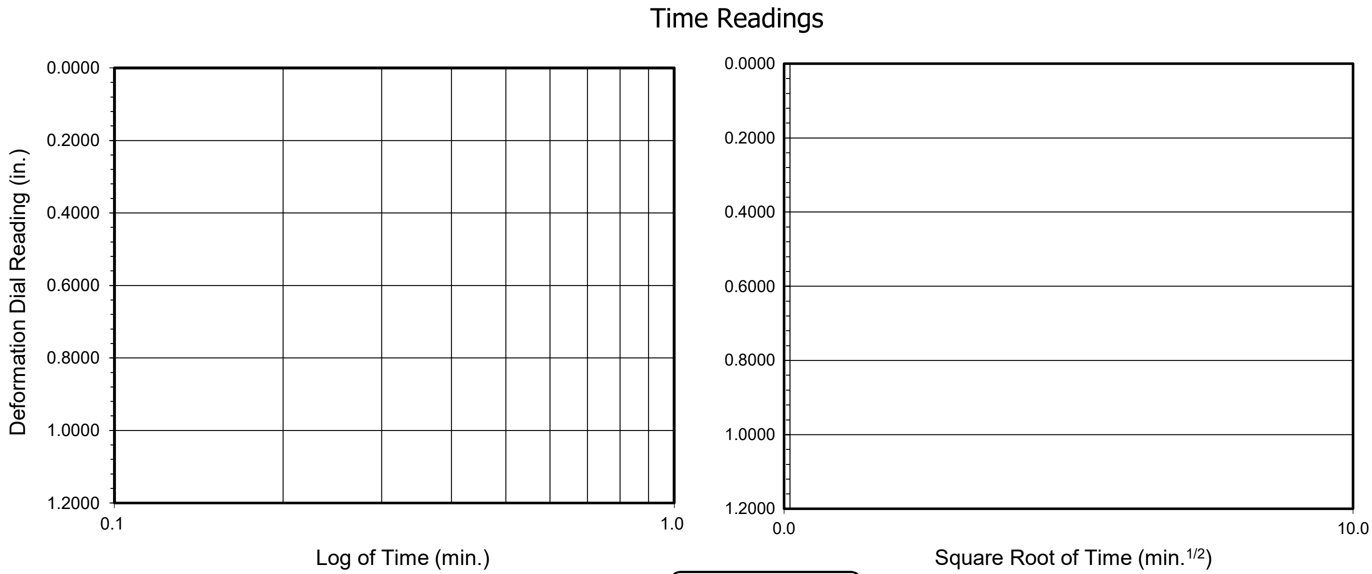
Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	193.08
Weight of Ring (g):	44.56
Height after consol. (in.):	0.9748
Before Test	
Wt. of Wet Sample+Cont. (g):	192.75
Wt. of Dry Sample+Cont. (g):	190.18
Weight of Container (g):	52.65
Initial Moisture Content (%)	1.9
Initial Dry Density (pcf)	121.3
Initial Saturation (%):	13
Initial Vertical Reading (in.)	0.1107
After Test	
Wt. of Wet Sample+Cont. (g):	246.17
Wt. of Dry Sample+Cont. (g):	228.05
Weight of Container (g):	39.00
Final Moisture Content (%)	12.54
Final Dry Density (pcf):	123.3
Final Saturation (%):	92
Final Vertical Reading (in.)	0.1400
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

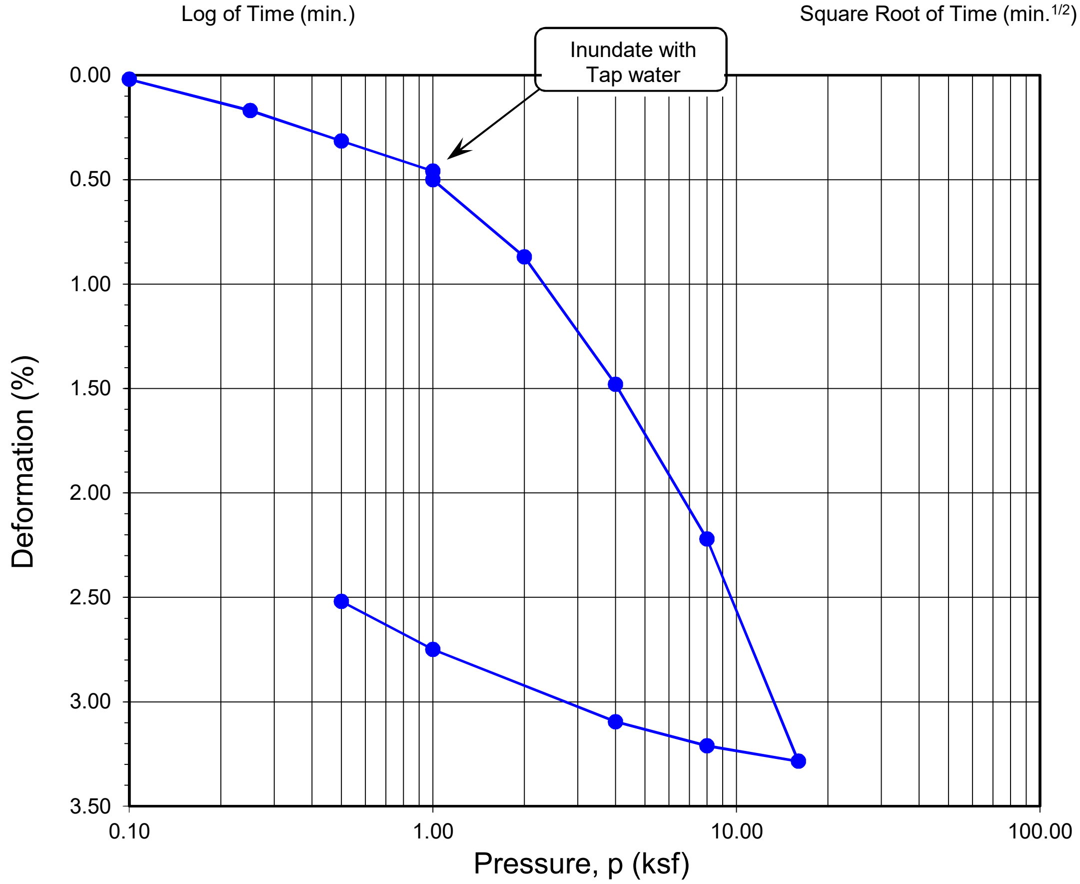


Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.1109	0.9998	0.00	0.02	0.390	0.02
0.25	0.1129	0.9978	0.05	0.22	0.388	0.17
0.50	0.1151	0.9957	0.12	0.43	0.386	0.31
1.00	0.1176	0.9931	0.23	0.69	0.384	0.46
1.00	0.1180	0.9927	0.23	0.73	0.383	0.50
2.00	0.1229	0.9878	0.35	1.22	0.378	0.87
4.00	0.1304	0.9803	0.49	1.97	0.370	1.48
8.00	0.1392	0.9715	0.63	2.85	0.359	2.22
16.00	0.1514	0.9594	0.78	4.07	0.345	3.29
8.00	0.1498	0.9609	0.70	3.91	0.346	3.21
4.00	0.1479	0.9629	0.62	3.72	0.347	3.10
1.00	0.1429	0.9678	0.47	3.22	0.352	2.75
0.50	0.1400	0.9707	0.41	2.93	0.355	2.52

Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-4	**R-1**	**5**	**1.9**	**12.5**	**121.3**	**123.3**	**0.390**	**0.355**	**13**	**92**

Soil Identification: Light olive gray silty sand (SM)

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 22124-01

Mojave 68, Victorville

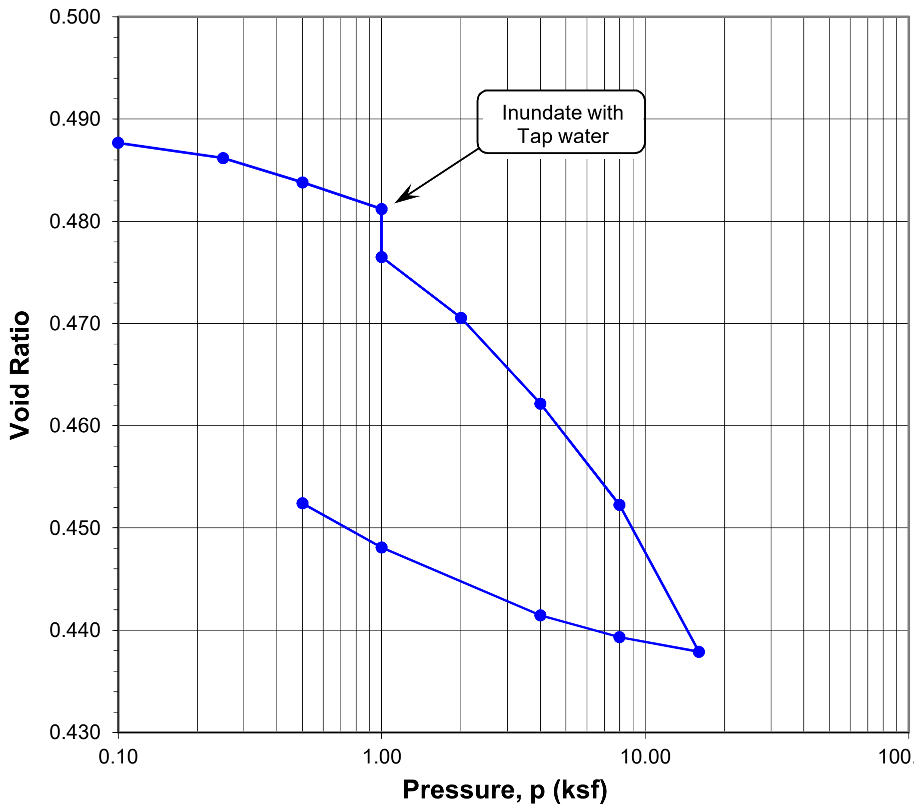
10-22

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	Mojave 68, Victorville	Tested By: GB/JD	Date: 09/22/22
Project No.:	22124-01	Checked By: J. Ward	Date: 10/06/22
Boring No.:	HS-9	Depth (ft.): 7.5	
Sample No.:	R-2	Sample Type:	Ring
Soil Identification:	Olive gray silty sand (SM)		

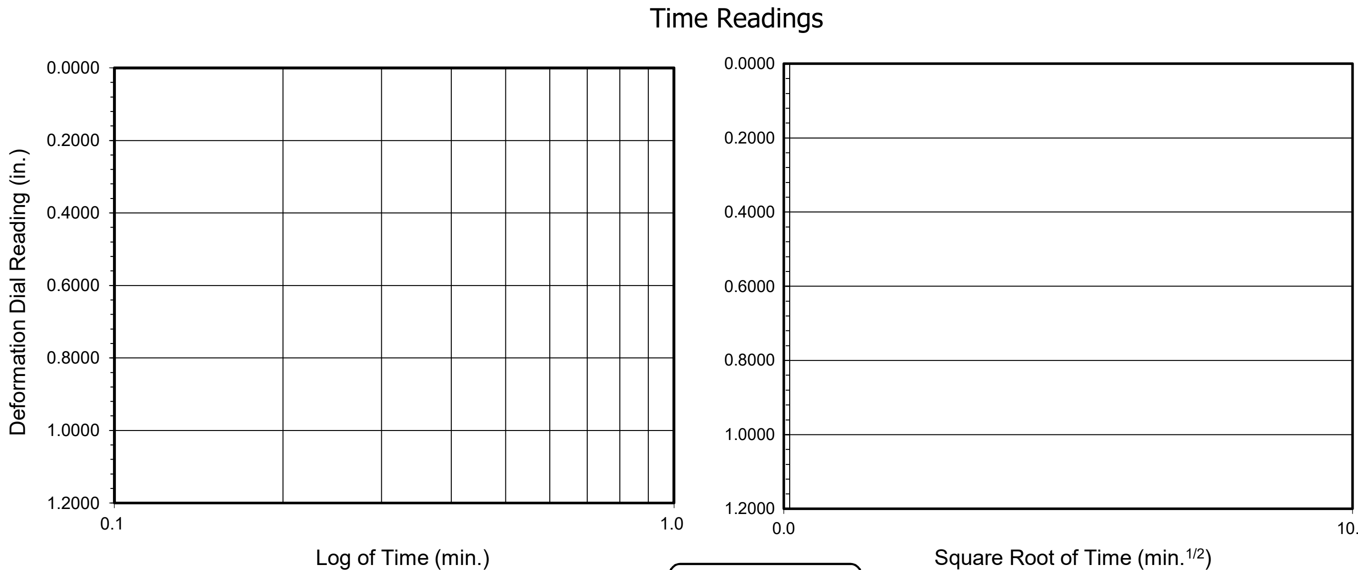
Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	185.48
Weight of Ring (g):	45.59
Height after consol. (in.):	0.9761
Before Test	
Wt. of Wet Sample+Cont. (g):	201.77
Wt. of Dry Sample+Cont. (g):	198.00
Weight of Container (g):	58.37
Initial Moisture Content (%)	2.7
Initial Dry Density (pcf)	113.3
Initial Saturation (%):	15
Initial Vertical Reading (in.)	0.1225
After Test	
Wt. of Wet Sample+Cont. (g):	269.05
Wt. of Dry Sample+Cont. (g):	249.11
Weight of Container (g):	66.85
Final Moisture Content (%)	14.59
Final Dry Density (pcf):	116.4
Final Saturation (%):	88
Final Vertical Reading (in.)	0.1504
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

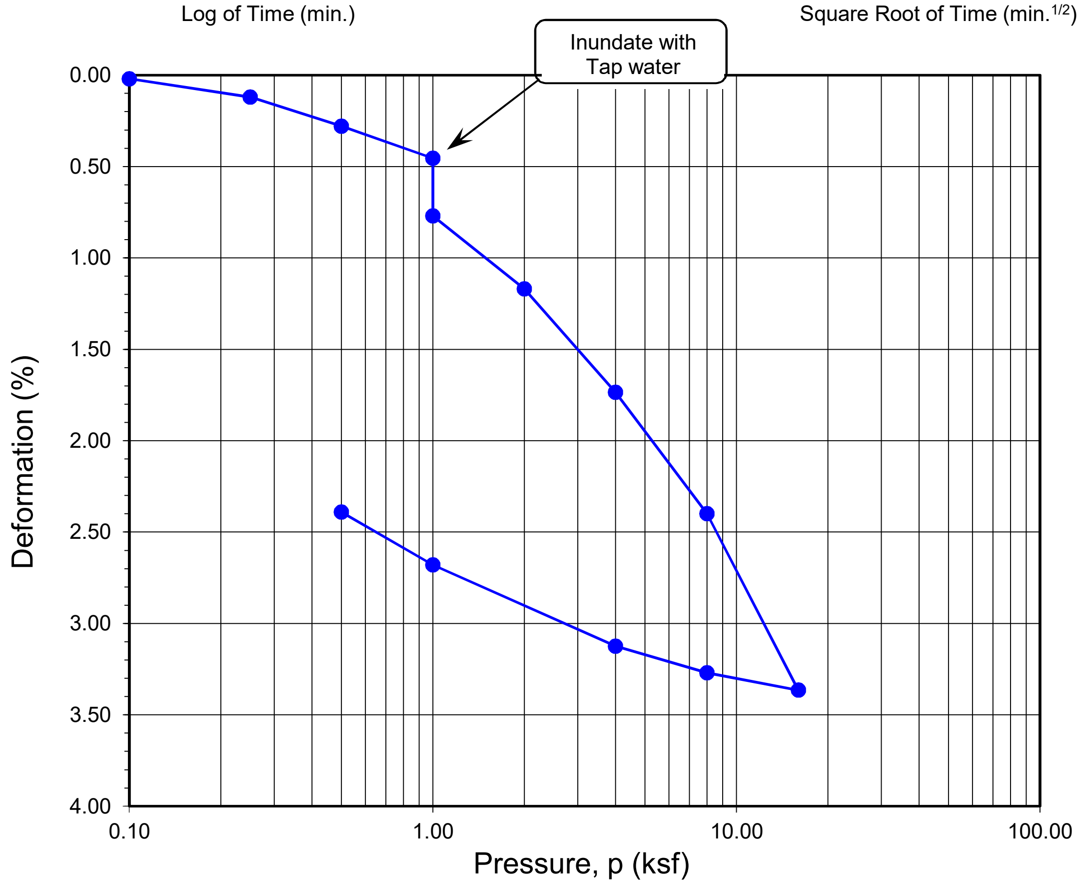


Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.1227	0.9998	0.00	0.02	0.488	0.02
0.25	0.1242	0.9983	0.05	0.17	0.486	0.12
0.50	0.1266	0.9959	0.13	0.41	0.484	0.28
1.00	0.1293	0.9933	0.22	0.68	0.481	0.46
1.00	0.1324	0.9901	0.22	0.99	0.477	0.77
2.00	0.1376	0.9849	0.34	1.51	0.471	1.17
4.00	0.1447	0.9779	0.48	2.22	0.462	1.74
8.00	0.1529	0.9696	0.64	3.04	0.452	2.40
16.00	0.1648	0.9578	0.86	4.23	0.438	3.37
8.00	0.1624	0.9601	0.72	3.99	0.439	3.27
4.00	0.1599	0.9627	0.61	3.74	0.441	3.13
1.00	0.1539	0.9686	0.46	3.14	0.448	2.68
0.50	0.1504	0.9721	0.40	2.79	0.452	2.39

Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-9	**R-2**	**7.5**	**2.7**	**14.6**	**113.3**	**116.4**	**0.488**	**0.452**	**15**	**88**

Soil Identification: Olive gray silty sand (SM)

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 22124-01

Mojave 68, Victorville

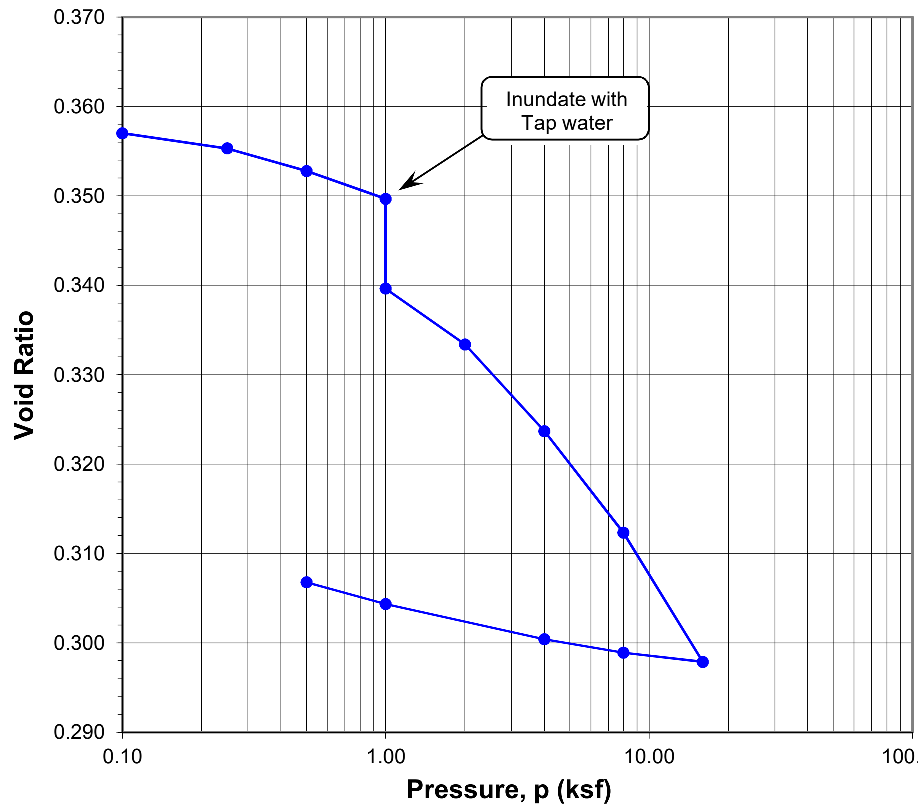
10-22

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	Mojave 68, Victorville	Tested By: GB/JD	Date: 09/22/22
Project No.:	22124-01	Checked By: J. Ward	Date: 10/06/22
Boring No.:	HS-11	Depth (ft.): 15.0	
Sample No.:	R-3	Sample Type: Ring	
Soil Identification:	Light brown poorly-graded sand with silt (SP-SM)		

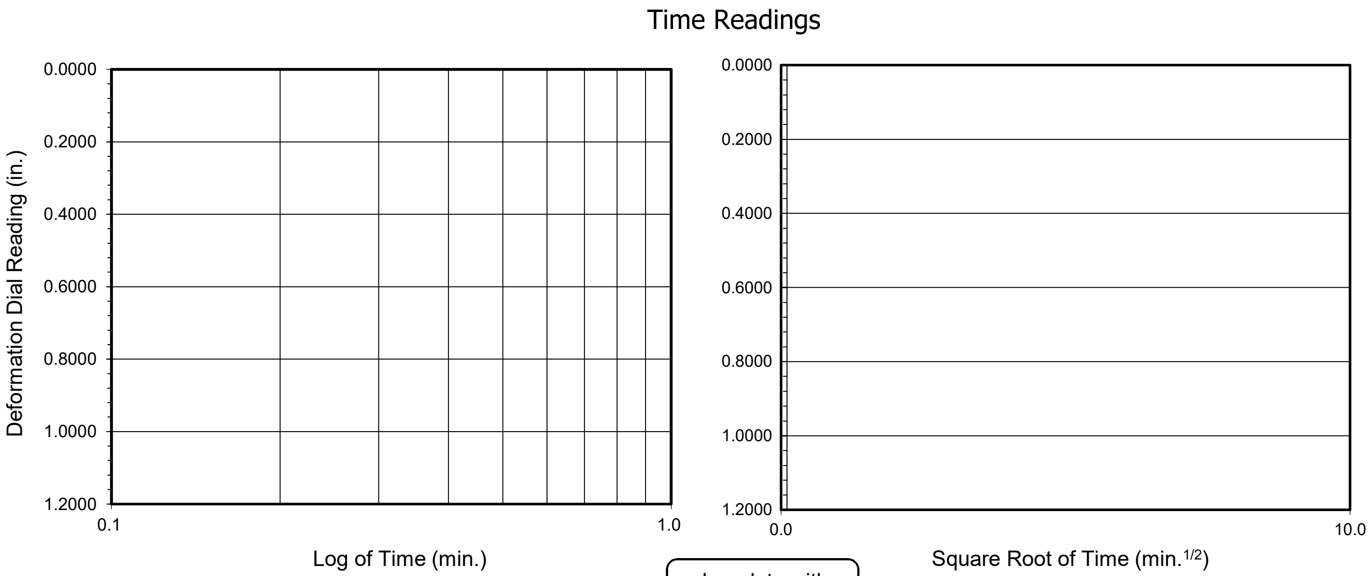
Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	190.17
Weight of Ring (g):	39.01
Height after consol. (in.):	0.9628
Before Test	
Wt. of Wet Sample+Cont. (g):	221.32
Wt. of Dry Sample+Cont. (g):	219.32
Weight of Container (g):	56.14
Initial Moisture Content (%)	1.2
Initial Dry Density (pcf)	124.2
Initial Saturation (%):	9
Initial Vertical Reading (in.)	0.0911
After Test	
Wt. of Wet Sample+Cont. (g):	264.06
Wt. of Dry Sample+Cont. (g):	247.18
Weight of Container (g):	61.73
Final Moisture Content (%)	11.53
Final Dry Density (pcf):	126.5
Final Saturation (%):	94
Final Vertical Reading (in.)	0.1312
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

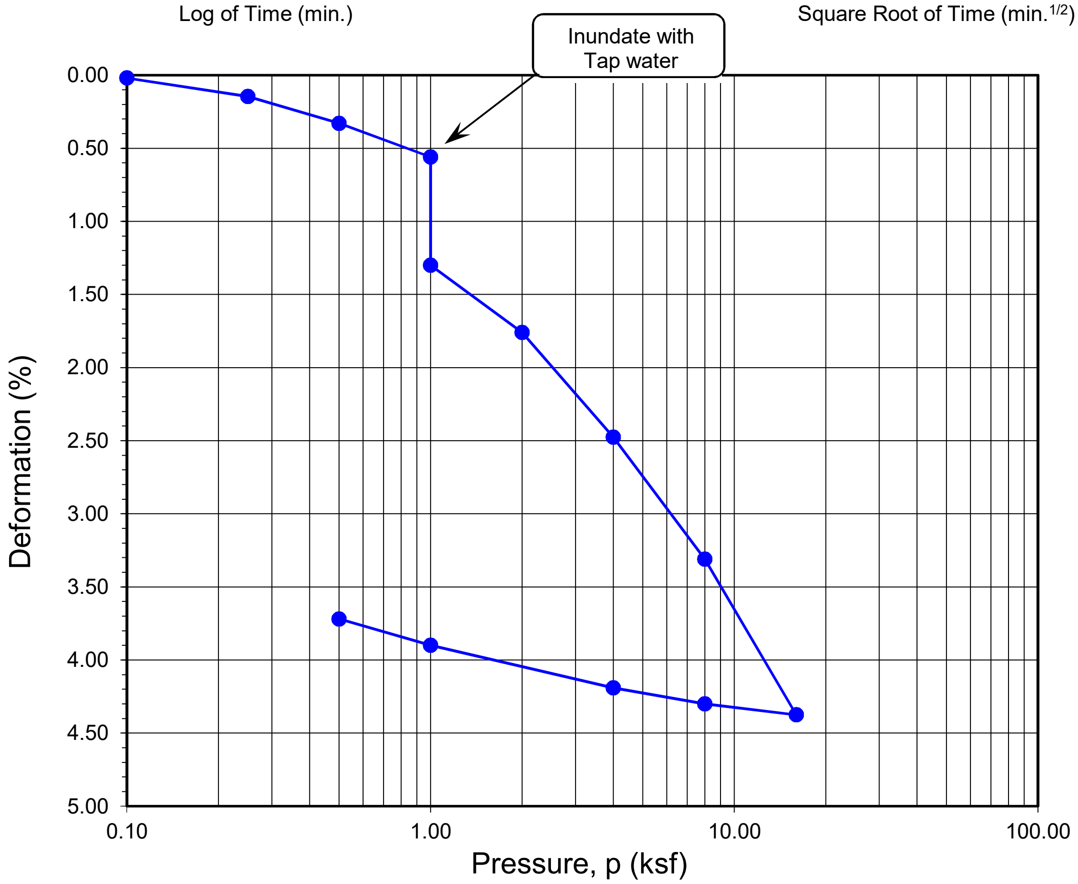


Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.0913	0.9998	0.00	0.02	0.357	0.02
0.25	0.0929	0.9983	0.03	0.18	0.355	0.15
0.50	0.0952	0.9959	0.08	0.41	0.353	0.33
1.00	0.0982	0.9929	0.15	0.71	0.350	0.56
1.00	0.1056	0.9855	0.15	1.45	0.340	1.30
2.00	0.1112	0.9799	0.25	2.01	0.333	1.76
4.00	0.1195	0.9717	0.36	2.84	0.324	2.48
8.00	0.1291	0.9620	0.49	3.80	0.312	3.31
16.00	0.1413	0.9499	0.64	5.02	0.298	4.38
8.00	0.1396	0.9515	0.55	4.85	0.299	4.30
4.00	0.1377	0.9534	0.47	4.66	0.300	4.19
1.00	0.1335	0.9576	0.34	4.24	0.304	3.90
0.50	0.1312	0.9599	0.29	4.01	0.307	3.72

Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-11	**R-3**	**15**	**1.2**	**11.5**	**124.2**	**126.5**	**0.357**	**0.307**	**9**	**94**

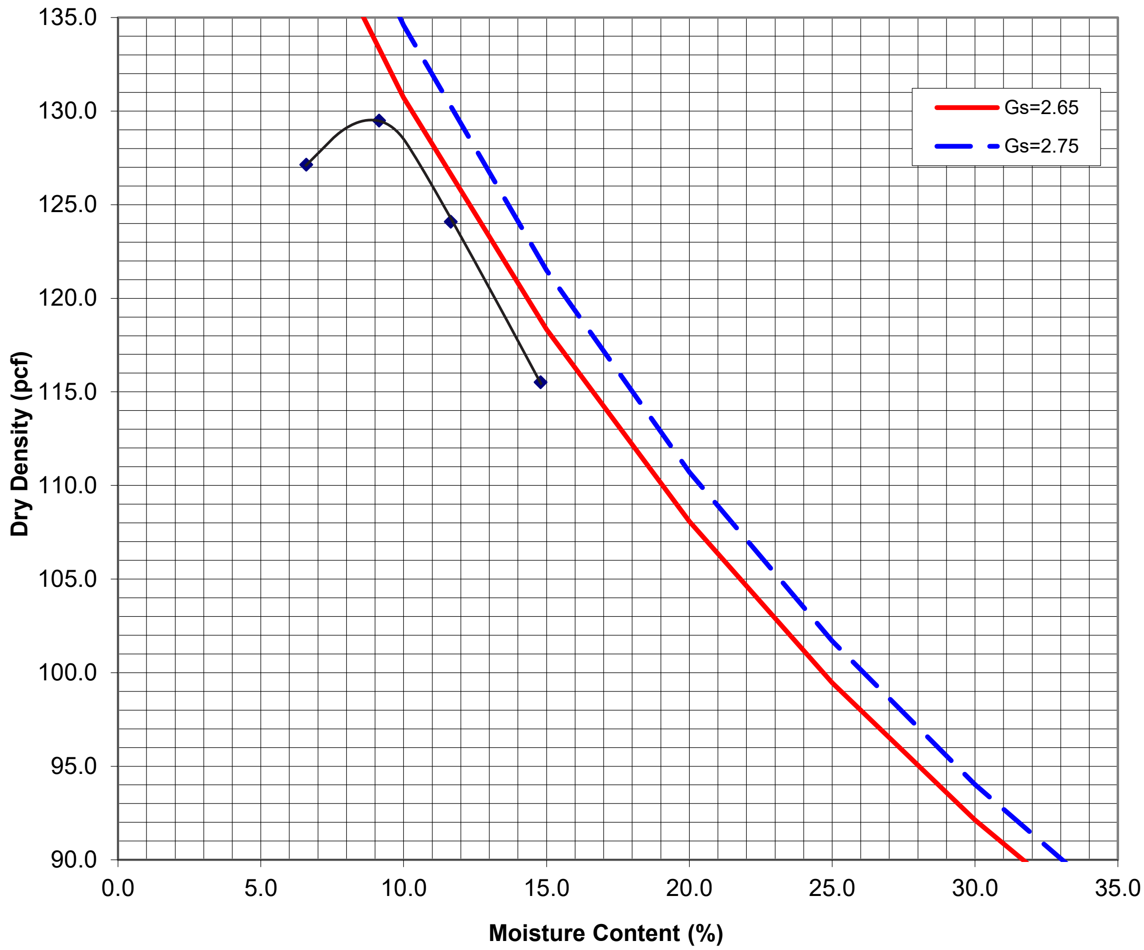
Soil Identification: Light brown poorly-graded sand with silt (SP-SM)

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 22124-01

Mojave 68, Victorville

10-22



Location:	Sample No.:	Depth (ft)	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
HS-4	**B-1**	**0-5'**	**Light brown silty SAND (SM)**	**129.5**	**9.0**

Geotechnical, Inc.

LABORATORY COMPACTION
(ASTM D 1557)

Project Number: 22124-01
Date: Sep-22

Mojave 68, Victorville

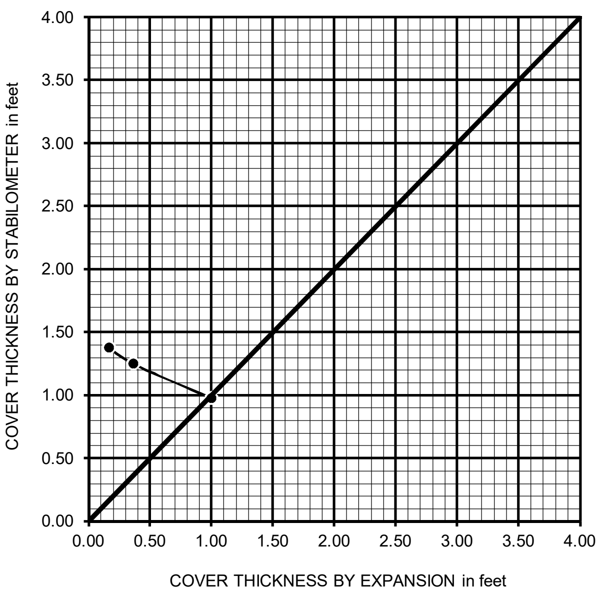
R-VALUE TEST RESULTS
DOT CA Test 301

PROJECT NAME:	Mojave 68, Victorville	PROJECT NUMBER:	22124-01
BORING NUMBER:	HS-3	DEPTH (FT.):	0-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	O. Figueroa
SAMPLE DESCRIPTION:	Dark yellowish brown sandy silt (ML)	DATE COMPLETED:	10/1/2022

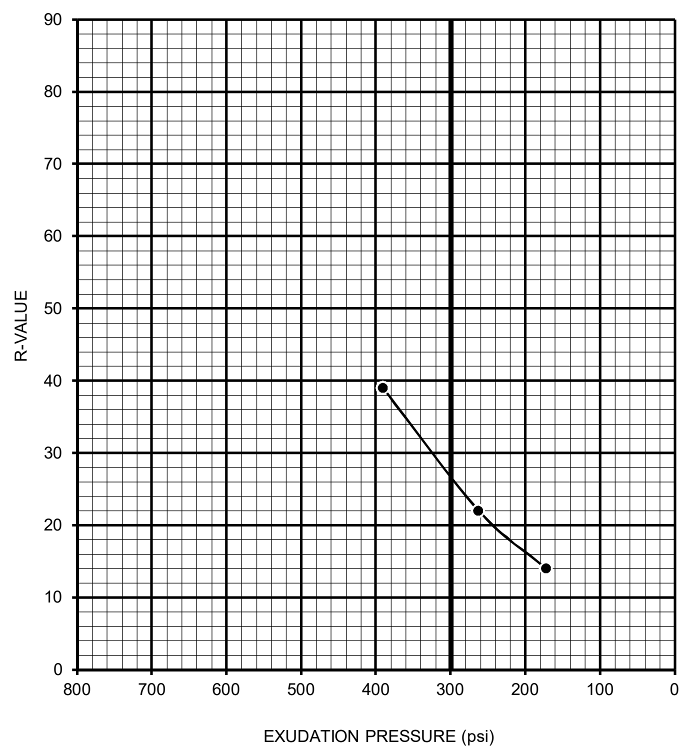
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	11.2	12.1	13.1
HEIGHT OF SAMPLE, Inches	2.48	2.54	2.53
DRY DENSITY, pcf	126.8	125.4	122.9
COMPACTOR PRESSURE, psi	130	80	60
EXUDATION PRESSURE, psi	391	263	172
EXPANSION, Inches x 10exp-4	30	11	5
STABILITY Ph 2,000 lbs (160 psi)	74	105	121
TURNS DISPLACEMENT	4.50	4.65	5.10
R-VALUE UNCORRECTED	39	22	14
R-VALUE CORRECTED	39	22	14

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.98	1.25	1.38
EXPANSION PRESSURE THICKNESS, ft.	1.00	0.37	0.17

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	38
R-VALUE BY EXUDATION:	27
EQUILIBRIUM R-VALUE:	27

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: Mojave 68, Victorville | Tested By : GEB/JD | Date: 09/21/22

Project No. : 22124-01 | Checked By: J. Ward | Date: 10/06/22

Boring No.	HS-2			
Sample No.	B-1			
Sample Depth (ft)	0-5			
Soil Identification:	Yellowish brown SC			
Wet Weight of Soil + Container (g)	210.67			
Dry Weight of Soil + Container (g)	204.81			
Weight of Container (g)	66.76			
Moisture Content (%)	4.24			
Weight of Soaked Soil (g)	100.02			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	2			
Crucible No.	2			
Furnace Temperature (°C)	860			
Time In / Time Out	8:00/8:45			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	28.7155			
Wt. of Crucible (g)	28.7129			
Wt. of Residue (g) (A)	0.0026			
PPM of Sulfate (A) x 41150	106.99			
PPM of Sulfate, Dry Weight Basis	**112**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	15			
ml of AgNO3 Soln. Used in Titration (C)	0.3			
PPM of Chloride (C -0.2) * 100 * 30 / B	20			
PPM of Chloride, Dry Wt. Basis	**21**			

pH TEST, DOT California Test 643

pH Value	**8.58**			
Temperature °C	20.4			

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	Mojave 68, Victorville	Tested By :	J. Domingo Date: 10/03/22
Project No. :	22124-01	Checked By:	J. Ward Date: 10/06/22
Boring No.:	HS-2	Depth (ft.) :	0-5
Sample No. :	B-1		

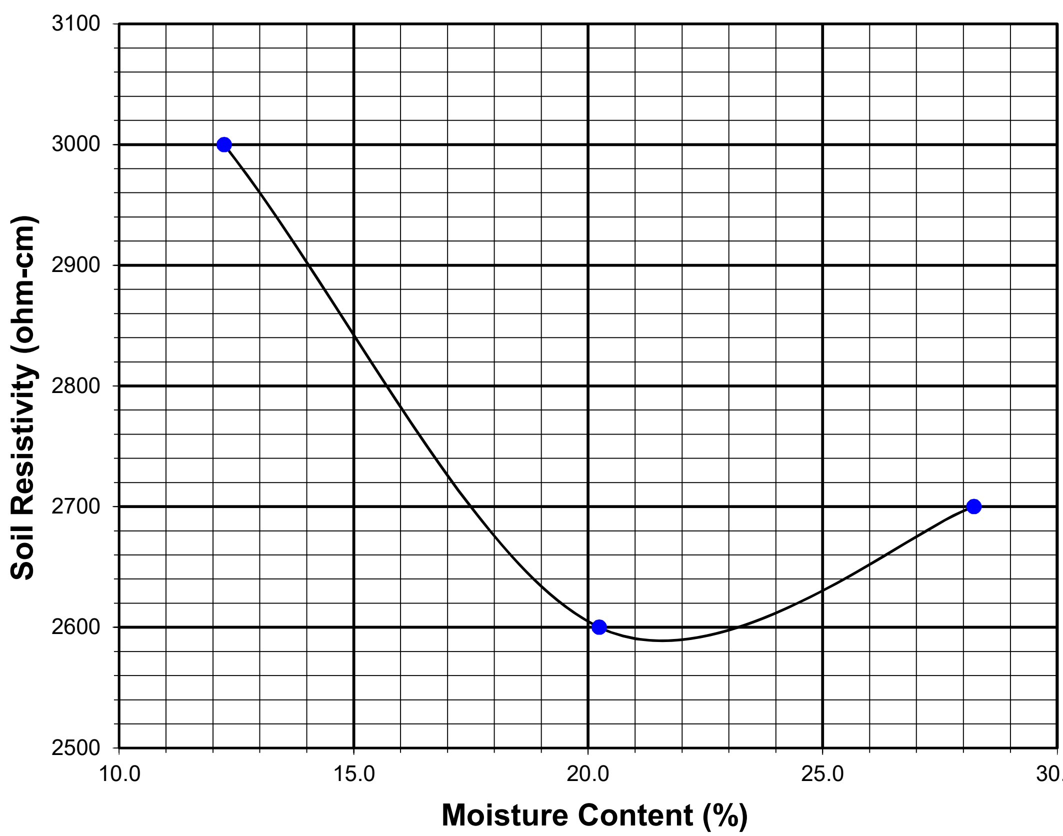
Soil Identification:* Yellowish brown SC

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	12.24	3000	3000
2	20	20.23	2600	2600
3	30	28.23	2700	2700
4				
5				

Moisture Content (%) (MCi)	4.24
Wet Wt. of Soil + Cont. (g)	210.67
Dry Wt. of Soil + Cont. (g)	204.81
Wt. of Container (g)	66.76
Container No.	
Initial Soil Wt. (g) (Wt)	130.40
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
2590	**21.6**	**112**	**21**	**8.58**	**20.4**



TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: Mojave 68, Victorville   Tested By : GEB/JD   Date: 09/21/22

Project No. : 22124-01   Checked By: J. Ward   Date: 10/06/22

Boring No.	HS-7			
Sample No.	B-1			
Sample Depth (ft)	0-5			
Soil Identification:	Yellowish brown SC			
Wet Weight of Soil + Container (g)	162.95			
Dry Weight of Soil + Container (g)	159.00			
Weight of Container (g)	58.55			
Moisture Content (%)	3.93			
Weight of Soaked Soil (g)	100.03			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	9			
Crucible No.	8			
Furnace Temperature (°C)	860			
Time In / Time Out	8:00/8:45			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	20.4031			
Wt. of Crucible (g)	20.4001			
Wt. of Residue (g) (A)	0.0030			
PPM of Sulfate (A) x 41150	123.45			
PPM of Sulfate, Dry Weight Basis	**129**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)				
ml of AgNO3 Soln. Used in Titration (C)				
PPM of Chloride (C -0.2) * 100 * 30 / B				
PPM of Chloride, Dry Wt. Basis	**N/A**			

pH TEST, DOT California Test 643

pH Value	**N/A**			
Temperature °C				

Appendix D
Infiltration Testing

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Mojave 68 - Victoville
Project Number: 22124-01
Date: 9/14/2022
Boring Number: I-1

Test hole dimensions (if circular)

Boring Depth (feet)*:	10.19
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)

Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

*Pre-Test (Sandy Soil Criteria)**

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Greater Than or Equal to 0.5 feet (yes/no)
1	8:41	9:06	25.0	8.09	9.72	1.63	Yes
2	9:09	9:34	25.0	7.85	9.65	1.80	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight, and then obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25 inches

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Observed Infiltration Rate(in/hr)
1	9:40	9:50	10.0	7.75	8.80	1.05	6.1
2	9:52	10:02	10.0	7.82	8.92	1.10	6.6
3	10:03	10:13	10.0	7.94	8.93	0.99	6.2
4	10:14	10:24	10.0	7.93	8.94	1.01	6.3
5	10:26	10:36	10.0	8.03	9.05	1.02	6.7
6	10:39	10:49	10.0	8.01	9.06	1.05	6.9

Observed Infiltration Rate (Does Not Include Any Factor of Safety) **6.9**

Sketch:

Notes:

Based on Guidelines from: San Bernardino County (2013)
Spreadsheet Revised on: 6/29/2018

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Mojave 68 - Victoville
Project Number: 22124-01
Date: 9/14/2022
Boring Number: I-2

Test hole dimensions (if circular)

Boring Depth (feet)*:	10.22
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)

Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

*Pre-Test (Sandy Soil Criteria)**

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Greater Than or Equal to 0.5 feet (yes/no)
1	8:52	9:17	25.0	7.90	9.35	1.45	Yes
2	9:19	9:44	25.0	8.05	9.36	1.31	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight, and then obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25 inches

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Observed Infiltration Rate(in/hr)
1	9:45	9:55	10.0	7.95	8.67	0.72	4.2
2	9:56	10:06	10.0	7.92	8.65	0.73	4.2
3	10:09	10:19	10.0	7.96	8.72	0.76	4.5
4	10:21	10:31	10.0	8.00	8.74	0.74	4.4
5	10:34	10:44	10.0	7.95	8.74	0.79	4.6
6	10:46	10:56	10.0	8.00	8.75	0.75	4.5

Observed Infiltration Rate (Does Not Include Any Factor of Safety) **4.5**

Sketch:

Notes:

Based on Guidelines from: San Bernardino County (2013)
Spreadsheet Revised on: 6/29/2018

LGC Geotechnical, Inc.

Appendix E
General Earthwork and Grading Specifications

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of “equipment” of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be over-excavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Over-excavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of the geotechnical consultant. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 Compaction Testing

Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

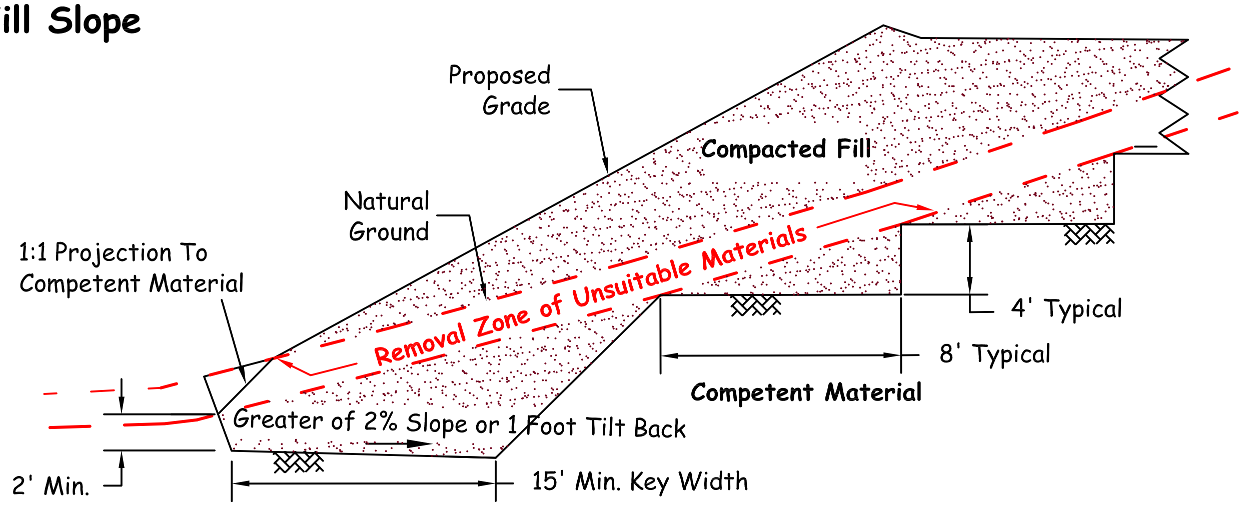
7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

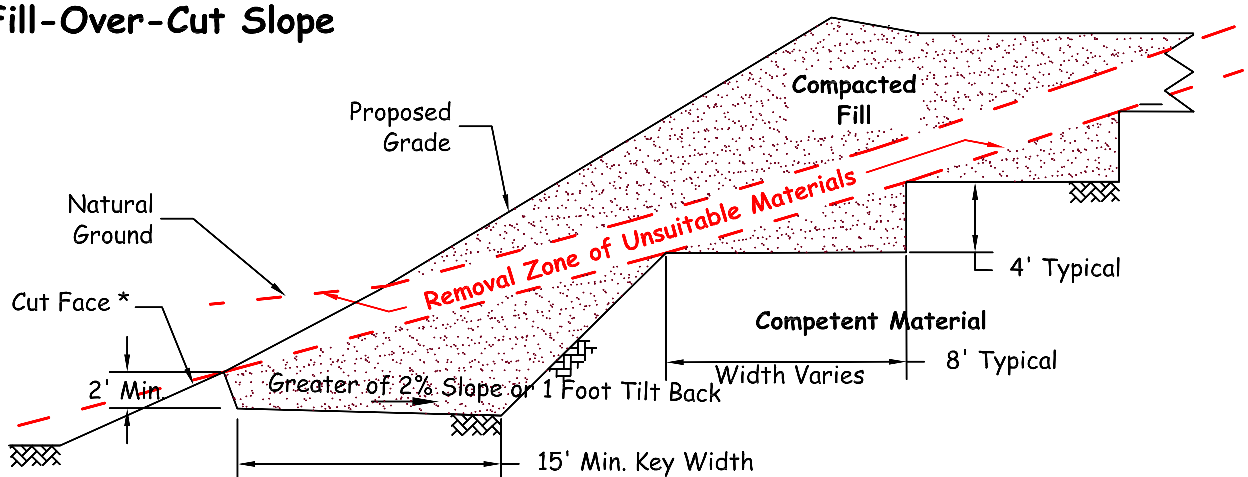
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

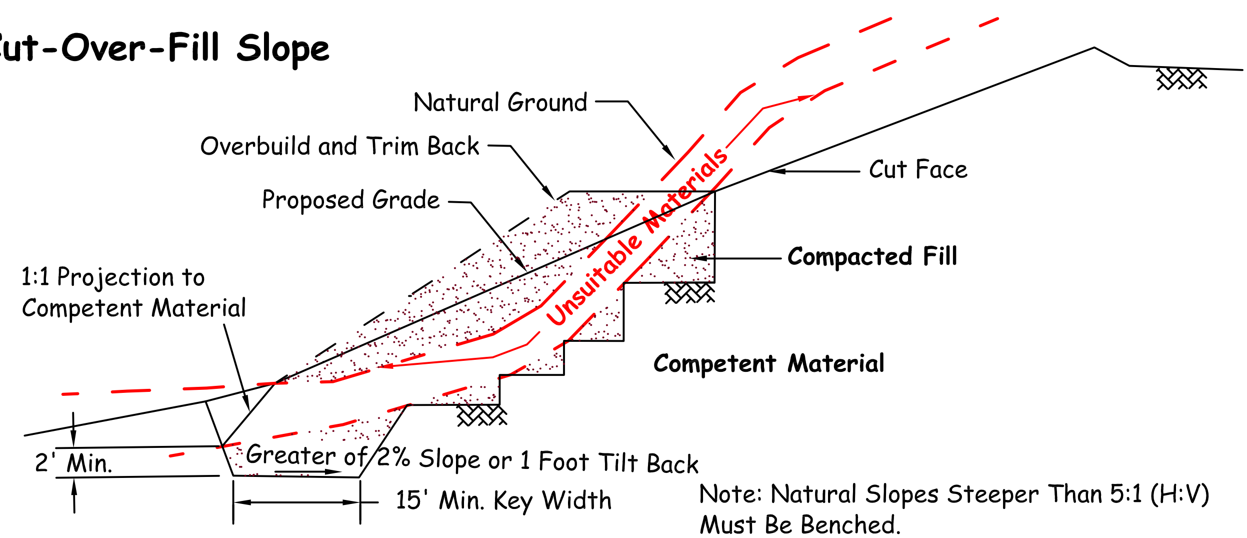
Fill Slope



Fill-Over-Cut Slope



Cut-Over-Fill Slope



Note: Natural Slopes Steeper Than 5:1 (H:V) Must Be Benched.

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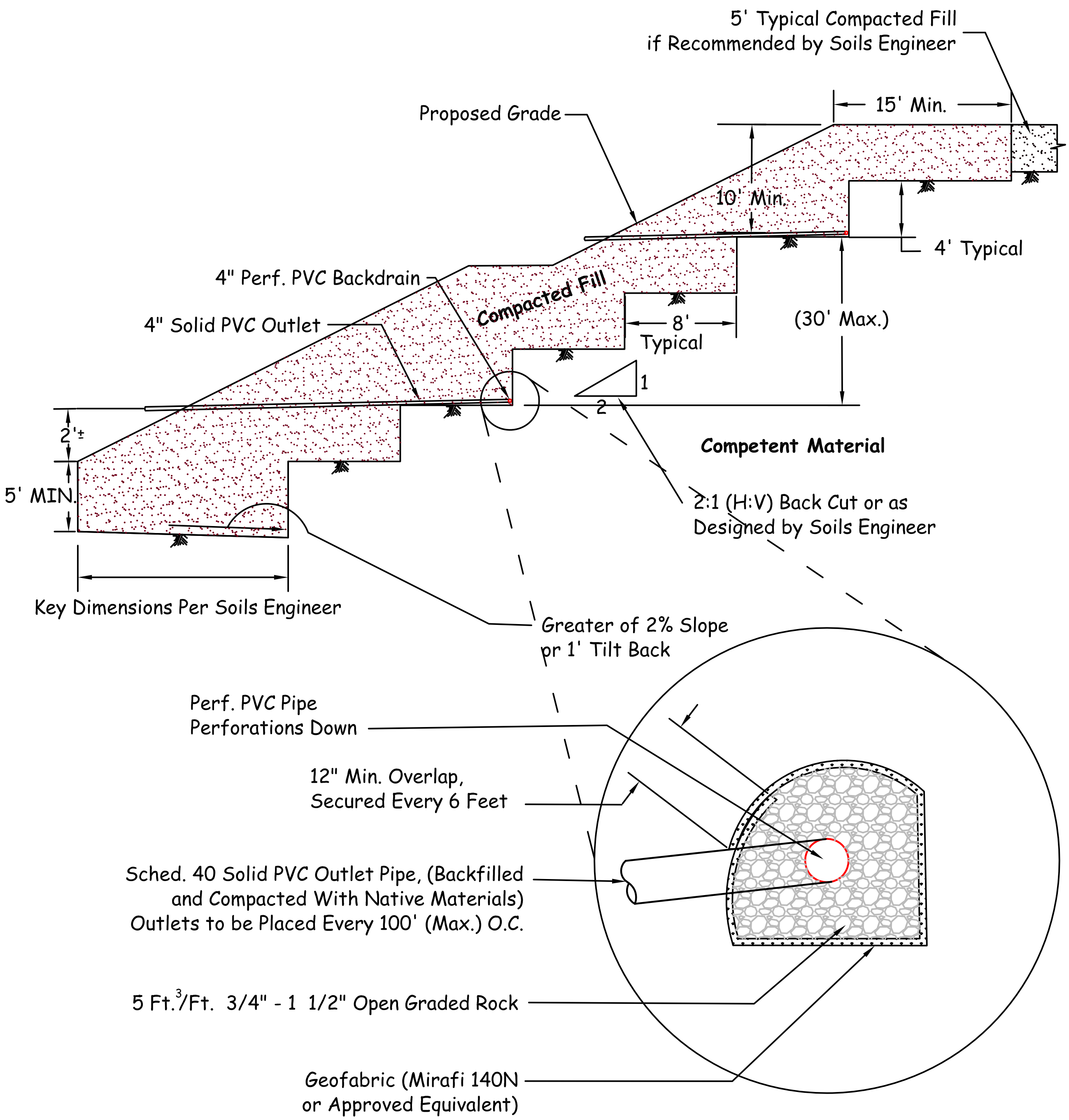
KEYING AND BENCHING



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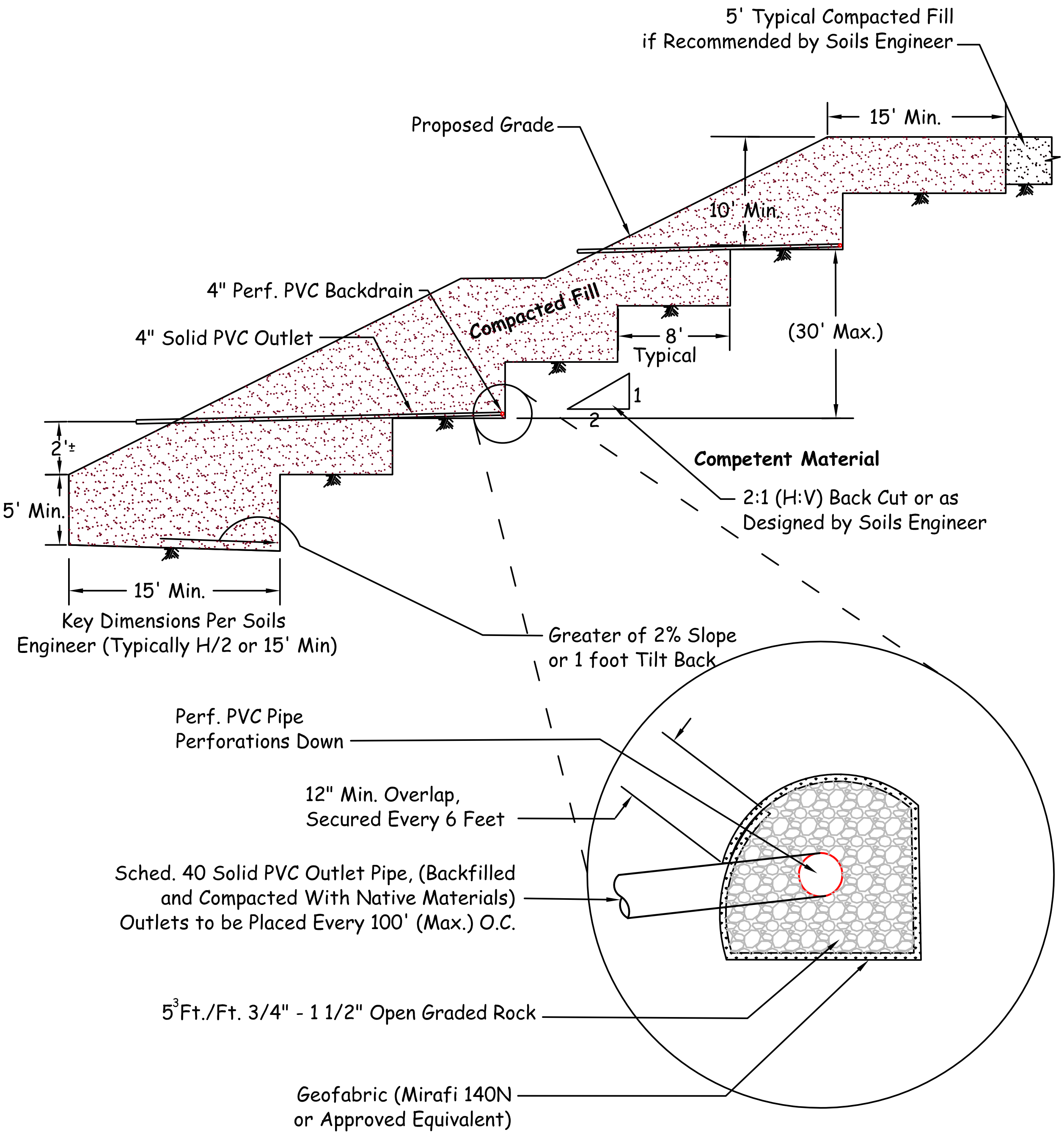
TYPICAL BUTTRESS DETAIL



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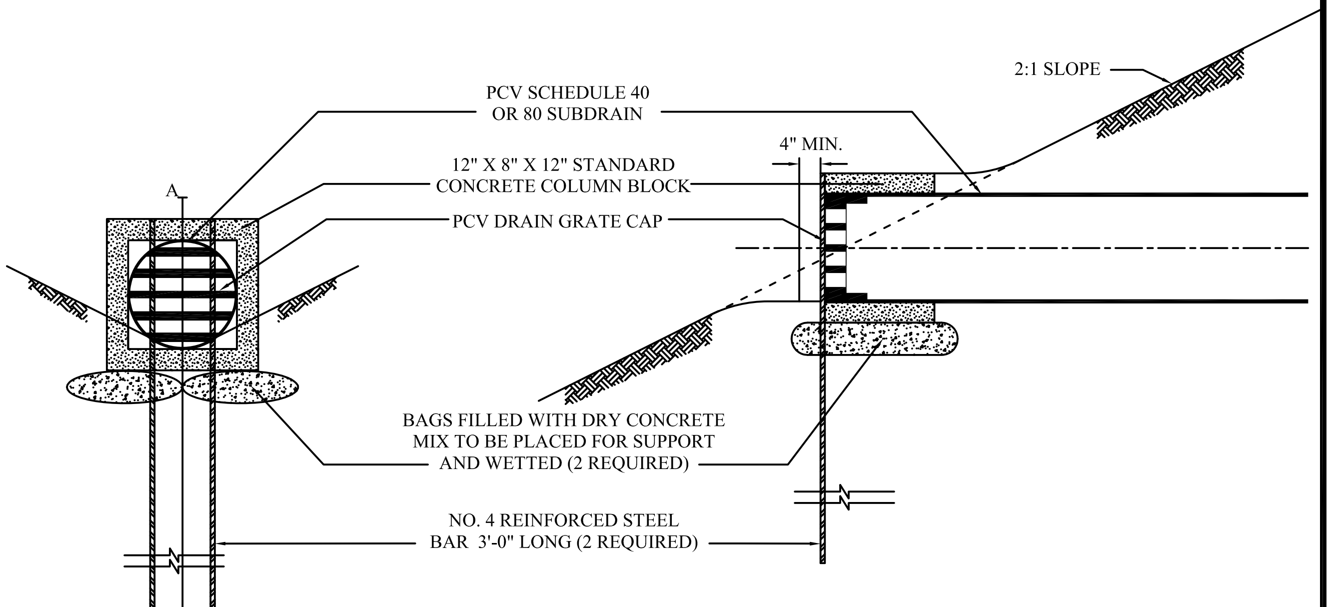
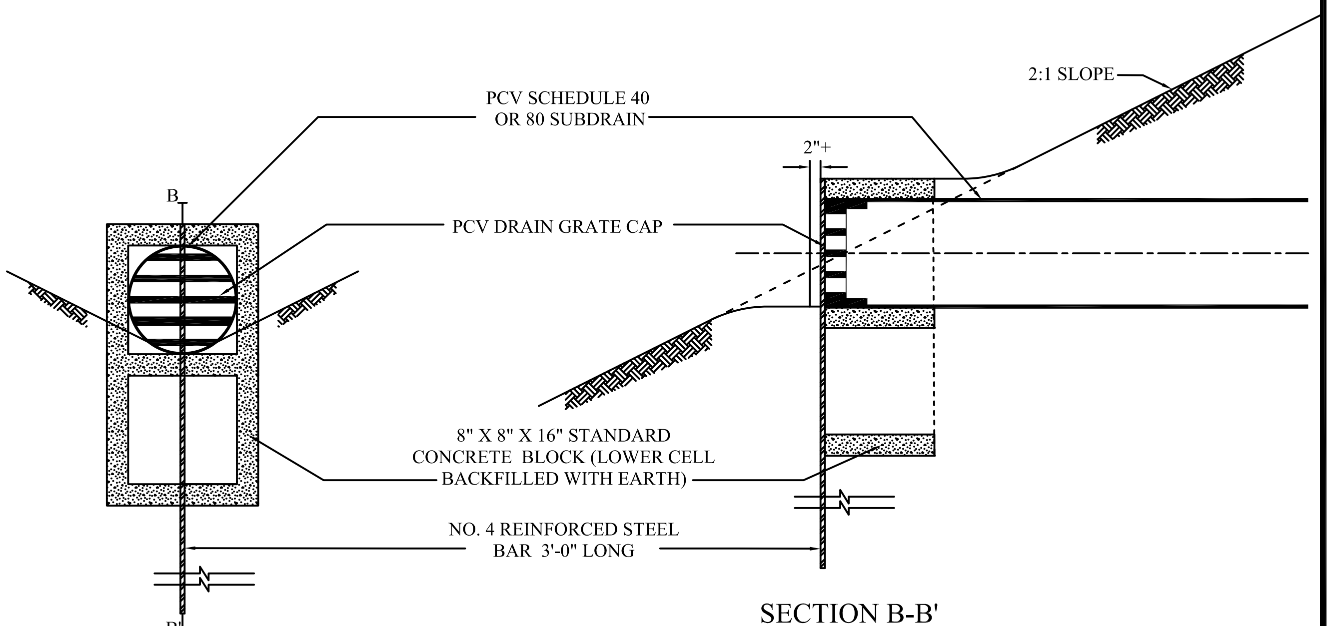
TYPICAL STABILIZATION FILL DETAIL

SUBDRAIN OUTLET MARKER -6" & 8" PIPE



SECTION A-A'

SUBDRAIN OUTLET MARKER -4" PIPE



SECTION B-B'

NOT TO SCALE

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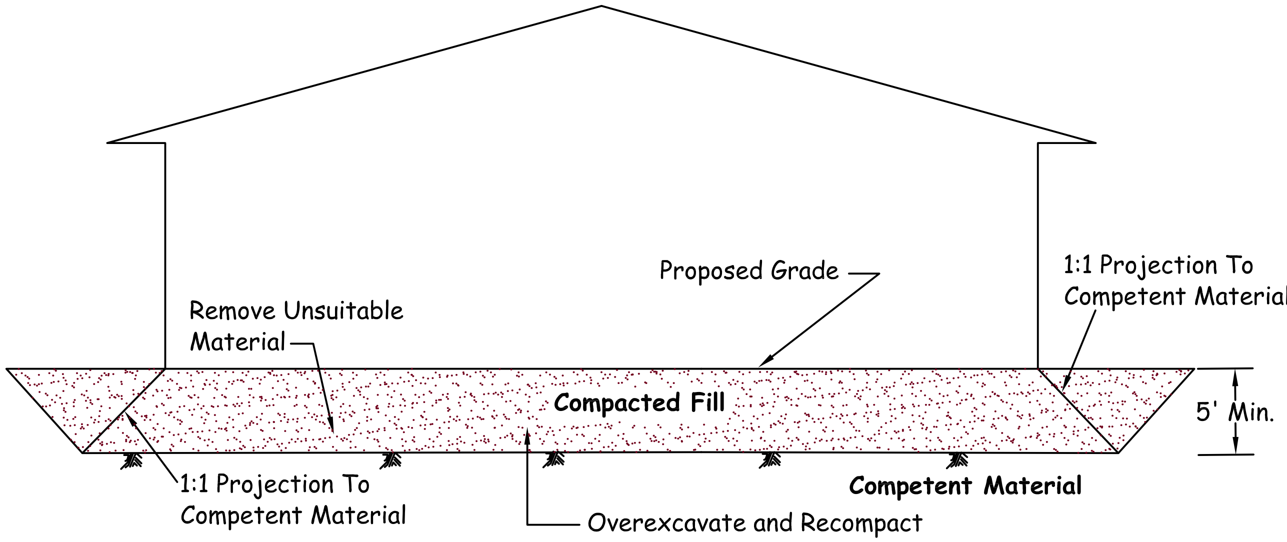
SUBDRAIN OUTLET MARKER DETAIL

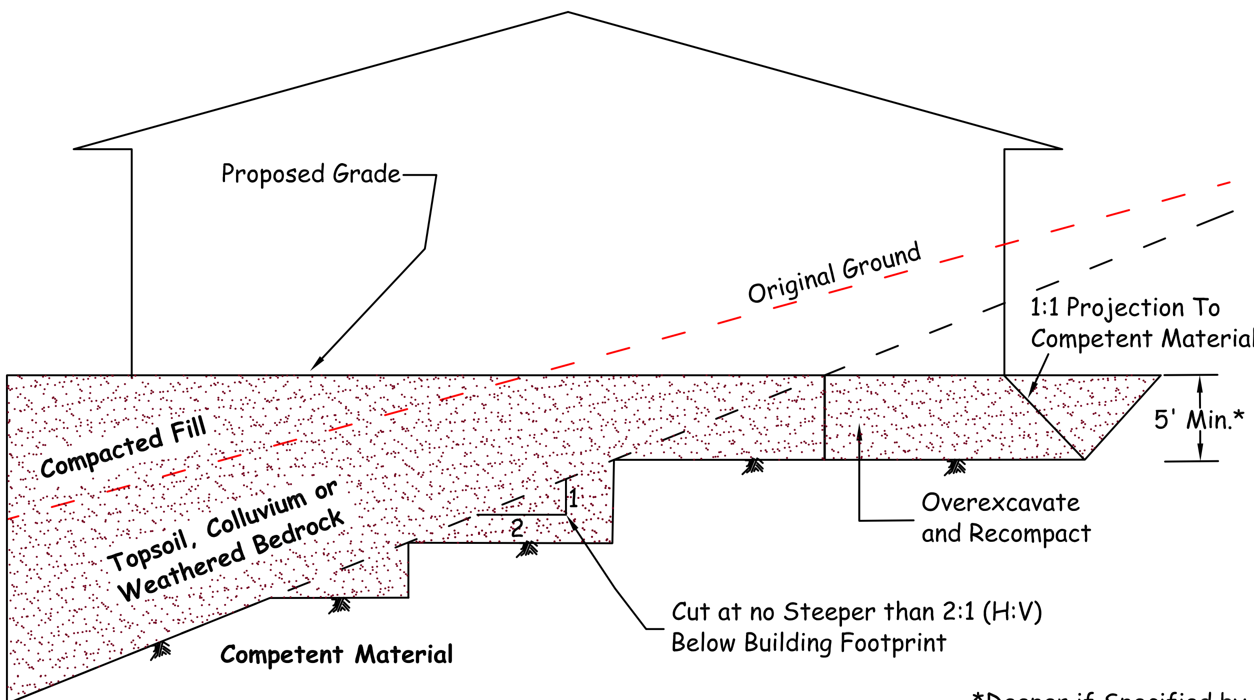
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

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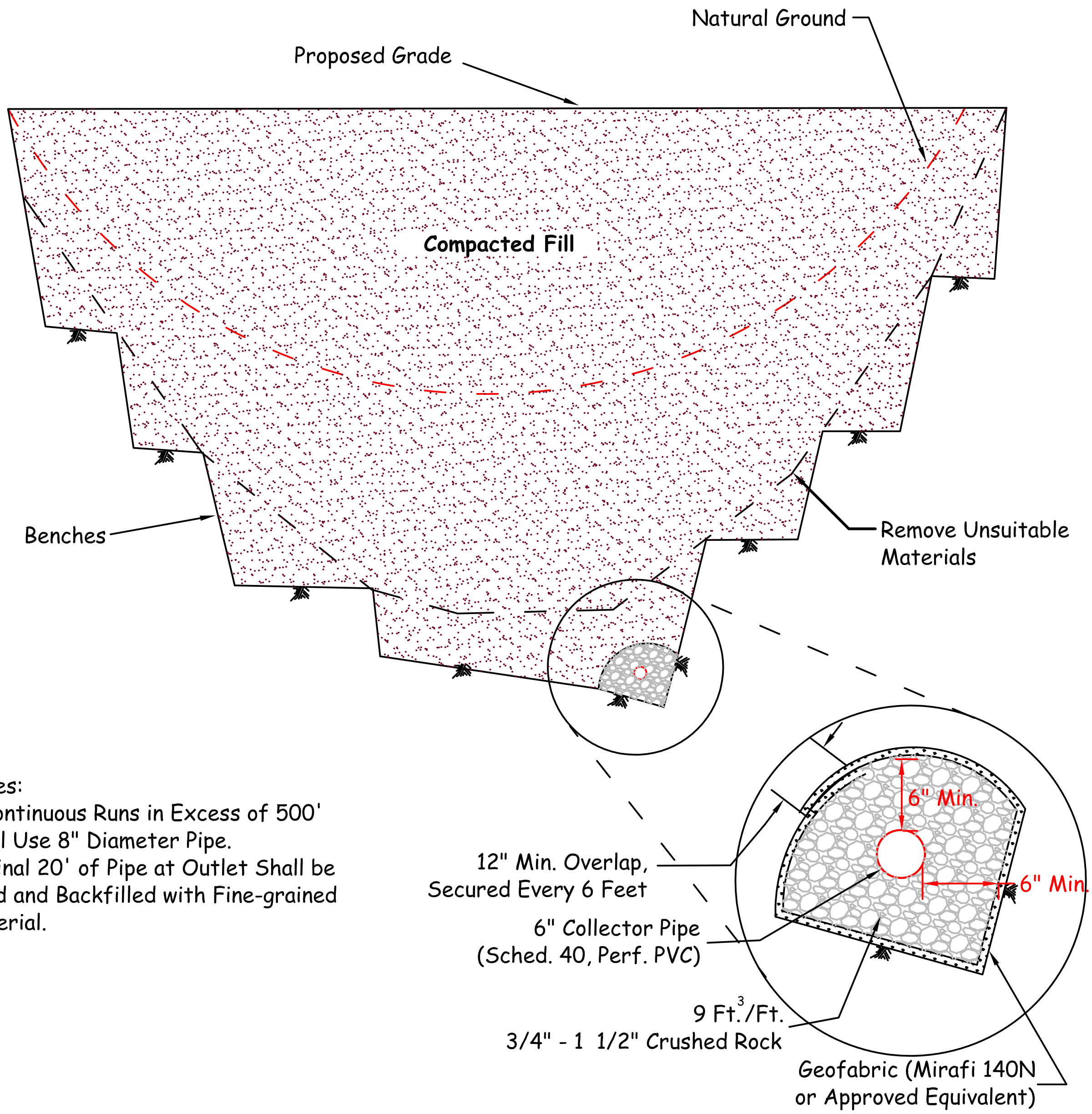
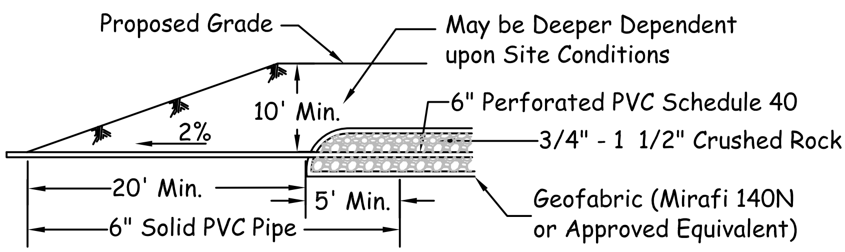
CUT AND TRANSITION LOT OVEREXCAVATION DETAIL



Notes:
1) Continuous Runs in Excess of 500' Shall Use 8" Diameter Pipe.
2) Final 20' of Pipe at Outlet Shall be Solid and Backfilled with Fine-grained Material.

Proposed Outlet Detail



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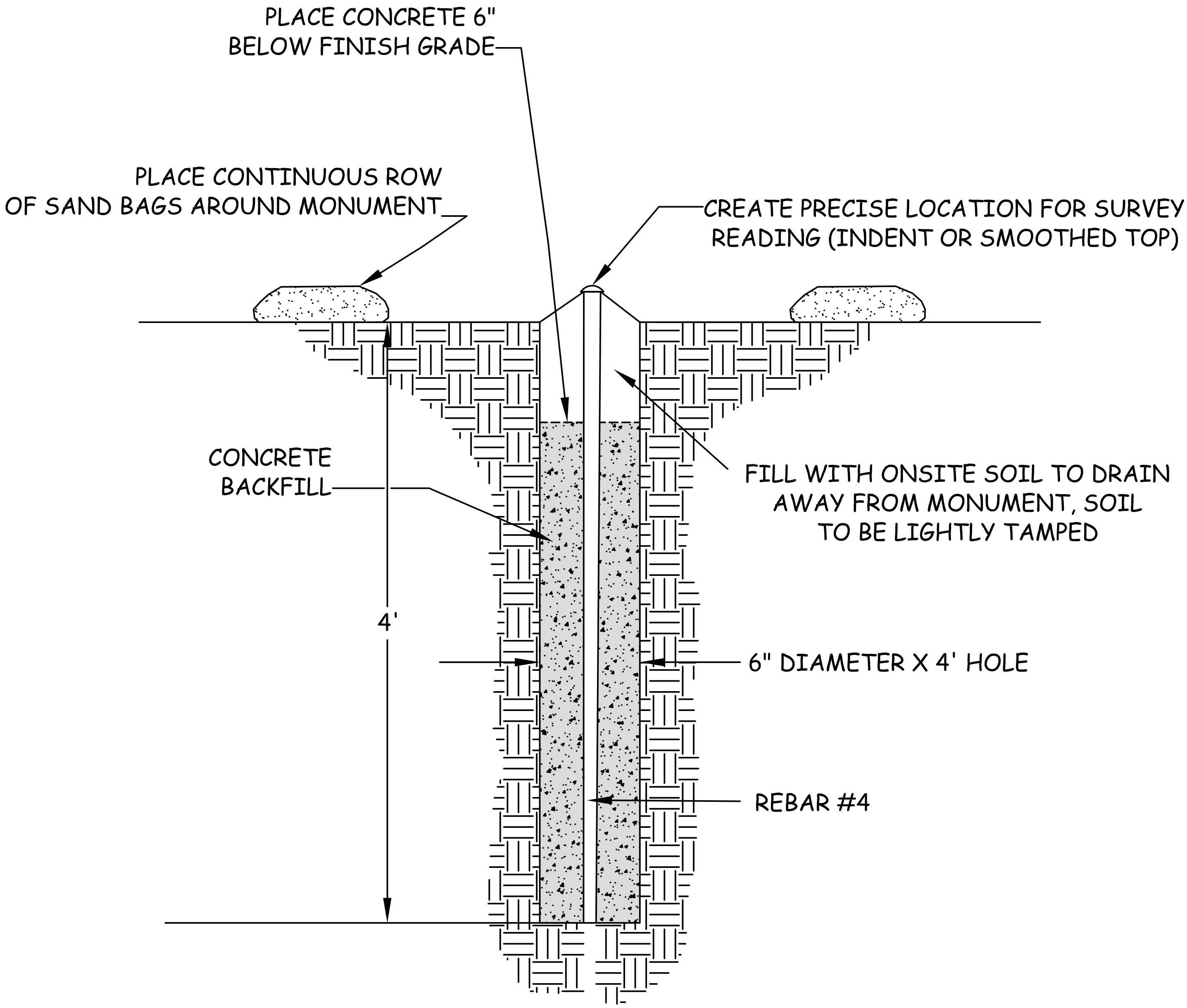
CANYON SUBDRAINS



NO CONSTRUCTION EQUIPMENT WITHIN 25 FEET
OF ANY INSTALLED SETTLEMENT MONUMENTS

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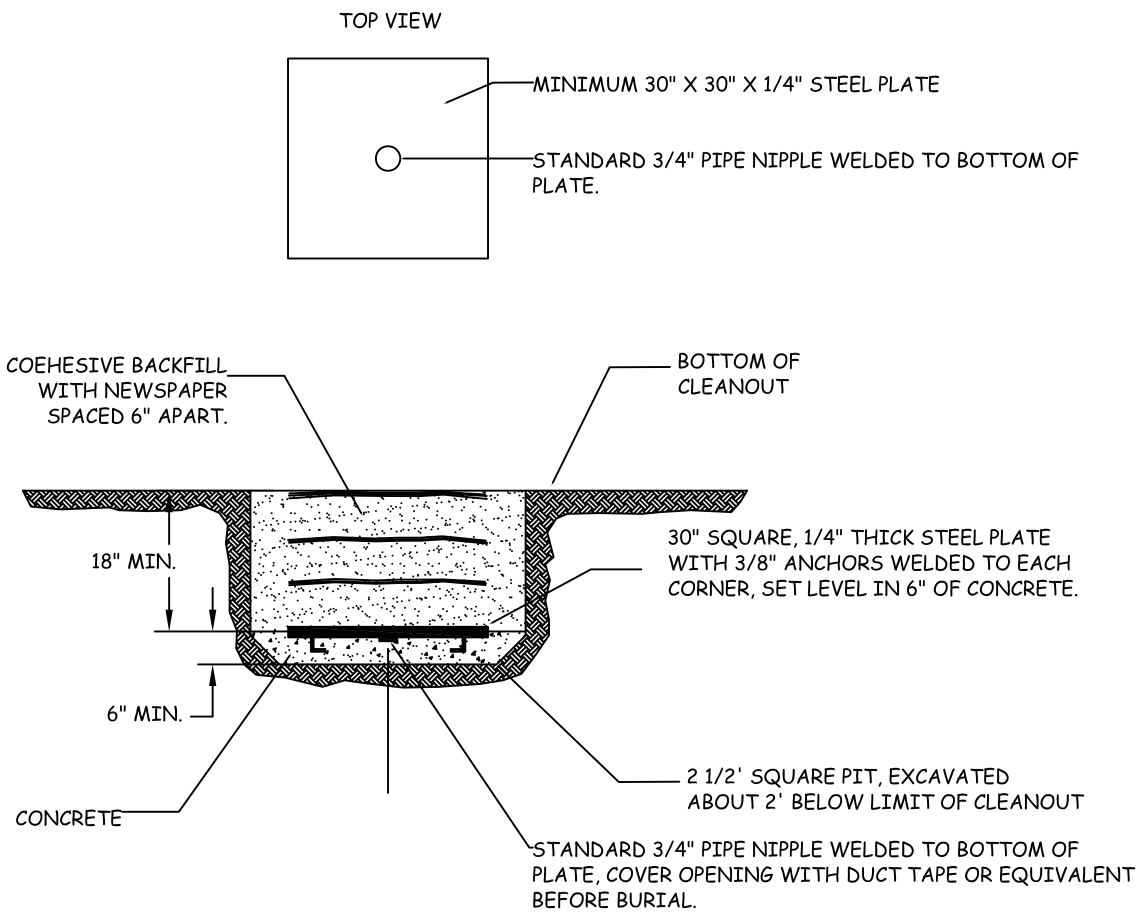
TYPICAL SURFACE SETTLEMENT MONUMENT



1. SURVEY FOR HORIZONTAL AND VERTICAL LOCATION TO NEAREST .01 INCH PRIOR TO BACKFILL USING KNOW LOCATIONS THAT WILL REMAIN INTACT DURING THE DURATION OF THE MONITORING PROGRAM. KNOW POINTS EXPLICITELY NOT ALLOWED ARE THOSE LOCATED ON FILL OR THAT WILL BE DESTROYED DURING GRADING.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE DURING GRADING, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. DRILL TO RECOVER AND ATTACH RISER PIPE.

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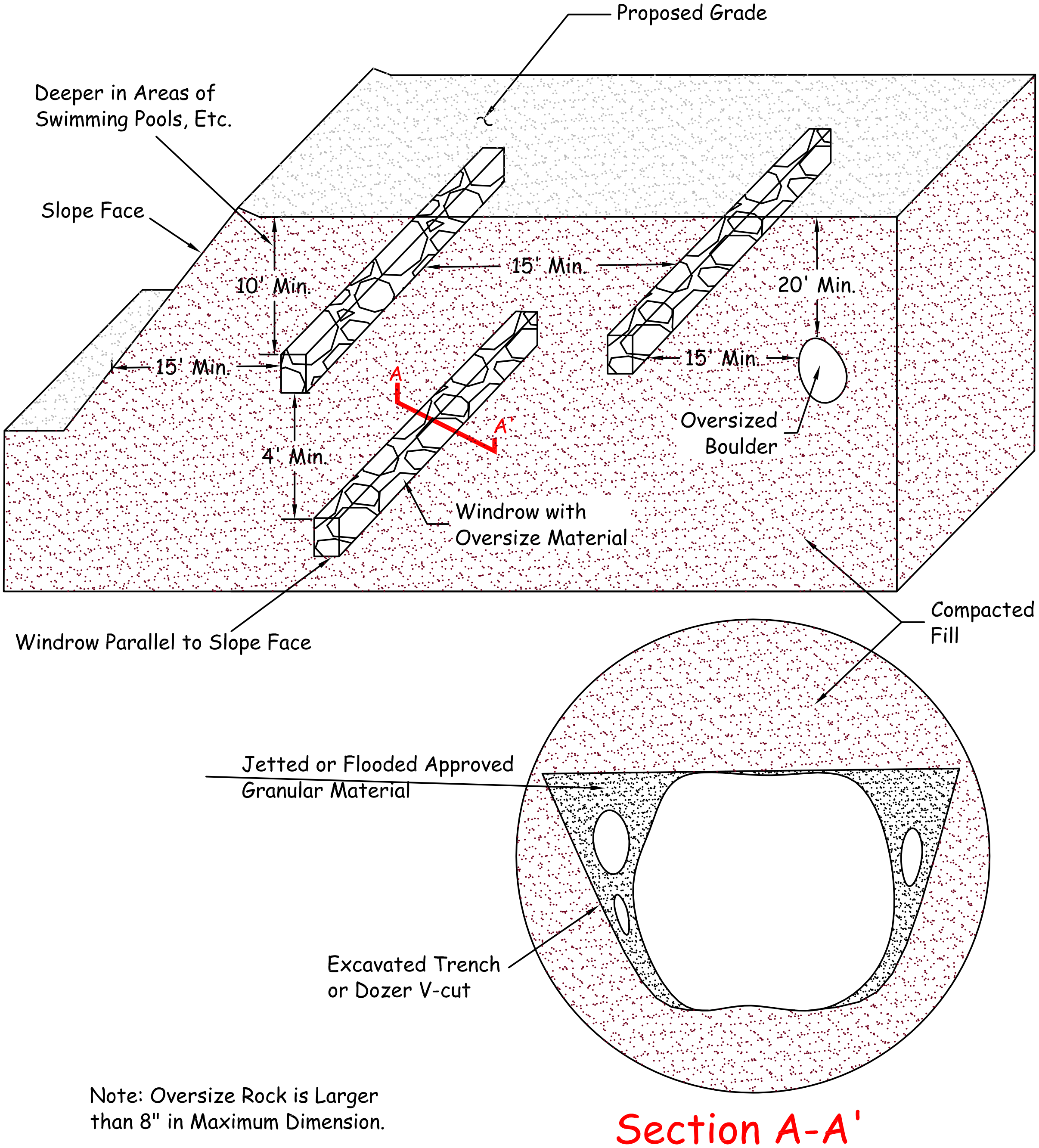
TYPICAL SETTLEMENT PLATE AND RISER



Note: Oversize Rock is Larger than 8" in Maximum Dimension.

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OVERSIZE ROCK DISPOSAL DETAIL

APPENDIX F:

EDUCATIONAL MATERIALS

(TO BE PROVIDED AT FINAL WQMP)

APPENDIX G:

OPERATION & MAINTENANCE PLAN

(TO BE PROVIDED AT FINAL WQMP)