City of Hesperia

Preliminary

Water Quality Management Plan

MOJAVE RIVER WATERSHED

San Bernardino County

For:

Pixior Distribution Center

APN: 0405-062-51-000

Prepared for:

55555 Amargosa LLC

5901 South Eastern Avenue

Commerce, CA 90040

(323) 423-3105

Prepared by:

DAVID EVANS AND ASSOCIATES INC.

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Ontario, CA 91764

(909) 481-5750

1st Submittal Date: May 13, 2020

Approval Date: _____

_Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for 55555 Amargosa LLC by David Evans & Associates, Inc.. The WQMP is intended to comply with the requirements of the City of Hesperia 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):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	PM XXXXX	Building Permit Number(s):	TBD
APN :			0405-062-0-000

Owner's Signature		
Owner Name: Simon Bouzaglou		
Title		
Company	55555 Amargosa LLC	
Address	5901 South Eastern Avenue, Commerce, CA 90040	
Email		
Telephone #	323-423-3105	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	PM XXXX	Building Permit Number(s):	
APN :			0405-062-51-0-000

"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:	Hong Zhang	PE Stamp Below
Title	Project Engineer	
Company	David Evans & Associates, Inc.	
Address	4141 E. Inland Empire Blvd., Ontario, CA 91764	
Email	hong.zhang@deainc.com	
Telephone #	909-481-5750	
Signature		
Date		

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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)

Form 1-1 Project Information

Project Name	Pixior Distribution Center				
Project Owner Contact Name:	Simon Bouzaglou				
Mailing Address:	55555 Amargosa LLC 5901 South Eastern Ave. Commerce, CA 90040	E-mail Address:		Telephone:	323-423-3105
Permit/Application Number(s):		Tract/Parcel Map Number(s):			
Additional Information/ Comments:					
Description of Project:	The project is located within the City of Hesperia west of Amargosa Road, Northeast of the California Aqueduct, Between the Aqueduct and Palmeto Way. The project is in the Mojave River Watershed. Latitude - 34d 25' 57", Longitude – 117d 22' 42" The Project consists of a Warehouse Building and associated with socks truck loading areas, parking lots, fire land, landscaped areas and drive ways. The site will be graded follow the existing drainage pattern, on-site surface runoff will be directed to a proposed underground perforated CMP Retention/Infiltration Basin. Off-site runoff will via an existing open channel crossing the west of the project site to north direction, stay same as the existing condition.. The Project is a "Priority Project and will require a WQMP.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	The Project site is 20.17 acres gross and 6.72 acre area, located in the City of Hesperia on west of Amargosa Road, north of the California Aqueduct. The Existing site is vacant, flat with a gentle slope 2%, and dirt and sparse vegetation. The runoff is directed to drain to northwest direction of the site, overflow to the Amargosa Road. For the proposed condition, the project consists of a 450,000-sqft Warehouse Building with parking lots, landscape area, fire land and on-site storm drain system. The site runoff will directed via ribbon gutter and downspouts into vegetated landscaped areas and sheet flow to low points, the catch basin locations. The runoff will be collected into the catch basins pass catch basin filter inserts, through proposed on-site storm drain pipes then to a proposed underground CMP Retention/Infiltration system on the east site of the project. The system is using the Contech perforate CMP products or approval quail's. The system is accommodate the increase in runoff per hydrology study of the project, as well as satisfying the LID-DCV volume of the WQMP requirement of development. The system will has infiltration and an emergency overflow pipe on top of the system to release the overflow. The overflow pipe will connected to a proposed bubbler basin and a Drywell, located at the northeast corner of the site, from there the excess will leave the site though a parkway drain to Amargosa Road, the existing outlet location. The proposed underground StormTech infiltration system to capture and treat storm water runoff for the site, as well as the BMP's practice in this project, the proposed landscaped areas, trees also employed to the accommodate the storm water treatment strategies.				

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 Project consists of a retail commercial and associated parking and drive aisles. LID measures are used such as landscaped self-treating areas where roof downspouts will be directed to and the primary LID BMP is the underground infiltration system as well as the source control BMPs listed in Section 4, form 4.1-1 and 4.1-2.

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.

Form 2.1-1 Description of Proposed Project

1 Regulated Development Project Category (Select all that apply):

☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface

☐ 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.*

2 Project Area (ft2):	833,303	**3** Number of Dwelling Units:	1	**4** SIC Code:	4225

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.*

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:

Ownership of the project will be held with 55555 Amargosa LLC. Long term maintenance will be the responsibility of the owner. This includes BMP maintenance, catch basin inspection, storm drain maintenance, efficient irrigation, landscape maintenance, etc until the property is sold or transferred.

55555 Amargosa LLC

5901 South Eastern Avenue.

Commerce , CA 90040

Tel: (323) 423-3105

Contact: Simon Bouzaglou

No onsite infrastructure will be transferred to a public agency after completion. The property owner will be formed for long-term maintenance of project stormwater facilites.

Refer to Section 5 and Attachment D of this WQMP report for detailed maintenance activities.

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 ☐	Wild Bird and Pet Waste, Garbage, Food Waste, Animals, Restroom
Nutrients - Phosphorous	E ☒	N ☐	Fertilizers, Waste, & Garbage, Landscaped area
Nutrients - Nitrogen	E ☒	N ☐	Potential Source – Landscape, Fertilizer, Food Waste, Garbage
Noxious Aquatic Plants	E ☐	N ☒	Not apply to the development
Sediment	E ☒	N ☐	Solid materials/ suspended solids from land surface is expected in addition to sediments from erosion, Landscaped area & Undeveloped pads.
Metals	E ☒	N ☐	Metal pollutants expected from vehicles circulating the parking lot, including tire wear and brake dust.
Oil and Grease	E ☒	N ☐	Surface area of parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production
Trash/Debris	E ☒	N ☐	Surface area of parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production
Pesticides / Herbicides	E ☒	N ☐	Expected pollutants from maintenance of the site landscape area is expected.
Organic Compounds	E ☒	N ☐	Use of cleaning solvents/chemicals and maintenace of landscape area will contribute to pollution from organic compounds.
Other: Toxic Organic Compounds	E ☒	N ☐	Expected from parking lots in general.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

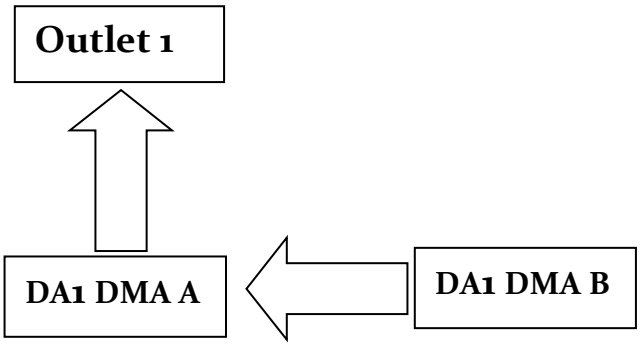
Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (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°24'12.32"N	Longitude 117°15'26.74"W	Thomas Bros Map page 4387 A6/A7

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 B flows to DA1 DMA A	The drainage area runoff drains into catch basins though catch basin filter inserts via on-site storm drain pipes to the underground CMP Retention/Infiltration System.
DA1 DMA A to Outlet 1	The drainage area runoff drains into catch basins though catch basin filter inserts via on-site storm drain pipes to the underground CMP Retention/Infiltration System, exceeds overflow to a bubbler basin with a Drywell, then through parkway drain (outlet 1) to Amargosa Road.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DA1 (Entire Area) DMA A+B	DMA	DMA C	DMA D
1 DMA drainage area (ft^2)	833,303			
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*	2			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	1,350			
6 Longest flowpath slope (ft/ft)	0.017			
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 Mojave Forks Reservoir Outlet to Upper Narrows • Fluoride
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	• Southwestern Willow Flycatcher • Desert Tortoise Habitat Cat 3 • 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	☒	☐	General information will be provided to the owner on housekeeping practices that contribute to the protection of storm water. The property owner and property manager will be familiar with the contents of this document and the BMPs used on the site. The owner will provide education materials to employees (if applicable) on BMPs and housekeeping practices that contribute to the protection of storm water
N2	Activity Restrictions	☒	☐	The property owner/manager shall control the discharge of the stormwater pollutants from this site through activity restrictions. Restrictions shall be provided to all new tenants/occupants through lease terms, or other mechanism upon first occupancy of the lease space and annually thereafter. Enforcement of activity restriction shall be on going during the operation of the project site
N3	Landscape Management BMPs	☒	☐	The property owner, building operators, and landscape maintenance contractors will practice on going landscape maintenance BMPs consistent with applicable local ordinances and will regular inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	☒	☐	The property owner/manager will maintain all post construction BMPs consistent with the O&M plan described in section 5 of this document (Form 5-1).
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	Storage of hazardous materials or waste on site must comply will all Title 22 CCR regulations
N6	Local Water Quality Ordinances	☒	☐	The owner shall comply with the City of Hesperia's Stormwater Ordinance through the implementation of BMPs.

Form 4.1-1 Non-Structural Source Control BMPs				
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials onsite for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc. Storage shall comply with Hazmat Regulations and any required contingency plans
N8	Underground Storage Tank Compliance	☐	☒	The proposed development does not have storage tanks on site
N9	Hazardous Materials Disclosure Compliance	☐	☒	The proposed development does not include hazardous materials.

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	☒	☐	The site shall conform to the building code requirements for fire safety implementation and all fire code requirements, regardless of product stored.
N11	Litter/Debris Control Program	☒	☐	The owner shall be responsible for trash and litter to be swept from the site and dumped into a City approved dumpster with lids. The owner shall contract with the city of Ontario or local trash collector to empty dumpsters on a weekly basis. Additionally ground maintenance personnel shall police the grounds for any litter
N12	Employee Training	☒	☐	The owner will ensure that all employees are also familiar with onsite BMPs and necessary maintenance required by the tenants/ employees. Owner will check with the City and county at least once a year to obtain new updated educational materials and provide these materials to tenants/employees. Employees shall be trained to cleanup spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hire training within 2 months.
N13	Housekeeping of Loading Docks	☒	☐	Dock areas shall be swept with litter control and cleanup procedures eliminating the use of water
N14	Catch Basin Inspection Program	☒	☐	Catch basins shall be inspected visually on a monthly basis; the entire storm drain system shall be inspected and cleaned prior to the start of the rainy season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking and dock areas will be swept regularly using a vacuum assisted sweeper. Frequency will depend on waste accumulations with a minimum

				of once per month and prior to the start of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Project is not classified as a public agency project
N17	Comply with all other applicable NPDES permits	☒	☐	The developer will comply with the California statewide Construction General Permit during construction and all future occupants of the site shall comply with the requirements of the statewide Industrial General Stormwater Permit.

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)	☒	☐	All storm drain inlets shall have Stenciling illustrating an anti-dumping message.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas shall be located away from storm drain inlets. All trash dumpsters/containers will be required to have a lid on at all times to prevent direct precipitation and prevent any rainfall from entering containers.
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)	☒	☐	Irrigation systems will be designed to each landscaped area's specific water need. Irrigation controls shall include rain-triggered shutoff devices to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas shall be below a minimum of 1" to 2" below the top of curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No protect slopes proposed within new development
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Unloading of truck trailers at docks will occur under cover of the building. It is not feasible to cover the entire loading area, as it would be cost prohibitive.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No vehicle wash areas proposed within new development
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No processing areas proposed within new development

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)	☐	☒	No equipment wash area on site. Owner will not allow outdoor processing area on this site
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling area onsite. Owner will not allow fueling area on this site.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	Not a hillside project
S14	Wash water control for food preparation areas	☐	☒	No food preparation area on site
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks on site

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: Vegetated areas and trees are increase the pervious area and decrease impervious areas.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Underground infiltration system bottom with natural soils, no compaction.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: After development the time of concentration direction will flow the proposed design drainage pattern.
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: Landscaped area next to buildings are disconnect the impervious areas.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: This project is not proposed porous pavement.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There is no significant existing vegetation and sensitive areas to protect.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☐ No ☒ Explanation: There is no re-vegetation areas on site.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: There is no compactions under the bottom of underground infiltration system.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Not apply to this project
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☐ No ☒ Explanation: The landscaped areas are too small.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: Not apply to this development.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☒ No ☐ Explanation: Project has more than 60 feet form California Aqueduct.

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): 843,757	[2] Imperviousness after applying preventative site design practices (Imp%): 85%	[3] Runoff Coefficient (Rc): _0.661 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.433 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.64 *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): 58,485 ft^3 *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

m Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	[1] 65,375 *Form 4.2-3 Item 12*	[2] 13.2 *Form 4.2-4 Item 13*	[3] 11.25 *Form 4.2-5 Item 10*
Post-developed	[4] 122,103 *Form 4.2-3 Item 13*	[5] 10.2 *Form 4.2-4 Item 14*	[6] 15.71 *Form 4.2-5 Item 14*
Difference	[7] *56,728* *Item 4 – Item 1*	[8] *3* *Item 2 – Item 5*	[9] *4.46* *Item 6 – Item 3*
Difference (as % of pre-developed)	[10] *86.8%* *Item 7 / Item 1*	[11] *22.7%* *Item 8 / Item 2*	[12] *39.6%* *Item 9 / Item 3*

Note: Mitigated storm for post-developed condition was analyzed using CivilD .
See table that follows table 4.3-10, and refer to Attachment B for more information.

Computer Calculation Details See Appendix B

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

Weighted Curve Number Determination for: Pre-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: Post-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*

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 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*								
11 Travel time to outlet (min) T_t *= Item 6 / (Item 10 * 60)*								
12 Total time of concentration (min) T_c *= Item 5 + 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): $T_{C\text{-}Hydro}$ *= (Item 13 * 0.95) – Item 14*								

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+B BMP Type Landscaped Self treatment	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	125,000		
3 Ratio of pervious area receiving runoff to impervious area	0.15		
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*	781		
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 781 $V_{retention}$ *=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 1 DMA B 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 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: 781 ft^3 *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.

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

1 Remaining LID DCV not met by site design BMP (ft^3): *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 1 BMP Type Underground CMP Infiltration System	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*	8.37		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	4.19		
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*	8		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	8		
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*	8112		
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))]*	n/a		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	60,231		

16 Total Retention Volume from LID Infiltration BMPs: 60,231 *(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 n/a

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*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ 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 2^1.67 * Item 3^0.5)*			
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 2^2)*			
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): 58,485 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 781 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 60,231 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-4*

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- F4
- -Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  4
  If yes, sum of Items 2, 3, and 4 is greater than Item 1 Provided Volume: 61,012 > 58,4825
- 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): 50,663 *(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): 58,781 *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): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): 0

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 ☒

The proposed project site will mitigate the hydrologic conditions of concern (HCOC) using underground Retention/ Infiltration Basins and MWS units will be used for water quality treatment, in addition to mitigation for the HCOC.

The runoff volume is being mitigated through storage within the 96" perforate CMP pipe system. The water quality volume within the basin ponds 8 feet above the infiltrating surface area. The remaining volume available within the basin for HCOC mitigation was determined by full volume of the system. An overflow pipe for the high flow on top of the system to release exceeds. The proposed underground CMP basin is not only to treat the LID volume and detain water before letting it out to the bubbler basin, but it also mitigates HCOC volume.

The post-project condition flow rates exceed the pre-project levels. As a result, the project site requires additional mitigation measures to effectively mitigate the flow rate associated with the HCOC. Detailed basin routing

calculations were performed for the basins to demonstrate that the basins and proposed outlet structures adequately mitigate the flows associated with the 10-year, 24-hour storm duration to below pre-project levels. An outlet structure was provided within basin system. Flows do not enter the structure in either basin until the depth of water within the basin exceeds the water quality volume. This ensures that the water quality volume will be effectively treated via infiltration. The basin outflow calculations utilized the infiltration rate (to account for water quality volume loss within the basin) in the stage versus storage volume table. The infiltration flow rate for the basin was calculated using the basin bottom surface area multiplied by the infiltration rate, and then converted appropriately. The basin routing calculations have been included in Attachment B. The calculations demonstrate that the flow rate of the developed site is mitigated with the basins.

The time of concentration decreases in the post-project condition (before considering the function of the infiltration basins, i.e. unmitigated) of the site because of land imperviousness, flow paths, and overall terrain modifications. However, the time of concentration ends up being mitigated in the post-project condition with the use of infiltration basins with outlet structures and a storm drain network. The basin outlet structures significantly increase the drawdown time for the 10-year 24-hour storm event.

The following table summarizes the HCOC analysis result:

	Pre-Project Condition			Post-Project Condition (Unmitigated)			Post-Project Basin Routed Condition		
	Flow Rate (ft^3/s)	Volume (ft^3)	T_c (min)	Flow Rate (ft^3/s)	Volume (ft^3)	T_c (min)	Flow Rate (ft^3/s)	Volume (ft^3)	T_c (hr)
DA 1 (Entire Onsite)	11.25	65,375	13.2	15.71	632,687	10.2	10.23	122,103	16.5

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Under Ground Infiltration System	By owner & future owner	Inspect the underground Arch via the access manhole, for accumulated sediment and debris levels and cleanout solids when > 6" build up occurs. Inspect for standing water with 48 hours of heavy rain events to ensure proper drawdown. Clean and flush underground systems to restore free drainage.	Annually, and after heavy rains
Signage & Stencil	By owner & future owner	Clean the stencil/signage surface to remove any excess dirt. Re-paint if necessary.	Annually
Catch Basins & Insert Filter	By owner & future owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Inspect inlet for excessive sediment, trash, and/or debris accumulation. Litter, leaves and debris should be removed from inlet to reduce risk of outlet clogging. Change the insert Filter as needed.	Annually, and after heavy rain
Litter Control	By owner & future owner	Maintain roofed waste collection areas and vacuum-sweep drive aisles and parking areas to remove potential stormwater contamination before anticipated storm events.	Weekly/Monthly
Landscape Areas	By owner & future owner	Implement - Mowing, Trimming, Pruning practices to prevent discharges of landscape waste into on-site retention structures. Control fertilizer, herbicide & pesticide applications to prevent stormwater contamination	Weekly
Irrigation System	By owner & future owner	Check and repair the irrigation system property functioning and verify there are no leaks or runoff from landscape areas. Adjust irrigation heads and system run time as necessary to prevent overwatering of vegetation, overspray or run-off from landscape	Weekly
Trash Enclosures	By owner & future owner	Empty trash receptacles. Clean the areas around enclosures by sweeping and /or mopping to prevent discharges of cleanup water.	Weekly

Bubbler Basin	By owner & future owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Inspect inlet for excessive sediment, trash, and/or debris accumulation. Litter, leaves and debris should be removed from inlet to reduce risk of outlet clogging.	Annually, and after heavy rain
Drywell	By owner & future owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Clean up excessive sediment, trash, and/or debris accumulation. Litter, leaves and debris should be removed from Drywell to reduce risk of well clogging. Pump stored runoff from an impaired or failed dry well can also be accomplished through the test well.	4 times Annually, and after heavy rain

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 Supporting Documentation

- Precise Grading Plan

6.3 Construction Information

- Soils information
- Infiltration Testing Report

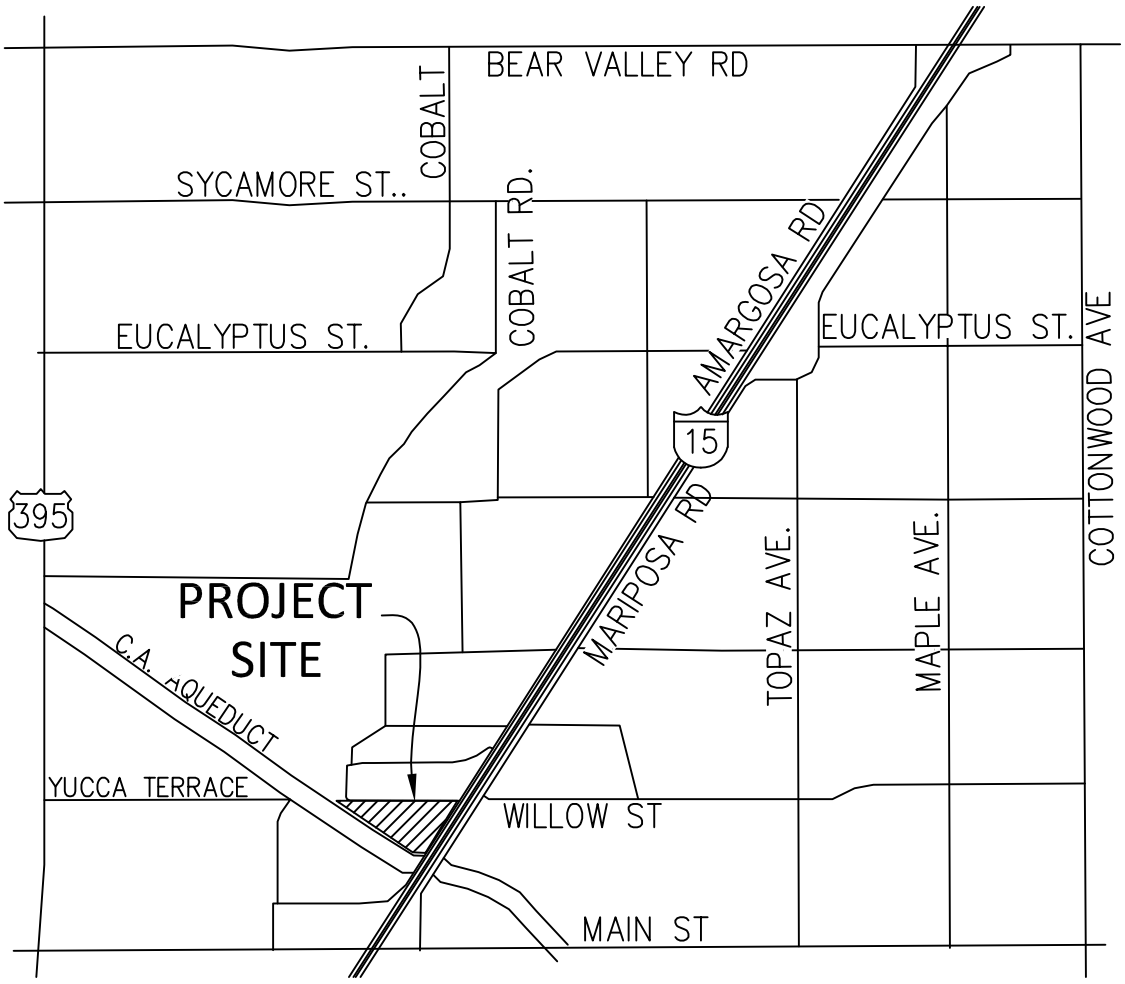
6.4 Other Supporting Documentation

- BMP Fact Sheets
- Activity Restriction – C,C&R's & Lease Agreements

6.5 Education Materials

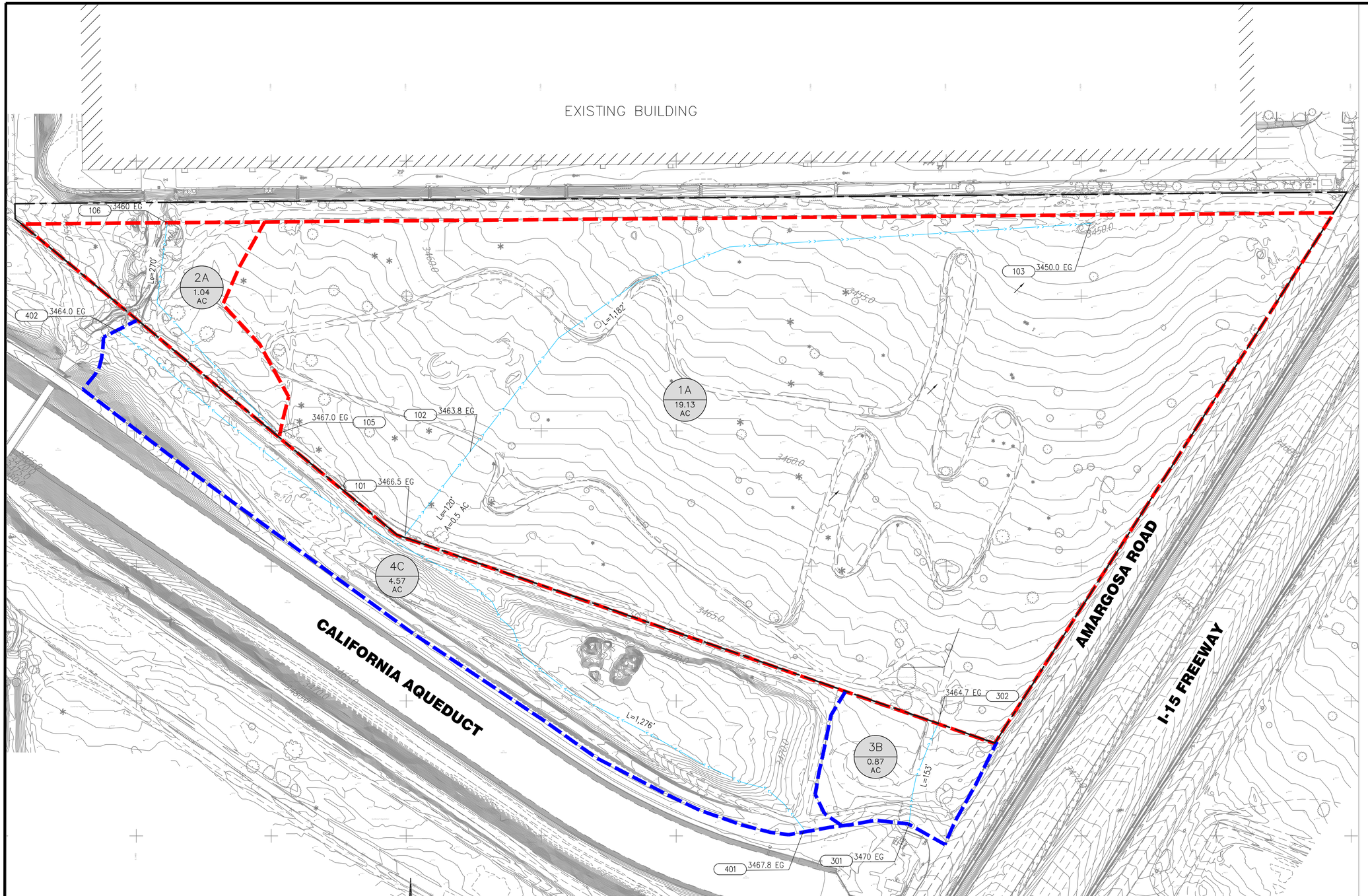
Appendix A: Exhibits & Maps

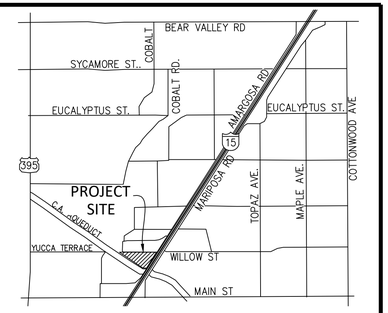
- Vicinity Map
- Existing Hydrology Map
- WQMP Exhibit



VICINITY MAP

NOT TO SCALE





VICINITY MAP
NOT TO SCALE

LEGEND

- DRAINAGE AREA BOUNDARY
- OFF-SITE DRAINAGE AREA BOUNDARY
- PROPERTY BOUNDARY
- FLOW PATH
- DIRECTION OF FLOW
- 100.00 249.97 FS — NODE DESIGNATION
- A / 5.0 AC — DA ID / ACREAGE

HYDROLOGY INFORMATION

SITE AREA:	20.17 AC	
SOIL GROUP:	A	(PER NRCS Soil Survey)
IMPERVIOUS:	0	(EXISTING CONDITION)
RAINFALL RATE:	1.25 IN/HR.	(100-YEAR)
AMC NUMBER:	2	(SOIL GROUP A)
	1	(For 2-YEAR STORM)
	3	(For 100-YEAR STORM)
FREQUENCY:	100 YEAR	(For STORM DRAIN DESIGN)
	2 YEAR	(For STORMWATER TREATMENT)
METHOD:	SAN BERNARDINO COUNTY HYDROLOGY MANUAL RATIONAL METHOD	

Pre-Development Hydrology Table (Rational Method):

DA No.	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO	Tc (min.)	Q100 (cfs)
1A	19.13	0.00	14.3	53.68
2A	1.04	0.00	10.5	3.69
3B	0.87	0.00	7.7	3.90
4C	4.57	0.00	29	7.28

N

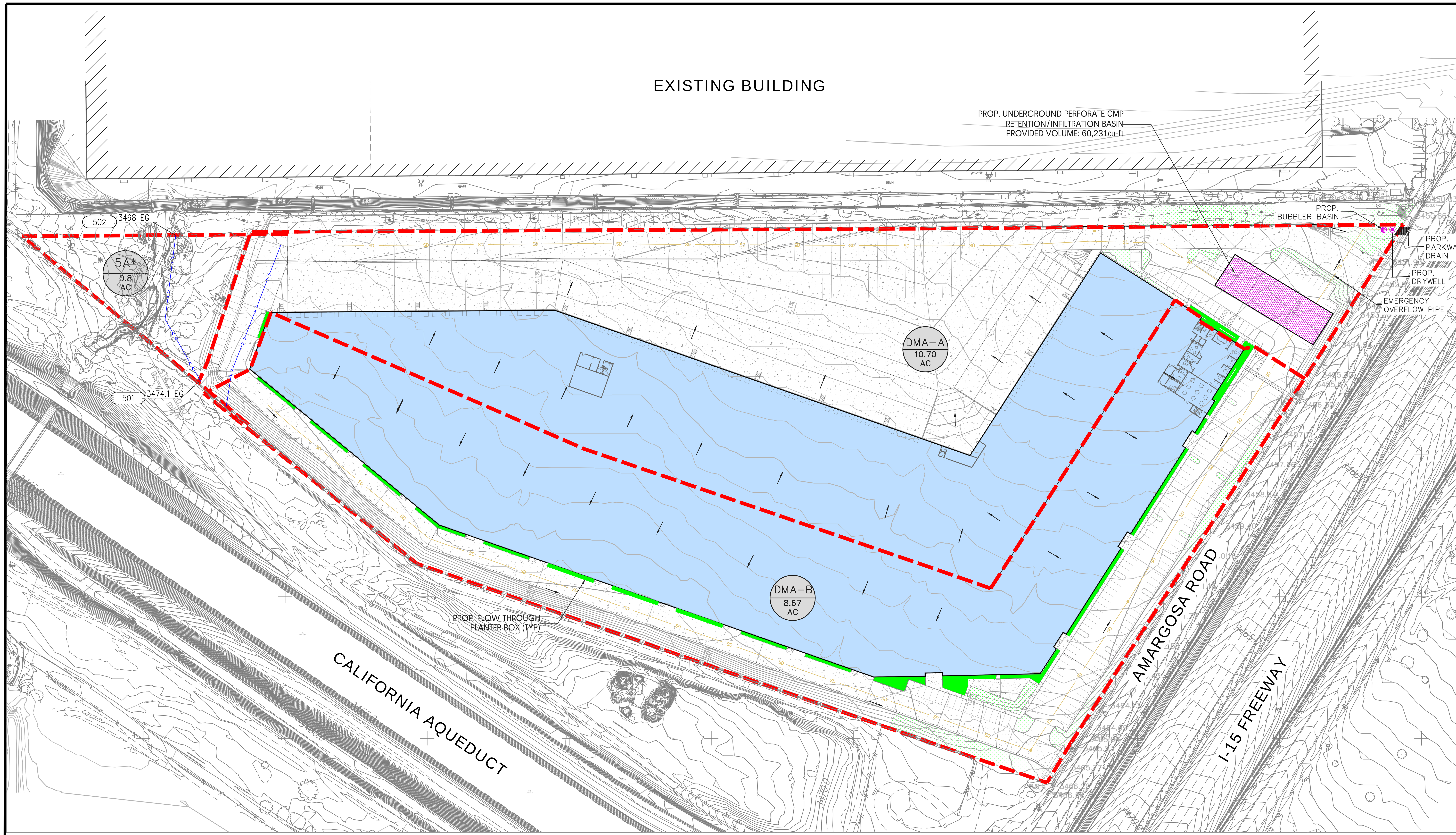
70 0 70 140
scale 1"= 70' feet

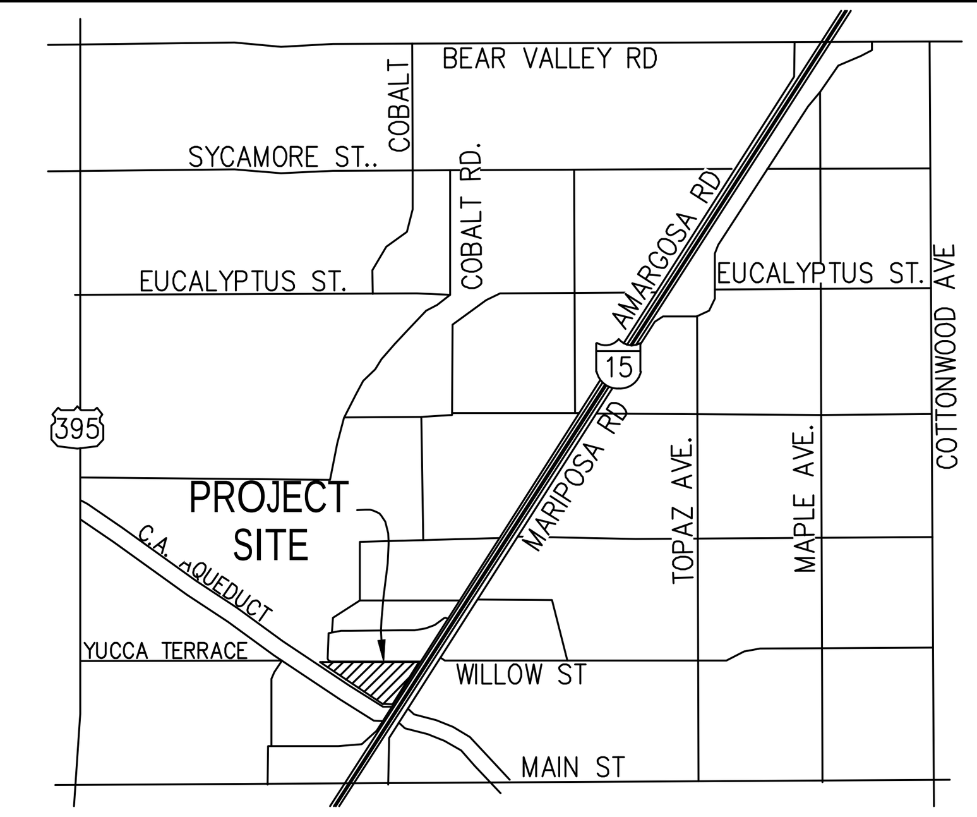
AVID EVANS SSOCIATES INC.
4141 Inland Empire Blvd., Suite 250
Ontario ,CA 91764
Phone: 909.481.5757 Fax: 909-481-5757

EXISTING CONDITION

HYDROLOGY MAP

Drawing Name: P:\P\P10000001\09DOINFO\06709Reports\Hydrology\Preliminary Hydrology\Exhibits\B_1_Hyd - Existing Condition.dwg
Last Opened: May 13, 2020 - 12:53pm by Hkz





VICINITY MAP
NOT TO SCALE

LEGEND

- PROPOSED UNDERGROUND CMP BASIN
- PROPOSED BUILDING
- PROPOSED LANDSCAPED AREA
- LANDSCAPED AREA – PROPOSED PLANTERS TO RECEIVE THE ROOF DRAIN STORM WATER
- DRAINGE MANAGEMENT AREA BOUNDARY
- FLOW PATH
- STORM DRAIN
- DIRECTION OF FLOW
- DMA–A / 5.0 AC: DMA ID / ACREAGE

*NOTE:
CANALIZATION OF EXISTING OFF-SITE CHANNEL FLOW THROUGH. NO OTHER IMPROVEMENTS IN THIS DRAINAGE AREA

Post-Development WQMP Summary Table

DMA No.	TRIBUTARY AREA (acre)	IMPERVIOUS RATIO	REQUIRED DCV (cu-ft)	TREATMENT BMP's	PROVIDED VOLUME (cu-ft)
DMA–A	10.70	0.85	32,307	Underground CMP Infiltration Basin	Total Basin Volume:
DMA–B	8.67	0.85	26,178 Total: 58,485	Flow Through Planters and Underground CMP Infiltration Basin	60,231

N

70 0 70 140
scale feet
1" = 70'

NOTE:
ROOF DRAINS WITHIN DRAINAGE AREA DMA TO BE ROUTED TO SPLASH ON GRADE IN THE DESIGNATED PLANTERS PRIOR TO DISCHARGING TO THE ON-SITE STORM DRAIN SYSTEM.

ROOF DRAINS WITHIN THE DRAINAGE AREA DMA–A ARE TO BE ROUTED WHERE FEASIABLY POSSIBLE TO THE FLOW THROUGH PLANTERS WITH DMA–B. TO BE FINALIZED IN CONSTRUCTION DOCUMENTS

HYDROLOGY INFORMATION

SITE AREA: 20.17 AC
SOIL GROUP: A (PER NRCS Soil Survey)
IMPERVIOUS: 85 (POST CONDITION)
RAINFALL RATE: 0.433 IN/HR. (2–YEAR, 1–HOUR)
METHOD: SAN BERNARDINO COUNTY WQMP MANUAL FOR MOJAVE RIVER WATERSHED

AVID EVANS SSOCIATES INC.
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Ontario ,CA 91764
Phone: 909.481.5757 Fax: 909-481-5757

POST- CONDITION

WQMP EXHIBIT

Appendix B: HCOC Analysis

- Rational Method (10-year, 24-hours Storm)
  - Existing & Post-Development Condition

- Unit Hydrograph Method (10-year, 24-hours Storm0
  - Existing & Post-Development Condition

- Basin Routing Calculation

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study Date: 02/24/20

Pixior Distribution Center
Existing Condition
10-year, 24-hour Storm

Program License Serial Number 4009

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 24 hour rainfall = 3.330 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.578(In/Hr)
Initial subarea data:
Initial area flow distance = 120.000(Ft.)
Top (of initial area) elevation = 3475.000(Ft.)
Bottom (of initial area) elevation = 3473.800(Ft.)
Difference in elevation = 1.200(Ft.)
Slope = 0.01000 s(%)= 1.00
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.950 min.
Rainfall intensity = 12.614(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.859
Subarea runoff = 5.416(CFS)
Total initial stream area = 0.500(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.578(In/Hr)

++

Process from Point/Station 102.000 to Point/Station 103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

```
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.222(Ft.), Average velocity =   5.359(Ft/s)
        ******* Irregular Channel Data **********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             10.00              1.00
        3             20.00              0.00
        4             30.00              1.00
        5             45.00              2.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =     80.727(CFS)
  '     '        flow top width =     25.557(Ft.)
  '     '    velocity=    5.359(Ft/s)
  '     '        area =     15.063(Sq.Ft)
  '     '        Froude number =     1.230

Upstream point elevation =  3473.800(Ft.)
Downstream point elevation =  3459.500(Ft.)
Flow length =  1350.000(Ft.)
Travel time  =    4.20 min.
Time of concentration =   13.15 min.
Depth of flow =   1.222(Ft.)
Average velocity =   5.359(Ft/s)
Total irregular channel flow =    80.727(CFS)
Irregular channel normal depth above invert elev. =   1.222(Ft.)
Average velocity of channel(s) =   5.359(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Rainfall intensity =      9.637(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.846
Subarea runoff =    150.544(CFS) for   18.630(Ac.)
Total runoff =    155.960(CFS)
Effective area this stream =       19.13(Ac.)
Total Study Area (Main Stream No. 1) =       19.13(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   1.558(Ft.), Average velocity =   6.226(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
```

```
Initial subarea data:
Initial area flow distance =   270.000(Ft.)
Top (of initial area) elevation =  3474.100(Ft.)
Bottom (of initial area) elevation =  3468.000(Ft.)
Difference in elevation =     6.100(Ft.)
Slope =    0.02259  s(%)=       2.26
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.517 min.
Rainfall intensity =     11.267(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.854
Subarea runoff =     10.005(CFS)
Total initial stream area =        1.040(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)
End of computations, Total Study Area =           20.17 (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 =  67.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study Date: 05/13/20

Pixior Distribition Center
Post-Development Condition
10-year, 24-hour Storm

Program License Serial Number 4009

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 24 hour rainfall = 3.330 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 290.000(Ft.)
Top (of initial area) elevation = 3460.000(Ft.)
Bottom (of initial area) elevation = 3456.800(Ft.)
Difference in elevation = 3.200(Ft.)
Slope = 0.01103 s(%)= 1.10
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.232 min.
Rainfall intensity = 14.644(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.894
Subarea runoff = 8.248(CFS)
Total initial stream area = 0.630(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

++

Process from Point/Station 102.000 to Point/Station 103.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Time of concentration = 7.23 min.
Rainfall intensity = 14.644(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.894
Subarea runoff = 116.382(CFS) for 8.890(Ac.)

Total runoff = 124.630(CFS)
Effective area this stream = 9.52(Ac.)
Total Study Area (Main Stream No. 1) = 9.52(Ac.)
Area averaged Fm value = 0.098(In/Hr)

++
Process from Point/Station 102.000 to Point/Station 103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 3453.800(Ft.)
Downstream point/station elevation = 3445.700(Ft.)
Pipe length = 1161.00(Ft.) Manning's N = 0.011
No. of pipes = 1 Required pipe flow = 124.630(CFS)
Nearest computed pipe diameter = 48.00(In.)
Calculated individual pipe flow = 124.630(CFS)
Normal flow depth in pipe = 34.92(In.)
Flow top width inside pipe = 42.74(In.)
Critical Depth = 40.24(In.)
Pipe flow velocity = 12.73(Ft/s)
Travel time through pipe = 1.52 min.
Time of concentration (TC) = 8.75 min.

++
Process from Point/Station 103.000 to Point/Station 104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 3445.700(Ft.)
Downstream point/station elevation = 3445.000(Ft.)
Pipe length = 120.00(Ft.) Manning's N = 0.011
No. of pipes = 1 Required pipe flow = 124.630(CFS)
Nearest computed pipe diameter = 48.00(In.)
Calculated individual pipe flow = 124.630(CFS)
Normal flow depth in pipe = 37.78(In.)
Flow top width inside pipe = 39.30(In.)
Critical Depth = 40.24(In.)
Pipe flow velocity = 11.75(Ft/s)
Travel time through pipe = 0.17 min.
Time of concentration (TC) = 8.92 min.

++
Process from Point/Station 301.000 to Point/Station 302.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 150.000(Ft.)
Top (of initial area) elevation = 3460.000(Ft.)
Bottom (of initial area) elevation = 3459.000(Ft.)
Difference in elevation = 1.000(Ft.)
Slope = 0.00667 s(%)= 0.67
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.145 min.
Rainfall intensity = 16.413(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff = 9.397(CFS)
Total initial stream area = 0.640(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

++
Process from Point/Station 302.000 to Point/Station 303.000

**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Time of concentration = 6.15 min.
Rainfall intensity = 16.413(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.895
Subarea runoff = 78.263(CFS) for 5.330(Ac.)
Total runoff = 87.660(CFS)
Effective area this stream = 5.97(Ac.)
Total Study Area (Main Stream No. 1) = 15.49(Ac.)
Area averaged Fm value = 0.098(In/Hr)

++
Process from Point/Station 302.000 to Point/Station 303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 3455.100(Ft.)
Downstream point/station elevation = 3449.100(Ft.)
Pipe length = 1192.00(Ft.) Manning's N = 0.011
No. of pipes = 1 Required pipe flow = 87.660(CFS)
Nearest computed pipe diameter = 45.00(In.)
Calculated individual pipe flow = 87.660(CFS)
Normal flow depth in pipe = 32.30(In.)
Flow top width inside pipe = 40.51(In.)
Critical Depth = 34.56(In.)
Pipe flow velocity = 10.33(Ft/s)
Travel time through pipe = 1.92 min.
Time of concentration (TC) = 8.07 min.

++
Process from Point/Station 303.000 to Point/Station 304.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Time of concentration = 8.07 min.
Rainfall intensity = 13.565(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.894
Subarea runoff = 17.424(CFS) for 2.700(Ac.)
Total runoff = 105.084(CFS)
Effective area this stream = 8.67(Ac.)
Total Study Area (Main Stream No. 1) = 18.19(Ac.)
Area averaged Fm value = 0.098(In/Hr)

++
Process from Point/Station 303.000 to Point/Station 304.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 3449.100(Ft.)
Downstream point/station elevation = 3445.000(Ft.)
Pipe length = 657.00(Ft.) Manning's N = 0.011
No. of pipes = 1 Required pipe flow = 105.084(CFS)
Nearest computed pipe diameter = 45.00(In.)
Calculated individual pipe flow = 105.084(CFS)
Normal flow depth in pipe = 34.36(In.)

```
Flow top width inside pipe =   38.24(In.)
Critical Depth =   37.58(In.)
Pipe flow velocity =     11.61(Ft/s)
Travel time through pipe =    0.94 min.
Time of concentration (TC) =     9.01 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      305.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   192.000(Ft.)
Top (of initial area) elevation =  3459.000(Ft.)
Bottom (of initial area) elevation =  3451.500(Ft.)
Difference in elevation =     7.500(Ft.)
Slope =    0.03906  s(%)=       3.91
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    4.763 min.
Rainfall intensity =     19.618(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.896
Subarea runoff =     20.731(CFS)
Total initial stream area =        1.180(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   270.000(Ft.)
Top (of initial area) elevation =  3465.000(Ft.)
Bottom (of initial area) elevation =  3459.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.02222  s(%)=       2.22
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.552 min.
Rainfall intensity =     11.241(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.854
Subarea runoff =      7.677(CFS)
Total initial stream area =        0.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)
End of computations, Total Study Area =           20.17 (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) = 0.136
Area averaged SCS curve number =  33.4
```

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

Study date 02/24/20

++

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

Program License Serial Number 4009

Pixior Distribution Center
Existing Condition
UH_Method
10-year, 24-hours Storm

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	19.13	1	0.75
Rainfall data for year 10	19.13	6	1.66
Rainfall data for year 10	19.13	24	3.33

++

******** 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)
67.0	67.0	0.00	0.000	0.578	1.000	0.578
67.0	67.0	19.13	1.000	0.578	1.000	0.578

Area-averaged adjusted loss rate Fm (In/Hr) = 0.578

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.00	0.000	67.0	67.0	4.93	0.227
19.13	1.000	67.0	67.0	4.93	0.227

Area-averaged catchment yield fraction, Y = 0.227
Area-averaged low loss fraction, Yb = 0.773

User entry of time of concentration = 0.220 (hours)

++

Watershed area = 19.13(Ac.)
Catchment Lag time = 0.176 hours
Unit interval = 15.000 minutes
Unit interval percentage of lag time = 142.0455
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.578(In/Hr)
Average low loss rate fraction (Yb) = 0.773 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.354(In)
Computed peak 30-minute rainfall = 0.607(In)
Specified peak 1-hour rainfall = 0.747(In)
Computed peak 3-hour rainfall = 1.219(In)
Specified peak 6-hour rainfall = 1.660(In)
Specified peak 24-hour rainfall = 3.330(In)

Rainfall depth area reduction factors:
Using a total area of 19.13(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.354(In)
30-minute factor = 0.999 Adjusted rainfall = 0.606(In)
1-hour factor = 0.999 Adjusted rainfall = 0.746(In)
3-hour factor = 1.000 Adjusted rainfall = 1.219(In)
6-hour factor = 1.000 Adjusted rainfall = 1.660(In)
24-hour factor = 1.000 Adjusted rainfall = 3.330(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 = 77.12 (CFS))	
1	31.201	24.061
2	78.771	36.685
3	90.441	8.999
4	95.575	3.960
5	98.284	2.089
6	100.000	1.324

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4924	0.0564
2	0.6062	0.0323
3	0.6846	0.0238
4	0.7463	0.0192
5	0.8245	0.0250
6	0.8944	0.0225
7	0.9581	0.0206
8	1.0170	0.0191
9	1.0719	0.0179
10	1.1235	0.0169
11	1.1723	0.0160
12	1.2187	0.0152
13	1.2630	0.0145
14	1.3054	0.0139
15	1.3462	0.0134
16	1.3855	0.0129
17	1.4234	0.0125
18	1.4601	0.0121
19	1.4958	0.0118
20	1.5303	0.0114
21	1.5640	0.0111
22	1.5968	0.0108
23	1.6287	0.0106
24	1.6599	0.0103
25	1.6943	0.0114
26	1.7280	0.0112

27	1.7610	0.0110
28	1.7935	0.0108
29	1.8254	0.0106
30	1.8567	0.0104
31	1.8876	0.0102
32	1.9179	0.0101
33	1.9478	0.0099
34	1.9772	0.0098
35	2.0062	0.0096
36	2.0348	0.0095
37	2.0630	0.0094
38	2.0908	0.0092
39	2.1182	0.0091
40	2.1453	0.0090
41	2.1721	0.0089
42	2.1985	0.0088
43	2.2247	0.0087
44	2.2505	0.0086
45	2.2761	0.0085
46	2.3013	0.0084
47	2.3263	0.0083
48	2.3510	0.0082
49	2.3755	0.0081
50	2.3997	0.0080
51	2.4237	0.0080
52	2.4475	0.0079
53	2.4710	0.0078
54	2.4943	0.0077
55	2.5174	0.0077
56	2.5403	0.0076
57	2.5629	0.0075
58	2.5854	0.0075
59	2.6077	0.0074
60	2.6298	0.0073
61	2.6517	0.0073
62	2.6735	0.0072
63	2.6951	0.0072
64	2.7164	0.0071
65	2.7377	0.0071
66	2.7588	0.0070
67	2.7797	0.0070
68	2.8004	0.0069
69	2.8210	0.0069
70	2.8415	0.0068
71	2.8618	0.0068
72	2.8820	0.0067
73	2.9020	0.0067
74	2.9219	0.0066
75	2.9417	0.0066
76	2.9613	0.0065
77	2.9808	0.0065
78	3.0002	0.0064
79	3.0194	0.0064
80	3.0386	0.0064
81	3.0576	0.0063
82	3.0765	0.0063
83	3.0953	0.0062
84	3.1139	0.0062
85	3.1325	0.0062
86	3.1510	0.0061
87	3.1693	0.0061
88	3.1875	0.0061
89	3.2057	0.0060
90	3.2237	0.0060
91	3.2417	0.0060
92	3.2595	0.0059
93	3.2772	0.0059
94	3.2949	0.0059
95	3.3125	0.0058
96	3.3299	0.0058

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0175	0.0135	0.0040
2	0.0176	0.0136	0.0040
3	0.0178	0.0137	0.0040
4	0.0179	0.0138	0.0041
5	0.0180	0.0140	0.0041
6	0.0182	0.0141	0.0041
7	0.0184	0.0142	0.0042
8	0.0185	0.0143	0.0042
9	0.0187	0.0144	0.0042
10	0.0188	0.0146	0.0043
11	0.0190	0.0147	0.0043
12	0.0192	0.0148	0.0044
13	0.0194	0.0150	0.0044
14	0.0196	0.0151	0.0044
15	0.0198	0.0153	0.0045
16	0.0200	0.0154	0.0045
17	0.0202	0.0156	0.0046
18	0.0204	0.0158	0.0046
19	0.0206	0.0159	0.0047
20	0.0208	0.0161	0.0047
21	0.0211	0.0163	0.0048
22	0.0213	0.0165	0.0048
23	0.0216	0.0167	0.0049
24	0.0218	0.0169	0.0050
25	0.0221	0.0171	0.0050
26	0.0224	0.0173	0.0051
27	0.0227	0.0175	0.0052
28	0.0230	0.0178	0.0052
29	0.0233	0.0180	0.0053
30	0.0236	0.0183	0.0054
31	0.0240	0.0186	0.0055
32	0.0244	0.0188	0.0055
33	0.0248	0.0191	0.0056
34	0.0251	0.0194	0.0057
35	0.0256	0.0198	0.0058
36	0.0260	0.0201	0.0059
37	0.0265	0.0205	0.0060
38	0.0270	0.0208	0.0061
39	0.0275	0.0212	0.0062
40	0.0280	0.0217	0.0064
41	0.0286	0.0221	0.0065
42	0.0292	0.0226	0.0066
43	0.0299	0.0231	0.0068
44	0.0306	0.0237	0.0070
45	0.0314	0.0243	0.0071
46	0.0322	0.0249	0.0073
47	0.0331	0.0256	0.0075
48	0.0341	0.0263	0.0077
49	0.0313	0.0242	0.0071
50	0.0324	0.0250	0.0074
51	0.0338	0.0261	0.0077
52	0.0352	0.0272	0.0080
53	0.0369	0.0285	0.0084
54	0.0387	0.0299	0.0088
55	0.0410	0.0316	0.0093
56	0.0434	0.0336	0.0099
57	0.0467	0.0361	0.0106
58	0.0503	0.0389	0.0114
59	0.0553	0.0428	0.0126
60	0.0615	0.0475	0.0140
61	0.0708	0.0547	0.0161
62	0.0657	0.0508	0.0149
63	0.0820	0.0634	0.0186
64	0.1754	0.1356	0.0398
65	0.4272	0.1446	0.2826
66	0.0732	0.0566	0.0166
67	0.0607	0.0469	0.0138

68	0.0498	0.0385	0.0113
69	0.0431	0.0333	0.0098
70	0.0384	0.0297	0.0087
71	0.0349	0.0270	0.0079
72	0.0322	0.0249	0.0073
73	0.0339	0.0262	0.0077
74	0.0321	0.0248	0.0073
75	0.0305	0.0236	0.0069
76	0.0291	0.0225	0.0066
77	0.0279	0.0216	0.0063
78	0.0269	0.0208	0.0061
79	0.0259	0.0200	0.0059
80	0.0251	0.0194	0.0057
81	0.0243	0.0188	0.0055
82	0.0236	0.0182	0.0054
83	0.0230	0.0177	0.0052
84	0.0224	0.0173	0.0051
85	0.0218	0.0169	0.0050
86	0.0213	0.0165	0.0048
87	0.0208	0.0161	0.0047
88	0.0204	0.0157	0.0046
89	0.0199	0.0154	0.0045
90	0.0195	0.0151	0.0044
91	0.0192	0.0148	0.0044
92	0.0188	0.0145	0.0043
93	0.0185	0.0143	0.0042
94	0.0182	0.0140	0.0041
95	0.0179	0.0138	0.0041
96	0.0176	0.0136	0.0040

Total soil rain loss = 2.39(In)
Total effective rainfall = 0.94(In)
Peak flow rate in flood hydrograph = 11.25(CFS)

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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 15 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+15	0.0020	0.10	Q	|	|	|	|
0+30	0.0070	0.24	Q	|	|	|	|
0+45	0.0127	0.28	Q	|	|	|	|
1+ 0	0.0189	0.30	Q	|	|	|	|
1+15	0.0253	0.31	Q	|	|	|	|
1+30	0.0318	0.32	Q	|	|	|	|
1+45	0.0384	0.32	QV	|	|	|	|
2+ 0	0.0450	0.32	QV	|	|	|	|
2+15	0.0517	0.32	QV	|	|	|	|
2+30	0.0585	0.33	QV	|	|	|	|
2+45	0.0653	0.33	QV	|	|	|	|
3+ 0	0.0722	0.33	QV	|	|	|	|
3+15	0.0791	0.34	Q V	|	|	|	|
3+30	0.0861	0.34	Q V	|	|	|	|
3+45	0.0932	0.34	Q V	|	|	|	|
4+ 0	0.1004	0.35	Q V	|	|	|	|
4+15	0.1076	0.35	Q V	|	|	|	|
4+30	0.1149	0.35	Q V	|	|	|	|
4+45	0.1223	0.36	Q V	|	|	|	|
5+ 0	0.1297	0.36	Q V	|	|	|	|
5+15	0.1373	0.36	Q V	|	|	|	|
5+30	0.1449	0.37	Q V	|	|	|	|
5+45	0.1526	0.37	Q V	|	|	|	|
6+ 0	0.1604	0.38	Q V	|	|	|	|
6+15	0.1683	0.38	Q V	|	|	|	|
6+30	0.1763	0.39	Q V	|	|	|	|
6+45	0.1844	0.39	Q V	|	|	|	|

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 7+ 0       0.1926      0.40  Q    V    |          |          |          |
 7+15       0.2010      0.40  Q    V    |          |          |          |
 7+30       0.2094      0.41  Q    V    |          |          |          |
 7+45       0.2179      0.41  Q    V    |          |          |          |
 8+ 0       0.2266      0.42  Q     V   |          |          |          |
 8+15       0.2354      0.43  Q     V   |          |          |          |
 8+30       0.2444      0.43  Q     V   |          |          |          |
 8+45       0.2535      0.44  Q     V   |          |          |          |
 9+ 0       0.2627      0.45  Q      V  |          |          |          |
 9+15       0.2721      0.46  Q      V  |          |          |          |
 9+30       0.2817      0.46  Q      V  |          |          |          |
 9+45       0.2915      0.47  Q      V  |          |          |          |
10+ 0       0.3014      0.48  Q       V |          |          |          |
10+15       0.3116      0.49  Q       V |          |          |          |
10+30       0.3219      0.50  |Q      V |          |          |          |
10+45       0.3325      0.51  |Q      V |          |          |          |
11+ 0       0.3433      0.52  |Q       V|          |          |          |
11+15       0.3544      0.54  |Q       V|          |          |          |
11+30       0.3657      0.55  |Q       V|          |          |          |
11+45       0.3774      0.56  |Q        V          |          |          |
12+ 0       0.3894      0.58  |Q        V          |          |          |
12+15       0.4013      0.58  |Q        V          |          |          |
12+30       0.4129      0.56  |Q         V         |          |          |
12+45       0.4247      0.57  |Q        |V         |          |          |
13+ 0       0.4370      0.59  |Q        |V         |          |          |
13+15       0.4498      0.62  |Q        |V         |          |          |
13+30       0.4631      0.65  |Q        | V        |          |          |
13+45       0.4771      0.68  |Q        | V        |          |          |
14+ 0       0.4920      0.72  |Q        |  V       |          |          |
14+15       0.5077      0.76  |Q        |  V       |          |          |
14+30       0.5247      0.82  |Q        |  V       |          |          |
14+45       0.5430      0.89  |Q        |   V      |          |          |
15+ 0       0.5631      0.97  |Q        |    V     |          |          |
15+15       0.5857      1.09  | Q       |    V     |          |          |
15+30       0.6097      1.16  | Q       |     V    |          |          |
15+45       0.6353      1.24  | Q       |     V    |          |          |
16+ 0       0.6742      1.89  |  Q      |      V   |          |          |
16+15       0.8507      8.54  |         |      Q   | V        |          |
16+30       1.0832     11.25  |         |          | Q     V  |          |
16+45       1.1597      3.70  |       Q |          |        V |          |
17+ 0       1.2042      2.15  |   Q     |          |          | V        |
17+15       1.2349      1.48  | Q       |          |          | V        |
17+30       1.2583      1.13  | Q       |          |          |  V       |
17+45       1.2727      0.69  |Q        |          |          |  V       |
18+ 0       1.2856      0.63  |Q        |          |          |   V      |
18+15       1.2979      0.60  |Q        |          |          |   V      |
18+30       1.3100      0.59  |Q        |          |          |   V      |
18+45       1.3216      0.56  |Q        |          |          |    V     |
19+ 0       1.3327      0.54  |Q        |          |          |    V     |
19+15       1.3432      0.51  |Q        |          |          |    V     |
19+30       1.3534      0.49  Q         |          |          |     V    |
19+45       1.3632      0.47  Q         |          |          |     V    |
20+ 0       1.3726      0.46  Q         |          |          |     V    |
20+15       1.3817      0.44  Q         |          |          |     V    |
20+30       1.3906      0.43  Q         |          |          |      V   |
20+45       1.3991      0.41  Q         |          |          |      V   |
21+ 0       1.4075      0.40  Q         |          |          |      V   |
21+15       1.4156      0.39  Q         |          |          |      V   |
21+30       1.4235      0.38  Q         |          |          |      V   |
21+45       1.4312      0.37  Q         |          |          |       V  |
22+ 0       1.4387      0.37  Q         |          |          |       V  |
22+15       1.4461      0.36  Q         |          |          |       V  |
22+30       1.4534      0.35  Q         |          |          |       V  |
22+45       1.4604      0.34  Q         |          |          |       V  |
23+ 0       1.4674      0.34  Q         |          |          |        V|
23+15       1.4742      0.33  Q         |          |          |        V|
23+30       1.4809      0.32  Q         |          |          |        V|
23+45       1.4875      0.32  Q         |          |          |        V|
24+ 0       1.4940      0.31  Q         |          |          |        V|
24+15       1.4984      0.21  Q         |          |          |        V|
24+30       1.4998      0.07  Q         |          |          |        V|
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U n i t H y d r o g r a p h A n a l y s i s

Study date 02/24/20

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

Program License Serial Number 4009

Pixior Distribution Center
Existing Condition
UH_Method
10-year, 24-hours Storm

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	19.13	1	0.75
Rainfall data for year 10	19.13	6	1.66
Rainfall data for year 10	19.13	24	3.33

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******** 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)
67.0	67.0	0.00	0.000	0.578	1.000	0.578
67.0	67.0	19.13	1.000	0.578	1.000	0.578

Area-averaged adjusted loss rate Fm (In/Hr) = 0.578

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.00	0.000	67.0	67.0	4.93	0.227
19.13	1.000	67.0	67.0	4.93	0.227

Area-averaged catchment yield fraction, Y = 0.227
Area-averaged low loss fraction, Yb = 0.773

User entry of time of concentration = 0.220 (hours)

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Watershed area = 19.13(Ac.)
Catchment Lag time = 0.176 hours
Unit interval = 15.000 minutes
Unit interval percentage of lag time = 142.0455
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.578(In/Hr)
Average low loss rate fraction (Yb) = 0.773 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.354(In)
Computed peak 30-minute rainfall = 0.607(In)
Specified peak 1-hour rainfall = 0.747(In)
Computed peak 3-hour rainfall = 1.219(In)
Specified peak 6-hour rainfall = 1.660(In)
Specified peak 24-hour rainfall = 3.330(In)

Rainfall depth area reduction factors:
Using a total area of 19.13(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.354(In)
30-minute factor = 0.999 Adjusted rainfall = 0.606(In)
1-hour factor = 0.999 Adjusted rainfall = 0.746(In)
3-hour factor = 1.000 Adjusted rainfall = 1.219(In)
6-hour factor = 1.000 Adjusted rainfall = 1.660(In)
24-hour factor = 1.000 Adjusted rainfall = 3.330(In)

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

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 77.12 (CFS))	
1	31.201	24.061
2	78.771	36.685
3	90.441	8.999
4	95.575	3.960
5	98.284	2.089
6	100.000	1.324

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4924	0.0564
2	0.6062	0.0323
3	0.6846	0.0238
4	0.7463	0.0192
5	0.8245	0.0250
6	0.8944	0.0225
7	0.9581	0.0206
8	1.0170	0.0191
9	1.0719	0.0179
10	1.1235	0.0169
11	1.1723	0.0160
12	1.2187	0.0152
13	1.2630	0.0145
14	1.3054	0.0139
15	1.3462	0.0134
16	1.3855	0.0129
17	1.4234	0.0125
18	1.4601	0.0121
19	1.4958	0.0118
20	1.5303	0.0114
21	1.5640	0.0111
22	1.5968	0.0108
23	1.6287	0.0106
24	1.6599	0.0103
25	1.6943	0.0114
26	1.7280	0.0112

27	1.7610	0.0110
28	1.7935	0.0108
29	1.8254	0.0106
30	1.8567	0.0104
31	1.8876	0.0102
32	1.9179	0.0101
33	1.9478	0.0099
34	1.9772	0.0098
35	2.0062	0.0096
36	2.0348	0.0095
37	2.0630	0.0094
38	2.0908	0.0092
39	2.1182	0.0091
40	2.1453	0.0090
41	2.1721	0.0089
42	2.1985	0.0088
43	2.2247	0.0087
44	2.2505	0.0086
45	2.2761	0.0085
46	2.3013	0.0084
47	2.3263	0.0083
48	2.3510	0.0082
49	2.3755	0.0081
50	2.3997	0.0080
51	2.4237	0.0080
52	2.4475	0.0079
53	2.4710	0.0078
54	2.4943	0.0077
55	2.5174	0.0077
56	2.5403	0.0076
57	2.5629	0.0075
58	2.5854	0.0075
59	2.6077	0.0074
60	2.6298	0.0073
61	2.6517	0.0073
62	2.6735	0.0072
63	2.6951	0.0072
64	2.7164	0.0071
65	2.7377	0.0071
66	2.7588	0.0070
67	2.7797	0.0070
68	2.8004	0.0069
69	2.8210	0.0069
70	2.8415	0.0068
71	2.8618	0.0068
72	2.8820	0.0067
73	2.9020	0.0067
74	2.9219	0.0066
75	2.9417	0.0066
76	2.9613	0.0065
77	2.9808	0.0065
78	3.0002	0.0064
79	3.0194	0.0064
80	3.0386	0.0064
81	3.0576	0.0063
82	3.0765	0.0063
83	3.0953	0.0062
84	3.1139	0.0062
85	3.1325	0.0062
86	3.1510	0.0061
87	3.1693	0.0061
88	3.1875	0.0061
89	3.2057	0.0060
90	3.2237	0.0060
91	3.2417	0.0060
92	3.2595	0.0059
93	3.2772	0.0059
94	3.2949	0.0059
95	3.3125	0.0058
96	3.3299	0.0058

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0175	0.0135	0.0040
2	0.0176	0.0136	0.0040
3	0.0178	0.0137	0.0040
4	0.0179	0.0138	0.0041
5	0.0180	0.0140	0.0041
6	0.0182	0.0141	0.0041
7	0.0184	0.0142	0.0042
8	0.0185	0.0143	0.0042
9	0.0187	0.0144	0.0042
10	0.0188	0.0146	0.0043
11	0.0190	0.0147	0.0043
12	0.0192	0.0148	0.0044
13	0.0194	0.0150	0.0044
14	0.0196	0.0151	0.0044
15	0.0198	0.0153	0.0045
16	0.0200	0.0154	0.0045
17	0.0202	0.0156	0.0046
18	0.0204	0.0158	0.0046
19	0.0206	0.0159	0.0047
20	0.0208	0.0161	0.0047
21	0.0211	0.0163	0.0048
22	0.0213	0.0165	0.0048
23	0.0216	0.0167	0.0049
24	0.0218	0.0169	0.0050
25	0.0221	0.0171	0.0050
26	0.0224	0.0173	0.0051
27	0.0227	0.0175	0.0052
28	0.0230	0.0178	0.0052
29	0.0233	0.0180	0.0053
30	0.0236	0.0183	0.0054
31	0.0240	0.0186	0.0055
32	0.0244	0.0188	0.0055
33	0.0248	0.0191	0.0056
34	0.0251	0.0194	0.0057
35	0.0256	0.0198	0.0058
36	0.0260	0.0201	0.0059
37	0.0265	0.0205	0.0060
38	0.0270	0.0208	0.0061
39	0.0275	0.0212	0.0062
40	0.0280	0.0217	0.0064
41	0.0286	0.0221	0.0065
42	0.0292	0.0226	0.0066
43	0.0299	0.0231	0.0068
44	0.0306	0.0237	0.0070
45	0.0314	0.0243	0.0071
46	0.0322	0.0249	0.0073
47	0.0331	0.0256	0.0075
48	0.0341	0.0263	0.0077
49	0.0313	0.0242	0.0071
50	0.0324	0.0250	0.0074
51	0.0338	0.0261	0.0077
52	0.0352	0.0272	0.0080
53	0.0369	0.0285	0.0084
54	0.0387	0.0299	0.0088
55	0.0410	0.0316	0.0093
56	0.0434	0.0336	0.0099
57	0.0467	0.0361	0.0106
58	0.0503	0.0389	0.0114
59	0.0553	0.0428	0.0126
60	0.0615	0.0475	0.0140
61	0.0708	0.0547	0.0161
62	0.0657	0.0508	0.0149
63	0.0820	0.0634	0.0186
64	0.1754	0.1356	0.0398
65	0.4272	0.1446	0.2826
66	0.0732	0.0566	0.0166
67	0.0607	0.0469	0.0138

68	0.0498	0.0385	0.0113
69	0.0431	0.0333	0.0098
70	0.0384	0.0297	0.0087
71	0.0349	0.0270	0.0079
72	0.0322	0.0249	0.0073
73	0.0339	0.0262	0.0077
74	0.0321	0.0248	0.0073
75	0.0305	0.0236	0.0069
76	0.0291	0.0225	0.0066
77	0.0279	0.0216	0.0063
78	0.0269	0.0208	0.0061
79	0.0259	0.0200	0.0059
80	0.0251	0.0194	0.0057
81	0.0243	0.0188	0.0055
82	0.0236	0.0182	0.0054
83	0.0230	0.0177	0.0052
84	0.0224	0.0173	0.0051
85	0.0218	0.0169	0.0050
86	0.0213	0.0165	0.0048
87	0.0208	0.0161	0.0047
88	0.0204	0.0157	0.0046
89	0.0199	0.0154	0.0045
90	0.0195	0.0151	0.0044
91	0.0192	0.0148	0.0044
92	0.0188	0.0145	0.0043
93	0.0185	0.0143	0.0042
94	0.0182	0.0140	0.0041
95	0.0179	0.0138	0.0041
96	0.0176	0.0136	0.0040

Total soil rain loss = 2.39(In)
Total effective rainfall = 0.94(In)
Peak flow rate in flood hydrograph = 11.25(CFS)

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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 15 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+15	0.0020	0.10	Q	|	|	|	|
0+30	0.0070	0.24	Q	|	|	|	|
0+45	0.0127	0.28	Q	|	|	|	|
1+ 0	0.0189	0.30	Q	|	|	|	|
1+15	0.0253	0.31	Q	|	|	|	|
1+30	0.0318	0.32	Q	|	|	|	|
1+45	0.0384	0.32	QV	|	|	|	|
2+ 0	0.0450	0.32	QV	|	|	|	|
2+15	0.0517	0.32	QV	|	|	|	|
2+30	0.0585	0.33	QV	|	|	|	|
2+45	0.0653	0.33	QV	|	|	|	|
3+ 0	0.0722	0.33	QV	|	|	|	|
3+15	0.0791	0.34	Q V	|	|	|	|
3+30	0.0861	0.34	Q V	|	|	|	|
3+45	0.0932	0.34	Q V	|	|	|	|
4+ 0	0.1004	0.35	Q V	|	|	|	|
4+15	0.1076	0.35	Q V	|	|	|	|
4+30	0.1149	0.35	Q V	|	|	|	|
4+45	0.1223	0.36	Q V	|	|	|	|
5+ 0	0.1297	0.36	Q V	|	|	|	|
5+15	0.1373	0.36	Q V	|	|	|	|
5+30	0.1449	0.37	Q V	|	|	|	|
5+45	0.1526	0.37	Q V	|	|	|	|
6+ 0	0.1604	0.38	Q V	|	|	|	|
6+15	0.1683	0.38	Q V	|	|	|	|
6+30	0.1763	0.39	Q V	|	|	|	|
6+45	0.1844	0.39	Q V	|	|	|	|

```
 7+ 0       0.1926      0.40  Q    V    |          |          |          |
 7+15       0.2010      0.40  Q    V    |          |          |          |
 7+30       0.2094      0.41  Q    V    |          |          |          |
 7+45       0.2179      0.41  Q    V    |          |          |          |
 8+ 0       0.2266      0.42  Q     V   |          |          |          |
 8+15       0.2354      0.43  Q     V   |          |          |          |
 8+30       0.2444      0.43  Q     V   |          |          |          |
 8+45       0.2535      0.44  Q     V   |          |          |          |
 9+ 0       0.2627      0.45  Q      V  |          |          |          |
 9+15       0.2721      0.46  Q      V  |          |          |          |
 9+30       0.2817      0.46  Q      V  |          |          |          |
 9+45       0.2915      0.47  Q      V  |          |          |          |
10+ 0       0.3014      0.48  Q       V |          |          |          |
10+15       0.3116      0.49  Q       V |          |          |          |
10+30       0.3219      0.50  |Q      V |          |          |          |
10+45       0.3325      0.51  |Q      V |          |          |          |
11+ 0       0.3433      0.52  |Q       V|          |          |          |
11+15       0.3544      0.54  |Q       V|          |          |          |
11+30       0.3657      0.55  |Q       V|          |          |          |
11+45       0.3774      0.56  |Q        V          |          |          |
12+ 0       0.3894      0.58  |Q        V          |          |          |
12+15       0.4013      0.58  |Q        V          |          |          |
12+30       0.4129      0.56  |Q         V         |          |          |
12+45       0.4247      0.57  |Q        |V         |          |          |
13+ 0       0.4370      0.59  |Q        |V         |          |          |
13+15       0.4498      0.62  |Q        |V         |          |          |
13+30       0.4631      0.65  |Q        | V        |          |          |
13+45       0.4771      0.68  |Q        | V        |          |          |
14+ 0       0.4920      0.72  |Q        |  V       |          |          |
14+15       0.5077      0.76  |Q        |  V       |          |          |
14+30       0.5247      0.82  |Q        |  V       |          |          |
14+45       0.5430      0.89  |Q        |   V      |          |          |
15+ 0       0.5631      0.97  |Q        |    V     |          |          |
15+15       0.5857      1.09  | Q       |    V     |          |          |
15+30       0.6097      1.16  | Q       |     V    |          |          |
15+45       0.6353      1.24  | Q       |     V    |          |          |
16+ 0       0.6742      1.89  |  Q      |      V   |          |          |
16+15       0.8507      8.54  |         |      Q   | V        |          |
16+30       1.0832     11.25  |         |          | Q     V  |          |
16+45       1.1597      3.70  |       Q |          |        V |          |
17+ 0       1.2042      2.15  |   Q     |          |          | V        |
17+15       1.2349      1.48  | Q       |          |          | V        |
17+30       1.2583      1.13  | Q       |          |          |  V       |
17+45       1.2727      0.69  |Q        |          |          |  V       |
18+ 0       1.2856      0.63  |Q        |          |          |   V      |
18+15       1.2979      0.60  |Q        |          |          |   V      |
18+30       1.3100      0.59  |Q        |          |          |   V      |
18+45       1.3216      0.56  |Q        |          |          |    V     |
19+ 0       1.3327      0.54  |Q        |          |          |    V     |
19+15       1.3432      0.51  |Q        |          |          |    V     |
19+30       1.3534      0.49  Q         |          |          |     V    |
19+45       1.3632      0.47  Q         |          |          |     V    |
20+ 0       1.3726      0.46  Q         |          |          |     V    |
20+15       1.3817      0.44  Q         |          |          |     V    |
20+30       1.3906      0.43  Q         |          |          |      V   |
20+45       1.3991      0.41  Q         |          |          |      V   |
21+ 0       1.4075      0.40  Q         |          |          |      V   |
21+15       1.4156      0.39  Q         |          |          |      V   |
21+30       1.4235      0.38  Q         |          |          |      V   |
21+45       1.4312      0.37  Q         |          |          |       V  |
22+ 0       1.4387      0.37  Q         |          |          |       V  |
22+15       1.4461      0.36  Q         |          |          |       V  |
22+30       1.4534      0.35  Q         |          |          |       V  |
22+45       1.4604      0.34  Q         |          |          |       V  |
23+ 0       1.4674      0.34  Q         |          |          |        V|
23+15       1.4742      0.33  Q         |          |          |        V|
23+30       1.4809      0.32  Q         |          |          |        V|
23+45       1.4875      0.32  Q         |          |          |        V|
24+ 0       1.4940      0.31  Q         |          |          |        V|
24+15       1.4984      0.21  Q         |          |          |        V|
24+30       1.4998      0.07  Q         |          |          |        V|
```

```
   24+45       1.5004      0.03  Q         |         |         |        V|
   25+ 0       1.5007      0.01  Q         |         |         |        V|
   25+15       1.5008      0.01  Q         |         |         |        V|
-------------------------------------------------------------------------
```

```
   24+45       1.5004      0.03  Q         |         |         |        V|
   25+ 0       1.5007      0.01  Q         |         |         |        V|
   25+15       1.5008      0.01  Q         |         |         |        V|
-------------------------------------------------------------------------
```

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

Study date 05/13/20

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

Program License Serial Number 4009

Pixior Distribition Center
Post-Development
UN_Method
10-year, 24-hours Storm

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		
19.37	1	0.75
Rainfall data for year 10		
19.37	6	1.66
Rainfall data for year 10		
19.37	24	3.33

++

******** 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)
32.0	32.0	19.37	1.000	0.978	0.150	0.147

Area-averaged adjusted loss rate Fm (In/Hr) = 0.147

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.91	0.150	32.0	32.0	16.65	0.000
16.46	0.850	98.0	98.0	0.20	0.930

Area-averaged catchment yield fraction, Y = 0.791
Area-averaged low loss fraction, Yb = 0.209
User entry of time of concentration = 0.170 (hours)

++

Watershed area = 19.37(Ac.)
Catchment Lag time = 0.136 hours
Unit interval = 15.000 minutes
Unit interval percentage of lag time = 183.8235
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.147(In/Hr)
Average low loss rate fraction (Yb) = 0.209 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.354(In)
Computed peak 30-minute rainfall = 0.607(In)
Specified peak 1-hour rainfall = 0.747(In)
Computed peak 3-hour rainfall = 1.219(In)
Specified peak 6-hour rainfall = 1.660(In)
Specified peak 24-hour rainfall = 3.330(In)

Rainfall depth area reduction factors:
Using a total area of 19.37(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.354(In)
30-minute factor = 0.999 Adjusted rainfall = 0.606(In)
1-hour factor = 0.999 Adjusted rainfall = 0.746(In)
3-hour factor = 1.000 Adjusted rainfall = 1.219(In)
6-hour factor = 1.000 Adjusted rainfall = 1.660(In)
24-hour factor = 1.000 Adjusted rainfall = 3.330(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 = 78.09 (CFS))	
1	44.297	34.590
2	100.000	17.295

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4924	0.0564
2	0.6062	0.0323
3	0.6846	0.0238
4	0.7463	0.0192
5	0.8245	0.0250
6	0.8944	0.0225
7	0.9581	0.0206
8	1.0169	0.0191
9	1.0718	0.0179
10	1.1235	0.0169
11	1.1723	0.0160
12	1.2187	0.0152
13	1.2630	0.0145
14	1.3054	0.0139
15	1.3462	0.0134
16	1.3855	0.0129
17	1.4234	0.0125
18	1.4601	0.0121
19	1.4957	0.0118
20	1.5303	0.0114
21	1.5640	0.0111
22	1.5968	0.0108
23	1.6287	0.0106
24	1.6599	0.0103
25	1.6943	0.0114
26	1.7280	0.0112
27	1.7610	0.0110
28	1.7935	0.0108
29	1.8254	0.0106
30	1.8567	0.0104
31	1.8876	0.0102
32	1.9179	0.0101

33	1.9478	0.0099
34	1.9772	0.0098
35	2.0062	0.0096
36	2.0348	0.0095
37	2.0630	0.0094
38	2.0908	0.0092
39	2.1182	0.0091
40	2.1453	0.0090
41	2.1721	0.0089
42	2.1985	0.0088
43	2.2247	0.0087
44	2.2505	0.0086
45	2.2761	0.0085
46	2.3013	0.0084
47	2.3263	0.0083
48	2.3510	0.0082
49	2.3755	0.0081
50	2.3997	0.0080
51	2.4237	0.0080
52	2.4475	0.0079
53	2.4710	0.0078
54	2.4943	0.0077
55	2.5174	0.0077
56	2.5403	0.0076
57	2.5629	0.0075
58	2.5854	0.0075
59	2.6077	0.0074
60	2.6298	0.0073
61	2.6517	0.0073
62	2.6735	0.0072
63	2.6950	0.0072
64	2.7164	0.0071
65	2.7377	0.0071
66	2.7588	0.0070
67	2.7797	0.0070
68	2.8004	0.0069
69	2.8210	0.0069
70	2.8415	0.0068
71	2.8618	0.0068
72	2.8820	0.0067
73	2.9020	0.0067
74	2.9219	0.0066
75	2.9417	0.0066
76	2.9613	0.0065
77	2.9808	0.0065
78	3.0002	0.0064
79	3.0194	0.0064
80	3.0386	0.0064
81	3.0576	0.0063
82	3.0765	0.0063
83	3.0953	0.0062
84	3.1139	0.0062
85	3.1325	0.0062
86	3.1510	0.0061
87	3.1693	0.0061
88	3.1875	0.0061
89	3.2057	0.0060
90	3.2237	0.0060
91	3.2417	0.0060
92	3.2595	0.0059
93	3.2772	0.0059
94	3.2949	0.0059
95	3.3125	0.0058
96	3.3299	0.0058

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0175	0.0037	0.0138
2	0.0176	0.0037	0.0139

3	0.0178	0.0037	0.0140
4	0.0179	0.0037	0.0141
5	0.0180	0.0038	0.0143
6	0.0182	0.0038	0.0144
7	0.0184	0.0038	0.0145
8	0.0185	0.0039	0.0146
9	0.0187	0.0039	0.0148
10	0.0188	0.0039	0.0149
11	0.0190	0.0040	0.0150
12	0.0192	0.0040	0.0152
13	0.0194	0.0041	0.0153
14	0.0196	0.0041	0.0155
15	0.0198	0.0041	0.0156
16	0.0200	0.0042	0.0158
17	0.0202	0.0042	0.0160
18	0.0204	0.0043	0.0161
19	0.0206	0.0043	0.0163
20	0.0208	0.0044	0.0165
21	0.0211	0.0044	0.0167
22	0.0213	0.0045	0.0169
23	0.0216	0.0045	0.0171
24	0.0218	0.0046	0.0173
25	0.0221	0.0046	0.0175
26	0.0224	0.0047	0.0177
27	0.0227	0.0048	0.0179
28	0.0230	0.0048	0.0182
29	0.0233	0.0049	0.0184
30	0.0236	0.0050	0.0187
31	0.0240	0.0050	0.0190
32	0.0244	0.0051	0.0193
33	0.0248	0.0052	0.0196
34	0.0251	0.0053	0.0199
35	0.0256	0.0054	0.0202
36	0.0260	0.0054	0.0206
37	0.0265	0.0055	0.0209
38	0.0270	0.0056	0.0213
39	0.0275	0.0058	0.0217
40	0.0280	0.0059	0.0222
41	0.0286	0.0060	0.0226
42	0.0292	0.0061	0.0231
43	0.0299	0.0063	0.0237
44	0.0306	0.0064	0.0242
45	0.0314	0.0066	0.0248
46	0.0322	0.0067	0.0255
47	0.0331	0.0069	0.0262
48	0.0341	0.0071	0.0269
49	0.0313	0.0066	0.0247
50	0.0324	0.0068	0.0256
51	0.0338	0.0071	0.0267
52	0.0352	0.0074	0.0278
53	0.0369	0.0077	0.0291
54	0.0387	0.0081	0.0306
55	0.0410	0.0086	0.0324
56	0.0434	0.0091	0.0343
57	0.0467	0.0098	0.0369
58	0.0503	0.0105	0.0398
59	0.0553	0.0116	0.0437
60	0.0615	0.0129	0.0486
61	0.0708	0.0148	0.0560
62	0.0657	0.0138	0.0520
63	0.0820	0.0172	0.0648
64	0.1754	0.0367	0.1387
65	0.4272	0.0367	0.3905
66	0.0732	0.0153	0.0579
67	0.0607	0.0127	0.0479
68	0.0498	0.0104	0.0394
69	0.0431	0.0090	0.0340
70	0.0384	0.0080	0.0304
71	0.0349	0.0073	0.0276
72	0.0322	0.0068	0.0255
73	0.0339	0.0071	0.0268

74	0.0321	0.0067	0.0254
75	0.0305	0.0064	0.0241
76	0.0291	0.0061	0.0230
77	0.0279	0.0059	0.0221
78	0.0269	0.0056	0.0213
79	0.0259	0.0054	0.0205
80	0.0251	0.0053	0.0198
81	0.0243	0.0051	0.0192
82	0.0236	0.0049	0.0187
83	0.0230	0.0048	0.0181
84	0.0224	0.0047	0.0177
85	0.0218	0.0046	0.0172
86	0.0213	0.0045	0.0168
87	0.0208	0.0044	0.0165
88	0.0204	0.0043	0.0161
89	0.0199	0.0042	0.0158
90	0.0195	0.0041	0.0155
91	0.0192	0.0040	0.0152
92	0.0188	0.0039	0.0149
93	0.0185	0.0039	0.0146
94	0.0182	0.0038	0.0144
95	0.0179	0.0037	0.0141
96	0.0176	0.0037	0.0139

Total soil rain loss = 0.64(In)
Total effective rainfall = 2.69(In)
Peak flow rate in flood hydrograph = 15.91(CFS)

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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 15 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0 5.0 10.0 15.0 20.0
0+15	0.0099	0.48	Q | | | |
0+30	0.0248	0.72	VQ | | | |
0+45	0.0398	0.73	VQ | | | |
1+ 0	0.0549	0.73	VQ | | | |
1+15	0.0701	0.74	VQ | | | |
1+30	0.0855	0.74	|Q | | | |
1+45	0.1010	0.75	|Q | | | |
2+ 0	0.1167	0.76	|Q | | | |
2+15	0.1325	0.76	|Q | | | |
2+30	0.1484	0.77	|QV | | | |
2+45	0.1645	0.78	|QV | | | |
3+ 0	0.1807	0.79	|QV | | | |
3+15	0.1971	0.79	|QV | | | |
3+30	0.2136	0.80	|QV | | | |
3+45	0.2303	0.81	|Q V | | | |
4+ 0	0.2472	0.82	|Q V | | | |
4+15	0.2642	0.83	|Q V | | | |
4+30	0.2814	0.83	|Q V | | | |
4+45	0.2989	0.84	|Q V | | | |
5+ 0	0.3165	0.85	|Q V | | | |
5+15	0.3343	0.86	|Q V | | | |
5+30	0.3523	0.87	|Q V | | | |
5+45	0.3705	0.88	|Q V | | | |
6+ 0	0.3889	0.89	|Q V | | | |
6+15	0.4076	0.90	|Q V | | | |
6+30	0.4265	0.91	|Q V | | | |
6+45	0.4457	0.93	|Q V | | | |
7+ 0	0.4651	0.94	|Q V | | | |
7+15	0.4847	0.95	|Q V | | | |
7+30	0.5047	0.97	|Q V | | | |
7+45	0.5249	0.98	|Q V | | | |
8+ 0	0.5455	0.99	|Q V | | | |
8+15	0.5663	1.01	| Q V | | | |

```
  8+30       0.5875      1.03  | Q     V |          |          |          |
  8+45       0.6091      1.04  | Q     V |          |          |          |
  9+ 0       0.6310      1.06  | Q     V |          |          |          |
  9+15       0.6533      1.08  | Q      V|          |          |          |
  9+30       0.6760      1.10  | Q      V|          |          |          |
  9+45       0.6992      1.12  | Q      V|          |          |          |
 10+ 0       0.7228      1.14  | Q       V          |          |          |
 10+15       0.7469      1.17  | Q       V          |          |          |
 10+30       0.7715      1.19  | Q       V          |          |          |
 10+45       0.7966      1.22  | Q        V         |          |          |
 11+ 0       0.8224      1.25  | Q       |V         |          |          |
 11+15       0.8488      1.28  | Q       |V         |          |          |
 11+30       0.8758      1.31  | Q       | V        |          |          |
 11+45       0.9036      1.35  | Q       | V        |          |          |
 12+ 0       0.9322      1.38  | Q       | V        |          |          |
 12+15       0.9595      1.32  | Q       |  V       |          |          |
 12+30       0.9867      1.31  | Q       |  V       |          |          |
 12+45       1.0149      1.37  | Q       |   V      |          |          |
 13+ 0       1.0443      1.42  | Q       |   V      |          |          |
 13+15       1.0751      1.49  | Q       |   V      |          |          |
 13+30       1.1073      1.56  |  Q      |    V     |          |          |
 13+45       1.1414      1.65  |  Q      |    V     |          |          |
 14+ 0       1.1775      1.75  |  Q      |     V    |          |          |
 14+15       1.2161      1.87  |  Q      |     V    |          |          |
 14+30       1.2578      2.01  |   Q     |      V   |          |          |
 14+45       1.3032      2.20  |   Q     |       V  |          |          |
 15+ 0       1.3536      2.44  |   Q     |       V  |          |          |
 15+15       1.4110      2.78  |    Q    |        V|          |          |
 15+30       1.4681      2.77  |    Q    |         V          |          |
 15+45       1.5330      3.14  |     Q   |          V         |          |
 16+ 0       1.6553      5.92  |         |Q         |  V       |          |
 16+15       1.9840     15.91  |         |          |      V   |Q         |
 16+30       2.1649      8.76  |         |      Q   |          V          |
 16+45       2.2199      2.66  |    Q    |          |          V          |
 17+ 0       2.2652      2.19  |   Q     |          |          |V         |
 17+15       2.3036      1.86  |  Q      |          |          | V        |
 17+30       2.3375      1.64  |  Q      |          |          | V        |
 17+45       2.3681      1.48  | Q       |          |          | V        |
 18+ 0       2.3961      1.36  | Q       |          |          |  V       |
 18+15       2.4244      1.37  | Q       |          |          |  V       |
 18+30       2.4521      1.34  | Q       |          |          |   V      |
 18+45       2.4784      1.27  | Q       |          |          |   V      |
 19+ 0       2.5035      1.21  | Q       |          |          |   V      |
 19+15       2.5275      1.16  | Q       |          |          |    V     |
 19+30       2.5506      1.12  | Q       |          |          |    V     |
 19+45       2.5729      1.08  | Q       |          |          |    V     |
 20+ 0       2.5944      1.04  | Q       |          |          |     V    |
 20+15       2.6152      1.01  | Q       |          |          |     V    |
 20+30       2.6354      0.98  |Q        |          |          |     V    |
 20+45       2.6550      0.95  |Q        |          |          |     V    |
 21+ 0       2.6741      0.93  |Q        |          |          |      V   |
 21+15       2.6928      0.90  |Q        |          |          |      V   |
 21+30       2.7109      0.88  |Q        |          |          |      V   |
 21+45       2.7287      0.86  |Q        |          |          |      V   |
 22+ 0       2.7461      0.84  |Q        |          |          |       V  |
 22+15       2.7631      0.82  |Q        |          |          |       V  |
 22+30       2.7798      0.81  |Q        |          |          |       V  |
 22+45       2.7961      0.79  |Q        |          |          |       V  |
 23+ 0       2.8122      0.78  |Q        |          |          |        V|
 23+15       2.8280      0.76  |Q        |          |          |        V|
 23+30       2.8434      0.75  |Q        |          |          |        V|
 23+45       2.8587      0.74  |Q        |          |          |        V|
 24+ 0       2.8737      0.73  |Q        |          |          |        V|
 24+15       2.8786      0.24  Q         |          |          |         V
-------------------------------------------------------------------------
```

FLOOD HYDROGRAPH ROUTING PROGRAM

Study date: 05/13/20

Pixior Distribution Center
Basin Routing
10-year, 24-hour Storm

Program License Serial Number 4009

********** HYDROGRAPH INFORMATION **********

From study/file name: PUN10.rte
**********HYDROGRAPH DATA**********
Number of intervals = 97
Time interval = 15.0 (Min.)
Maximum/Peak flow rate = 15.908 (CFS)
Total volume = 2.879 (Ac.Ft)
Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

++
Process from Point/Station 1.000 to Point/Station 2.000
**** RETARDING BASIN ROUTING ****
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User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 97
Hydrograph time unit = 15.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
3.000	0.410	0.010	0.410	0.410
6.000	0.930	0.015	0.930	0.930
9.000	1.330	15.200	1.173	1.487

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0	4.0	7.95	11.93	15.91	Depth (Ft.)
0.250	0.48	0.00	0.005	O	|	|	|	|	0.04
0.500	0.72	0.00	0.017	OI	|	|	|	|	0.13
0.750	0.73	0.00	0.032	OI	|	|	|	|	0.24

1.000	0.73	0.00	0.047	OI	|	|	|	0.35
1.250	0.74	0.00	0.062	OI	|	|	|	0.46
1.500	0.74	0.00	0.078	OI	|	|	|	0.57
1.750	0.75	0.00	0.093	OI	|	|	|	0.68
2.000	0.76	0.00	0.109	OI	|	|	|	0.80
2.250	0.76	0.00	0.124	OI	|	|	|	0.91
2.500	0.77	0.00	0.140	OI	|	|	|	1.03
2.750	0.78	0.00	0.156	OI	|	|	|	1.14
3.000	0.79	0.00	0.172	OI	|	|	|	1.26
3.250	0.79	0.00	0.188	OI	|	|	|	1.38
3.500	0.80	0.00	0.205	OI	|	|	|	1.50
3.750	0.81	0.01	0.221	OI	|	|	|	1.62
4.000	0.82	0.01	0.238	OI	|	|	|	1.74
4.250	0.83	0.01	0.255	OI	|	|	|	1.86
4.500	0.83	0.01	0.272	OI	|	|	|	1.99
4.750	0.84	0.01	0.289	OI	|	|	|	2.11
5.000	0.85	0.01	0.306	OI	|	|	|	2.24
5.250	0.86	0.01	0.324	OI	|	|	|	2.37
5.500	0.87	0.01	0.342	OI	|	|	|	2.50
5.750	0.88	0.01	0.359	OI	|	|	|	2.63
6.000	0.89	0.01	0.378	OI	|	|	|	2.76
6.250	0.90	0.01	0.396	OI	|	|	|	2.90
6.500	0.91	0.01	0.415	OI	|	|	|	3.03
6.750	0.93	0.01	0.433	OI	|	|	|	3.13
7.000	0.94	0.01	0.452	OI	|	|	|	3.24
7.250	0.95	0.01	0.472	OI	|	|	|	3.36
7.500	0.97	0.01	0.491	OI	|	|	|	3.47
7.750	0.98	0.01	0.511	OI	|	|	|	3.58
8.000	0.99	0.01	0.531	O I	|	|	|	3.70
8.250	1.01	0.01	0.552	O I	|	|	|	3.82
8.500	1.03	0.01	0.573	O I	|	|	|	3.94
8.750	1.04	0.01	0.594	O I	|	|	|	4.06
9.000	1.06	0.01	0.615	O I	|	|	|	4.18
9.250	1.08	0.01	0.637	O I	|	|	|	4.31
9.500	1.10	0.01	0.659	O I	|	|	|	4.44
9.750	1.12	0.01	0.682	O I	|	|	|	4.57
10.000	1.14	0.01	0.705	O I	|	|	|	4.70
10.250	1.17	0.01	0.729	O I	|	|	|	4.84
10.500	1.19	0.01	0.753	O I	|	|	|	4.98
10.750	1.22	0.01	0.777	O I	|	|	|	5.12
11.000	1.25	0.01	0.803	O I	|	|	|	5.26
11.250	1.28	0.01	0.828	O I	|	|	|	5.41
11.500	1.31	0.01	0.855	O I	|	|	|	5.57
11.750	1.35	0.01	0.882	O I	|	|	|	5.72
12.000	1.38	0.01	0.910	O I	|	|	|	5.88
12.250	1.32	0.22	0.935	O I	|	|	|	6.04
12.500	1.31	0.84	0.952	|OI	|	|	|	6.16
12.750	1.37	1.12	0.959	| O	|	|	|	6.22
13.000	1.42	1.27	0.963	| O	|	|	|	6.25
13.250	1.49	1.38	0.966	| O	|	|	|	6.27
13.500	1.56	1.46	0.968	| OI	|	|	|	6.29
13.750	1.65	1.54	0.970	| O	|	|	|	6.30
14.000	1.75	1.63	0.973	| O	|	|	|	6.32
14.250	1.87	1.73	0.975	| O	|	|	|	6.34
14.500	2.01	1.85	0.978	| OI	|	|	|	6.36
14.750	2.20	2.00	0.982	| O	|	|	|	6.39
15.000	2.44	2.18	0.987	| O	|	|	|	6.43
15.250	2.78	2.42	0.993	| OI	|	|	|	6.48
15.500	2.77	2.62	0.999	| O	|	|	|	6.51
15.750	3.14	2.81	1.004	| OI	|	|	|	6.55
16.000	5.92	3.78	1.029	| O| I	|	|	|	6.74
16.250	15.91	7.80	1.135	| | O|	|	| I	7.54
16.500	8.76	10.35	1.202	| | |I O	|	|	8.04
16.750	2.66	7.74	1.133	| I | O|	|	|	7.53
17.000	2.19	4.74	1.055	| I |O	|	|	|	6.93
17.250	1.86	3.21	1.014	| I O |	|	|	|	6.63
17.500	1.64	2.39	0.993	| IO	|	|	|	6.47
17.750	1.48	1.92	0.980	| IO	|	|	|	6.38
18.000	1.36	1.64	0.973	| IO	|	|	|	6.32
18.250	1.37	1.48	0.969	| O	|	|	|	6.29
18.500	1.34	1.41	0.967	| O	|	|	|	6.28

18.750	1.27	1.35	0.965	| O	|	|	|	6.26
19.000	1.21	1.29	0.964	| O	|	|	|	6.25
19.250	1.16	1.23	0.962	| O	|	|	|	6.24
19.500	1.12	1.18	0.961	| O	|	|	|	6.23
19.750	1.08	1.13	0.959	| O	|	|	|	6.22
20.000	1.04	1.09	0.958	| O	|	|	|	6.21
20.250	1.01	1.05	0.957	| O	|	|	|	6.21
20.500	0.98	1.02	0.956	|IO	|	|	|	6.20
20.750	0.95	0.99	0.956	|O	|	|	|	6.19
21.000	0.93	0.96	0.955	|O	|	|	|	6.19
21.250	0.90	0.93	0.954	|O	|	|	|	6.18
21.500	0.88	0.91	0.954	|O	|	|	|	6.18
21.750	0.86	0.89	0.953	|O	|	|	|	6.17
22.000	0.84	0.87	0.952	|O	|	|	|	6.17
22.250	0.82	0.85	0.952	|O	|	|	|	6.16
22.500	0.81	0.83	0.951	|O	|	|	|	6.16
22.750	0.79	0.81	0.951	|O	|	|	|	6.16
23.000	0.78	0.80	0.951	|O	|	|	|	6.15
23.250	0.76	0.78	0.950	|O	|	|	|	6.15
23.500	0.75	0.77	0.950	|O	|	|	|	6.15
23.750	0.74	0.75	0.949	|O	|	|	|	6.15
24.000	0.73	0.74	0.949	|O	|	|	|	6.14
24.250	0.24	0.60	0.945	IO	|	|	|	6.11
24.500	0.00	0.33	0.938	O	|	|	|	6.06
24.750	0.00	0.14	0.933	O	|	|	|	6.03
25.000	0.00	0.06	0.931	O	|	|	|	6.01

Remaining water in basin = 0.93 (Ac.Ft)

**********HYDROGRAPH DATA**********

Number of intervals = 100
Time interval = 15.0 (Min.)
Maximum/Peak flow rate = 10.353 (CFS)
Total volume = 1.948 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

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Appendix C: BMP's Calculation & Details

- Underground CMP Calculation & Details
- Catch Basin Insert Filter Details
- Drywell Details

CONTECH ENGINEERED SOLUTIONS

CMP: Underground Detention System
Storage Volume Estimation

Date: 5/13/20
Project Name: Pixior Distribution Center

City / County: Hesperia
State: CA

Designed By: Hong Zhang
Company: David Evans And Associates, Inc
Telephone: 909-912-7351

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

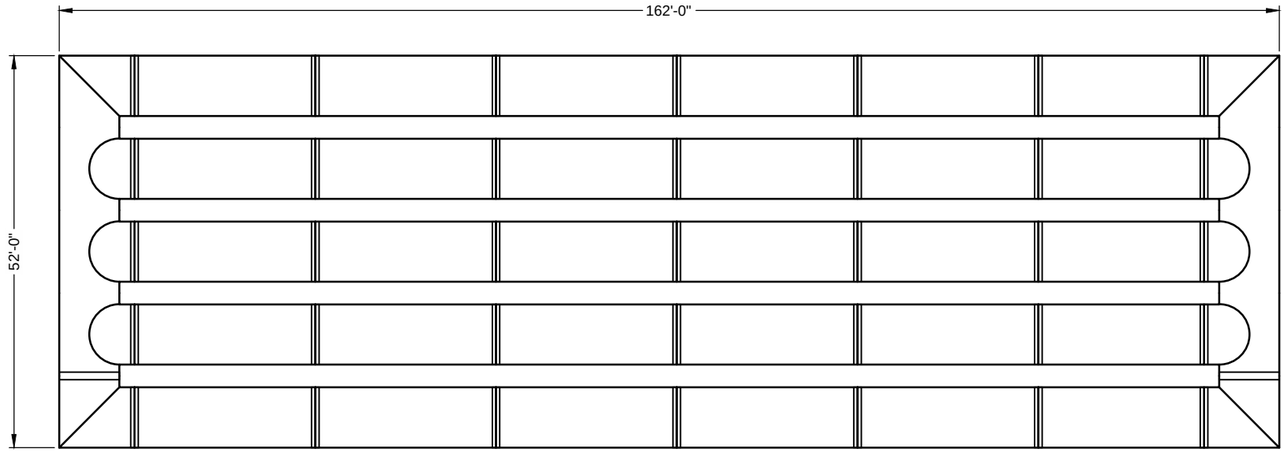
Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	162.0	Backfill Porosity (%):	40%	System Diameter (in):	96
Out-to-out width (ft):	52.0	Depth Above Pipe (in):	6.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	2.0	Depth Below Pipe (in):	6.0	Incremental Analysis (in):	2
Number of Barrels (ea):	5.0	Width At Ends (ft):	3.0	System Invert (Elevation):	0
		Width At Sides (ft):	3.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	3,897.6
0.17	0.16	0.0	0.0	649.6	649.6	649.6	649.6	0.0%	3,897.6
0.33	0.33	0.0	0.0	649.6	1,299.2	649.6	1,299.2	0.0%	3,897.6
0.50	0.50	0.0	0.0	649.6	1,948.8	649.6	1,948.8	0.0%	3,897.6
0.67	0.66	212.7	212.7	564.5	2,513.3	777.2	2,726.0	7.8%	5,041.1
0.83	0.83	385.0	597.7	495.6	3,008.9	880.6	3,606.6	16.6%	5,497.5
1.00	1.00	493.2	1,090.9	452.3	3,461.2	945.5	4,552.1	24.0%	5,835.6
1.17	1.16	577.7	1,668.6	418.5	3,879.8	996.2	5,548.3	30.1%	6,110.5
1.33	1.33	647.8	2,316.4	390.5	4,270.2	1,038.3	6,586.7	35.2%	6,343.4
1.50	1.50	708.1	3,024.5	366.4	4,636.6	1,074.4	7,661.1	39.5%	6,545.5
1.67	1.66	760.7	3,785.2	345.3	4,981.9	1,106.0	8,767.1	43.2%	6,723.4
1.83	1.83	807.3	4,592.5	326.7	5,308.6	1,134.0	9,901.1	46.4%	6,881.4
2.00	2.00	848.8	5,441.3	310.1	5,618.7	1,158.9	11,060.0	49.2%	7,022.6
2.17	2.16	885.9	6,327.3	295.2	5,913.9	1,181.2	12,241.2	51.7%	7,149.1
2.33	2.33	919.3	7,246.5	281.9	6,195.8	1,201.2	13,442.3	53.9%	7,262.7
2.50	2.50	949.1	8,195.7	269.9	6,465.7	1,219.1	14,661.4	55.9%	7,364.5
2.67	2.66	975.9	9,171.6	259.2	6,725.0	1,235.1	15,896.6	57.7%	7,455.6
2.83	2.83	999.8	10,171.4	249.7	6,974.6	1,249.5	17,146.0	59.3%	7,536.7
3.00	3.00	1,021.1	11,192.5	241.2	7,215.8	1,262.2	18,408.3	60.8%	7,608.7
3.17	3.16	1,039.8	12,232.3	233.7	7,449.5	1,273.5	19,681.8	62.2%	7,671.9
3.33	3.33	1,056.2	13,288.5	227.1	7,676.6	1,283.3	20,965.1	63.4%	7,726.7
3.50	3.50	1,070.4	14,358.9	221.5	7,898.1	1,291.8	22,256.9	64.5%	7,773.7
3.67	3.66	1,082.3	15,441.2	216.7	8,114.7	1,299.0	23,555.9	65.6%	7,813.0
3.83	3.83	1,092.2	16,533.4	212.7	8,327.4	1,304.9	24,860.8	66.5%	7,844.8
4.00	4.00	1,100.0	17,633.4	209.6	8,537.0	1,309.6	26,170.4	67.4%	7,869.4
4.17	4.16	1,105.9	18,739.3	207.3	8,744.3	1,313.1	27,483.6	68.2%	7,886.9
4.33	4.33	1,109.7	19,849.0	205.7	8,950.0	1,315.4	28,799.0	68.9%	7,897.3
4.50	4.50	1,111.7	20,960.7	204.9	9,154.9	1,316.6	30,115.6	69.6%	7,900.8
4.67	4.66	1,111.7	22,072.4	204.9	9,359.8	1,316.6	31,432.2	70.2%	7,897.3
4.83	4.83	1,109.7	23,182.1	205.7	9,565.5	1,315.4	32,747.7	70.8%	7,886.9
5.00	5.00	1,105.9	24,288.0	207.3	9,772.8	1,313.1	34,060.8	71.3%	7,869.4
5.17	5.16	1,100.0	25,388.0	209.6	9,982.4	1,309.6	35,370.4	71.8%	7,844.8
5.33	5.33	1,092.2	26,480.2	212.7	10,195.1	1,304.9	36,675.3	72.2%	7,813.0
5.50	5.50	1,082.3	27,562.5	216.7	10,411.8	1,299.0	37,974.3	72.6%	7,773.7
5.67	5.66	1,070.4	28,632.9	221.5	10,633.2	1,291.8	39,266.1	72.9%	7,726.7
5.83	5.83	1,056.2	29,689.1	227.1	10,860.4	1,283.3	40,549.5	73.2%	7,671.9
6.00	6.00	1,039.8	30,728.9	233.7	11,094.0	1,273.5	41,823.0	73.5%	7,608.7

6.17	6.16	1,021.1	31,750.0	241.2	11,335.2	1,262.2	43,085.2	73.7%	7,536.7
6.33	6.33	999.8	32,749.8	249.7	11,584.9	1,249.5	44,334.7	73.9%	7,455.6
6.50	6.50	975.9	33,725.7	259.2	11,844.1	1,235.1	45,569.8	74.0%	7,364.5
6.67	6.66	949.1	34,674.9	269.9	12,114.1	1,219.1	46,788.9	74.1%	7,262.7
6.83	6.83	919.3	35,594.1	281.9	12,396.0	1,201.2	47,990.1	74.2%	7,149.1
7.00	7.00	885.9	36,480.1	295.2	12,691.2	1,181.2	49,171.2	74.2%	7,022.6
7.17	7.16	848.8	37,328.9	310.1	13,001.2	1,158.9	50,330.1	74.2%	6,881.4
7.33	7.33	807.3	38,136.2	326.7	13,327.9	1,134.0	51,464.1	74.1%	6,723.4
7.50	7.50	760.7	38,896.9	345.3	13,673.2	1,106.0	52,570.1	74.0%	6,545.5
7.67	7.66	708.1	39,605.0	366.4	14,039.6	1,074.4	53,644.6	73.8%	6,343.4
7.83	7.83	647.8	40,252.8	390.5	14,430.1	1,038.3	54,682.9	73.6%	6,110.5
8.00	8.00	577.7	40,830.5	418.5	14,848.6	996.2	55,679.1	73.3%	5,835.6
8.17	8.16	493.2	41,323.7	452.3	15,300.9	945.5	56,624.6	73.0%	5,497.5
8.33	8.33	385.0	41,708.8	495.6	15,796.5	880.6	57,505.3	72.5%	5,041.1
8.50	8.50	212.7	41,921.4	564.5	16,361.0	777.2	58,282.4	71.9%	3,897.6
8.67	8.66	0.0	41,921.4	649.6	17,010.6	649.6	58,932.0	71.1%	3,897.6
8.83	8.83	0.0	41,921.4	649.6	17,660.2	649.6	59,581.6	70.4%	3,897.6
9.00	9.00	0.0	41,921.4	649.6	18,309.8	649.6	60,231.2	69.6%	3,897.6



ASSEMBLY
SCALE: 1" = 20'

PROJECT SUMMARY

CALCULATION DETAILS
- LENGTH PER BARREL = 146 FT
- LENGTH PER HEADER = 52 FT
- LOADING = H20 & H25
- APPROX. CMP FOOTAGE = 834 FT

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED 60,000 CF
- PIPE STORAGE = 41,921 CF
- STRUCTURAL BACKFILL STORAGE = 18,309 CF
- TOTAL STORAGE PROVIDED = 60,231 CF

PIPE DETAILS
- DIAMETER = 96 IN
- CORRUGATION = 5" X 1" OR 3" X 1"
- GAGE = 16
- COATING = ALUMINIZED STEEL TYPE 2 (ALT2)
- WALL TYPE = PERFORATED
- BARREL SPACING = 36 IN

BACKFILL DETAILS
- WIDTH AT ENDS = 36 IN
- ABOVE PIPE = 6 IN
- WIDTH AT SIDES = 36 IN
- BELOW PIPE = 6 IN

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

NOTES
- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2 ⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH **DYODS** DRAWING

DYODS - 14192-2-0
PROJECT NAME: Pixior Distribution Center
Hesperia, CA
DESCRIPTION: UNDERGROUND RETENTION / INFILTRATION BASIN

PROJECT No.:	SEQ. No.:	DATE:
14192-2	0	5/13/2020
DESIGNED:		DRAWN:
DYODS		DYODS
CHECKED:		APPROVED:
SHEET NO.:		D1

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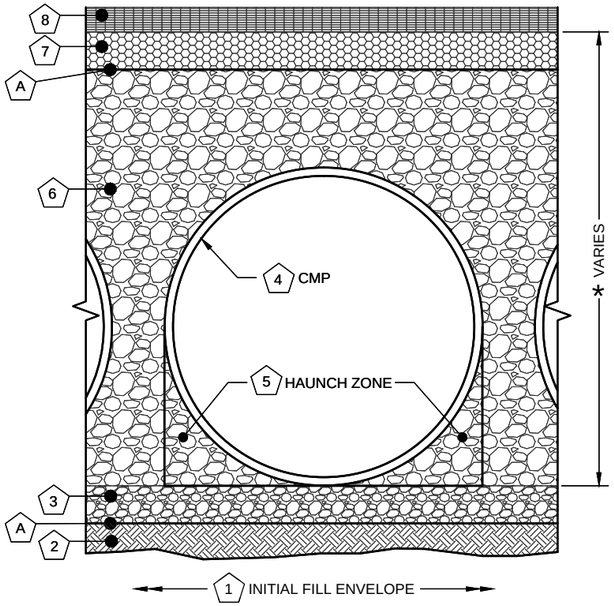

Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe			
Material Location	Description	Material Designation	Designation
8 Rigid or Flexible Pavement (if applicable)			
7 Road Base (if applicable			
A Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types. Wrap the trench only.
6 Backfill	Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded, free draining stone, with a particle size of ½" – 2 ½" diameter is recommended.	AASHTO M 145-A-1 or AASHTO M 43 - 3, 4	Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, air-tamper, vibratory rod, or other effective methods. Compaction of all placed fill material is necessary and shall be considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the Project Engineer or his representative is satisfied with the level of compaction"
3 Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	For soil aggregates larger than 3/8" a dedicated bedding layer is not required for CMP. Pipe may be placed on the trench bottom comprised of native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Soil aggregates less than 3/8" and unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation.
A Geotextile Layer	None	None	Contech does not recommend geotextiles be placed under the invert of Infiltration systems due to the propensity for geotextiles to clog over time.
* Note: The listed AASHTO designations are for gradation only. The stone must also be angular and clean.			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

BACKFILL
MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT. MAINTAIN BALANCED LOADING ON ALL PIPES IN THE SYSTEM DURING ALL SUCH OPERATIONS.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

BACKFILL DETAIL
SCALE: N.T.S.

NOTE:
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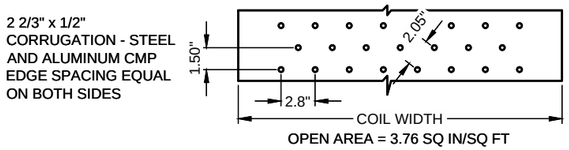
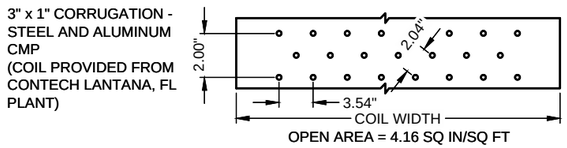
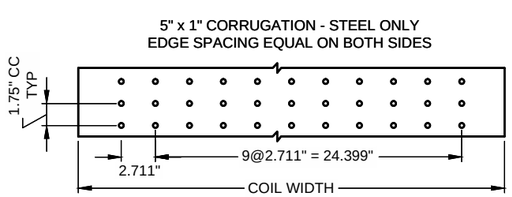


OPEN AREA = 3.76 SQ IN/SQ FT



OPEN AREA = 4.16 SQ IN/SQ FT

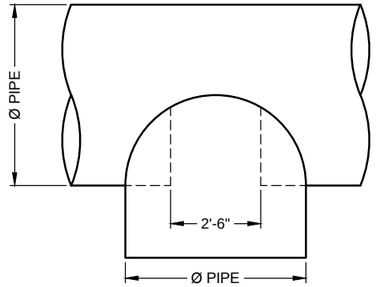


OPEN AREA = 3.33 SQ IN/SQ FT

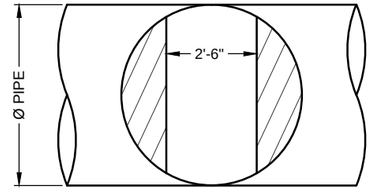
NOTES:

1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES Ø3/8".

TYPICAL PERFORATION DETAIL
SCALE: N.T.S.



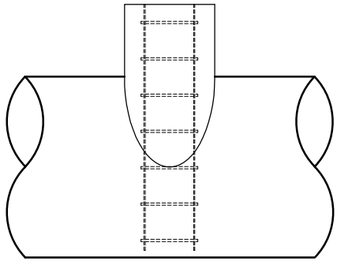
PLAN



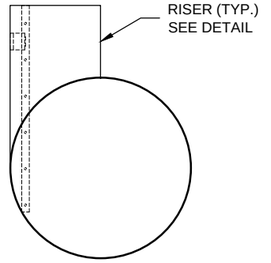
FRONT

TYPICAL MANWAY DETAIL
SCALE: N.T.S.

NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.



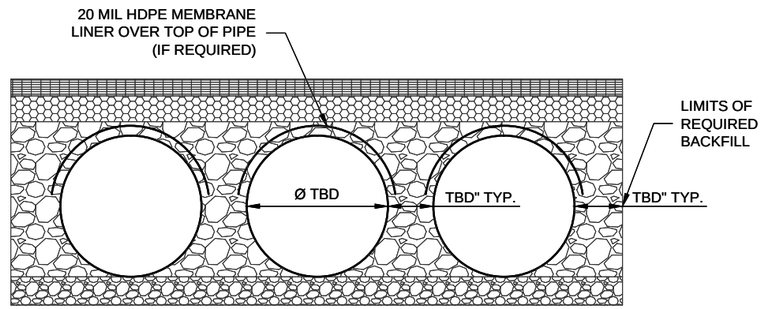
ELEVATION



END

TYPICAL RISER DETAIL
SCALE: N.T.S.

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.



TYPICAL SECTION VIEW
LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
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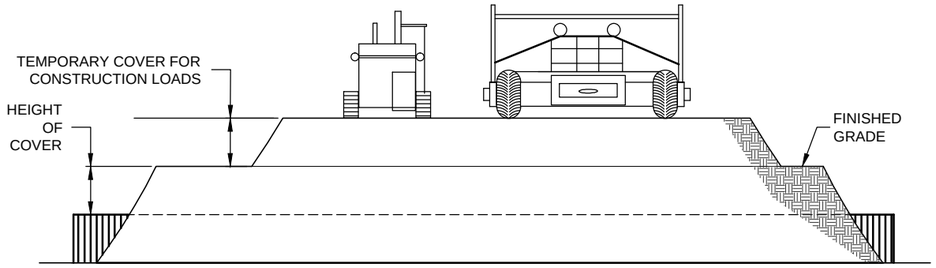

CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

NOTE:
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PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

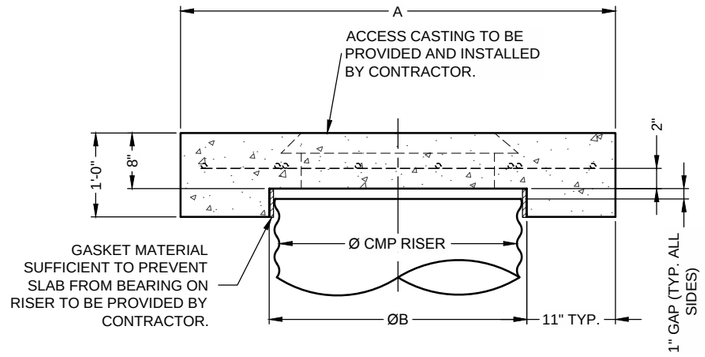
POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

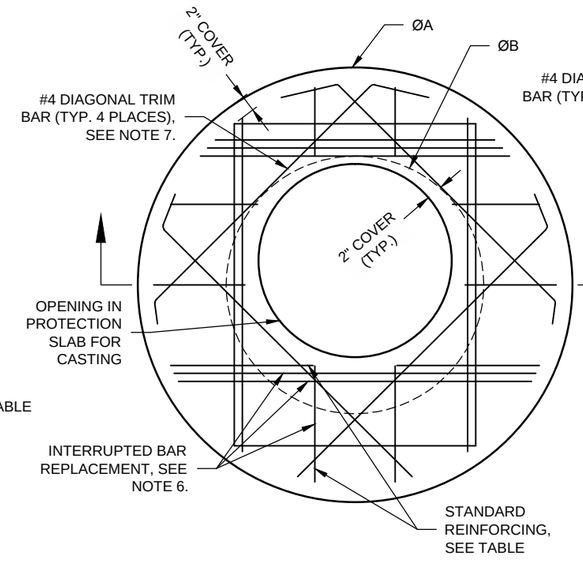
IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.



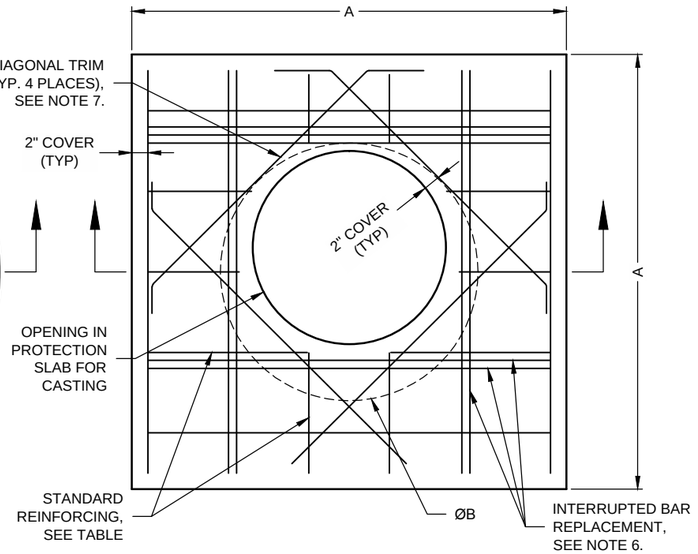
SECTION VIEW

REINFORCING TABLE				
Ø CMP RISER	A	Ø B	REINFORCING	**BEARING PRESSURE (PSF)
24"	Ø 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	Ø 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	Ø 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	Ø 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	Ø 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

MARK	DATE	REVISION DESCRIPTION	BY

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SHEET NO.: D3		

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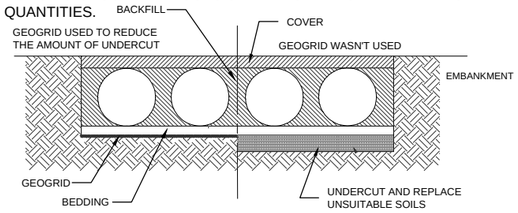
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

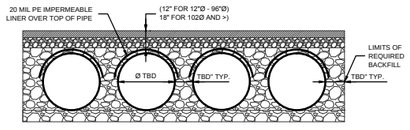


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

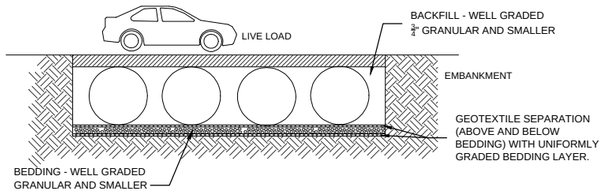
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

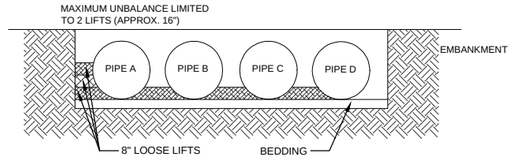
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



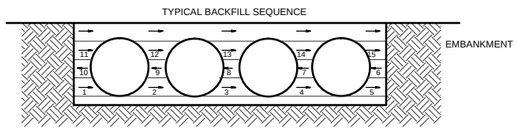
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

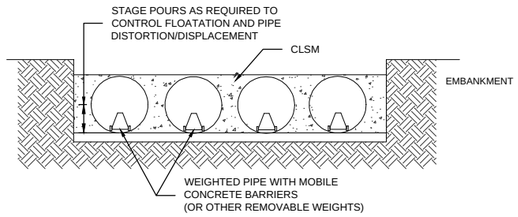


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

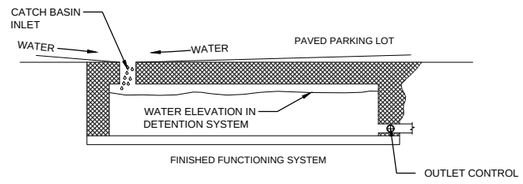


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, QUARTERLY INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH **DYODS** DRAWING

DYODS - 14192-2-0
PROJECT NAME: Pixior Distribution Center
Hesperia, CA
DESCRIPTION: UNDERGROUND RETENTION / INFILTRATION BASIN

PROJECT No.:	SEQ. No.:	DATE:
14192-2	0	5/13/2020
DESIGNED: DYODS	DRAWN: DYODS	
CHECKED:	APPROVED:	
SHEET NO.: D4		

C:\DYODS\DATA\CP\CIDYODS_14192-2.DWG 5/13/2020 6:51 PM

KRISTAR

FloGard®+PLUS

Catch Basin Insert Filter

FloGard®+PLUS Catch Basin Insert Filter

GENERAL FILTER CONFIGURATION

FloGard®+PLUS catch basin insert filter shall provide solids filtration through a filter screen or filter liner, and hydrocarbon capture shall be effected using a non-leaching absorbent material contained in a pouch or similar removable restraint. Hydrocarbon absorbent shall not be placed at an exposed location at the entry to the filter that would allow blinding by debris and sediment without provision for self-cleaning in operation.

Filter shall conform to the dimensions of the inlet in which it is applied, allow removal and replacement of all internal components, and allow complete inspection and cleaning in the field.

FLOW CAPACITY

Filter shall provide two internal high-flow bypass locations that in total exceed the inlet peak flow capacity. Filter shall provide filtered flow capacity in excess of the required "first flush" treatment flow. Unit shall not impede flow into or through the catch basin when properly sized and installed.

MATERIALS

Filter support frame shall be constructed of type 304 stainless steel. Filter screen, when used in place of filter liner, shall be type 304 or 316 stainless steel, with an apparent opening size of not less than 4 U.S. mesh. Filter liner, when used in place of filter screen, shall be woven polypropylene geotextile fabric liner with an apparent opening size (AOS) of not less than 40 U.S. mesh as determined by ASTM D 4751. Filter liner shall include a support basket of polypropylene geogrid with stainless steel cable reinforcement.

Filter frame shall be rated at a minimum 25-year service life. All other materials, with the exception of the hydrocarbon absorbent, shall have a rated service life in excess of 2 years.

FloGard®+PLUS TEST RESULTS SUMMARY

Testing Agency	% TSS Removal	% Oil and Grease Removal	% PAH Removal
UCLA	80	70 to 80	
U of Auckland Tonking & Taylor Ltd. (for city of Auckland)	78 to 95		
U of Hawaii (for city of Honolulu)	80		20 to 40

FEATURES

- Easy to install, inspect and maintain
- Can be retrofitted to existing drain catch basins – or used in new projects
- Economical and efficient
- Catches pollutants where they are easiest to catch (at the inlet)
- No standing water – minimizes vector, bacteria and odor problems
- Can be incorporated as part of a "Treatment Train"

BENEFITS

- Lower installation, inspection and maintenance costs
- Versatile installation applications
- Higher return on investment
- Allows for installation on small and confined sites
- Minimizes vector, bacteria and odor problems
- Allows user to target specific pollutants

Innovative stormwater management products

FloGard® +PLUS
Catch Basin Insert Filter

INSTALLATION AND MAINTENANCE
Filter shall be installed and maintained in accordance with manufacturer's general instructions and recommendations.

PERFORMANCE
Filter shall provide 80% removal of total suspended solids (TSS) from treated flow with a particle size distribution consistent with typical urban street deposited sediments. Filter shall capture at least 70% of oil and grease and 40% of total phosphorus (TP) associated with organic debris from treated flow. Unit shall provide for isolation of trapped pollutants, including debris, sediments, and floatable trash and hydrocarbons, from bypass flow such that re-suspension and loss of pollutants is minimized during peak flow events.

FloGard®+PLUS COMPETITIVE FEATURE COMPARISON

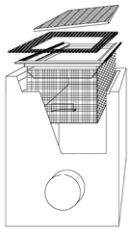
Evaluation of FloGard+PLUS Units (Based on flow-comparable units) (Scale 1-10, 10 being best)	**FloGard+PLUS**	**Other Insert Filter Types****
Flow Rate	10	7
Removal Efficiency*	80%	45%
Capacity – Sludge and Oil	7	7
Service Life	10	3
Installation – Ease of Handling / Installation	8	6
Ease of Inspections & Maintenance	7	7
Value	**10**	**2**

*approximate, based on field sediment removal testing in urban street application **average

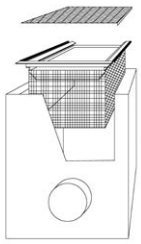
Long-Term Cost Comparison (Scale 1-10, 10 being lowest cost, higher number being best)	**FloGard+PLUS**	**Other Insert Filter Types**
Unit cost — initial ($/cfs treated)	10	4
Installation cost ($/cfs treated)	10	7
Adsorbent replacement (annual avg $/cfs treated)	10	2
Unit materials replacement (annual avg $/cfs treated)	10	10
Maintenance cost (annual avg $/cfs treated)	10	7
Total first yr ($/cfs treated)	10	5
Total Annual Avg ($/cfs treated, avg over 20 yrs)*	**10**	**5**

*assumes 3% annual inflation

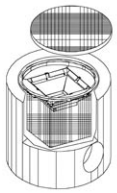
Captured debris from FloGard+PLUS, Dana Point, CA



FloGard+PLUS Combination Inlet



FloGard+PLUS Flat Grate



FloGard+PLUS Round Gated Inlet

KriStar Enterprises, Inc.
360 Sutton Place
Santa Rosa, CA 95407

PH: 800-579-8819
FAX: 707-524-8186
www.kristar.com

The watermark for drainage solutions.®

TORRENT RESOURCES

INDUSTRY SERVICES

Site Drainage Systems
- Stormwater Drywells
- French Drains
- Piping
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Technical Analysis
- Design Review
- Percolation Testing
- Geologic Database
- ADEQ Drywell Registration

Recharge Systems
- Municipal/Private Recharge Wells
- Injection Wells & Galleries

Environmental Applications
- Pattern Drilling/Soil Remediation
- Drainage Rehabilitation
- Drywell Abandonments
- OSHA HAZMAT-Certified

Drainage Renovation
- Problem Assessment
- Site Redesign/Modification
- System Retrofit

Drainage Maintenance
- Preventive Maintenance
- Service Contracts
- Drywell Cleaning

TORRENT RESOURCES INCORPORATED

1509 East Elwood Street
Phoenix Arizona 85040-1391

phone 602-268-0785
fax 602-268-0820

Nevada
702-366-1234

AZ Lic. ROC070465 A,
ROC047067 B-4; ADWR 363

CA Lic. 528080 A, C-42, HAZ

NV Lic. 0035350 A

NM Lic. 90504 GF04

TORRENT RESOURCES (CA) INCORPORATED

phone 661-947-9836

CA Lic. 886759 A, C-42

www.TorrentResources.com

An evolution of McGuckin Drilling

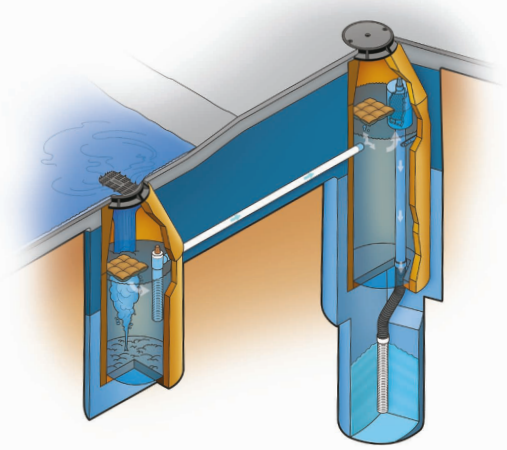
1/12

MaxWell® Plus DRAINAGE SYSTEM

Product Information and Design Features

TORRENT RESOURCES

The ***MaxWell® Plus,*** as manufactured and installed exclusively by Torrent Resources Incorporated, is the industry standard for draining large paved surfaces, nuisance water and other demanding applications. This patented system incorporates state-of-the-art pre-treatment technology.



THE ULTIMATE IN DESIGN

Since 1974, nearly 65,000 MaxWell® Systems have proven their value as a cost-effective solution in a wide variety of drainage applications. They are accepted by state and municipal agencies and are a standard detail in numerous drainage manuals. Many municipalities have recognized the inherent benefits of the MaxWell Plus and now require it for drainage of all paved surfaces.

SUPERIOR PRE-TREATMENT

Industry research, together with Torrent Resources' own experience, have shown that initial storm drainage flows have the greatest impact on system performance. This "first flush" occurs during the first few minutes of runoff, and carries the majority of sediment and debris. Larger paved surfaces or connecting pipes from catch basins, underground storage, etc. can also generate high peak flows which may strain system function. In addition, nuisance water flows require controlled processing separate from normal storm runoff demands.

Manufactured and Installed Exclusively by Torrent Resources Incorporated
Please see reverse side for additional information
U.S. Patent No. 4,923,330

In the ***MaxWell® Plus,*** preliminary treatment is provided through collection and separation in deep large-volume settling chambers. The standard MaxWell Plus System has over 2,500 gallons of capacity to contain sediment and debris carried by incoming water. Floating trash, paper, pavement oil, etc. are effectively stopped by the **PureFlo®** Debris Shields in each chamber. These shielding devices are equipped with an effective screen to filter suspended material and are vented to prevent siphoning of floating surface debris as the system drains.

EFFECTIVE PROCESSING

Incoming water from the surface grated inlets or connecting pipes is received in the Primary Settling Chamber where silt and other heavy particles settle to the bottom. A PureFlo Debris Shield ensures containment by trapping floating debris and pavement oil. The pre-treated flow is then regulated to a design rate of up to 0.25cfs and directed to a Secondary Settling Chamber. The settling and containment process is repeated, thereby effectively achieving controlled, uniform treatment. The system is drained as water rises under the PureFlo Debris Shield and spills into the top of the overflow pipe. The drainage assembly returns the cleaned water into the surrounding soil through the **FloFast®** Drainage Screen.

ABSORBENT TECHNOLOGY

Both MaxWell Plus settling chambers are equipped with absorbent sponges to provide prompt removal of pavement oils. These floating pillow-like devices are 100% water repellent and literally wick petrochemical compounds from the water. Each sponge has a capacity of up to 128 ounces to accommodate effective, long-term treatment. The absorbent is completely inert and will safely remove runoff constituents down to rainbow sheens that are typically no more than one molecule thick.

SECURITY FEATURES

MaxWell Plus Systems include bolted, theft-deterrent, cast iron gratings and covers as standard security features. Special inset castings which are resistant to loosening from accidental impact are available for use in landscaped applications. Machined mating surfaces and "Storm Water Only" wording are standard.

THE MAXWELL FIVE-YEAR WARRANTY

Innovative engineering, quality materials and exacting construction are standard with every MaxWell System designed, manufactured and installed by Torrent Resources Incorporated. The MaxWell Drainage Systems Warranty is the best in the industry and guarantees against failures due to workmanship or materials for a period of five years from date of completion.

MAXWELL® PLUS DRAINAGE SYSTEM DETAIL AND SPECIFICATIONS

CALCULATING MAXWELL PLUS REQUIREMENTS:

The type of property, soil permeability, rainfall intensity and local drainage ordinances determine the number and design of MaxWell Systems. For general applications draining retained stormwater, use one standard ***MaxWell® Plus*** per the instructions below for up to 5 acres of landscaped contributory area, and up to 2 acres of paved surface. To drain nuisance water flows in storm runoff systems, add a remote inlet to the system. For smaller drainage needs, refer to our ***MaxWell® IV.*** For industrial drainage, our ***Envibro® System*** may be recommended. For additional considerations, please refer to **"Design Suggestions For Retention And Drainage Systems"** or consult our Design Staff.

COMPLETING THE MAXWELL PLUS DRAWING

To apply the MaxWell Plus drawing to your specific project, simply fill in the blue boxes per the following instructions. For assistance, please consult our Design Staff.

PRIMARY SETTLING CHAMBER DEPTH

The overall depth of the Primary Settling Chamber is determined by the amount of surface area being drained. Use a standard depth of **15 feet** for the initial acre of contributory drainage area, **plus 2 feet** for each additional acre, up to the design limits of the property type noted in "Calculating MaxWell Plus Requirements" noted above. Other conditions that would require increased chamber depths are property usage, maintenance scheduling, and severe or unusual service conditions. Connecting pipe depth may dictate deeper chambers so as to maintain the effectiveness of the settling process. Maximum chamber depth is 25 feet. A pump and lift station is recommended for systems with deeper requirements.

ESTIMATED TOTAL DEPTH

The Estimated Total Depth is the approximate total system depth required to achieve 10 continuous feet of penetration into permeable soils, based upon known soil information. Torrent utilizes specialized **"crowd"** equipped rigs to get through the difficult cemented soil and to reach clean drainage soils at depths up to **180 feet.** An extensive drilling log database is available to use as a reference.

SETTLING CHAMBER DEPTH

On MaxWell Plus Systems of over 30 feet overall depth and up to 0.25cfs design rate, the standard Settling Chamber Depth is **18 feet.** Maximum chamber depth is 25 feet.

OVERFLOW HEIGHT

The Overflow Height and Secondary Settling Chamber Depth determine the effectiveness of the settling process. The higher the overflow pipe, the deeper the chamber, the greater the settling capacity. An overflow height of **13 feet** is used with the standard settling chamber depth of **18 feet.**

DRAINAGE PIPE

This dimension also applies to the **PureFlo®** Debris Shields, the **FloFast®** Drainage Screen, and fittings. The size is based upon system design rates, multiple primary settling chambers, soil conditions, and need for adequate venting. Choices are 6", 8", or 12" diameter. Refer to our company's **"Design Suggestions for Retention and Drainage Systems"** for recommendations on which size best matches your application.

BOLTED RING & GRATE/COVER

Standard models are quality cast iron and available to fit 24" Ø or 30" Ø manhole openings. All units are bolted in two locations with wording "Storm Water Only" in raised letters. For other surface treatments, please refer to "Design Suggestions for Retention and Drainage Systems."

INLET PIPE INVERT

Pipes up to 12" in diameter from catch basins, underground storage, etc. may be connected into the primary settling chamber. Larger pipe diameters dictate the use of manhole material for the primary setting chamber with 48" grates on the cone.Inverts deeper than 5 feet will require additional depth in both system settling chambers to maintain respective effective settling capacities.

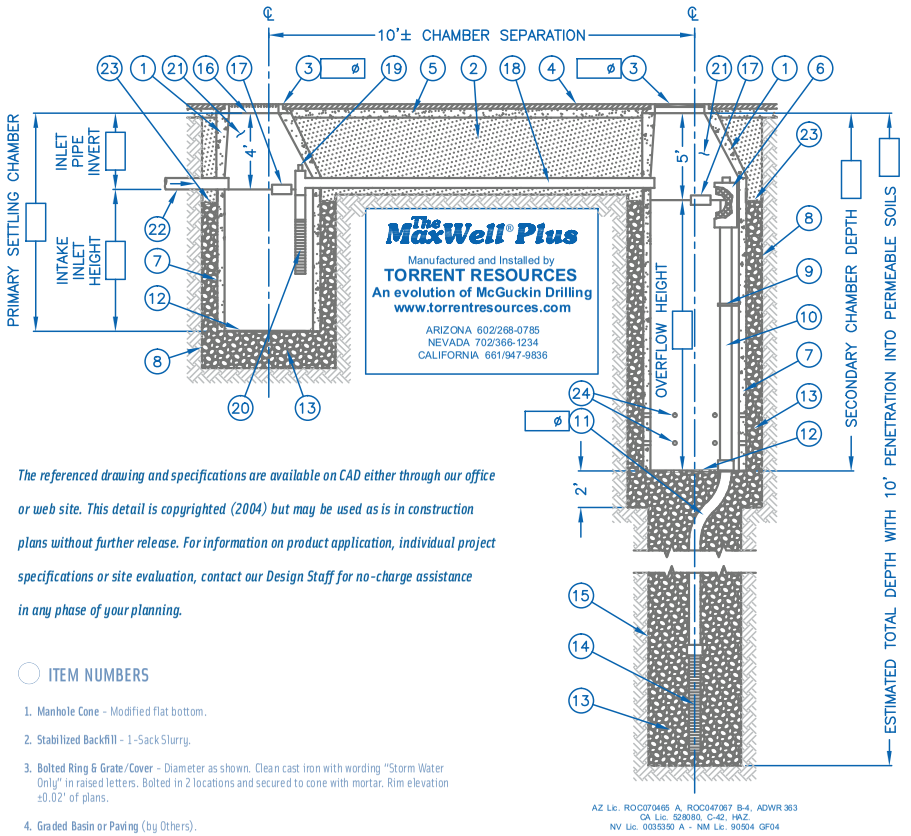
INTAKE INLET HEIGHT

The Intake Inlet Height determines the effectiveness of the settling process in the Primary Settling Chamber. A minimum inlet height of **11 feet** is used with the standard primary settling chamber depth of 15 feet. Greater inlet heights would be required with increased system demands as noted in Primary Settling Chamber Depth. Freeboard Depth Varies with inlet pipe elevation. Increase primary/secondary settling chamber depths as needed to maintain all inlet pipe elevations above connector pipe overflow.

CHAMBER SEPARATION

The standard separation between chambers is **10 feet** from center to center.
Soil conditions and deeper inverts may dictate required variations in chamber separation.

The MaxWell® Plus Drainage System Detail And Specifications



AZ Lic. ROC070465 A, ROC047067 B-4, ADWR 363
CA Lic. 528080, C-42, HAZ
NV Lic. 0035350 A - NM Lic. 90504 GF04

The referenced drawing and specifications are available on CAD either through our office or web site. This detail is copyrighted (2004) but may be used as is in construction plans without further release. For information on product application, individual project specifications or site evaluation, contact our Design Staff for no-charge assistance in any phase of your planning.

ITEM NUMBERS

1. **Manhole Cone** - Modified flat bottom.
2. **Stabilized Backfill** - 1-Sack Slurry.
3. **Bolted Ring & Grate/Cover** - Diameter as shown. Clean cast iron with wording "Storm Water Only" in raised letters. Bolted in 2 locations and secured to cone with mortar. Rim elevation ±0.02' of plans.
4. **Graded Basin or Paving** (by Others).
5. **Compacted Base Material** (by Others).
6. **PureFlo® Debris Shield** - Rolled 16 Ga. steel X 24" length with vented anti-siphon and internal .265" Max. SWO flattened expanded steel screen X 12" length. **Fusion bonded epoxy coated.**
7. **Pre-cast Liner** - 4000 PSI concrete 48" ID. X 54" OD. **Center in hole** and align sections to **maximize bearing surface.**
8. **Min. 6' Ø Drilled Shaft.**
9. **Support Bracket** - Formed 12 Ga. steel. **Fusion bonded epoxy coated.**
10. **Overflow Pipe** - Sch. 40 PVC mated to drainage pipe at base seal.
11. **Drainage Pipe** - ADS highway grade with TRI-A coupler. **Suspend pipe** during backfill operations to prevent buckling or breakage. Diameter as noted.
12. **Base Seal** - Geotextile or concrete slurry.
13. **Rock** - Washed, sized between 3/8" and 1-1/2" to **best complement soil conditions.**
14. **FloFast® Drainage Screen** - Sch. 40 PVC 0.120" slotted well screen with 32 slots per row/ft. Diameter varies 120" overall length with TRI-B coupler.
15. **Min. 4' Ø Shaft** - Drilled to **maintain permeability** of drainage soils.
16. **Fabric Seal** - U.V. Resistant Geotextile - **To be removed by customer** at project completion.
17. **Absorbent** – Hydrophobic Petrochemical Sponge. Min 128 oz. capacity.
18. **Connector Pipe** – 4" Ø Sch. 40 PVC.
19. **Anti-Siphon Vent** with flow regulator.
20. **Intake Screen** – Sch. 40 PVC 0.120" modified slotted well screen with 32 slots per row/ft. 48" overall length with TRI-C end cap.
21. **Freeboard Depth Varies** with inlet pipe elevation. Increase primary/secondary settling chamber depths as needed to maintain all inlet pipe elevations above connector pipe overflow.
22. **Optional Inlet Pipe** (by Others).
23. **Moisture Membrane** – 6 mil. Plastic. Place securely against eccentric cone and hole sidewall. Used in lieu of slurry in landscaped areas.
24. **Eight – (8) perforations per foot,** 2 row minimum.

Appendix D: BMP Maintenances

- O & M Agreement

RECORDING REQUESTED BY
AND WHEN RECORDED MAIL TO:

CITY OF HESPERIA
CITY CLERK'S OFFICE
9700 SEVENTH AVENUE
HESPERIA, CALIFORNIA 92345

Exempt Recording Fees per Government Code Sections 6103 and 27383

SPACE ABOVE FOR RECORDER'S USE ONLY

AGREEMENT

Water Quality Management Plan and Storm water BMP Maintenance Agreement
55555 Amargosa LLC and the City of Hesperia

Property Address:

Northwest Side of Amargasa Road & Northeast Side of California Aqueduct
City of Hesperia, CA 92345

APN: 0405-062-51-0-00

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION (Additional Recording Fees Apply)

Water Quality Management Plan and Stormwater BMP Maintenance Agreement

OWNER NAME: 55555 Amargosa LLC

PROPERTY ADDRESS: Northwest Side of Amargasa Road & Northeast Side of California Aqueduct
Hesperia, CA 92345

APN: APN: 0405-062-51-0-00

THIS AGREEMENT is made and entered into in

_____ , California, this _____ day of

_____ , by and between

_____ , herein after

referred to as "Owner" and the CITY OF HESPERIA, a municipal corporation, located in the County of San Bernardino, State of California hereinafter referred to as "CITY";

WHEREAS, the Owner owns real property ("Property") in the City of Hesperia, County of San Bernardino, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference;

WHEREAS, at the time of initial approval of development project known as

Pixior Distribution Center within the Property described herein, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, on file with the City, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

WHEREAS, said WQMP has been certified by the Owner, and reviewed and approved by the City;

WHEREAS, said BMPs, with installation and/or implementation on private property and draining only private property, are part of a private facility with all maintenance or replacement, therefore, the sole responsibility of the Owner in accordance with the terms of this Agreement;

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner hereby provides the City of Hesperia's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the City's Public Works Director, no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.

2. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

3. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City, the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the Civil Code from the date of the notice of expense until paid in full.

4. This agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

5. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

6. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

7. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

8. Time is of the essence in the performance of this Agreement.

9. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

IF TO CITY:

_____

_____

_____

_____

IF TO OWNER:

_____

_____

_____

_____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

_____ _____
Signature Title

_____ _____
Print Name Date

OWNER:

_____
Signature

_____
Print Name

_____
Title

_____
Date

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation (attach appropriate acknowledgement).

ACCEPTED BY:

_____
City of Hesperia, California

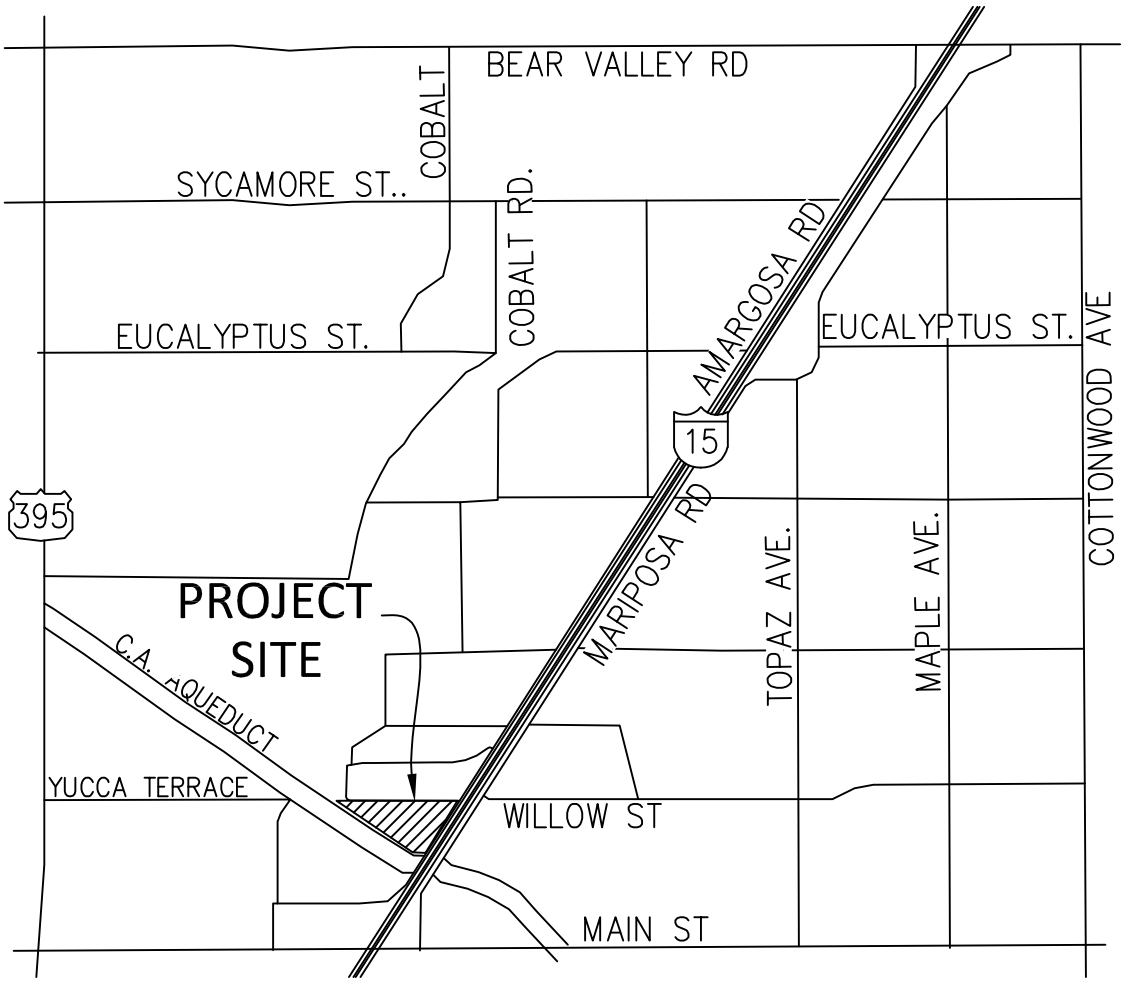
Date: _____

Attachment: Standard Notary Acknowledgement

EXHIBIT A

(Legal Description)

EXHIBIT B



VICINITY MAP

NOT TO SCALE

EXHIBIT C

Form 5-1 BMP Inspection and Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Under Ground Infiltration System	By owner & future owner	Inspect the underground Arch via the access manhole, for accumulated sediment and debris levels and cleanout solids when > 6" build up occurs. Inspect for standing water with 48 hours of heavy rain events to ensure proper drawdown. Clean and flush underground systems to restore free drainage.	Annually, and after heavy rains
Signage & Stencil	By owner & future owner	Clean the stencil/signage surface to remove any excess dirt. Re-paint if necessary.	Annually
Catch Basins & Insert Filter	By owner & future owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Inspect inlet for excessive sediment, trash, and/or debris accumulation. Litter, leaves and debris should be removed from inlet to reduce risk of outlet clogging. Change the insert Filter as needed.	Annually, and after heavy rain
Litter Control	By owner & future owner	Maintain roofed waste collection areas and vacuum-sweep drive aisles and parking areas to remove potential stormwater contamination before anticipated storm events.	Weekly/Monthly
Landscape Areas	By owner & future owner	Implement - Mowing, Trimming, Pruning practices to prevent discharges of landscape waste into on-site retention structures. Control fertilizer, herbicide & pesticide applications to prevent stormwater contamination	Weekly
Irrigation System	By owner & future owner	Check and repair the irrigation system property functioning and verify there are no leaks or runoff from landscape areas. Adjust irrigation heads and system run time as necessary to prevent overwatering of vegetation, overspray or run-off from landscape	Weekly
Trash Enclosures	By owner & future owner	Empty trash receptacles. Clean the areas around enclosures by sweeping and /or mopping to prevent discharges of cleanup water.	Weekly

Bubbler Basin	By owner & future owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Inspect inlet for excessive sediment, trash, and/or debris accumulation. Litter, leaves and debris should be removed from inlet to reduce risk of outlet clogging.	Annually, and after heavy rain
Drywell	By owner & future owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Clean up excessive sediment, trash, and/or debris accumulation. Litter, leaves and debris should be removed from Drywell to reduce risk of well clogging. Pump stored runoff from an impaired or failed dry well can also be accomplished through the test well.	4 times Annually, and after heavy rain

Appendix E: Soil Information

- Soil Report & Infiltration Test
- NRCS Soil Survey

SOILS ENGINEERING INVESTIGATION

Proposed Warehouse/Distribution Center
APN: 0405-062-51
Amargosa Road & Live Oak Lane
Hesperia, California

February 24, 2020
Project No. 30-5468-00

Prepared for:

55555 Amargosa Rd., LLC
Attn: Mr. Jason Green
5901 S. Eastern Ave.
Commerce, CA 90040

A.G.I. GEOTECHNICAL, INC.

A. G. I. GEOTECHNICAL, INC.
16555 Sherman Way, Suite A - Van Nuys, CA 91406 - Office: (818) 785-5244 - Facsimile: (818) 785-6251

February 24, 2020

Project No. 30-5468-00

55555 Amargosa Rd., LLC
5901 S. Eastern Ave.
Commerce, CA 90040

Attention: Mr. Jason Green

Subject: **SOILS ENGINEERING INVESTIGATION**
Proposed Warehouse/Distribution Center
APN: 0405-062-51
Amargosa Road & Live Oak Lane
Hesperia, California

Dear Mr. Green:

This report presents the results of the investigation and our opinions regarding the soils engineering factors affecting the development of the subject site. This investigation was performed in January and February, 2020, and consisted of field depthexploration, laboratory testing, engineering analyses of the field and laboratory data and the preparation of this report. *Determination of the presence or not of hazardous or toxic materials in the on-site soils is beyond the scope of this investigation.*

If you have any questions regarding this report, please contact this office.

Respectfully submitted,
A.G.I. GEOTECHNICAL, INC.

Juan A. Vidal, R.G.E. 861
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
JUAN A. VIDAL
No. 861
Exp. 12-31-21
GEOTECHNICAL
STATE OF CALIFORNIA

JAV:wb

Distribution: (4) 55555 Amargosa Rd., LLC

Enclosures: Location Map (Figure 1)
Site Plan (Figure 2)
Boring Logs
Laboratory Test Results
U.S. Seismic Design Maps
Slot Cut Stability Analysis

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INTRODUCTION

DESCRIPTION OF SITE

The subject site is located on the northwest side of Amargosa Road, between Live Oak Lane and the California Aqueduct, in the City of Hesperia, California. The subject property is practically level and presently vacant. The site is bound on the north by a developed property. The location of the site is shown on the enclosed Location Map, Figure 1.

PROPOSED SITE DEVELOPMENT

The proposed development consists of a warehouse/distribution center that will include an approximately 450,000ft^2 building with driveways and adjacent asphalt parking areas, a trash enclosure, guard shacks and advertising signs. It is understood that the proposed building will be tilt-up walls with a concrete slab-on-grade construction. Structural loads are anticipated to be relatively light, less than ten kips per linear foot for continuous footings and less than 100 kips for column loads.

FIELD EXPLORATION

Subsurface conditions were explored by drilling nine exploratory borings at the locations shown on the Site Plan, Figure 2. The borings were drilled to a maximum depth of 41.5 feet below existing ground surface using a truck mounted 8-inch diameter hollow stem flight auger.

The drilling of borings was supervised by our field engineer who logged the materials brought up from borings. Undisturbed and bulk samples were collected at depths appropriate to the investigation. The undisturbed samples were sealed immediately in watertight containers for shipment to our laboratory. The soil sampler used in our investigation included a 2.50-inch I.D. drive barrel lined with 1-inch brass rings. The sampler used in the exploratory boring was driven to a depth of 12 inches with a 140-pound hammer falling from a height of 30 inches. The blow counts noted on the Boring Logs represent the accumulated number of blows that were required to drive the sampler.

SUBSURFACE CONDITIONS

Soil Profile

The existing soil profile, as depicted in the borings to the depth explored, consists of light brown and brown silty sands, well-graded sands with silt and gravel, and poorly-graded sandswith silt and gravel in a damp to slightly moist and medium dense to very dense condition. For a more detailed description of the soils encountered in the exploratory borings, please refer to the Boring Logs enclosed in this report.

Groundwater

No groundwater was encountered in the exploratory borings to the maximum depth explored, 41.5 feet below existing ground surface. The groundwater level may fluctuate because of seasonal changes, injection or extraction of water, variations in temperature and other causes.

LIQUEFACTION POTENTIAL (CYCLIC MOBILITY)

Since the site is **not** located within a State of California Liquefaction Seismic Hazard Zone, a liquefaction analysis was not performed.

ON-SITE INFILTRATION FACILITIES

The soil profile, as depicted in the borings to the depth explored, consists of silty sands, well-graded sands with silt and gravel, and poorly-graded sands with silt and gravel in a damp to slightly moist and very dense condition. These soils generally have poor permeability and they carry the potential for creating perched water conditions. Based on the soils present at the site to the depths explored, it is our opinion that the percolation characteristics of these soils would **not** be suitable for use of a properly functioning infiltration-type of SUSMP system on the subject property.

SEISMICITY AND SEISMIC DESIGN CRITERIA

The southern California region is seismically active and commonly experiences strong ground shaking resulting from earthquakes along active faults. Earthquakes along these faults are part of a continuous, naturally occurring process which has contributed to the characteristic landscape of the region. Research on earthquakes during the past forty years has greatly enhanced our knowledge on the nature of faulting in California; however, seismology is a relatively new science and standard procedures for prediction of geoseismic parameters have not yet been widely accepted. The time, location, and magnitude of an earthquake cannot be

accurately predicted at this time; therefore, data on faults and the nature of earthquakes in California is presently incomplete. However, numerous investigations performed by the United States Geological Survey, California Division of Mines and Geology, and other research institutions have presented techniques to quantify the nature of earthquakes and the estimated impact to development in a seismically active environment.

It is our opinion that future structures should be designed in accordance with the applicable seismic building code as determined by the structural engineer. The subject site is located within **Site Class D** per 2019 California Building Code. The following values of short and long period accelerations are recommended for the Risk-Targeted Maximum Considered Earthquake (MCE_R). The design spectral response acceleration parameters presented on the following table for **Site Class D**, generated by the U.S. Seismic Design Maps Website (https://seismicmaps.org), may be utilized for seismic design:

2019 CBC Seismic Design Parameters

Latitude	34.4328 N
Longitude	117.3783 W
Site Class Definition (ASCE 7-16 Table 20.3-1)	D
Mapped Spectral Response Acceleration at 0.2s Period, S_s (Figure 1613A.2.1)	1.487
Mapped Spectral Response Acceleration at 1s Period, S_1 (Figure 1613A.2.1)	0.577
Short Period Site Coefficient at 0.2s Period, F_a (Table 1613A.2.3(1))	1.000
Long Period Site Coefficient at 1s Period, F_v (Table 1613A.2.3(2))	1.723
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS} (Eq. 16A-36)	1.487
Adjusted Spectral Response Acceleration at 1s Period, S_{M1} (Eq. 16A-37)	0.994
Design Spectral Response Acceleration at 0.2s Period, S_{DS} (Eq. 16A-38)	0.992
Design Spectral Response Acceleration at 1s Period, S_{D1} (Eq. 16A-39)	0.663

LABORATORY TESTING

CLASSIFICATION

Soils were classified visually according to the Unified Soil Classification System. Unit weight and moisture determinations were performed for each undisturbed sample. Results of density and moisture determinations, together with classifications, are shown on the enclosed Boring Logs.

DIRECT SHEAR TESTS (ASTM:D-3080)

In order to determine the shear strength of the soils, direct shear tests were performed on undisturbed and remolded samples of the on-site soils. The remolded sample was tested at 90% of the maximum dry density. To simulate possible adverse field conditions, the samples were saturated prior to shearing. Graphic summaries of the test results, including moisture content at the time of shearing, are included in this report.

GRAIN SIZE DISTRIBUTION (ASTM:D-422-63 (2002))

To aid in classification, sieve analyses and hydrometer tests were performed on typical samples of the upper soils. The results of the tests are shown on the enclosed Grain Size Distribution Charts.

MAXIMUM DENSITY/OPTIMUM MOISTURE (ASTM:D-1557)

The maximum density/optimum moisture content relationship was determined for typical samples of the upper soils. The tests were conducted in accordance with the ASTM:D-1557 standard. Graphic summaries of the results are included with this report.

EXPANSION TESTS (ASTM:D-4829)

Expansion tests were performed on representative samples of the on-site soils in accordance with ASTM:D-4829 to evaluate their volume change with increasing moisture conditions. The results are as follows:

Location	Depth (ft.)	Expansion Index	Potential Expansion
B-1	0-5	1	Very Low
B-3	0-5	1	Very Low
B-5	0-5	1	Very Low
B-9	0-5	2	Very Low

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The property is suitable for the proposed construction from a geotechnical engineering standpoint. The construction plans should take into account the appropriate soils engineering features of the site. The on-site soils are medium dense to very dense. No groundwater was encountered to the maximum depth explored, 41.5 feet below existing surface. The on-site soils have a very low potential expansion.

SITE PREPARATION

Debris from demolition, vegetation and underground utility lines to be abandoned should be removed from the site. After site clearance, the upper three feet of the on-site soils should be removed and placed back as compacted fill. The removal and compaction should extend three feet beyond the building lines in each direction. After removal, the exposed surface should be scarified to a depth of eight inches, brought to about optimum moisture content and compacted to at least 90% of the maximum dry density as determined by ASTM:D-1557. An estimated shrinkage percentage of 5% was determined by our calculations for the on-site soils.

All excavations resulting from removal of existing obstructions should be backfilled with soil compacted to at least 90% of the maximum dry density as determined by ASTM:D-1557. If any cesspools or seepage pits are encountered during grading, they should be backfilled with vibrated gravel or slurry mix to five feet below finish grade. The upper five feet should be backfilled with soil compacted by mechanical means.

FILL PLACEMENT

Fill soils should be cleared of deleterious debris, placed in six to eight inch lifts, brought to about optimum moisture content, and compacted to at least 90% of the maximum dry density as determined by ASTM:D-1557. **The placement of the fill should be performed under our observation and testing.**

FOUNDATION DESIGN

Type of Foundation

The proposed strucure may be supported on conventional shallow spread (isolated) and continuous footings. Exterior and interior footings should be founded on compacted fill with a minimum embedment of 18 inches below lowest adjacent grade. Minimum

reinforcement in continuous footings should consist of four No. 4 bars: two placed about four inches from the top and two placed about four inches from the bottom.

Soil Bearing Pressures

Footings founded on compacted fill may be designed for a maximum soil bearing pressure of 2,000lb/ft^2. The recommended soil bearing pressure may be increased by 400lb/ft^2 per each additional foot of embedment over 18 inches and by 200lb/ft^2 per each additional foot in width over 18 inches up to 3,500lb/ft^2. In addition, the recommended soil bearing pressures may be increased by one-third when designing for wind and seismic forces.

Expected Settlements

If footings are supported on compacted fill and are sized for the recommended bearing pressures, differential settlements are not expected to exceed ¼ inch in a 30-foot span. Total settlements are anticipated to be less than ¾ inch.

FLOOR SLABS-ON-GRADE

Concrete floor slabs-on-grade thickness and reinforcement should reflect the anticipated use of the slabs and should be designed by the structural engineer. Concrete floor slabs-on-grade should be a minimum of four inches (full) thick with minimum reinforcement consisting of No.4 deformed bars spaced a maximum of 16 inches each way. In areas where floor coverings or equipment that are sensitive to moisture are contemplated, a 10-mil visqueen moisture barrier should be placed beneath the slab with one inch of clean sand between the concrete slabs and the visqueen to aid in curing and to prevent puncture of the visqueen. Cracking of reinforced concrete is a relatively common occurrence. Some cracking of reinforced concrete, including slabs, can be anticipated. Irregularities in new slabs are also common. If cracking of slabs cannot be tolerated, heavily reinforced structural slabs are an option.

The recommendations presented above are intended to reduce the potential for random cracking to which concrete flatwork is often prone. Judicious spacing of crack control joints has proven effective in further reducing random cracking. A structural engineer may recommend the desirable spacing. Usually the crack control joints are placed 12 to 15 feet apart in each direction. Factors influencing cracking of concrete flatwork, (other than expansion, settlement and creep of soils), and which should be avoided, include: poor-quality concrete, excessive time passing between the mixing and placement of the concrete (the concrete should be rejected if this time interval exceeds two hours), temperature and wind conditions at the time of placement of the concrete, curing of the concrete and workmanship. The concrete should be maintained in a moist condition (curing) for at least the first seven days after concrete placement. During hot weather, proper attention should be given to the ingredients, production methods, handling,

placement, protection and curing to prevent excessive concrete temperature or water evaporation. In hot weather and windy conditions, water evaporates more rapidly from the surface of the concrete flatwork. This requires more frequent moistening of the concrete during the curing period or the use of a protective chemical film to prevent evaporation.

LATERAL RESISTANCE

An allowable lateral bearing of 300lb/ft^2 per foot of depth may be assumed up to a maximum of 3,000lb/ft^2. A coefficient of friction between soil and concrete of 0.4 may be used.

LATERAL LOADS

No retaining walls are proposed. Backfill for retaining walls, if any, should consist of granular, free-draining material. Cantilevered retaining walls should be designed to resist an active pressure of 30lb/ft^3 equivalent fluid pressure. Restrained walls should be designed for an at-rest earth pressure of 45lb/ft^3 equivalent fluid pressure. If the on-site upper soils are used for backfill, the at-rest earth pressure should be increased to 100lb/ft^3.

Walls subject to surcharge loads should be designed to include the additional lateral pressure. Walls should have adequate drainage to prevent build-up of hydrostatic pressure.

BACKFILL

All backfill of walls, footings or trenches should be compacted to 90% of the maximum dry density as determined by ASTM:D-1557 **and should be tested by the soils engineer**.

DRAINAGE

Adequate drainage at the site is absolutely essential and it should be provided. Rain gutters should be connected to an appropriate drainage system and carried away from the building and to the street. Yard drainage should be kept adequate to prevent ponding of water and saturation of the soils. Water should be directed to the street in an approved manner. Future performance of the building and other structures will be significantly influenced by the site drainage conditions.

PLANTERS

Planters and lawns adjacent to the building should be avoided. If planters are planned adjacent to the building, they should have the bottom and walls waterproofed and a drain installed to carry irrigation water away from the footing areas.

CONSTRUCTION CUTS

Construction cuts up to five feet in height may be excavated vertically for their entire length and height provided they do not undermine adjacent buildings or property line walls; otherwise, the construction cuts will need to be excavated using the 'A, B, C' slot-cutting method. If the slot-cutting method is used, the cut should be opened at a gradient of 1:1 first, then each slot opened and the removed soils replaced as engineered compacted fill before the subsequent slot is opened. The slots should not exceed eight feet in width or five feet in height. If the construction cuts are to remain open for more than two weeks or if rain is expected while they are open, they should be covered by a plastic membrane kept in place by holding blocks or driven re-bars at the top and bottom of the membrane. No equipment or personnel should stand closer than ten feet from the top of the temporary cut. **We should examine the construction cuts periodically to verify performance.** All construction cuts should comply with the State of California Construction Safety Orders (CAL/OSHA).

PAVED AREAS

The upper on-site soils are fair subgrade. Based on an estimated "R" value of 60 and assuming traffic indices of 5.2 for light duty and 6.3 for heavy duty, the following pavement sections may be used for a twenty-year life. "R" value tests should be performed on the soils exposed at subgrade elevation upon completion of grading to verify the recommended pavement sections.

Light Duty (T.I.5.2)

Two and one-half (2 ½) inches of asphaltic concrete placed on four inches of untreated aggregate base. The aggregate base should be compacted to at least 95% of the maximum density as determined by California Test Method 216-G, the California Impact.

Heavy Duty (T.I.6.3)

Three inches of asphaltic concrete placed on four inches of untreated aggregate base. The aggregate base should be compacted to at least 95% of the maximum density as determined by California Test Method 216-G, the California Impact.

Concrete Floor Slabs (Loading and Unloading Areas)

We recommend that concrete slabs be used for loading, unloading and truck turning areas. The concrete slabs should be a minimum of six inches thick, reinforced with 6x6-6/6 welded wire mesh or #3 bars placed at 18 inches on-center and placed at slab about mid-height. The upper six inches of earth material beneath the slabs should consist of untreated aggregate base. The aggregate base should be compacted to at least 95% of

the maximum density as determined by California Test Method 216-G, the California Impact.

RECOMMENDED INSPECTIONS

It is strongly recommended (and is a condition of use of this report), that the developer ensures that each phase of construction be properly inspected and approved by the local Building Department official.

WORKMAN SAFETY-EXCAVATIONS

It is essential for the contractor to provide adequate shoring and safety equipment as required by the State or Federal OSHA regulations. All regulations of the State or Federal OSHA should be followed before allowing workmen in a trench or other excavation. If excavations are to be made during the rainy season, particular care should be given to ensure that berms or other devices will prevent surface water from flowing over the top of the excavation or ponding at the top of the excavations.

OBSERVATION

Removal bottoms should be examined and approved by us and the City inspector before any fill is placed. Footing excavations should be examined by us prior to forming or placement of reinforcing steel to confirm that the soil conditions meet the requirements set by this report. Footing excavations should be kept moist and concrete should be placed as soon as possible after excavations are completed, examined and approved by us and the City inspector.

REVIEW

The geotechnical consultants shall review and sign the plans and specifications.

REGULATORY AGENCY REVIEW AND ADDITIONAL CONSULTING

All geotechnical and/or engineering geologic aspects of the proposed development are subject to review and approval by the government reviewing agency. It should be understood that the government reviewing agency may approve or deny any portion of the proposed development which may require additional geotechnical services by this office. Additional geotechnical services may include review responses, supplemental letters, plan reviews, construction/site observations, meetings, etc. The fees for generating additional reports, letters, exploration, analyses, etc. will be billed on a time and material basis.

COMMENTS

The conclusions and recommendations presented in this report are based on research, site observations and limited subsurface information. The conclusions and recommendations presented are based on the supposition that subsurface conditions do not vary significantly from those indicated. Although no significant variations in subsurface conditions are anticipated, the possibility of significant variations cannot be ruled out. If such conditions are encountered, this consultant should be contacted immediately to consider the need for modification of this project.

This report was prepared for the exclusive use of 55555 Amargosa Rd., LLC and their design consultants for the specific project outlined herein. This report may not be suitable for use by other parties or other uses. This report is subject to review by regulatory agencies and these agencies may require their approval before the project can proceed. No guarantee that the regulatory public agency or agencies will approve the project is intended, expressed or implied.

One of the purposes of this report is to provide the client with advice regarding geotechnical conditions on the site. It is important to recognize that other consultants could arrive at different conclusions and recommendations. No warranties of future site performance are intended, expressed or implied.

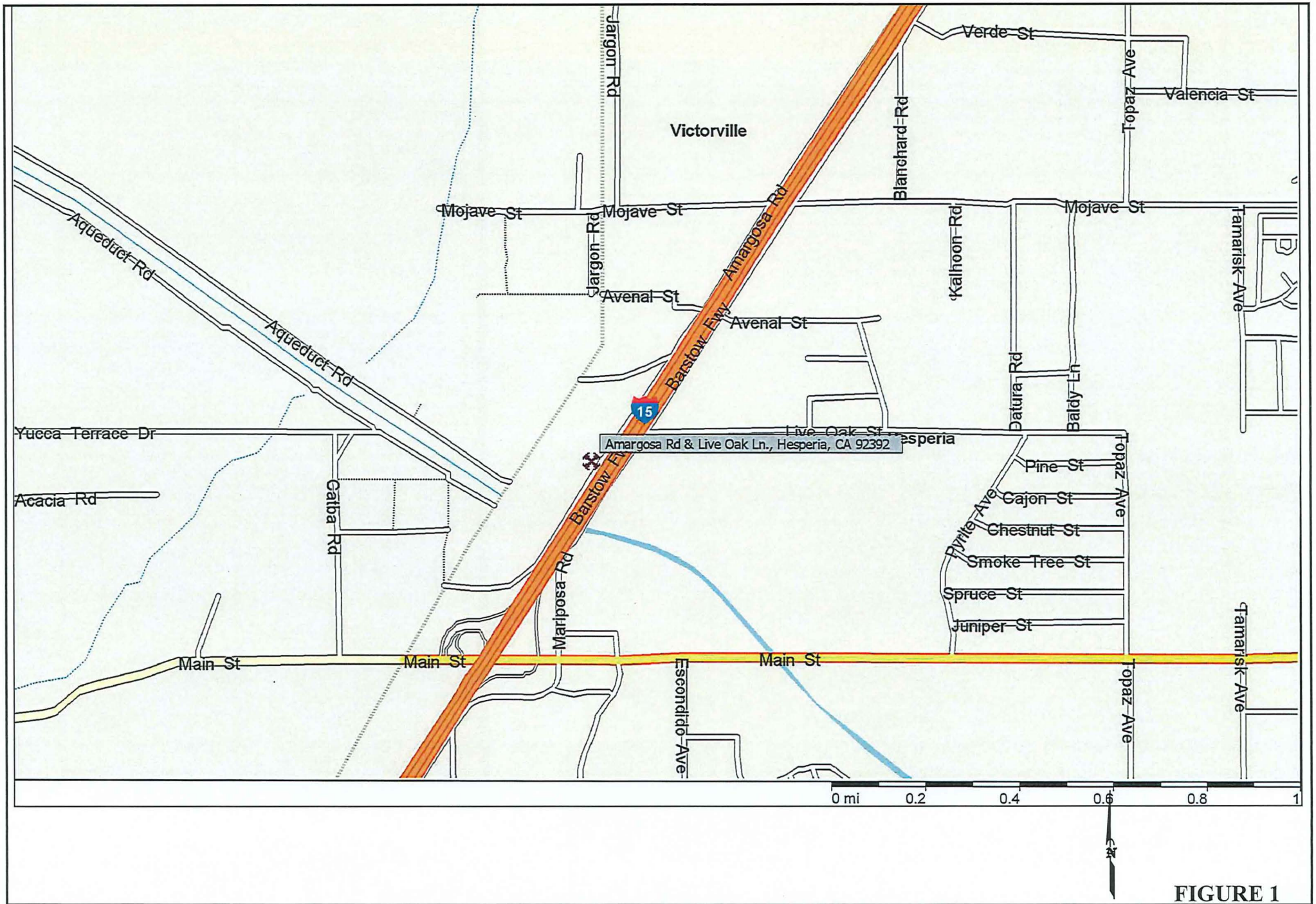


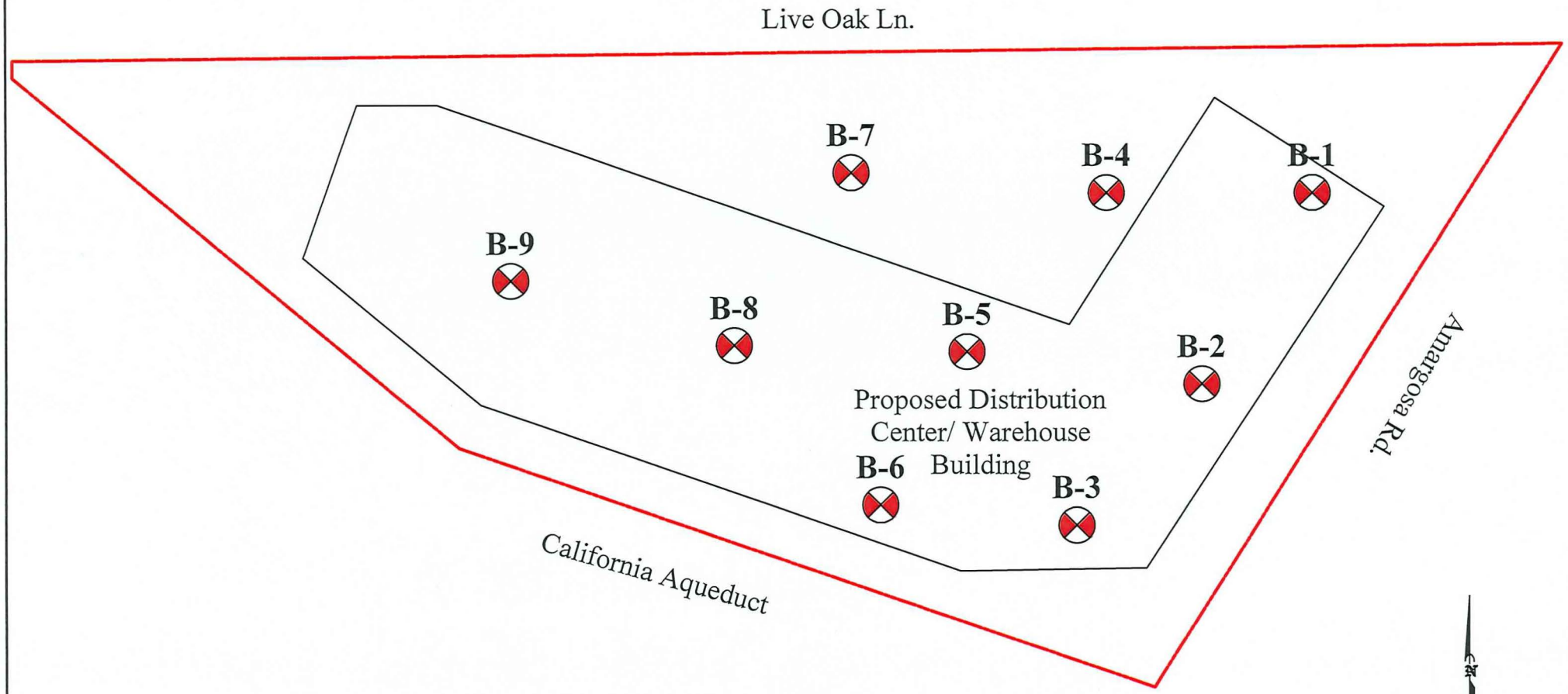
FIGURE 1

LOCATION MAP

Amargosa Rd. & Live Oak Ln., Hesperia

A.G.I. GEOTECHNICAL, INC.
Engineering Geology • Geotechnical Engineering
16555 Sherman Way, Ste. A • Van Nuys, CA 91406
(818) 785-5244 • Fax (818) 785-6251

PROJECT NO.	30-5468-00
DATE	1-2020
PREPARED BY	AM
APPROVED BY	JAV



EXPLANATION

B-1 ⊗ Approximate Location of Exploratory Boring

Scale 1/16" = 1'-0"

FIGURE 2

A.G.I. GEOTECHNICAL, INC.
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16555 Sherman Way, Ste. A • Van Nuys, CA 91406
(818) 785-5244 • Fax (818) 785-6251

SITE PLAN

Amargosa Rd. & Live Oak Ln., Hesperia

PROJECT NO.	30-5468-00
DATE	02-2020
PREPARED BY	WFB
APPROVED BY	JAV

BORING LOGS

LEGEND

 Ring Sample, or Bulk Sample

 Standard Penetration Test (SPT)

 Ground Water Level

SOIL SIZE	
COMPONENT	SIZE RANGE
Boulders	Above 12"
Cobbles	3"-12"
Gravel	#4 - 3"
coarse	¾" - 3"
fine	#4 - ¾"
Sand	#200-#4
coarse	#10-#4
medium	#40-#10
fine	#200-#40
Fines (Silt or Clays)	Below #200

PLASTICITY OF FINE GRAINED SOILS	
PLASTICITY INDEX	VOLUME CHANGE POTENTIAL
0-15	Probably Low
15-30	Probably Moderate
30 or more	Probably High

WATER CONTENT
Dry: No feel of moisture
Damp: Much less than normal moisture
Moist: Normal moisture
Wet: Much greater than normal moisture
Saturated: At or near saturation

	GROUP SYMBOLS	DESCRIPTIONS	DIVISIONS
COARSE-GRAINED SOILS (Less than 50% Fines)	GW	Well-graded gravels or gravel-sand mixtures, less than 5% fines	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
	GP	Poorly-graded gravels or gravel-sand mixtures, less than 5% fines	
	GM	Silty gravels, gravel-sand silt mixtures, more than 12% fines	
	GC	Clayey gravels, gravel-sand-clay mixtures, more than 12% fines	
	SW	Well-graded sands or gravelly sands, less than 5% fines	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
	SP	Poorly-graded sands or gravelly sands, less than 5% fines	
	SM	Silty sands, sand-silt mixtures, more than 12% fines	
	SC	Clayey sands, sand-clay mixtures, more than 12% fines	
FINE-GRAINED SOILS (More than 50% Fines	ML	Inorganic silt, very fine sands, rock flour, silty or clayey fine sands	SILTS AND CLAYS Liquid limit less than 50
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
	OL	Organic silts or organic silt-clays of low plasticity	
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	SILTS AND CLAYS Liquid limit less than 50
	CH	Inorganic clays of high plasticity, fat clays	
	OH	Organic clays of medium to high plasticity	
	PT	Peat, mulch, and other highly organic soils	HIGHLY ORGANIC SOILS

RELATIVE DENSITY	
SANDS & GRAVELS	BLOWS PER FOOT
Very loose	0-4
Loose	4-10
Medium dense	10-30
Dense	30-50
Very dense	Over 50

CONSISTENCY	
CLAYS & SILTS	BLOWS PER FOOT
Very soft	0-2
Soft	2-4
Firm	4-8
Stiff	8-15
Very stiff	15-30
Hard	Over 30

BORING NUMBER B-1

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	X	48/$\frac{50}{4"}$	X	8.3	125	136				Alluvium Brown Silty SAND (Slightly moist, very dense)			SM
5	X	19/28/41		1.6	124	126				Light brown Silty SAND (Damp, dense)			SM
10	X	26/28/45		2.2	114	116							
15	X	26/28/32		1.3	112	114							
20	X	19/28/37		1.7	121	123				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	21/46/49		1.4	121	122							
30	X	32/40/$\frac{50}{2"}$		3.6	117	122				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-2

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0													
	☒	11/22/$\frac{50}{5"}$		11.2	129	144				Alluvium Brown Silty SAND (Slightly moist, very dense)			SM
5	☒	$\frac{50}{5"}$		3.7	124	129				Light brown Silty SAND (Damp, very dense to dense)			SM
10	☒	18/21/26		4.1	119	124							
15	☒	23/31/50		2.1	113	116							
20	☒	29/$\frac{50}{6"}$		1.8	111	113				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	☒	28/43/$\frac{50}{5"}$		2.0	127	129							
30	☒	11/26/50		4.1	117	121				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-3

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0													
	X	10/21/5"	X	5.9	130	138				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	22/33/41		4.9	128	135				Light brown Silty SAND (Damp, dense to very dense)			SM
10	X	25/32/38		3.1	119	123							
15	X	33/34/3"		2.2	118	120							
20	X	37/48/3"		1.8	115	117				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	28/42/2"		1.9	119	121							
30	X	22/48/2"		4.3	119	124				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-4

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0													
	X	7/32/$\frac{50}{4"}$		3.0	121	125				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	38/$\frac{50}{4"}$		3.9	116	120				Light brown Silty SAND (Damp, dense to very dense)			SM
10	X	19/20/31		3.7	121	125							
15	X	11/30/$\frac{50}{2"}$		2.1	115	118							
20	X	17/$\frac{50}{6"}$		1.9	119	121				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense to dense)			SW - SM
25	X	16/21/36		2.8	126	130							
30	X	20/21/46		2.1	116	119				Brown Well-graded SAND with Silt (Damp, dense)			SW - SM

A.G.I. GEOTECHNICAL, INC.
A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center
PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia
DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"
EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A
DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop
LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
35	X	18/36/$\frac{50}{5"}$		1.8	119	122				Light brown Poorly-graded SAND with Silt & Gravel (Damp, dense)			SP - SM
40	X	38/$\frac{50}{6"}$		1.8	116	118							
45										Total Depth: 41.5' No Water			
50													
55													
60													
65													

BORING NUMBER B-5

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	X	8/10/20	X	4.7	121	127				Alluvium Brown Silty SAND (Damp, medium dense)			SM
5	X	19/31/40		4.6	127	133				Light brown Silty SAND (Damp, dense to very dense)			SM
10	X	15/25/46		2.5	123	126							
15	X	16/29/$\frac{50}{5"}$		2.0	120	123							
20	X	9/21/36		1.8	120	122				Light brown Well-graded SAND with Silt & Gravel (Damp, dense)			SW - SM
25	X	20/27/50		4.0	115	120							
30	X	20/49/$\frac{50}{4"}$		2.3	124	126				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-6

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	X	15/$\frac{50}{6"}$		6.7	132	141				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	30/$\frac{50}{5"}$		4.5	126	132				Light brown Silty SAND (Damp, very dense)			SM
10	X	28/38/36		2.4	124	127							
15	X	19/26/$\frac{50}{5"}$		1.7	118	120							
20	X	34/36/$\frac{50}{4"}$		2.4	110	113				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	18/35/$\frac{50}{5"}$		2.6	117	120							
30	X	$\frac{50}{6"}$		2.5	105	108				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-7

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	X	18/5"		7.2	136	146				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	18/30/5"		3.9	128	133				Light brown Silty SAND (Damp, very dense)			SM
10	X	22/38/50		2.2	124	127							
15	X	31/36/50		2.0	121	124							
20	X	22/34/45		1.5	124	126				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	20/40/4"		4.4	126	132							
30	X	26/6"		2.2	118	121				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-8

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D50	Classification
0										Alluvium Brown Silty SAND (Damp, very dense)			SM
	X	44/49/$\frac{50}{4"}$		3.7	127	132							
5	X	45/32/46		2.8	125	128				Light brown Silty SAND (Damp, dense to very dense)			SM
10	X	25/28/40		7.1	114	122							
15	X	20/30/$\frac{50}{6"}$		2.0	121	123							
20	X	34/38/50		2.0	116	119				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	21/40/50		1.2	125	127							
30	X	24/$\frac{50}{5"}$		2.3	121	123				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-9

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

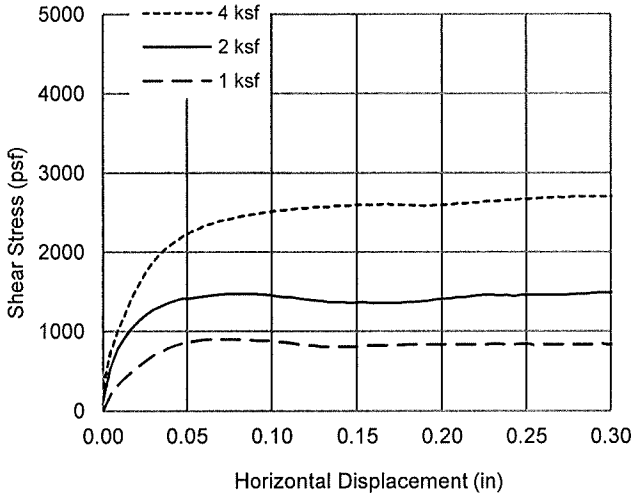
DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

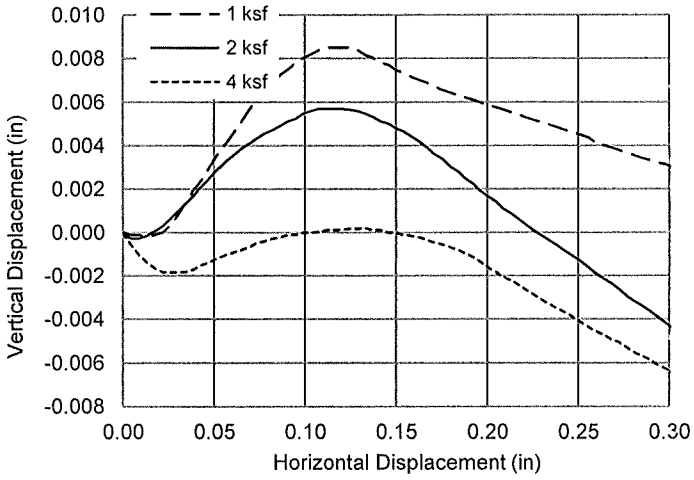
LOGGED BY: CWL CHECKED BY: JAV

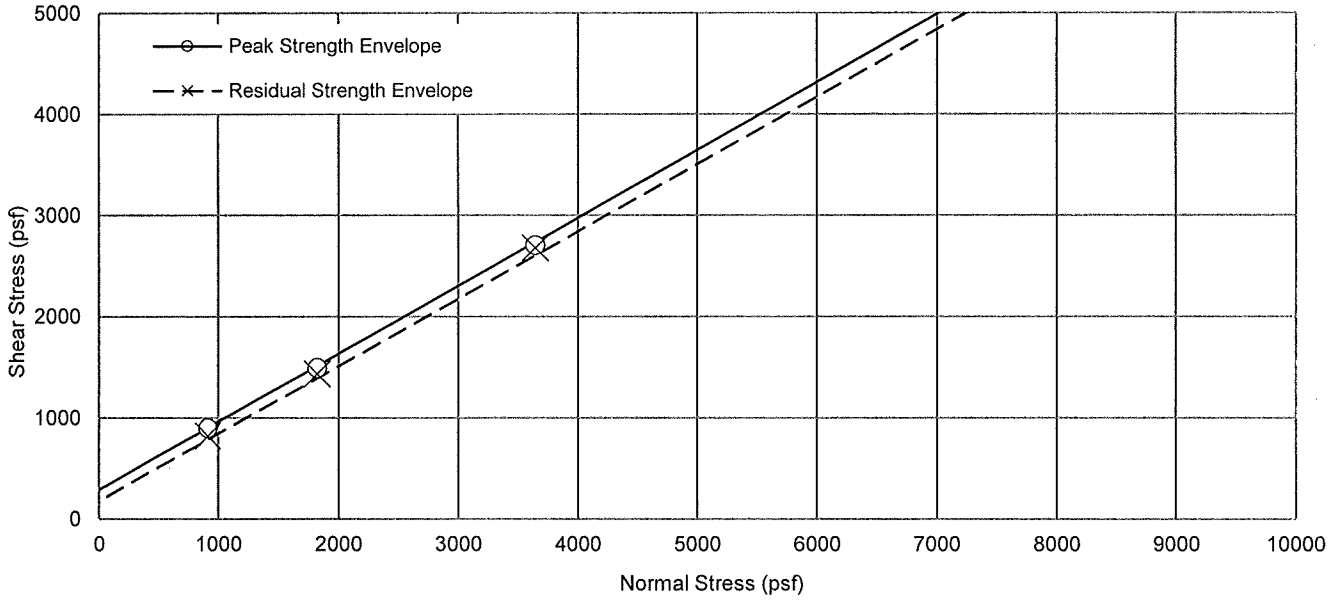
DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	☒	24/$\frac{50}{4"}$	☒	5.6	121	127				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	☒	30/$\frac{50}{4"}$		4.3	122	128				Light brown Silty SAND (Damp, very dense to dense)			SM
10	☒	17/22/30		3.4	128	133							
15	☒	12/24/28		4.4	116	121							
20	☒	16/32/40		1.3	118	119				Light brown Well-graded SAND with Silt & Gravel (Damp, dense to very dense)			SW - SM
25	☒	24/$\frac{50}{5"}$		3.4	118	122							
30	☒	49/$\frac{50}{5"}$		3.5	116	120				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

LABORATORY TEST RESULTS

Sample ID :		1 ksf	2 ksf	4 ksf			
Initial	Water Content (%)	7.5	7.5	7.5			
	Dry Density (%)	136.0	135.6	135.0			
	Saturation (%)	84.8	83.5	81.7			
Final	Water Content (%)	9.6	9.9	9.8			
	Dry Density (pcf)	135.4	134.7	133.8			
	Saturation (%)	106.1	106.6	102.1			
Normal Stress (psf)		910	1821	3642			
Peak Shear Stress (psf)		898	1490	2703			
Residual Shear Stress (psf)		817	1432	2673			







Peak Cohesion, c' (psf):	291	Residual Cohesion, c (psf):	180
Peak Friction, ϕ' (deg):	33.9	Residual Friction, ϕ' (deg):	33.6

DIRECT SHEAR TEST (ASTM:D-3080)

SAMPLE TYPE: Remolded
DESCRIPTION: Silty SAND

LL:
PL:
PI:
% <0.75μ
% <0.02μ
EI

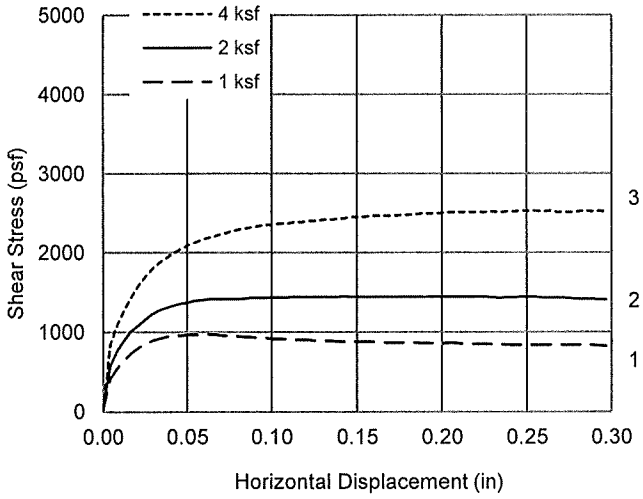
USCS:
GEOLOGY:
SYMBOL:
REMARKS:

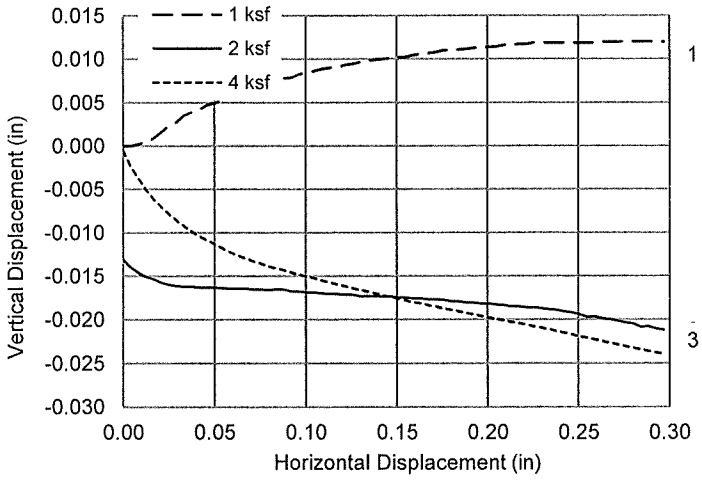
CLIENT: 55555 Amargosa Rd., LLC
PROJECT NAME:
LOCATION: Amargosa Rd. & Live Oak Ln.
Hesperia
SAMPLE LOCATION: B-1 @ 0-5'

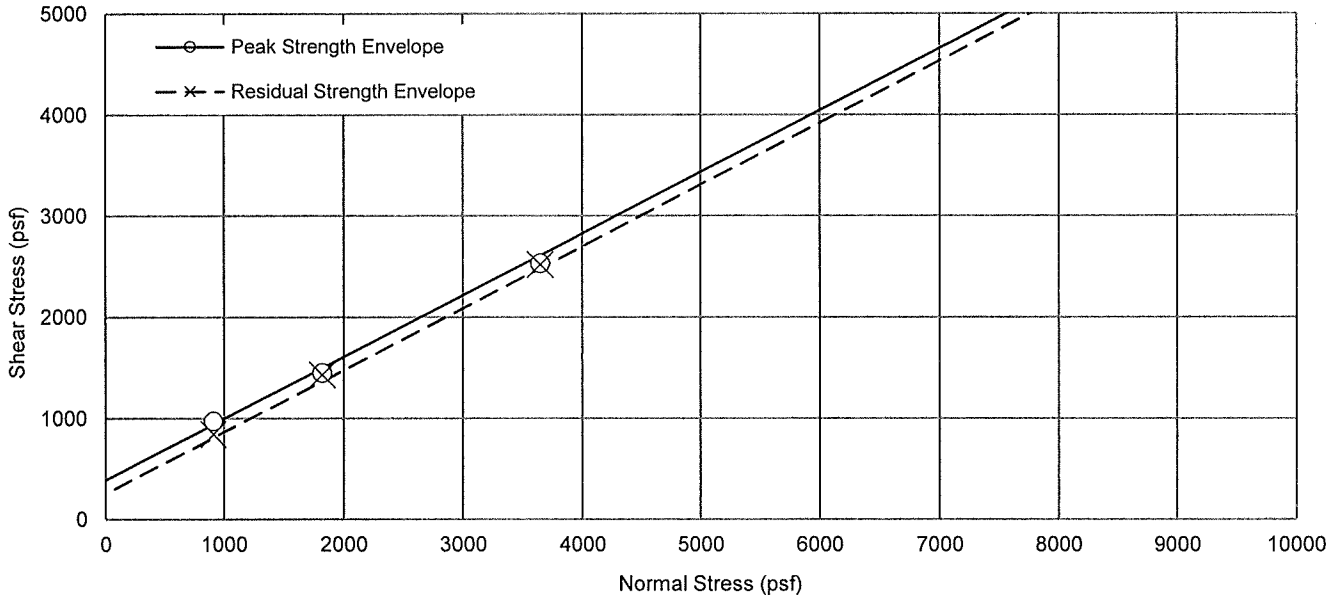
PROJECT NO.: 30-5468-00 TESTED: 02/19/20

A.G.I. GEOTECHNICAL, INC.

	Sample ID :	1 ksf	2 ksf	4 ksf			
Initial	Water Content (%)	8.3	8.3	8.3			
	Dry Density (%)	124.6	124.1	123.7			
	Saturation (%)	63.6	62.7	61.9			
Final	Water Content (%)	13.7	13.8	14.1			
	Dry Density (pcf)	123.5	123.1	122.5			
	Saturation (%)	101.6	101.1	101.4			
Normal Stress (psf)		910	1821	3642			
Peak Shear Stress (psf)		971	1447	2528			
Residual Shear Stress (psf)		840	1428	2517			







Peak Cohesion, c' (psf):	388	Residual Cohesion, c (psf):	254
Peak Friction, ϕ' (deg):	31.4	Residual Friction, ϕ' (deg):	31.5

DIRECT SHEAR TEST (ASTM:D-3080)

SAMPLE TYPE: Undisturbed
DESCRIPTION: Silty SAND

LL:
PL:
PI:
% <0.75μ
% <0.02μ
EI

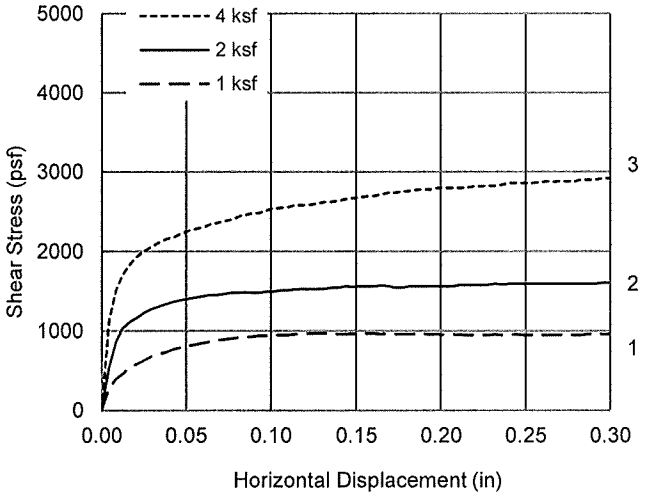
USCS:
GEOLOGY:
SYMBOL:
REMARKS:

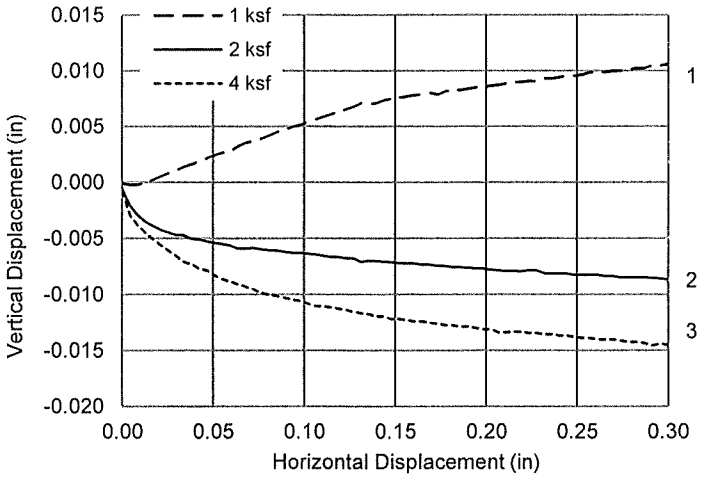
CLIENT: 55555 Amargosa Rd., LLC
PROJECT NAME:
LOCATION: Amargosa Rd. & Live Oak Ln.
Los Angeles
SAMPLE LOCATION: B-1 @ 2.5'

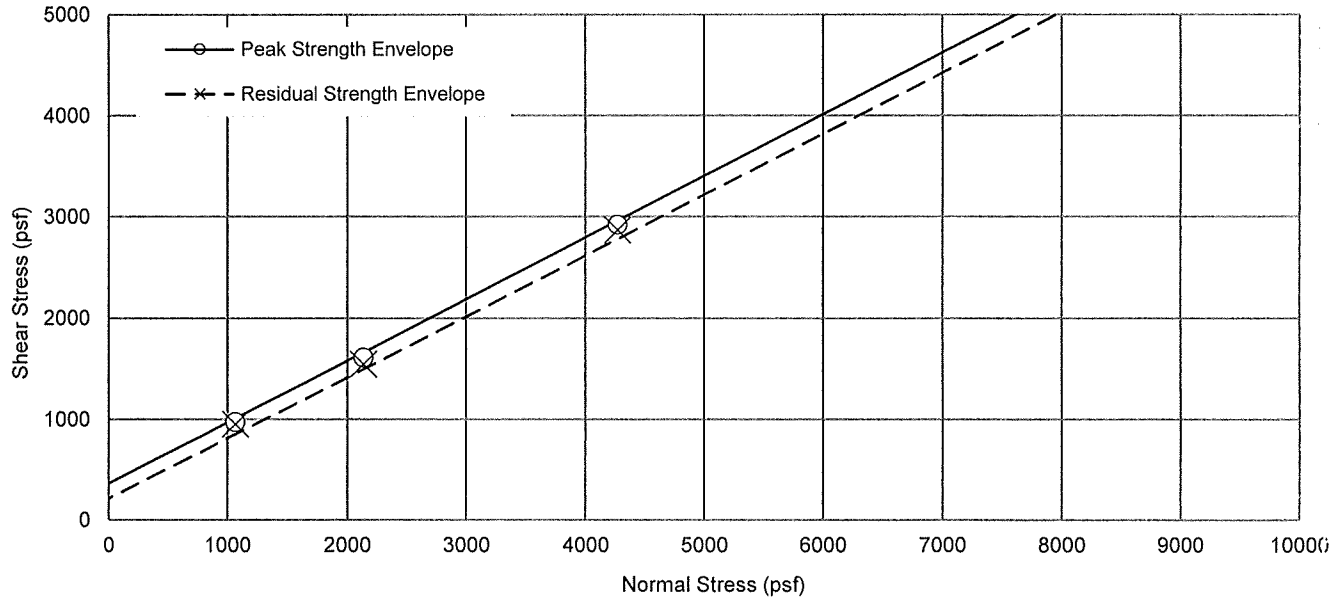
PROJECT NO.: 30-5468-00 TESTED: 02/19/20

A.G.I. GEOTECHNICAL, INC.

	Sample ID :	1 ksf	2 ksf	4 ksf			
Initial	Water Content (%)	7.5	7.5	7.5			
	Dry Density (%)	134.9	134.3	133.7			
	Saturation (%)	81.3	79.6	77.8			
Final	Water Content (%)	10.0	10.2	10.3			
	Dry Density (pcf)	134.1	133.3	132.4			
	Saturation (%)	105.3	104.4	102.1			
Normal Stress (psf)		1067	2134	4269			
Peak Shear Stress (psf)		972	1607	2918			
Residual Shear Stress (psf)		949	1543	2866			







Peak Cohesion, c' (psf):	360	Residual Cohesion, c (psf):	211	**DIRECT SHEAR TEST (ASTM:D-3080)**
Peak Friction, ϕ' (deg):	31.3	Residual Friction, Φ' (deg):	31.0	

SAMPLE TYPE: Remolded
DESCRIPTION: Silty SAND

LL:
PL:
PI:
% <0.75μ
% <0.02μ
EI

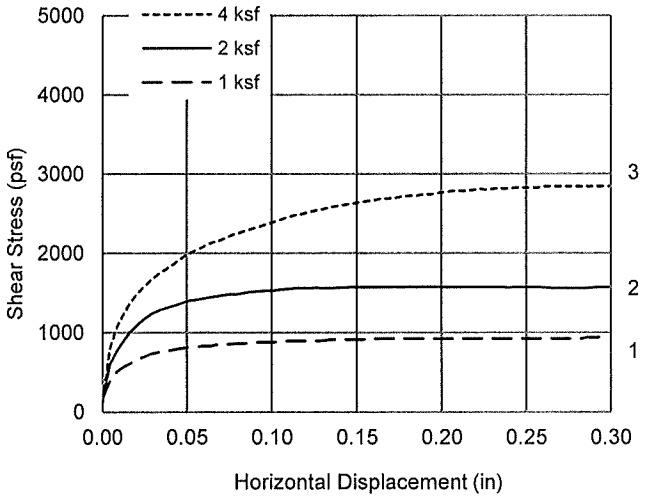
USCS:
GEOLOGY:
SYMBOL:
REMARKS:

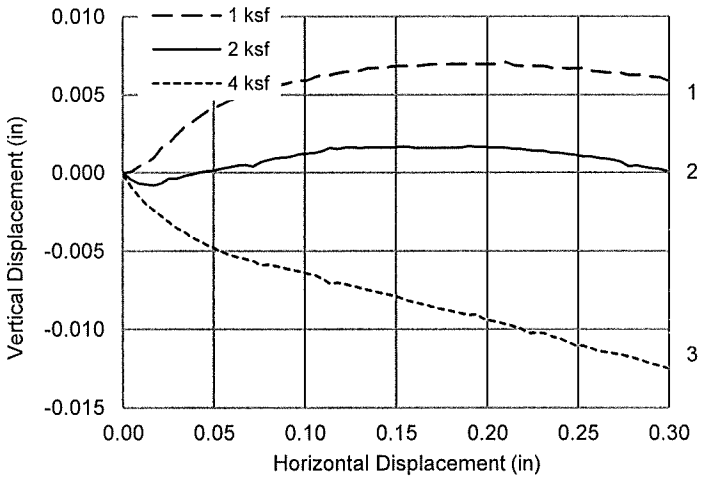
CLIENT: 55555 Amargosa Rd., LLC
PROJECT NAME:
LOCATION: Amargosa Rd. & Live Oak Ln.
Hesperia
SAMPLE LOCATION: B-3 @ 0-5'

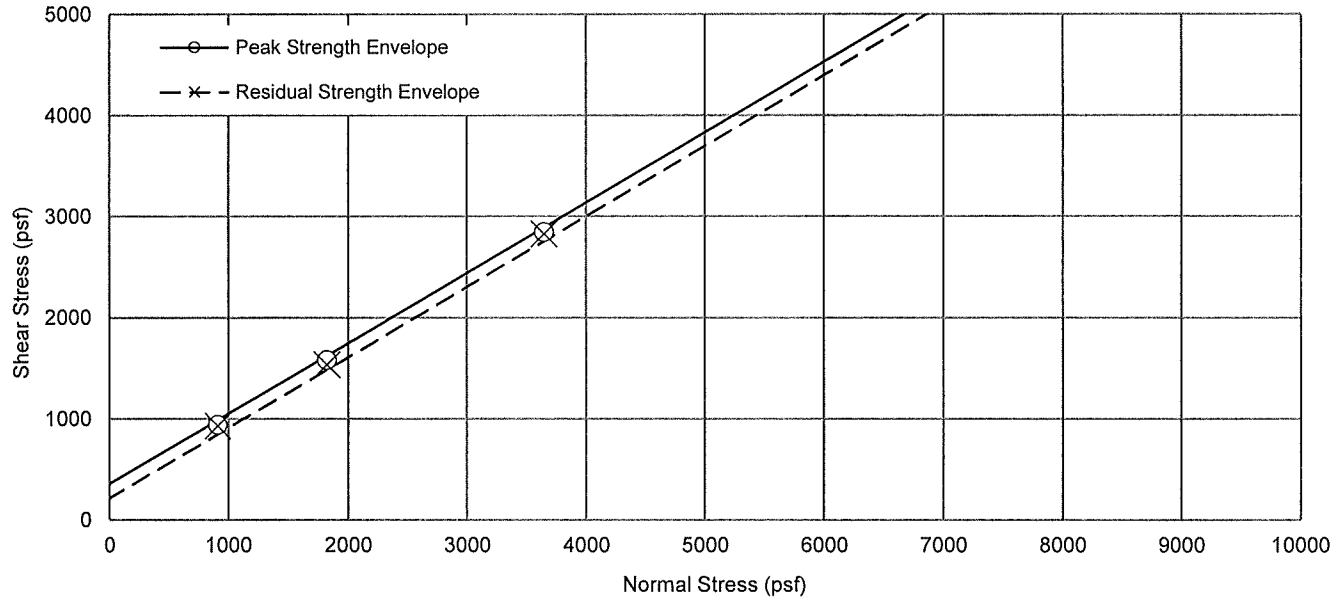
PROJECT NO.: 30-5468-00 TESTED: 02/22/20

A.G.I. GEOTECHNICAL, INC.

	Sample ID :	1 ksf	2 ksf	4 ksf			
Initial	Water Content (%)	7.5	7.5	7.5			
	Dry Density (%)	136.4	135.9	135.4			
	Saturation (%)	86.1	84.5	82.9			
Final	Water Content (%)	9.2	9.5	9.7			
	Dry Density (pcf)	135.7	135.0	134.2			
	Saturation (%)	102.8	103.4	102.5			
Normal Stress (psf)		910	1821	3642			
Peak Shear Stress (psf)		940	1579	2842			
Residual Shear Stress (psf)		925	1532	2825			







Peak Cohesion, c' (psf):	355	Residual Cohesion, c (psf):	214
Peak Friction, ϕ' (deg):	34.8	Residual Friction, ϕ' (deg):	34.9

DIRECT SHEAR TEST (ASTM:D-3080)

SAMPLE TYPE: Remolded
DESCRIPTION: Silty SAND

LL:
PL:
PI:
% <0.75μ
% <0.02μ
EI

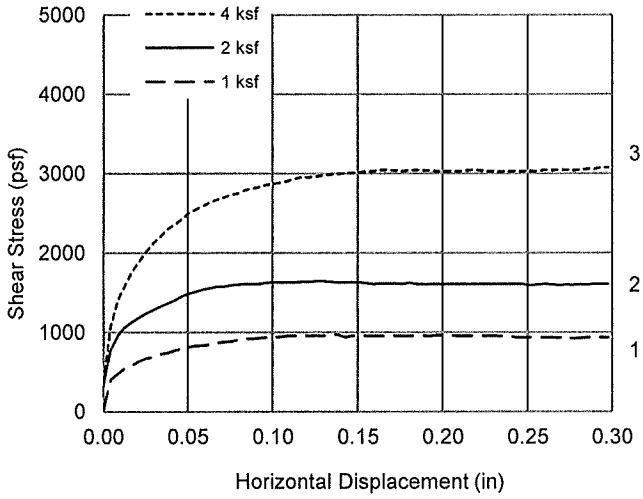
USCS:
GEOLOGY:
SYMBOL:
REMARKS:

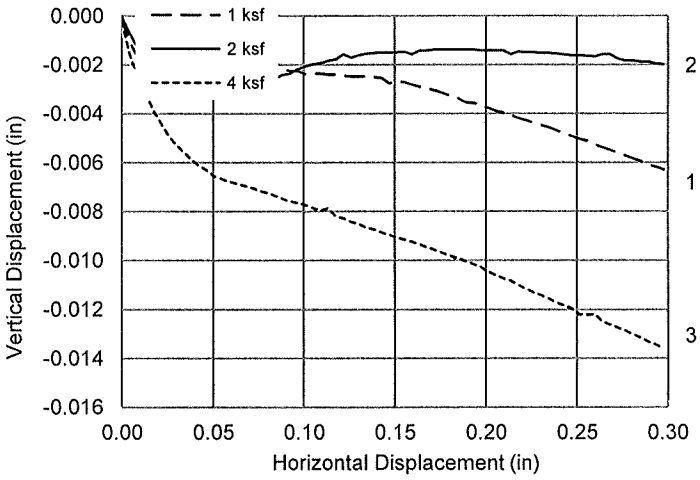
CLIENT: 55555 Amargosa Rd., LLC
PROJECT NAME:
LOCATION: Amargosa Rd. & Live Oak Ln.
Hesperia
SAMPLE LOCATION: B-5 @ 0-5'

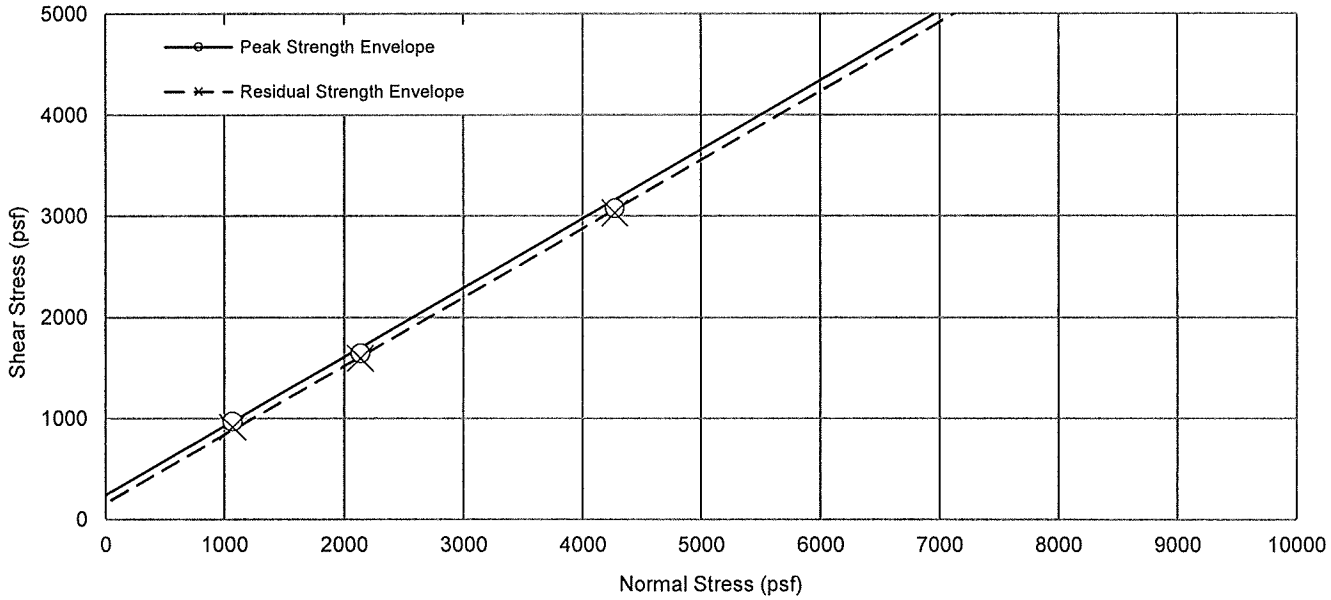
PROJECT NO.: 30-5468-00 TESTED: 02/22/20

A.G.I. GEOTECHNICAL, INC.

	Sample ID :	1 ksf	2 ksf	4 ksf			
Initial	Water Content (%)	3.7	3.7	3.7			
	Dry Density (%)	126.9	126.3	125.8			
	Saturation (%)	30.5	29.9	29.4			
Final	Water Content (%)	12.9	13.2	13.3			
	Dry Density (pcf)	126.3	125.6	124.8			
	Saturation (%)	104.3	104.4	102.6			
Normal Stress (psf)		1067	2134	4269			
Peak Shear Stress (psf)		969	1644	3074			
Residual Shear Stress (psf)		911	1591	3028			







Peak Cohesion, c' (psf):	240	Residual Cohesion, c (psf):	159
Peak Friction, ϕ' (deg):	34.4	Residual Friction, ϕ' (deg):	34.2

DIRECT SHEAR TEST (ASTM:D-3080)

SAMPLE TYPE: Undisturbed
DESCRIPTION: Silty SAND

LL:
PL:
PI:
% <0.75μ
% <0.02μ
EI

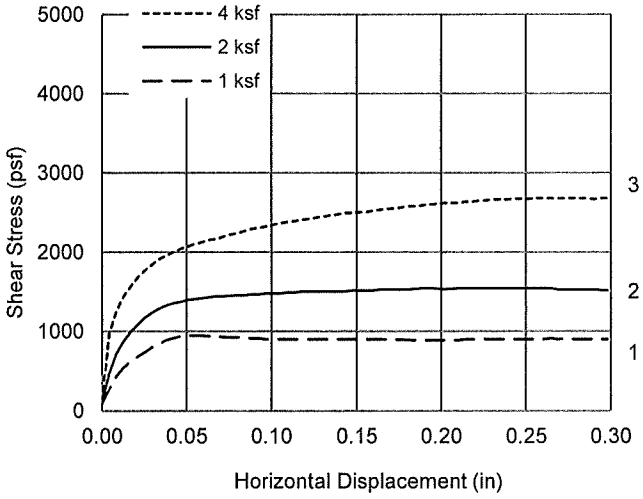
USCS:
GEOLOGY:
SYMBOL:
REMARKS:

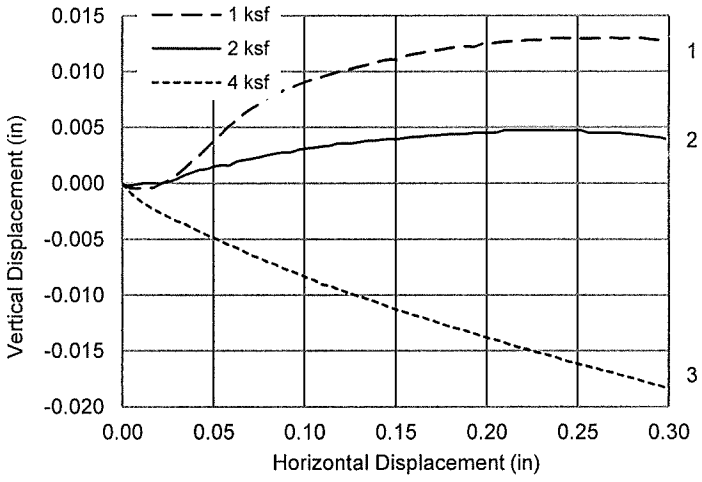
CLIENT: 55555 Amargosa Rd., LLC
PROJECT NAME:
LOCATION: Amargosa Rd. & Live Oak Ln.
Hesperia
SAMPLE LOCATION: B-8 @ 2.5'

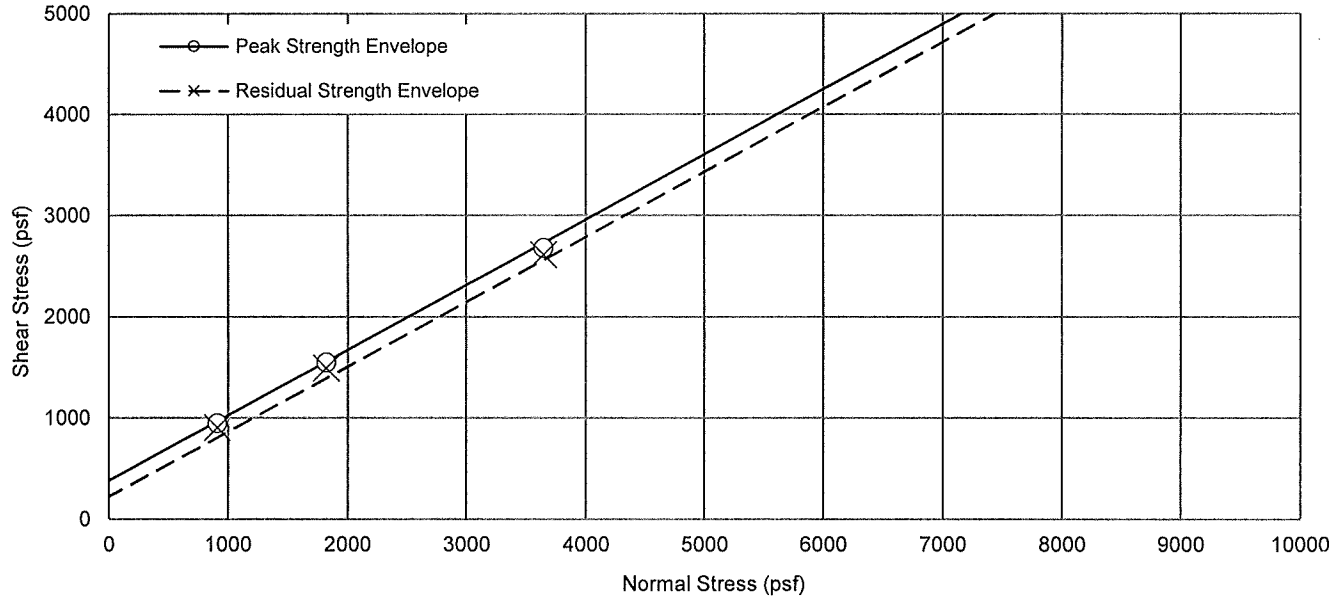
PROJECT NO.: 30-5468-00 TESTED: 02/21/20

A.G.I. GEOTECHNICAL, INC.

	Sample ID :	1 ksf	2 ksf	4 ksf			
Initial	Water Content (%)	8.0	8.0	8.0			
	Dry Density (%)	134.7	134.1	133.6			
	Saturation (%)	86.1	84.3	82.7			
Final	Water Content (%)	9.8	10.1	10.4			
	Dry Density (pcf)	133.8	133.0	132.3			
	Saturation (%)	102.1	102.2	102.7			
Normal Stress (psf)		910	1821	3642			
Peak Shear Stress (psf)		946	1545	2677			
Residual Shear Stress (psf)		900	1488	2611			







Peak Cohesion, c' (psf):	379	Residual Cohesion, c (psf):	222
Peak Friction, ϕ' (deg):	32.8	Residual Friction, ϕ' (deg):	32.7

DIRECT SHEAR TEST (ASTM:D-3080)

SAMPLE TYPE: Remolded
DESCRIPTION: Silty SAND

LL:
PL:
PI:
% <0.75μ
% <0.02μ
EI

USCS:
GEOLOGY:
SYMBOL:
REMARKS:

CLIENT: 55555 Amargosa Rd., LLC
PROJECT NAME:
LOCATION: Amargosa Rd. & Live Oak Ln. Hesperia
SAMPLE LOCATION: B-9 @ 0-5'

PROJECT NO.: 30-5468-00 TESTED: 02/19/20

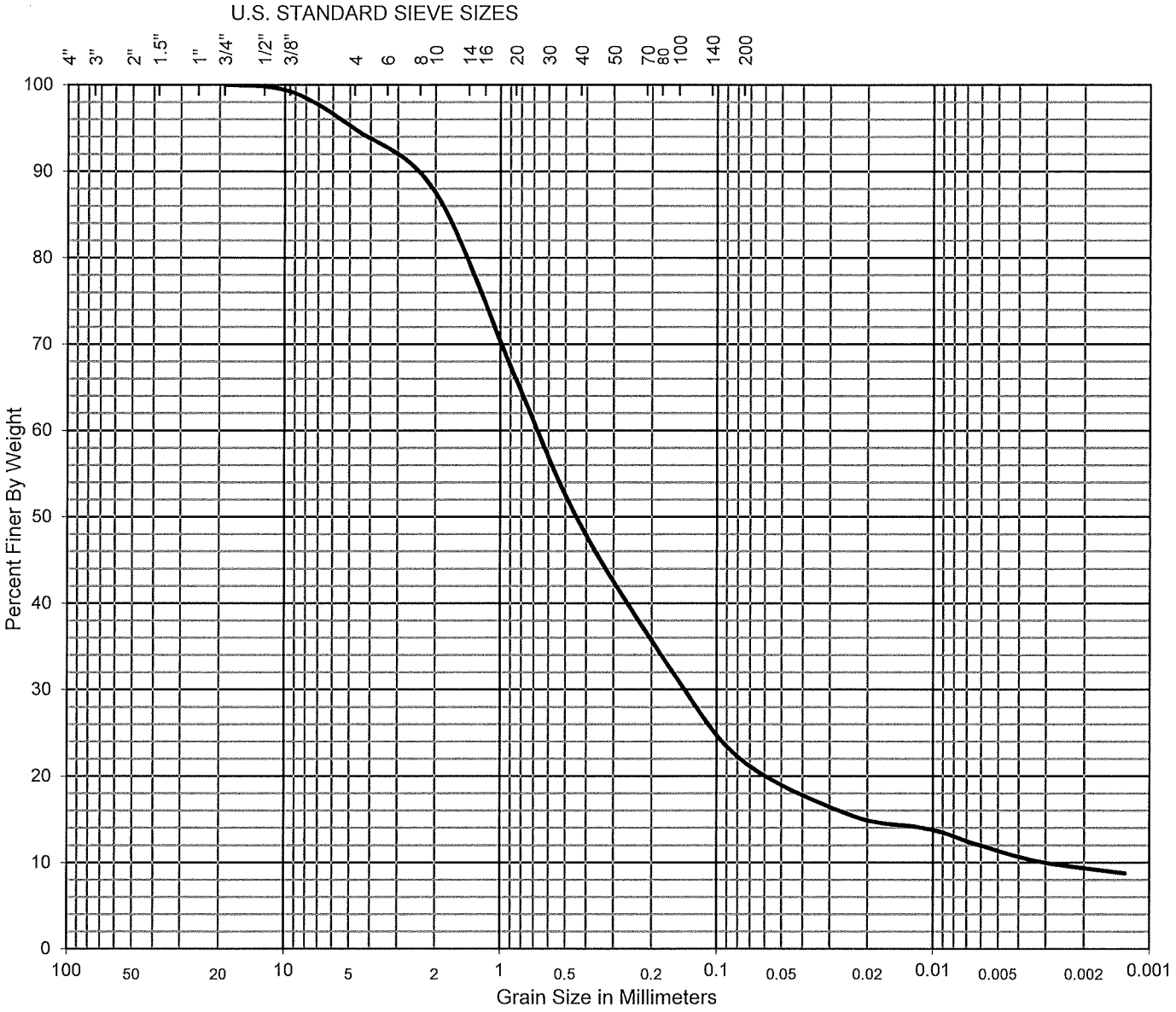
A.G.I. GEOTECHNICAL, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-1			**DEPTH (FT)**	0-5
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	5.1	**Sand (%)**	73.2			**Silt & Clay (%)**	21.7
D_{10} (mm)	-	**D_{30} (mm)**	-	**D_{60} (mm)**	-	**D_{50} (mm)**	-
C_u	-	**C_c**	-			**% Fines (< 75υm)**	21.7

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM)



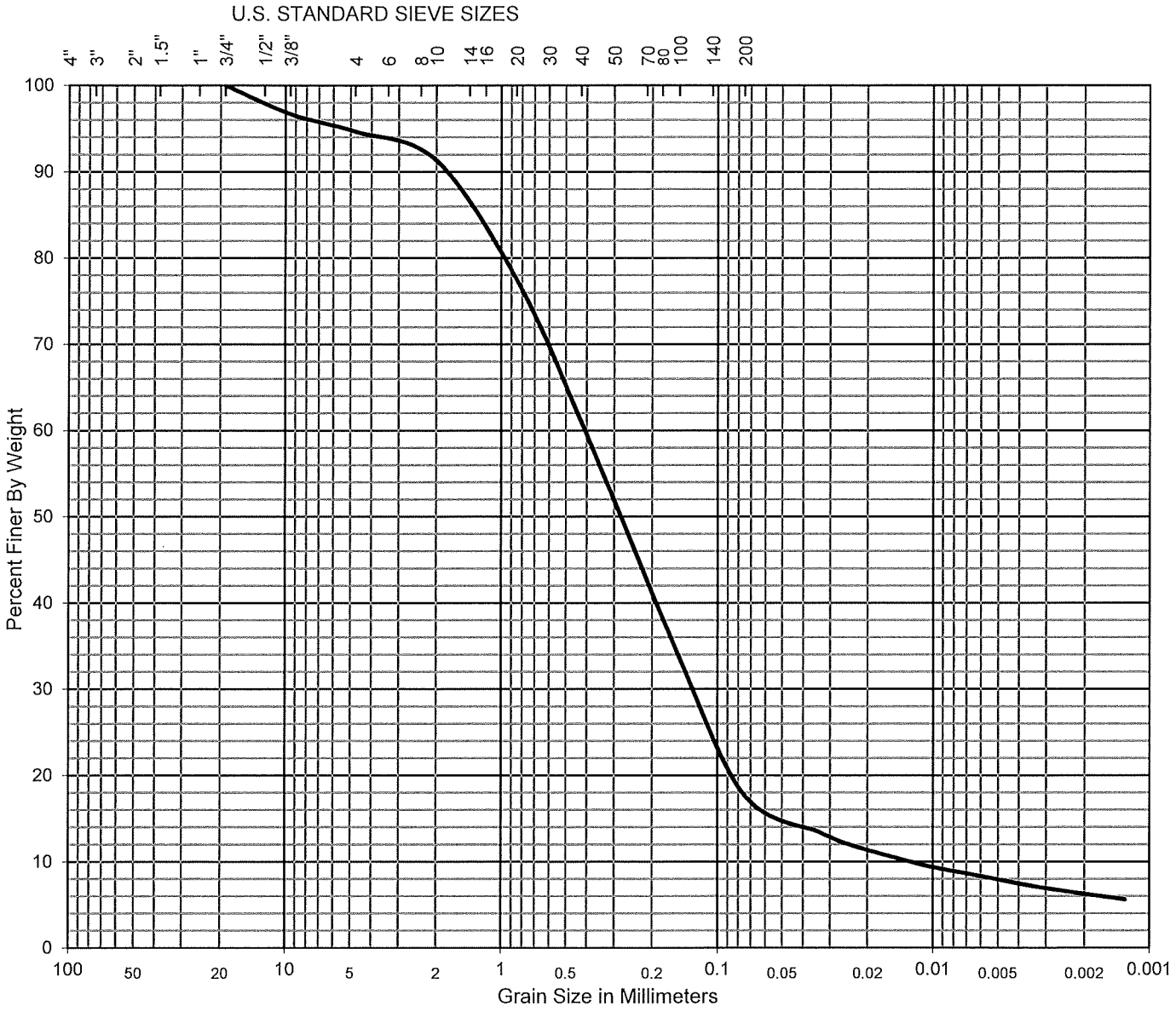
GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-2			**DEPTH (FT)**	10
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	5.3	**Sand (%)**	77.0			**Silt & Clay (%)**	17.7
D_{10} (mm)	-	**D_{30} (mm)**	-	**D_{60} (mm)**	-	**D_{50} (mm)**	-
C_u	-	**C_c**	-			**% Fines (< 75υm)**	17.7

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM)



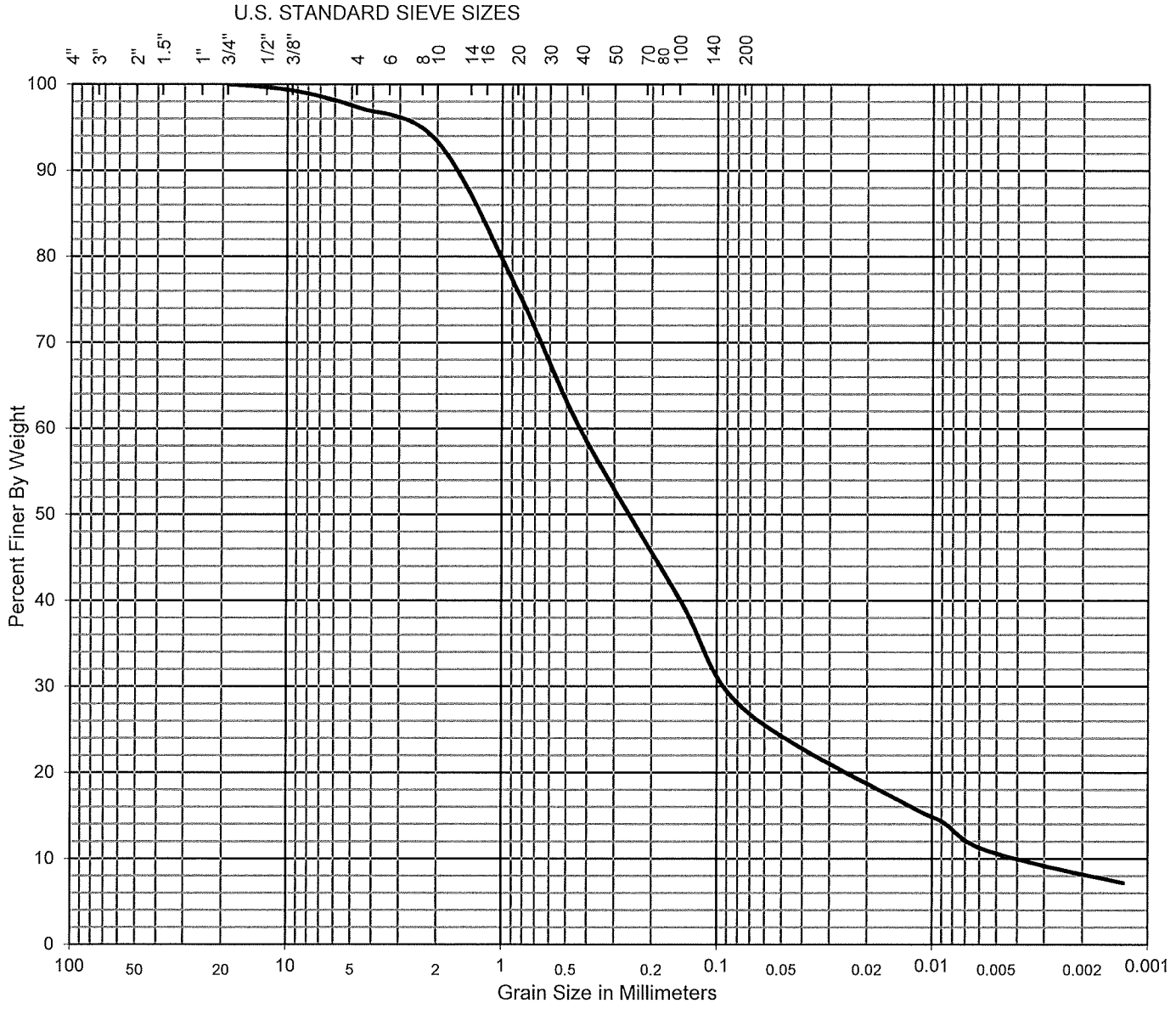
GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-3			**DEPTH (FT)**	0-5
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	2.6	**Sand (%)**	70.0			**Silt & Clay (%)**	27.4
D_{10} (mm)	-	**D_{30} (mm)**	-	**D_{60} (mm)**	-	**D_{50} (mm)**	-
C_u	-	**C_c**	-			**% Fines (< 75υm)**	27.4

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM)



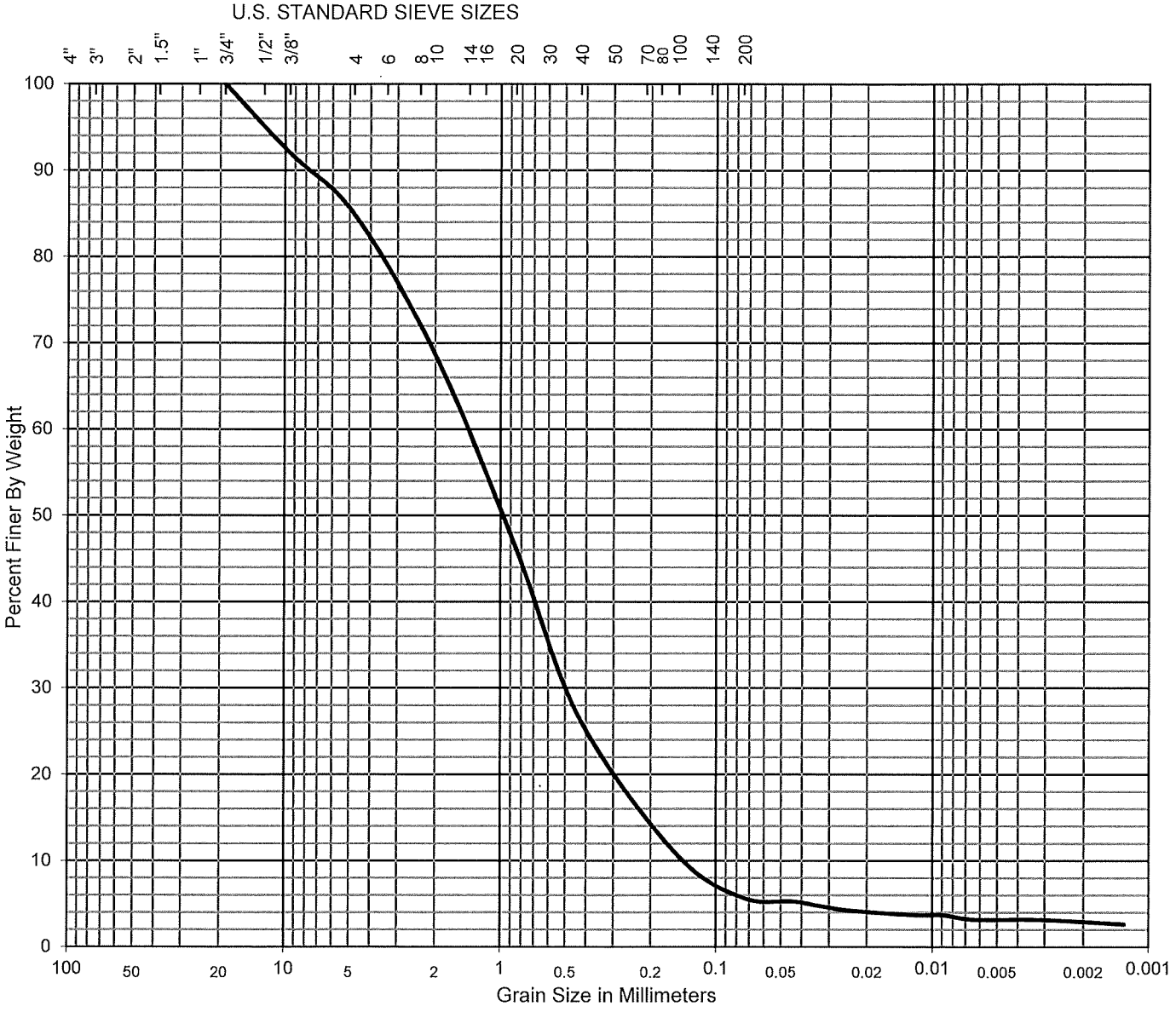
GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-3			**DEPTH (FT)**	20
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	15.1	**Sand (%)**	79.2			**Silt & Clay (%)**	5.7
D_{10} (mm)	0.15	**D_{30} (mm)**	0.50	**D_{60} (mm)**	1.50	**D_{50} (mm)**	1.00
C_u	10.00	**C_c**	1.11			**% Fines (< 75υm)**	5.7

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Well-Graded SAND with Silt & Gravel (SW-SM)



GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

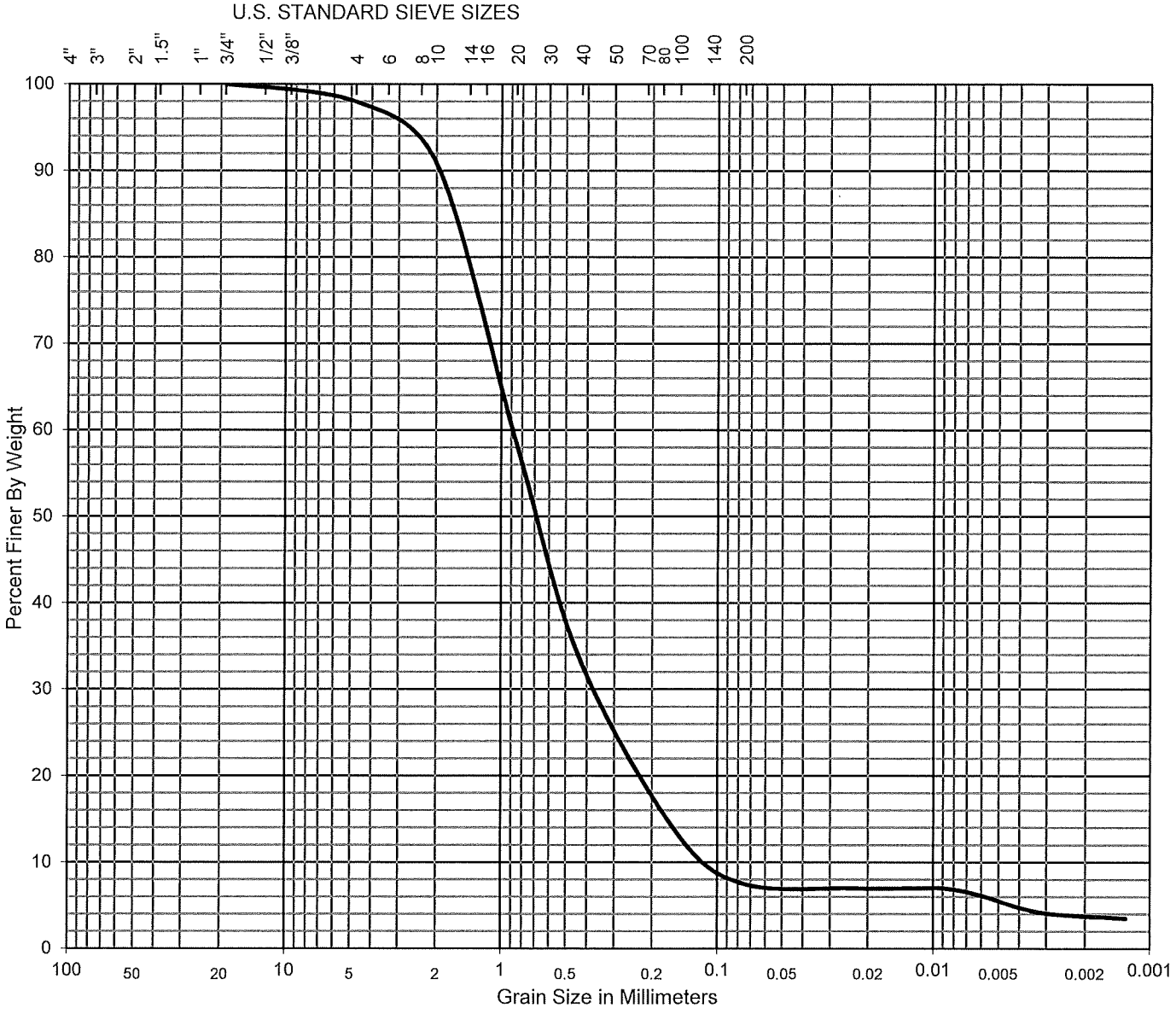
A.G.I. GEOTECHNICAL, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-4			**DEPTH (FT)**	30
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	2.0	**Sand (%)**	90.5			**Silt & Clay (%)**	7.5
D_{10} (mm)	0.13	**D_{30} (mm)**	0.38	**D_{60} (mm)**	0.90	**D_{50} (mm)**	0.70
C_u	6.92	**C_c**	1.23			**% Fines (< 75υm)**	7.5

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Well-Graded SAND with Silt (SW-SM)



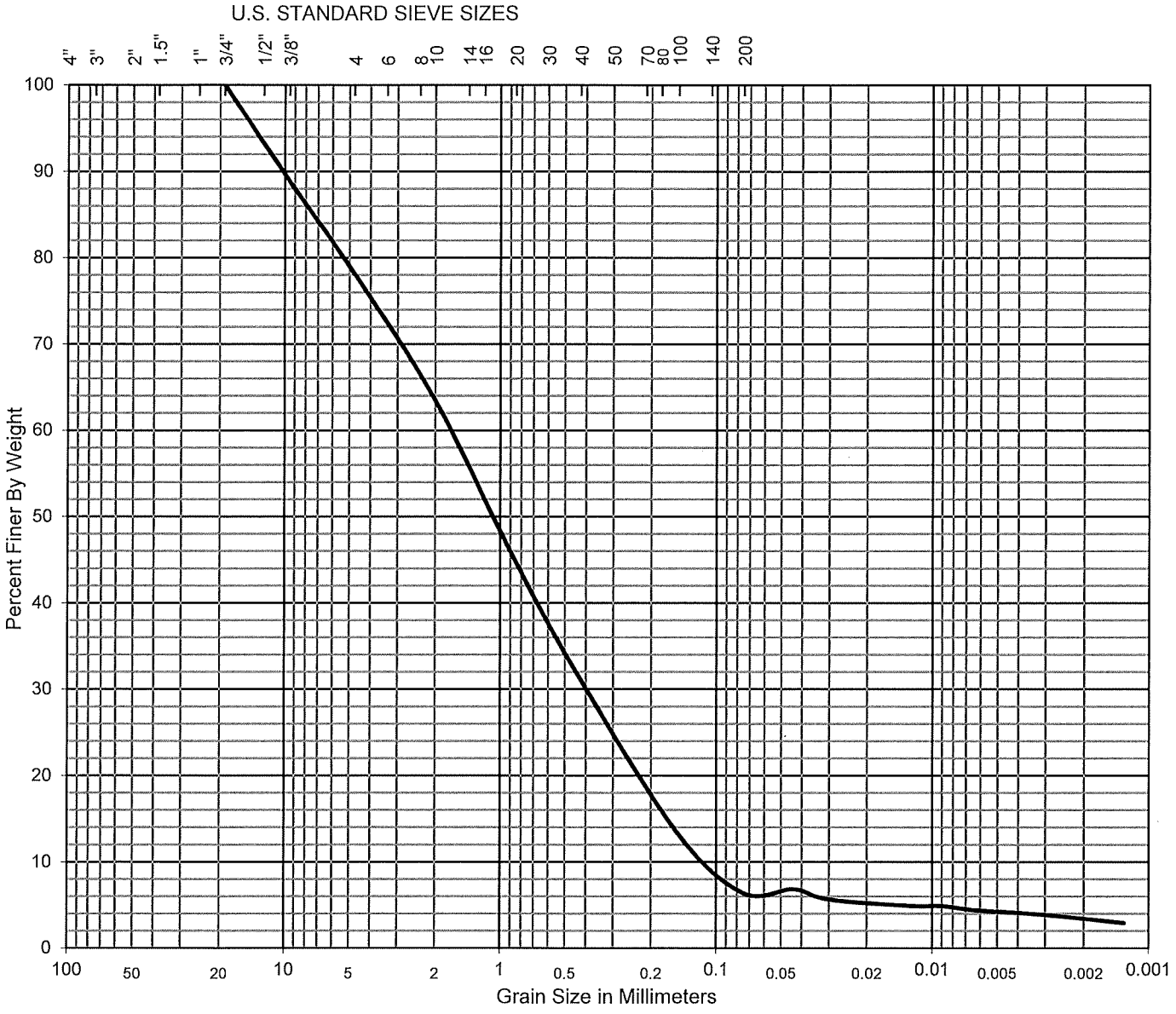
GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-4			**DEPTH (FT)**	40
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	21.8	**Sand (%)**	71.8			**Silt & Clay (%)**	6.4
D_{10} (mm)	0.13	**D_{30} (mm)**	0.40	**D_{60} (mm)**	1.80	**D_{50} (mm)**	1.20
C_u	13.85	**C_c**	0.68			**% Fines (< 75υm)**	6.4

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Poorly-Graded SAND with Silt & Gravel (SP-SM)



GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

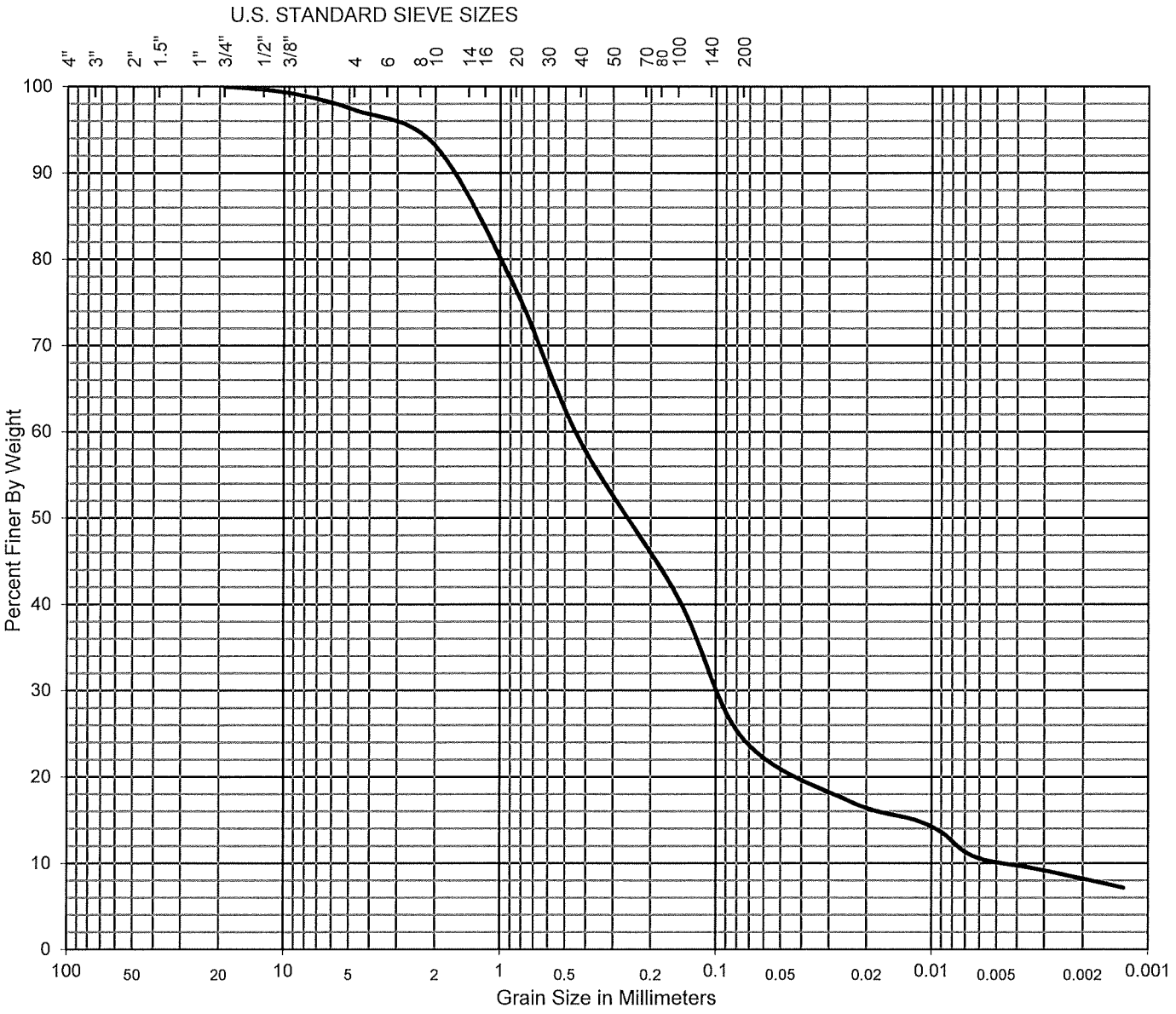
A.G.I. GEOTECHNICAL, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-5			**DEPTH (FT)**	0-5
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	2.7	**Sand (%)**	72.9			**Silt & Clay (%)**	24.5
D_{10} (mm)	-	**D_{30} (mm)**	-	**D_{60} (mm)**	-	**D_{50} (mm)**	-
C_u	-	**C_c**	-			**% Fines (< 75υm)**	24.5

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM)



GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

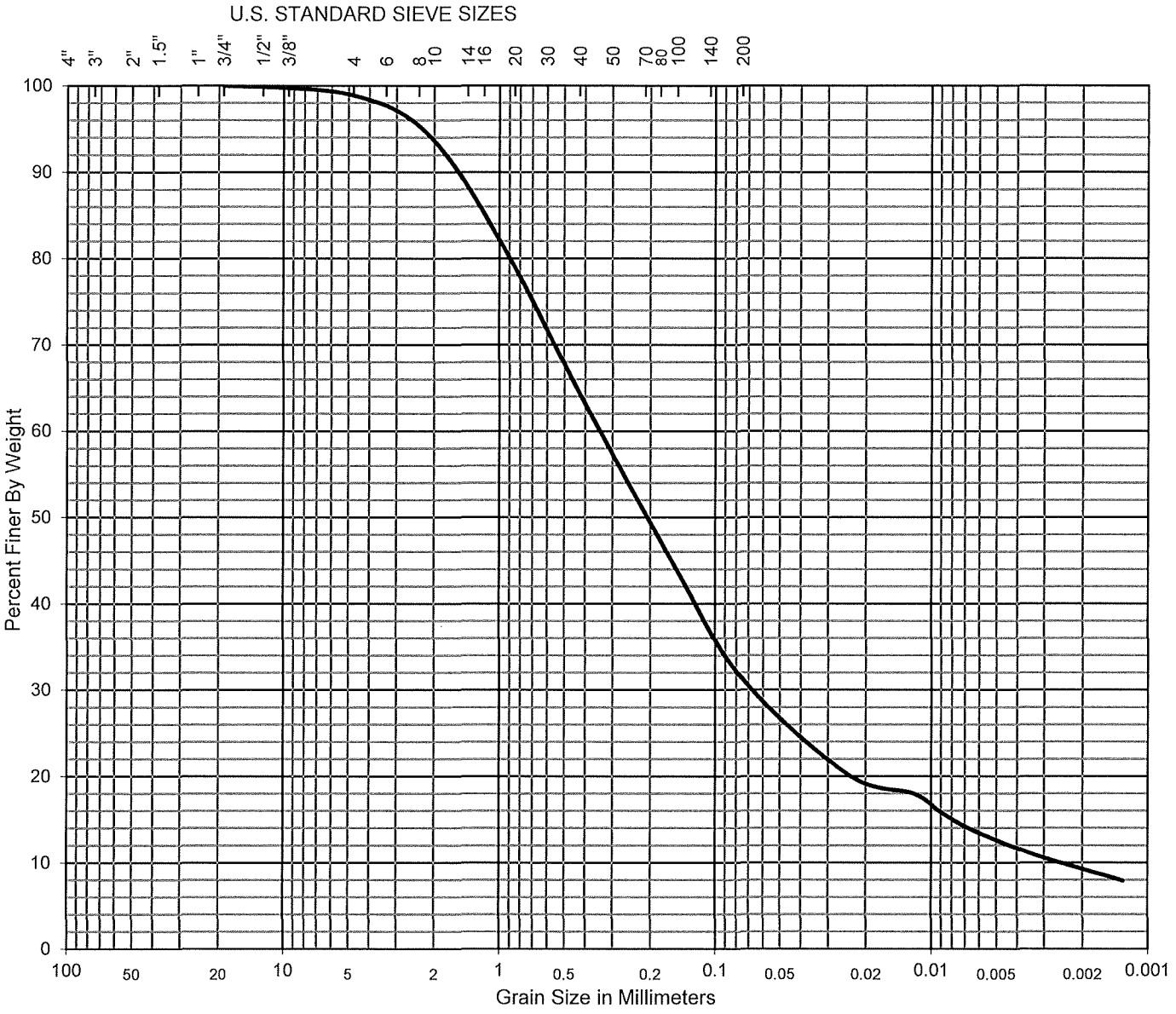
A.G.I. GEOTECHNICAL, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NO.	30-5468-00	**BORING NO.**	B-9			**DEPTH (FT)**	0-5
Liquid Limit (%)	-	**Plastic Limit (%)**	-			**Plasticity Index**	-
Gravel (%)	1.1	**Sand (%)**	67.6			**Silt & Clay (%)**	31.3
D_{10} (mm)	-	**D_{30} (mm)**	-	**D_{60} (mm)**	-	**D_{50} (mm)**	-
C_u	-	**C_c**	-			**% Fines (< 75υm)**	31.3

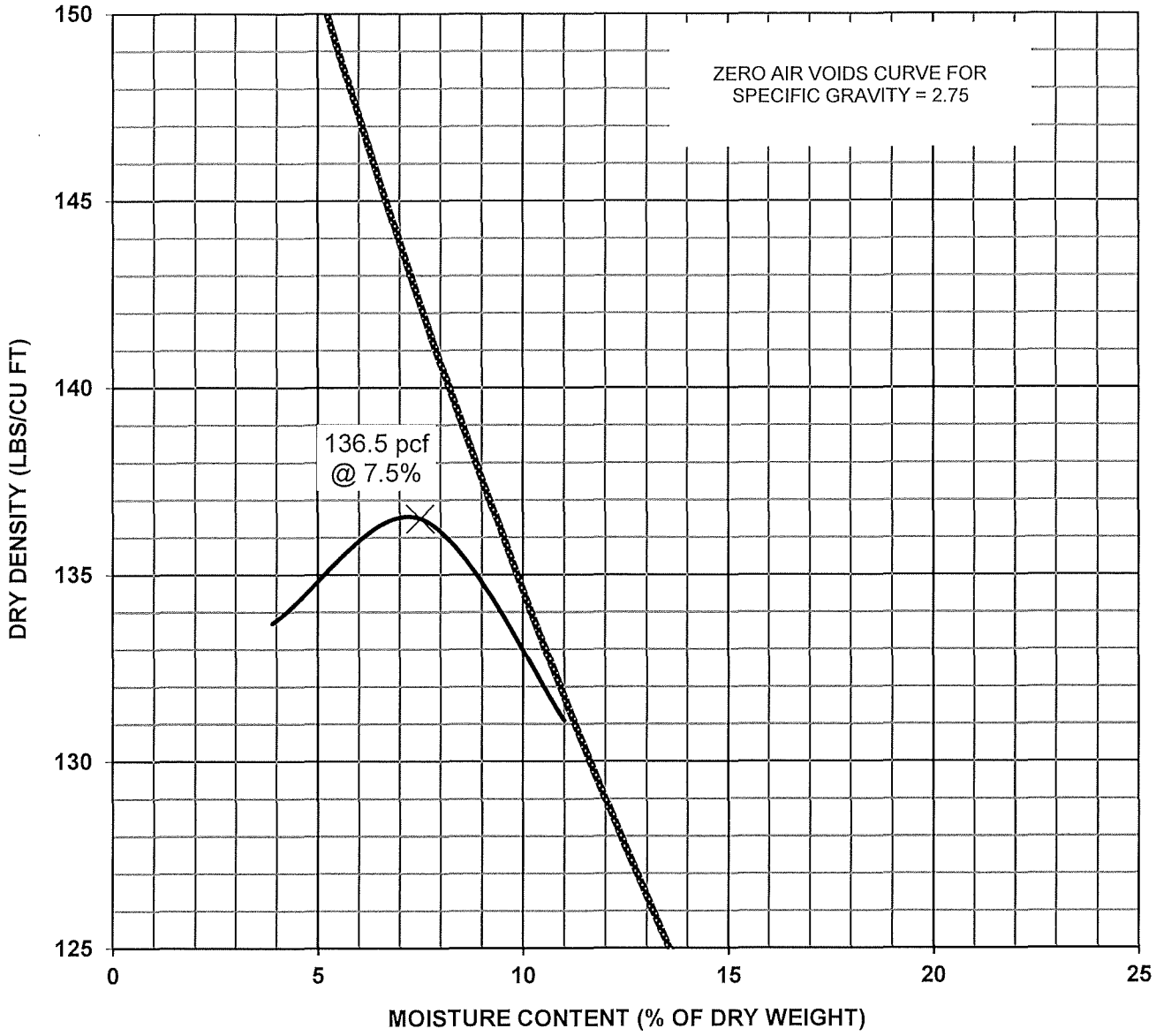
REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM)



GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

MAXIMUM DENSITY CURVE



PROJECT NO. 30-5468-00 **BORING NO.** B-1 **DEPTH (FT)** 0-5

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM), (E.I. = 1, Very Low)

MAXIMUM DRY DENSITY (LBS/CU FT) 136.5

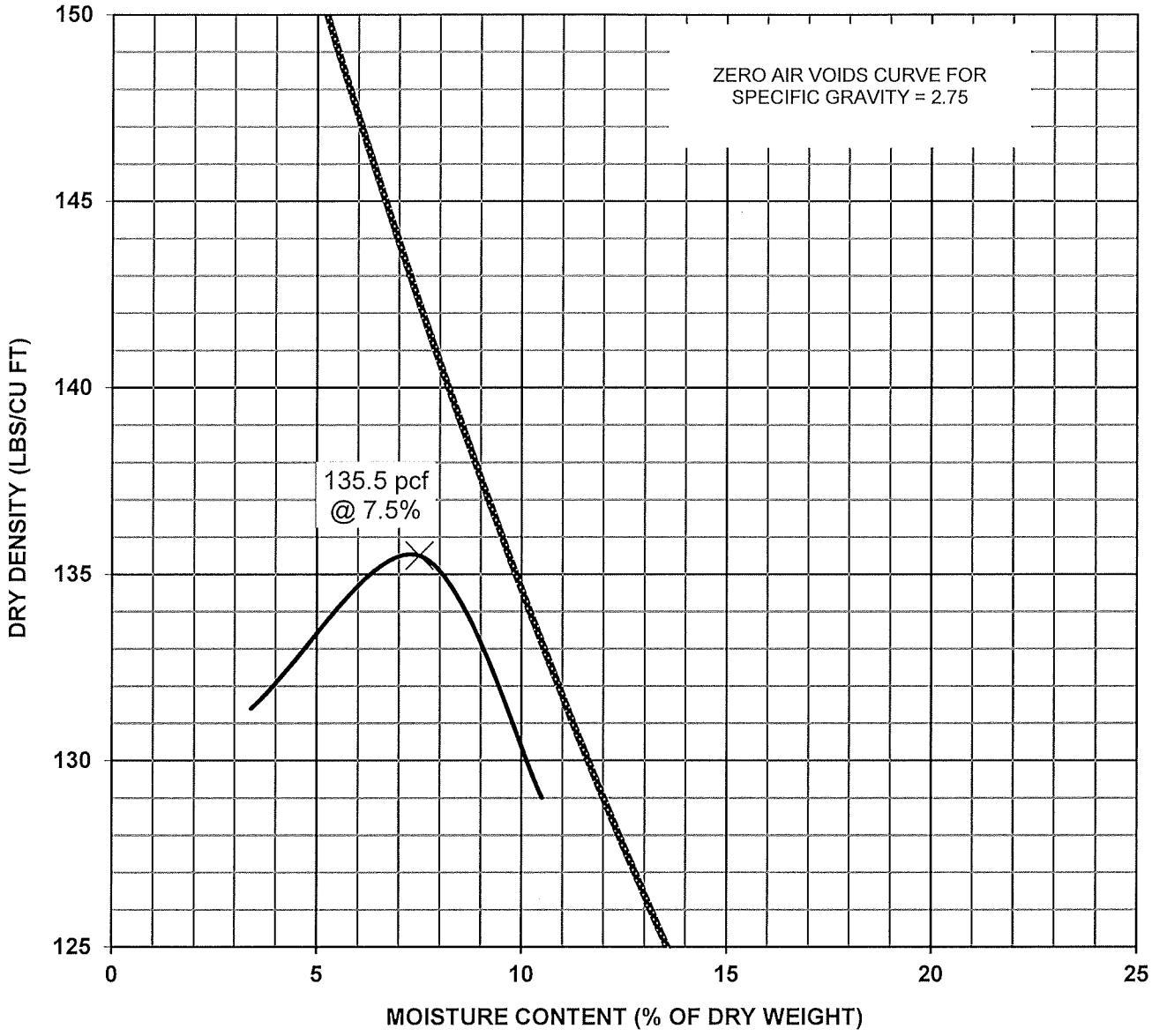
OPTIMUM MOISTURE CONTENT (% OF DRY WEIGHT) 7.5

METHOD OF COMPACTION
ASTM:D-1557

AGI

A.G.I. GEOTECHNICAL, INC.

MAXIMUM DENSITY CURVE



PROJECT NO. 30-5468-00 **BORING NO.** B-3 **DEPTH (FT)** 0-5

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM), (E.I. = 1, Very Low)

MAXIMUM DRY DENSITY (LBS/CU FT) 135.5

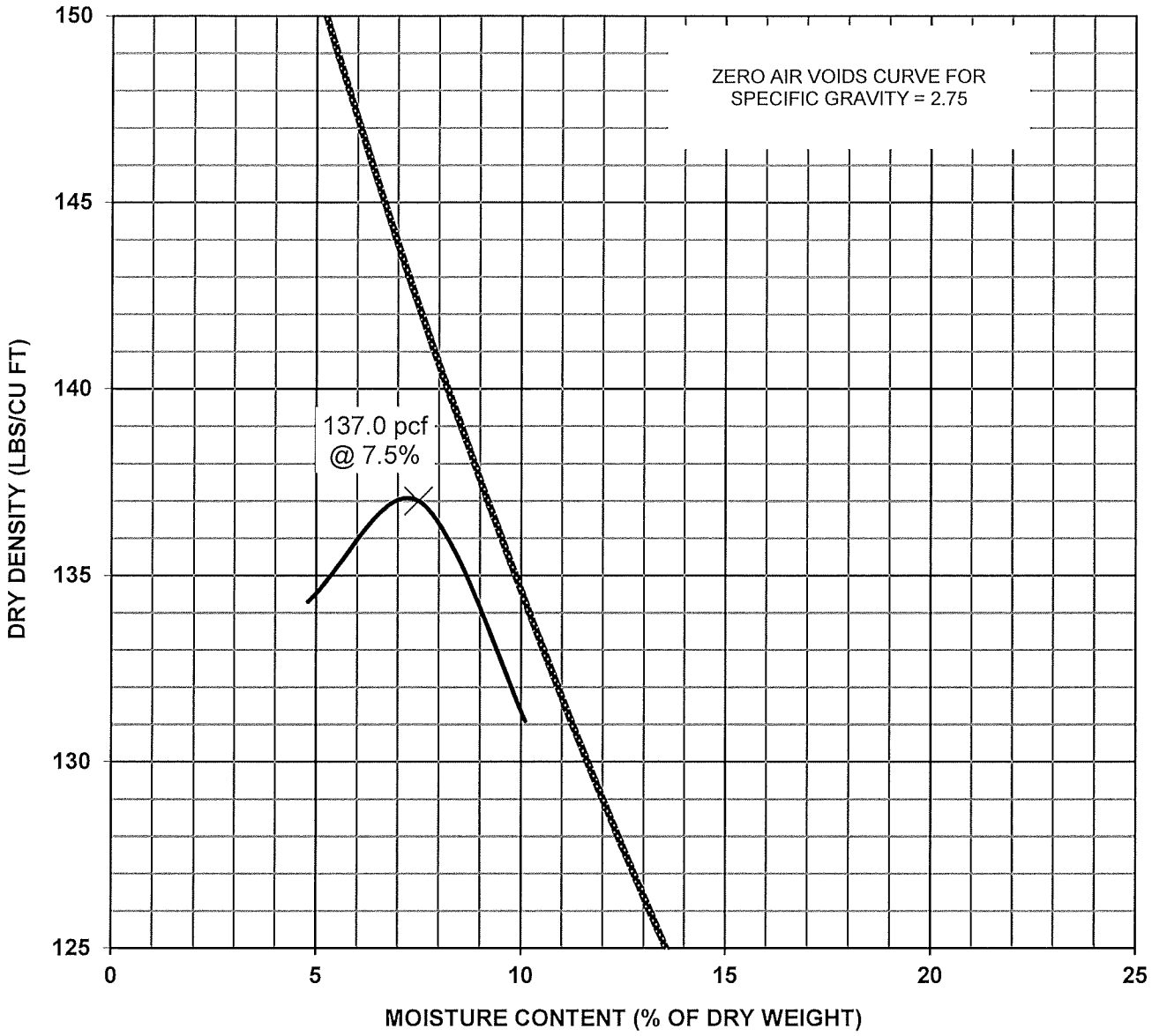
OPTIMUM MOISTURE CONTENT (% OF DRY WEIGHT) 7.5

METHOD OF COMPACTION
ASTM:D-1557

AGI

A.G.I. GEOTECHNICAL, INC.

MAXIMUM DENSITY CURVE



PROJECT NO. 30-5468-00 **BORING NO.** B-5 **DEPTH (FT)** 0-5

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM), (E.I. = 1, Very Low)

MAXIMUM DRY DENSITY (LBS/CU FT) 137.0

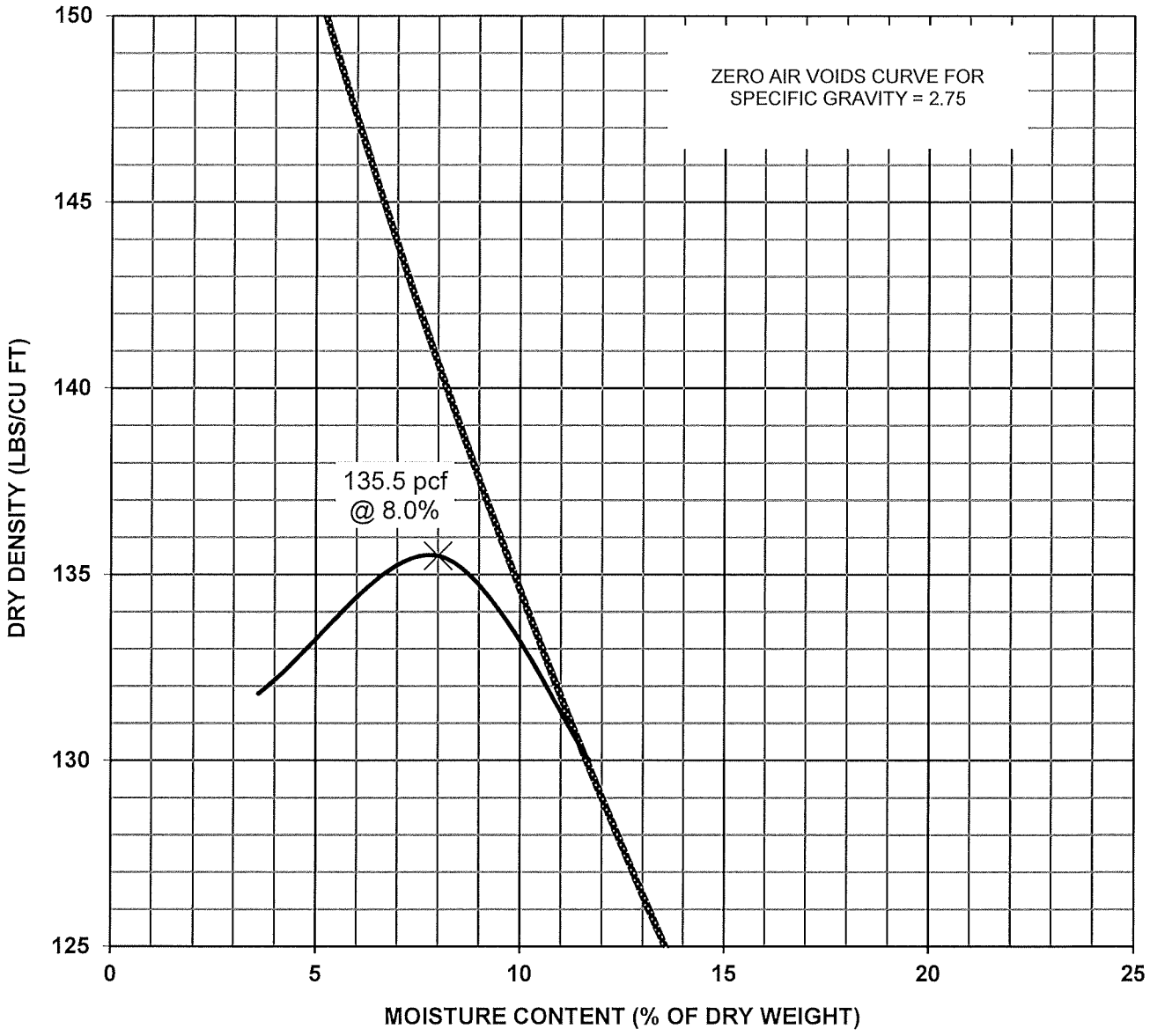
OPTIMUM MOISTURE CONTENT (% OF DRY WEIGHT) 7.5

METHOD OF COMPACTION
ASTM:D-1557

AGI

A.G.I. GEOTECHNICAL, INC.

MAXIMUM DENSITY CURVE



PROJECT NO. 30-5468-00 **BORING NO.** B-9 **DEPTH (FT)** 0-5

REPRESENTATIVE FOR Alluvium

SOIL TYPE AND DESCRIPTION Silty SAND (SM), (E.I. = 2, Very Low)

MAXIMUM DRY DENSITY (LBS/CU FT) 135.5

OPTIMUM MOISTURE CONTENT (% OF DRY WEIGHT) 8.0

METHOD OF COMPACTION
ASTM:D-1557

AGI

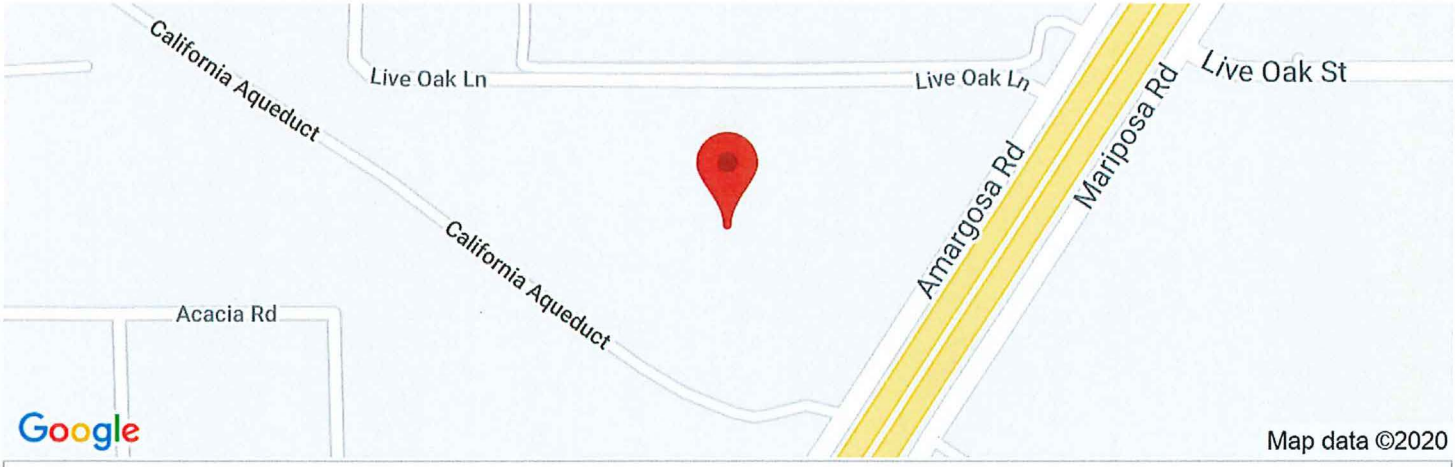
A.G.I. GEOTECHNICAL, INC.

U.S. SEISMIC DESIGN MAPS

A.G.I. GEOTECHNICAL, INC.

Amargosa Rd. & Live Oak Ln., Hesperia

Latitude, Longitude: 34.43279482, -117.37832187



Date	2/25/2020, 12:10:00 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.487	MCE_R ground motion. (for 0.2 second period)
S_1	0.577	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.487	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.992	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.55	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.487	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.604	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.577	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.637	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.927	Mapped value of the risk coefficient at short periods
C_{R1}	0.906	Mapped value of the risk coefficient at a period of 1 s

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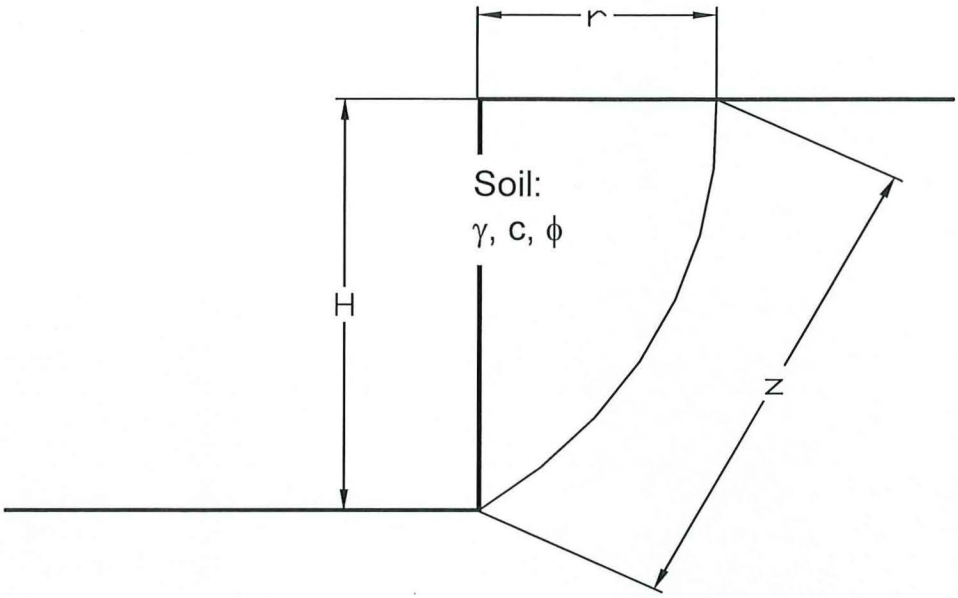
SLOT CUT STABILITY ANALYSIS

A.G.I. GEOTECHNICAL, INC.

SLOT CUT STABILITY ANALYSIS



Description	Value
Unit Weight, γ (pcf)	130.0
Friction, ϕ (deg)	31.0
Cohesion, c (psf)	159.0

Cut Height, H (ft)	5.0
Failure Radius, r (ft)	4.0
Failure Width, B = 2r (ft)	8.0

Volume, $V = \pi r^2 H / 4$ (ft^3)	63
Weight, $W = V\gamma$ (lb)	8,190
Surcharge, Q (lb)	1,000
Weight+Surcharge, W + Q, (lb)	9,190

Surface Area, $A = 0.5236r((r^2+4H^2)^{3/2} - r^3)$ (ft^2)	50
Driving Force, $F_D = WH / (r^2+H^2)^{1/2}$ (lb)	7,176
Normal Force, $F_N = Wr / (r^2+H^2)^{1/2}$ (lb)	5,741
Frictional Resistance, $R_F = F_N \tan\phi$ (lb)	3,450
Cohesive Resistance, $R_C = A\ c$ (lb)	7,950
Total Resistance, $R = R_F + R_C$ (lb)	11,400
Factor of Safety, $FS = R / F_D$	1.59

A.G.I. GEOTECHNICAL, INC.

Project No.: 30-5468-00	Date: 2/24/2020
Calc. By: WFB	
Proj Name: Amargosa Rd. & Live Oak Ln.	

PERCOLATION TESTING RESULTS

Proposed On-Site Stormwater Infiltration System for a
Proposed Warehouse/Distribution Center
APN 0405-062-51
Amargosa Road & Live Oak Lane
Hesperia, California

March 23, 2020
Project No. 30-5468-01

Prepared for:

55555 Amargosa Rd., LLC
Attn: Mr. Jason Green
5901 S. Eastern Ave.
Commerce, CA 90040

A.G.I. GEOTECHNICAL, INC.

A. G. I. GEOTECHNICAL, INC.
16555 Sherman Way, Suite A - Van Nuys, CA 91406 - Office: (818) 785-5244 - Facsimile: (818) 785-6251

March 23, 2020 Project No. 30-5468-01

55555 Amargosa Rd., LLC
5901 S. Eastern Ave.
Commerce, CA 90040

Attention: Mr. Jason Green

Subject: **PERCOLATION TESTING RESULTS**
Proposed On-Site Stormwater Infiltration System for a
Proposed Warehouse/Distribution Center
APN: 0405-062-51
Amargosa Road & Live Oak Lane
Hesperia, California

Reference: **SOILS ENGINEERING INVESTIGATION**
Proposed Warehouse/Distribution Center
APN: 0405-062-51
Amargosa Road & Live Oak Lane
Hesperia, California
Prepared by A.G.I. Geotechnical, Inc., Project No. 30-5468-00
dated February 24, 2020

Dear Mr. Green:

Pursuant to your request, A.G.I. Geotechnical, Inc. has completed percolation testing at the subject site for a proposed on-site stormwater infiltration system. This report has been prepared to present the findings of our investigation and to provide you with our preliminary geotechnical recommendations for the planned stormwater infiltration. If you have any questions regarding the information contained in this report, please feel free to call this office. *Determination of the presence or not of hazardous or toxic materials in the on-site soils or within the subject property is beyond the scope of this investigation.*

Sincerely,
A.G.I. GEOTECHNICAL, INC.

Juan A. Vidal, R.G.E. 861
Principal Engineer

JAV:wb

Distribution: (4) 55555 Amargosa Rd., LLC

Enclosures: Site Plan, Figure 1
Boring Logs (From Soils Engineering Investigation report dated February 24, 2020)
Percolation Test Data Sheets

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INTRODUCTION

BACKGROUND

The site was previously investigated for a proposed warehouse/distribution center (See Referenced Soils Engineering Investigation Report dated February 24, 2020). It is understood that a drywell infiltration system is currently proposed for an on-site stormwater infiltration system at the subject site.

SITE DESCRIPTION

The subject site is located on the northwest side of Amargosa Road, between Live Oak Lane and the California Aqueduct, in the City of Hesperia, California. The subject property is practically level, is presently vacant, and is bound on the north by a developed property. The location of the site is shown on the enclosed Location Map, Figure 1.

PROPOSED INFILTRATION DRY WELL

The purpose of this report is to provide a soil infiltration rate so that the client can evaluate the feasibility and design of a stormwater infiltration drywell system. Four additional borings were drilled to a maximum depth of 25 feet on March 13, 2020 to conduct percolation testing. Locations of the additional borings (as well as the borings drilled on January 30, 2020) are shown on the Site Plan, Figure 1. Percolation testing was performed in accordance with the Boring Percolation Test Procedure per the County of San Bernardino "Technical Guidance Documents for Water Quality Management Plans (WQMP)". Design infiltration rates of 0.06, 0.07, 0.1, and 0.1 minutes per inch were determined for borings P-1, P-2, P-3, and P-4 respectively.

Based on the preliminary information provided to us, we understand that multiple infiltration drywells are considered to discharge "first" stormwater runoff into the subsurface which apparently reduces surface runoff and/or contributes to the recharge of groundwater. The actual or final infiltration drywell system (Designed by your civil engineer) must comply with minimum setback requirements and shall contain an overflow drain that conducts overall drainage to the street, an approved location, and/or per the regulatory government agency. We recommend that the proposed infiltration dry well(s) be sealed or capped at a minimum depth of ten feet below floor slab.

Provided minimum setback is followed, the proposed stormwater infiltration system is not anticipated to saturate the foundation bearing soils adjacent to existing or neighboring structures and is not anticipated to contribute to the effects of hydro-consolidation or expansive soils. Resulting settlements from stormwater infiltration are anticipated to less than ¼ inch and are not expected to affect any existing or proposed structures. Based on our investigation, the potential for groundwater mounding or perched groundwater, liquefaction, lateral spreading, slope instability, effects of expansion soils, etc. as a result of the proposed stormwater infiltration are anticipated to be low.

The site is **not** located in a State-Defined Liquefaction Hazard Zone. No groundwater was encountered in our exploratory borings excavated on March 13, 2020 to a maximum depth of 25 feet below existing ground level or the nine previous borings excavated on January 31, 2020 to a maximum depth of 41.5 feet below existing ground level.

The proposed infiltration drywell location should be reviewed and approved by this office. Provided that the proposed infiltration pit complies with minimum setback requirements, use of an infiltration pit at the subject site is acceptable from a geotechnical standpoint. Sustained long-term use of the stormwater infiltration system is not expected to adversely affect the site or adjacent site stability.

SCOPE OF WORK & FIELD EXPLORATION

We completed the following tasks to reach the opinions, findings and/or recommendations presented in this report.

- We researched available geologic, topographic, and seismic hazard maps relevant to the subject site.
- We excavated, logged, and sampled four exploratory, truck-mounted 8-inch diameter hollow-stem augers boring to a maximum depth of 25 feet below grade in the general areas of the proposed stormwater infiltration systems. Percolation testing was performed in Boring P-1 thru P-4. The locations of our percolation test borings are shown on the Site Plan, Figure 1.
- Preparation of this report.

SUBSURFACE CONDITIONS

SOIL PROFILE

No artificial fill was encountered in the exploratory borings. The natural soil profile, as depicted in the borings to the depth explored, consists of light brown silty sand and well graded sand with silt. In general, the alluvium is dense to very dense and damp. For a more detailed description of the soils encountered in the exploratory borings, please refer to the Boring Logs enclosed in this report.

EXCAVATION CHARACTERISTICS

Alluvium was observed to be damp and dense to very dense. Localized caving should be expected while installing the proposed infiltration drywell(s). We recommend that an experienced driller be consulted and utilized to install the proposed infiltration pit due to caving in the highly granular alluvial soils.

GROUNDWATER

No groundwater or seepage was encountered in the exploratory borings to a maximum depth explored, 25 feet below the existing ground surface on March 13, 2020, nor in our previous exploratory borings excavated to a maximum depth of 41.5 feet on January 31, 2020. It should be noted that local fluctuations in groundwater levels may occur due to seasonal variations, rainfall, irrigation, sewage disposal, and water line leaks.

CONCLUSIONS AND RECOMMENDATIONS

Based on our investigation, it is our conclusion that current geotechnical conditions at the site are suitable for the proposed stormwater infiltration system in accordance with current County of San Bernardino requirements, provided our recommendations are incorporated into the development plans.

PERCOLATION TESTING

Upon completion of drilling for the percolation test borings, a 3-inch diameter perforated PVC pipe, covered with a filter fabric sock, was inserted into the holes. Following removal of the augers, the borings were pre-soaked to a depth of four feet below the existing ground surface (measured from a fixed reference point).

Percolation testing was performed on March 13, 2020. To perform the tests, each boring was filled with water to a depth of approximately 48 inches below the existing ground surface. After the initial measurement, water was allowed to drain for a period of 25 minutes before being measured. This procedure was then repeated. The hole was refilled between each test interval. Measurements showed that more than six inches of water drained within both 25-minute test intervals, thereby meeting the criteria for the sandy soil percolation testing procedure.

In accordance with the sandy soil criteria, the percolation test was conducted for an additional hour with measurements taken every ten minutes. The water level was refilled between each test increment. Measurements were taken with a precision of 0.25 inch from a fixed reference point at the top of the hole and recorded. Test data and calculated percolation rates are shown on the Percolation Test Data Sheets.

The percolation rate for the last 10-minute test interval reading was 0.06, 0.07, 0.1, and 0.1 for borings P-1, P-2, P-3, and P-4 respectively. No factor of safety was applied.

PLAN REVIEW

When infiltration system design, foundation and/or final development plans become available, they should be forwarded to our office for review.

REGULATORY AGENCY REVIEW AND ADDITIONAL CONSULTING

All geotechnical and/or engineering geologic aspects of the proposed development are subject to review and approval by the government reviewing agency. It should be understood that the government reviewing agency may approve or deny any portion of the proposed development which may require additional geotechnical services by this office. Additional geotechnical services may include review responses, supplemental letters, plan reviews, construction/site observations, meetings, etc. The fees for generating additional reports, letters, exploration, analyses, etc. will be billed on a time and material basis.

COMMENTS

The investigation findings and recommendations presented in this report are based on research, site observations, and limited subsurface information. The investigation findings and recommendations presented are based on the supposition that subsurface conditions do not vary significantly from those indicated. Although no significant variations in subsurface conditions are anticipated, the possibility of significant variations cannot be ruled out. If such conditions are encountered, this consultant should be contacted immediately to consider the need for modification of this project.

This report is subject to review by regulatory agencies and these agencies may require their approval before the project can proceed. No guarantee that the regulatory public agency or agencies will approve the project is intended, expressed or implied.

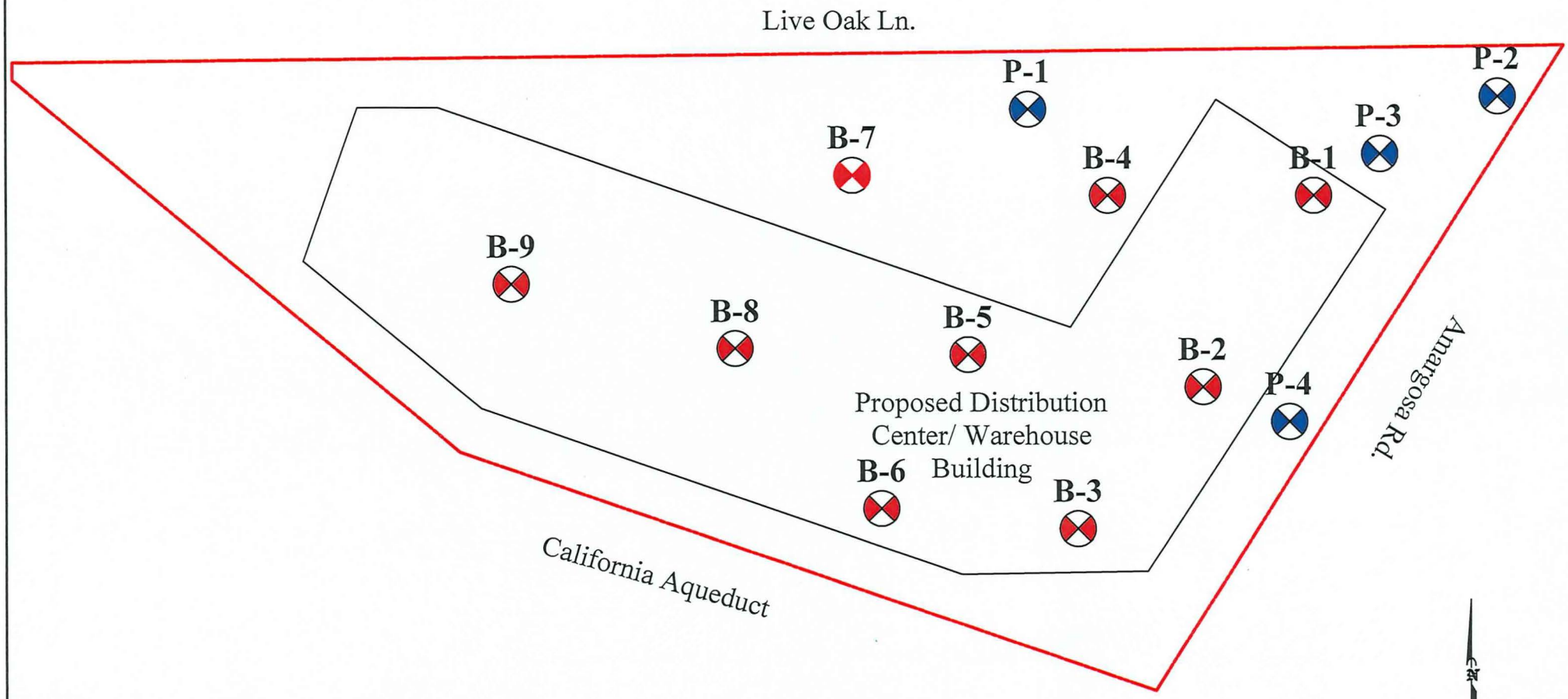
One of the purposes of this report is to provide the client with advice regarding geotechnical conditions on the site. It is important to recognize that other consultants could arrive at different conclusions and recommendations. No warranties of future site performance are intended, expressed or implied.

We trust that the foregoing information currently fulfills your requirements. If you have any questions regarding this report, or if we may be of any further service to you, please do not hesitate to contact us.

REFERENCES

California Geological Survey, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117A, 108 p.

San Bernardino County Stormwater Program "Technical Guidance Document for Water Quality Management Plans (WQMP)"; dated July 28, 2011.



EXPLANATION

B-1 Approximate Location of Exploratory Boring

P-1 Approximate Location of Exploratory Boring

Scale 1/16" = 1'-0"

FIGURE 1

A.G.I. GEOTECHNICAL, INC.
Engineering Geology • Geotechnical Engineering
16555 Sherman Way, Ste. A • Van Nuys, CA 91406
(818) 785-5244 • Fax (818) 785-6251

SITE PLAN

Amargosa Rd. & Live Oak Ln., Hesperia

PROJECT NO.	30-5468-01
DATE	03-2020
PREPARED BY	WFB
APPROVED BY	JAV

BORING LOGS

LEGEND


Ring Sample, or Bulk Sample


Standard Penetration Test (SPT)


Ground Water Level

SOIL SIZE	
COMPONENT	SIZE RANGE
Boulders	Above 12"
Cobbles	3"-12"
Gravel	#4 - 3"
coarse	¾" - 3"
fine	#4 - ¾"
Sand	#200-#4
coarse	#10-#4
medium	#40-#10
fine	#200-#40
Fines (Silt or Clays)	Below #200

PLASTICITY OF FINE GRAINED SOILS	
PLASTICITY INDEX	VOLUME CHANGE POTENTIAL
0-15	Probably Low
15-30	Probably Moderate
30 or more	Probably High

WATER CONTENT
Dry: No feel of moisture
Damp: Much less than normal moisture
Moist: Normal moisture
Wet: Much greater than normal moisture
Saturated: At or near saturation

RELATIVE DENSITY	
SANDS & GRAVELS	BLOWS PER FOOT
Very loose	0-4
Loose	4-10
Medium dense	10-30
Dense	30-50
Very dense	Over 50

	GROUP SYMBOLS	DESCRIPTIONS	DIVISIONS
COARSE-GRAINED SOILS (Less than 50% Fines)	GW	Well-graded gravels or gravel-sand mixtures, less than 5% fines	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
	GP	Poorly-graded gravels or gravel-sand mixtures, less than 5% fines	
	GM	Silty gravels, gravel-sand silt mixtures, more than 12% fines	
	GC	Clayey gravels, gravel-sand-clay mixtures, more than 12% fines	
	SW	Well-graded sands or gravelly sands, less than 5% fines	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
	SP	Poorly-graded sands or gravelly sands, less than 5% fines	
	SM	Silty sands, sand-silt mixtures, more than 12% fines	
	SC	Clayey sands, sand-clay mixtures, more than 12% fines	
FINE-GRAINED SOILS (More than 50% Fines	ML	Inorganic silt, very fine sands, rock flour, silty or clayey fine sands	SILTS AND CLAYS Liquid limit less than 50
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
	OL	Organic silts or organic silt-clays of low plasticity	
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	SILTS AND CLAYS Liquid limit less than 50
	CH	Inorganic clays of high plasticity, fat clays	
	OH	Organic clays of medium to high plasticity	
	PT	Peat, mulch, and other highly organic soils	HIGHLY ORGANIC SOILS

CONSISTENCY	
CLAYS & SILTS	BLOWS PER FOOT
Very soft	0-2
Soft	2-4
Firm	4-8
Stiff	8-15
Very stiff	15-30
Hard	Over 30

A.G.I. GEOTECHNICAL, INC.
Engineering Geology • Geotechnical Engineering

BORING NUMBER B-1

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	X	48/$\frac{50}{4"}$	X	8.3	125	136				Alluvium Brown Silty SAND (Slightly moist, very dense)			SM
5	X	19/28/41		1.6	124	126				Light brown Silty SAND (Damp, dense)			SM
10	X	26/28/45		2.2	114	116							
15	X	26/28/32		1.3	112	114							
20	X	19/28/37		1.7	121	123				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	21/46/49		1.4	121	122							
30	X	32/40/$\frac{50}{2"}$		3.6	117	122				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-2

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D50	Classification
0													
	X	11/22/$\frac{50}{5"}$		11.2	129	144				Alluvium Brown Silty SAND (Slightly moist, very dense)			SM
5	X	$\frac{50}{5"}$		3.7	124	129				Light brown Silty SAND (Damp, very dense to dense)			SM
10	X	18/21/26		4.1	119	124							
15	X	23/31/50		2.1	113	116							
20	X	29/$\frac{50}{6"}$		1.8	111	113				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	28/43/$\frac{50}{5"}$		2.0	127	129							
30	X	11/26/50		4.1	117	121				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-3

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	X	10/21/$\frac{50}{5"}$	X	5.9	130	138				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	22/33/41		4.9	128	135				Light brown Silty SAND (Damp, dense to very dense)			SM
10	X	25/32/38		3.1	119	123							
15	X	33/34/$\frac{50}{3"}$		2.2	118	120							
20	X	37/48/$\frac{50}{3"}$		1.8	115	117				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	28/42/$\frac{50}{2"}$		1.9	119	121							
30	X	22/48/$\frac{50}{2"}$		4.3	119	124				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-4

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0													
	X	7/32/$\frac{50}{4"}$		3.0	121	125				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	38/$\frac{50}{4"}$		3.9	116	120				Light brown Silty SAND (Damp, dense to very dense)			SM
10	X	19/20/31		3.7	121	125							
15	X	11/30/$\frac{50}{2"}$		2.1	115	118							
20	X	17/$\frac{50}{6"}$		1.9	119	121				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense to dense)			SW - SM
25	X	16/21/36		2.8	126	130							
30	X	20/21/46		2.1	116	119				Brown Well-graded SAND with Silt (Damp, dense)			SW - SM

A.G.I. GEOTECHNICAL, INC.
A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center
PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia
DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"
EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A
DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop
LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
35	X	18/36/$\frac{50}{5"}$		1.8	119	122				Light brown Poorly-graded SAND with Silt & Gravel (Damp, dense)			SP - SM
40	X	38/$\frac{50}{6"}$		1.8	116	118							
45										Total Depth: 41.5' No Water			
50													
55													
60													
65													

BORING NUMBER B-5

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0													
	☒	8/10/20	☒	4.7	121	127				Alluvium Brown Silty SAND (Damp, medium dense)			SM
5	☒	19/31/40		4.6	127	133				Light brown Silty SAND (Damp, dense to very dense)			SM
10	☒	15/25/46		2.5	123	126							
15	☒	16/29/50/5"		2.0	120	123							
20	☒	9/21/36		1.8	120	122				Light brown Well-graded SAND with Silt & Gravel (Damp, dense)			SW - SM
25	☒	20/27/50		4.0	115	120							
30	☒	20/49/50/4"		2.3	124	126				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-6

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0													
	X	15/$\frac{50}{6"}$		6.7	132	141				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	30/$\frac{50}{5"}$		4.5	126	132				Light brown Silty SAND (Damp, very dense)			SM
10	X	28/38/36		2.4	124	127							
15	X	19/26/$\frac{50}{5"}$		1.7	118	120							
20	X	34/36/$\frac{50}{4"}$		2.4	110	113				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	18/35/$\frac{50}{5"}$		2.6	117	120							
30	X	$\frac{50}{6"}$		2.5	105	108				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-7

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D50	Classification
0										Alluvium Brown Silty SAND (Damp, very dense)			SM
	X	18/5"		7.2	136	146							
5													
	X	18/30/5"		3.9	128	133				Light brown Silty SAND (Damp, very dense)			SM
10	X	22/38/50		2.2	124	127							
15	X	31/36/50		2.0	121	124							
20	X	22/34/45		1.5	124	126				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	20/40/4"		4.4	126	132							
30	X	26/6"		2.2	118	121				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-8

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0										Alluvium Brown Silty SAND (Damp, very dense)			SM
	X	44/49/$\frac{50}{4"}$		3.7	127	132							
5	X	45/32/46		2.8	125	128				Light brown Silty SAND (Damp, dense to very dense)			SM
10	X	25/28/40		7.1	114	122							
15	X	20/30/$\frac{50}{6"}$		2.0	121	123							
20	X	34/38/50		2.0	116	119				Light brown Well-graded SAND with Silt & Gravel (Damp, very dense)			SW - SM
25	X	21/40/50		1.2	125	127							
30	X	24/$\frac{50}{5"}$		2.3	121	123				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

BORING NUMBER B-9

A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: 55555 Amargosa Rd., LLC PROJECT NAME: Proposed Warehouse/ Distribution Center

PROJECT NUMBER: 30-5468-00 PROJECT LOCATION: Amargosa Rd. & Live Oak Ln., Hesperia

DATE STARTED: 01/30/2020 COMPLETED: 01/31/2020 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: N/A

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

LOGGED BY: CWL CHECKED BY: JAV

DEPTH (ft)	DRIVE SAMPLE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0													
	X	24/4"	X	5.6	121	127				Alluvium Brown Silty SAND (Damp, very dense)			SM
5	X	30/4"		4.3	122	128				Light brown Silty SAND (Damp, very dense to dense)			SM
10	X	17/22/30		3.4	128	133							
15	X	12/24/28		4.4	116	121							
20	X	16/32/40		1.3	118	119				Light brown Well-graded SAND with Silt & Gravel (Damp, dense to very dense)			SW - SM
25	X	24/5"		3.4	118	122							
30	X	49/5"		3.5	116	120				Brown Well-graded SAND with Silt (Damp, very dense)			SW - SM
										Total Depth: 31.5' No Water			

PERCOLATION TEST DATA SHEETS

PERCOLATION TEST DATA SHEET

Project	Amargosa Rd. & Live Oak Ln., Hesperia	Project No.:	30-5468-01	Date	3/13/2020
Test Hole No.:	P-1	Tested By:	A.G.I. Geotechnical		
Depth of Test Hole:	25'	USCS Soil Classification		SM-SW	
Test Hole Dimentions (inches)				Length	Width
Diameter {if round}	8"	Sides {if Rectangular}		N/A	N/A

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Greater Than or Equal to 6"? (Y/N)
1	10:55 a.m.	11:20 a.m.	25	48	291.0	243.0	Y
2	12:15 p.m.	12:40 p.m.	25	48	255.8	207.8	Y

***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. Obtain at least twelve measurements per hole over at least six hours {approximately 30 minutes intervals} with a precision of at least 0.25".**

Percolation Rate: 952.3 in/hr.
Infiltration Rate: 10.95 in/hr.

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Percolation Rate (min./in.)
1	12:41 p.m.	12:57 p.m.	10	48	204.0	156.0	0.064
2	12:53 p.m.	1:03 p.m.	10	48	205.2	157.2	0.064
3	1:06 p.m.	1:16 p.m.	10	48	205.8	157.8	0.063
4	1:18 p.m.	1:28 p.m.	10	48	206.8	158.8	0.063
5	1:30 p.m.	1:40 p.m.	10	48	205.7	157.7	0.063
6	1:42 p.m.	1:52 p.m.	10	48	207.2	159.2	0.063
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

A.G.I. GEOTECHNICAL, INC.

Project No.:	30-5468-01	Date: 03/19/2020
Calc. By:	WFB	
Proj Name:	Amargosa Rd. & Live Oak Ln.	

PERCOLATION TEST DATA SHEET

Project	Amargosa Rd. & Live Oak Ln., Hesperia	Project No.:	30-5468-01	Date	3/13/2020
Test Hole No.:	P-2	Tested By:	A.G.I. Geotechnical		
Depth of Test Hole:	25'	USCS Soil Classification		SM-SW	
Test Hole Dimentions (inches)				Length	Width
Diameter {if round}	8"	Sides {if Rectangular}		N/A	N/A

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Greater Than or Equal to 6"? (Y/N)
1	11:00 a.m.	11:25 a.m.	25	48	252.0	204.0	Y
2	12:20 p.m.	12:45 p.m.	25	48	261.6	213.6	Y

***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. Obtain at least twelve measurements per hole over at least six hours {approximately 30 minutes intervals} with a precision of at least 0.25".**

Infiltration Rate: 855.0 in/hr

Percolation Rate: 869.6 in/hr

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Percolation Rate (min./in.)
1	2:00 p.m.	2:10 p.m.	10	48	192.1	144.1	0.069
2	2:12 p.m.	2:22 p.m.	10	48	192.6	144.6	0.069
3	2:24 p.m.	2:34 p.m.	10	48	192.2	144.2	0.069
4	2:36 p.m.	2:46 p.m.	10	48	193.3	145.3	0.069
5	2:48 p.m.	2:58 p.m.	10	48	194.8	146.8	0.068
6	3:00 p.m.	3:10 p.m.	10	48	193.0	145.0	0.069
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

A.G.I. GEOTECHNICAL, INC.

Project No.:	30-5468-01	Date: 03/19/2020
Calc. By:	WFB	
Proj Name:	Amargosa Rd. & Live Oak Ln.	

PERCOLATION TEST DATA SHEET

Project	Amargosa Rd. & Live Oak Ln., Hesperia	Project No.:	30-5468-01	Date	3/13/2020
Test Hole No.:	P-3	Tested By:	A.G.I. Geotechnical		
Depth of Test Hole:	20'	USCS Soil Classification		SM	
Test Hole Dimentions (inches)				Length	Width
Diameter {if round}	8"	Sides {if Rectangular}		N/A	N/A

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Greater Than or Equal to 6"? (Y/N)
1	11:05 a.m.	11:30 a.m.	25	48	232.8	184.8	Y
2	12:25 p.m.	12:50 p.m.	25	48	230.5	182.5	Y

***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. Obtain at least twelve measurements per hole over at least six hours {approximately 30 minutes intervals} with a precision of at least 0.25".**

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Percolation Rate (min./in.)
1	3:15 p.m.	3:25 p.m.	10	48	150.5	102.5	0.098
2	3:27 p.m.	3:37 p.m.	10	48	148.7	100.7	0.099
3	3:39 p.m.	3:49 p.m.	10	48	149.6	101.6	0.098
4	3:51 p.m.	4:01 p.m.	10	48	149.9	101.9	0.098
5	4:03 p.m.	4:13 p.m.	10	48	151.0	103.0	0.097
6	4:15 p.m.	4:25 p.m.	10	48	148.3	100.3	0.100
7							
8							
9							
10							
11							
12							
13							
14							
15							

Infiltration Rate: 6.37 in/hr

Percolation Rate: 612.2 in/hr

Comments:

A.G.I. GEOTECHNICAL, INC.

Project No.:	30-5468-01	Date: 03/19/2020
Calc. By:	WFB	
Proj Name:	Amargosa Rd. & Live Oak Ln.	

PERCOLATION TEST DATA SHEET

Project	Amargosa Rd. & Live Oak Ln., Hesperia	Project No.:	30-5468-01	Date	3/13/2020
Test Hole No.:	P-4	Tested By:	A.G.I. Geotechnical		
Depth of Test Hole:	20'	USCS Soil Classification		SM	
Test Hole Dimentions (inches)				Length	Width
Diameter {if round}	8"	Sides {if Rectangular}		N/A	N/A

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Greater Than or Equal to 6"? (Y/N)
1	11:45 a.m.	12:10 p.m.	25	48	227.2	179.2	Y
2	12:30 p.m.	12:55 p.m.	25	48	225.0	177.0	Y

***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. Obtain at least twelve measurements per hole over at least six hours {approximately 30 minutes intervals} with a precision of at least 0.25".**

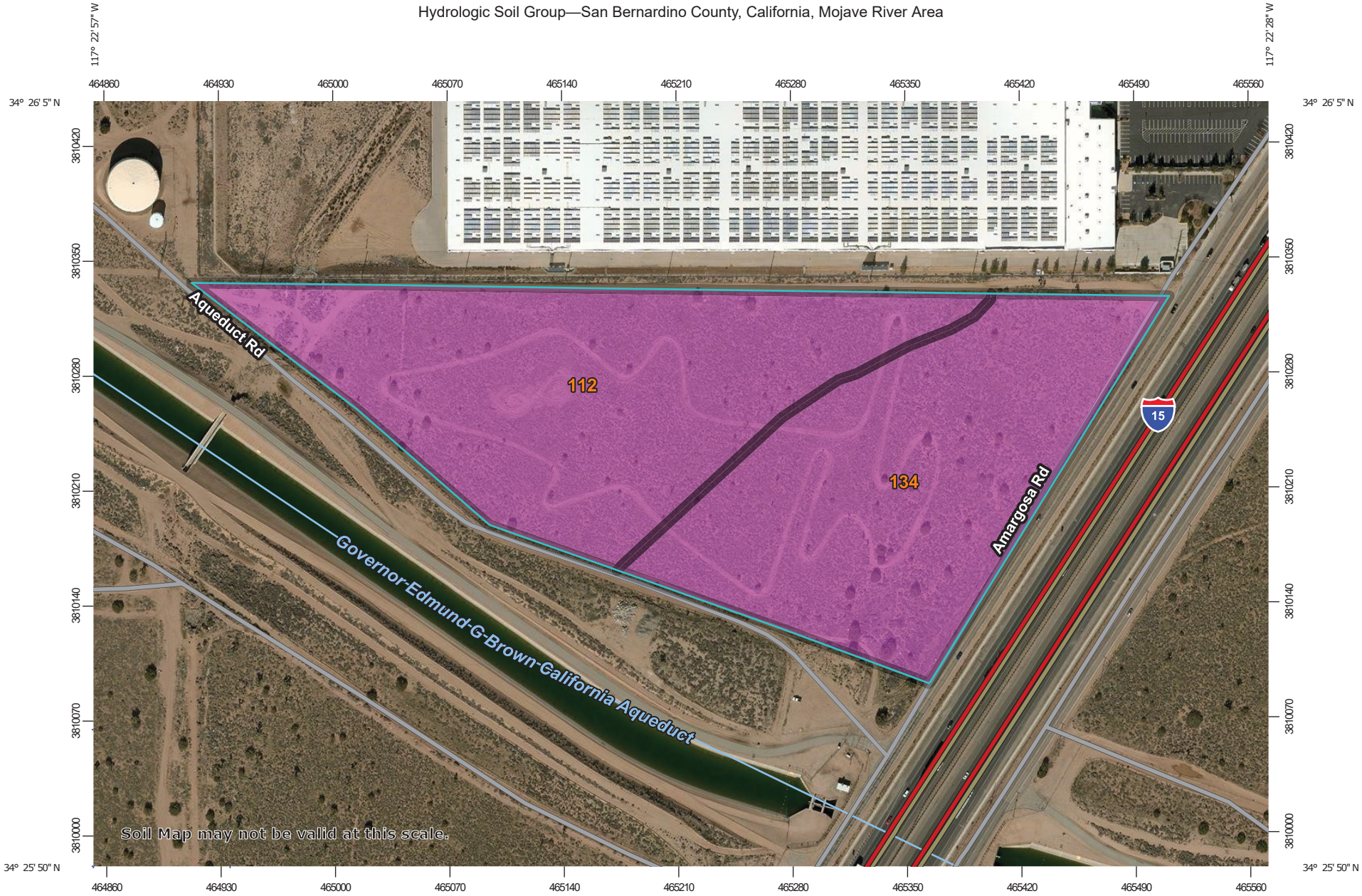
Infiltration Rate: 8.33 in/hr. Percolation Rate: 606.1 in/hr.

Trial No.	Start Time	Stop Time	Time Intrval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in)	Change in Water Level (in.)	Percolation Rate (min./in.)
1	4:30 p.m.	4:40 p.m.	10	48	154.4	106.4	0.094
2	4:42 p.m.	4:52 p.m.	10	48	149.4	101.4	0.099
3	4:54 p.m.	5:04 p.m.	10	48	148.7	100.7	0.099
4	5:06 p.m.	5:16 p.m.	10	48	148.9	100.9	0.099
5	5:18 p.m.	5:28 p.m.	10	48	147.2	99.2	0.101
6	5:30 p.m.	5:40 p.m.	10	48	148.0	100.0	0.100
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

A.G.I. GEOTECHNICAL, INC.

Project No.:	30-5468-01	Date: 03/19/2020
Calc. By:	WFB	
Proj Name:	Amargosa Rd. & Live Oak Ln.	



Map Scale: 1:3,290 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 11, Sep 17, 2019

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

Date(s) aerial images were photographed: Feb 1, 2015—Feb 4, 2015

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	A	10.6	52.5%
134	HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	A	9.6	47.5%
Totals for Area of Interest			**20.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix F: Education Material

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Site Design & Landscape Planning SD-10

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

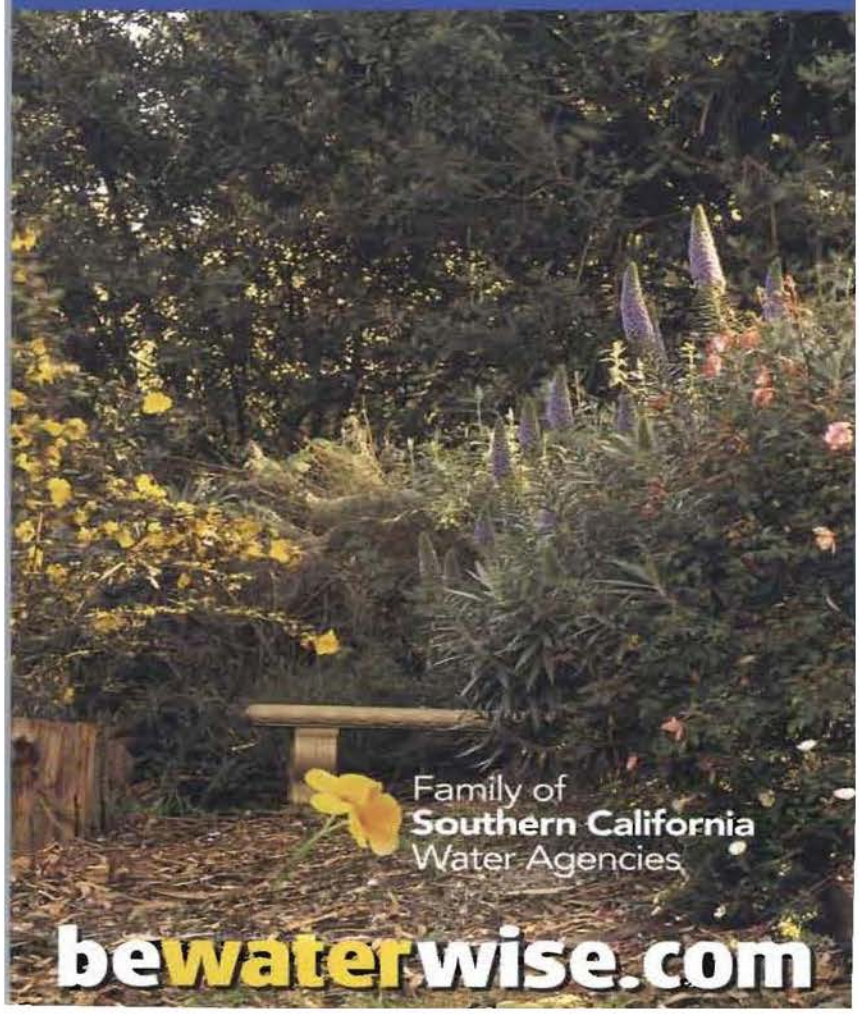
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

10 Ways to Save Water Outdoors



Helpful telephone numbers and links:

WATER AGENCY LIST in Riverside County

City of Banning	(951) 922-3130
City of Beaumont	(951) 769-8520
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
Coachella Valley Water District	(760) 398-2651
City of Corona	(951) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley MWD	(951) 674-3146
Farm Mutual Water Company	(951) 244-4198
City of Hemet	(951) 765-3712
Idyllwild Water District	(951) 659-2143
Jurupa Community Services District	(951) 360-8795
Lake Hemet MWD	(951) 658-3241
Lee Lake Water District	(951) 277-1414
March Air Force Base	(951) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8253
Rancho Caballero	(951) 780-9272
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
City of Riverside	(951) 351-6170
Rubidoux Services District	(951) 684-7580
Silent Valley Club, Inc	(951) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or online at
www.rcflood.org

Online resources include:

- Riverside County Flood Control and Water Conservation District **www.rcflood.org**
- California Storm Water Quality Association **www.casqa.org**
- State Water Resources Control Board **www.swrcb.ca.gov/**
- Power Washers of North America **www.thepwna.org**

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES AND PROFESSIONAL MOBILE SERVICE PROVIDERS

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

Do you know where street flows actually go?

Storm Drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry rain water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills**.** Only emergency **Mechanical** repairs should be done in City streets and use drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Always prevent runoff water from entering storm drains.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or nearest body of water is ***PROHIBITED*** by law and can bring about stiff penalties.

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. *Each of us* can do our part to keep storm water clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose *small amounts* of power washing waste water to landscaped, gravel or unpaved surfaces.

Do...check with your local sanitary sewer agency's policies on wash water disposal regulations. (See list on reverse side).

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal,
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them for being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a *high-pressure washer* or *steam cleaner*, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks.

Screening Wash Water

A thorough dry cleanup before washing exterior surfaces, such as buildings and decks *without loose paint*, sidewalks, or plaza areas should be sufficient to protect receiving waters. Keep debris from entering the storm drain after cleaning by first passing the wash water first through a "20 mesh" or finer screen to catch the solid materials, then disposing the mesh in a refuse container.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or rubber mats.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Equipment and Supplies

For special materials, equipment and supplies:

- New Pig — (800) 468-4647
- Lab Safety Supply — (800) 356-0783
- C&H — (800) 558-90966
- W.W. Grainger — (800) 994-9174
- Cleaning Equipment Trade Association — (800) 441-0111

After the Storm

A Citizen's Guide to Understanding Stormwater

EPA 833-B-03-002

January 2003

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

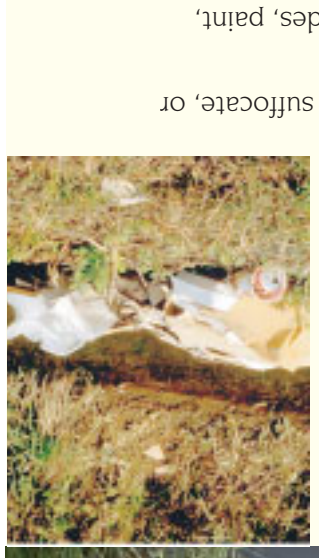
Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

Why is stormwater runoff a problem?

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.



Stormwater Pollution Solutions

Residential

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

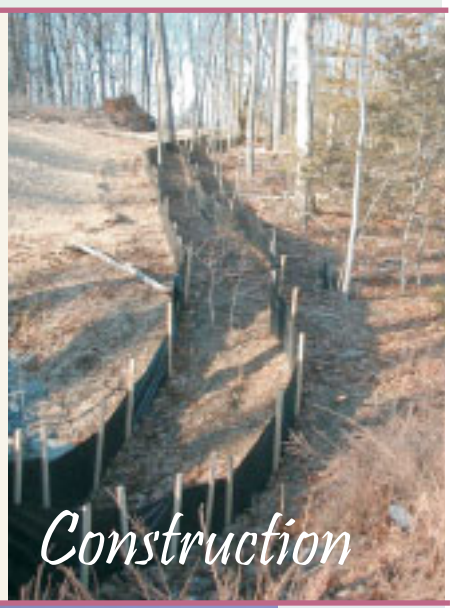
Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



Agriculture

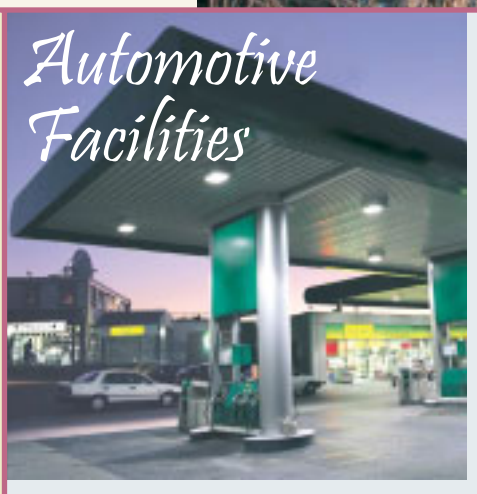
Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.



Automotive Facilities

Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Landscaping and garden maintenance activities can be major contributors to water pollution. Soils, yard wastes, over-watering and garden chemicals become part of the urban runoff mix that winds its way through streets, gutters and storm drains before entering lakes, rivers, streams, etc. Urban runoff pollution contaminates water and harms aquatic life!

In Riverside County, report illegal discharges into the storm drain, call
1-800-506-2555
"Only Rain Down the Storm Drain"

Important Links:

Riverside County Household Hazardous Waste Collection Information
1-800-304-2226 or www.rivcowm.org

Riverside County Backyard Composting Program
1-800-366-SAVE

Integrated Pest Management (IPM) Solutions
www.ipm.ucdavis.edu

California Master Gardener Programs
www.mastergardeners.org
www.camastergardeners.ucdavis.edu

California Native Plant Society
www.cnps.org

The Riverside County "Only Rain Down the Storm Drain" Pollution Prevention Program gratefully acknowledges Orange County's Storm Water Program for their contribution to this brochure.

...Only Rain Down ...the Storm Drain

What you should know for... Landscape and Gardening

Best Management tips for:

- Professionals
- Novices
- Landscapers
- Gardeners
- Cultivators

Tips for Landscape & Gardening

This brochure will help you to get the most of your lawn and gardening efforts and keep our waterways clean. Clean waterways provide recreation, establish thriving fish habitats, secure safe sanctuaries for wildlife, and add beauty to our communities. NEVER allow gardening products or waste water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers and pesticides applied to the landscape.
- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro-spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Consider recycling your green waste and adding "nature's own fertilizer" to your lawn or garden.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.
- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains or sewers. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting.
- Try natural long-term common sense solutions first. Integrated Pest Management (IPM) can provide landscaping guidance and solutions, such as:
  - **Physical Controls** - Try hand picking, barriers, traps or caulking holes to control weeds and pests.
  - **Biological Controls** - Use predatory insects to control harmful pests.
  - **Chemical Controls** - Check out www.ipm.ucdavis.edu before using chemicals. Remember, all chemicals should be used cautiously and in moderation.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Waste Collection Center to be recycled.
- *Dumping toxics into the street, gutter or storm drain is illegal!*

www.bewaterwise.com Great water conservation tips and drought tolerant garden designs.

www.ourwaterourworld.com Learn how to safely manage home and garden pests.

Additional information can also be found on the back of this brochure.

Outdoor Container Storage SC-31

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Accidental releases of materials from above ground liquid storage tanks, drums, and dumpsters present the potential for contaminating stormwaters with many different pollutants. Tanks may store many potential stormwater runoff pollutants, such as gasoline, aviation gas, diesel fuel, ammonia, solvents, syrups, etc. Materials spilled, leaked, or lost from storage tanks may accumulate in soils or on other surfaces and be carried away by rainfall runoff. These source controls apply to containers located outside of a building used to temporarily store liquid materials and include installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓
Oxygen Demanding	✓

Approach

Pollution Prevention

- Educate employees about pollution prevention measures and goals
- Keep an accurate, up-to-date inventory of the materials delivered and stored on-site. Re-evaluate inventory needs and consider purchasing alternative products. Properly dispose of outdated products.
- Try to keep chemicals in their original containers, and keep them well labeled.

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Suggested Protocols

General

- Develop an operations plan that describes procedures for loading and/or unloading. Refer to SC-30 Outdoor Loading/Unloading for more detailed BMP information pertaining to loading and unloading of liquids.
- Protect materials from rainfall, runon, runoff, and wind dispersal:
  - Cover the storage area with a roof.
  - Minimize stormwater runon by enclosing the area or building a berm around it.
  - Use a "doghouse" structure for storage of liquid containers.
  - Use covered dumpsters for waste product containers.
- Employ safeguards against accidental releases:
  - Provide overflow protection devices to warn operator or automatic shut down transfer pumps.
  - Provide protection guards (bollards) around tanks and piping to prevent vehicle or forklift damage, and
  - Provide clear tagging or labeling, and restricting access to valves to reduce human error.
- Berm or surround tank or container with secondary containment system using dikes, liners, vaults, or double walled tanks.
- Contact the appropriate regulatory agency regarding environmental compliance for facilities with "spill ponds" designed to intercept, treat, and/or divert spills.
- Have registered and specifically trained professional engineers can identify and correct potential problems such as loose fittings, poor welding, and improper or poorly fitted gaskets for newly installed tank systems.

Storage Areas

- Provide storage tank piping located below product level with a shut-off valve at the tank; ideally this valve should be an automatic shear valve with the shut-off located inside the tank.
- Provide barriers such as posts or guard rails, where tanks are exposed, to prevent collision damage with vehicles.
- Provide secure storage to prevent vandalism.
- Place tight-fitting lids on all containers.
- Enclose or cover the containers where they are stored.

- Raise the containers off the ground by use of pallet or similar method, with provisions for spill control and secondary containment.
- Contain the material in such a manner that if the container leaks or spills, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters or groundwater.
- Place drip pans or absorbent materials beneath all mounted container taps, and at all potential drip and spill locations during filling and unloading of containers. Drip pans must be cleaned periodically, and all collected liquids and soiled absorbent materials must be reused/recycled or properly disposed.
- Ensure that any underground or aboveground storage tanks shall be designed and managed in accordance with applicable regulations, be identified as a potential pollution source, have secondary containment, such as a berm or dike with an impervious surface.
- Rainfall collected in secondary containment system must not contain pollutants for discharge to storm drain system.

Container Management

- Keep containers in good condition without corrosion or leaky seams.
- Place containers in a lean-to structure or otherwise covered to keep rainfall from reaching the drums.
- Replace containers if they are deteriorating to the point where leakage is occurring. Keep all containers undercover to prevent the entry of stormwater. Employees should be made aware of the importance of keeping the containers free from leaks.
- Keep waste container drums in an area such as a service bay. Drums stored outside must be stored in a lean-to type structure, shed or walk-in container.

Storage of Hazardous Materials

- Storage of reactive, ignitable, or flammable liquids must comply with the fire and hazardous waste codes.
- Place containers in a designated area that is paved, free of cracks and gaps, and impervious in order to contain leaks and spills. The area should also be covered.
- Surround stored hazardous materials and waste with a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain and a dead-end sump should be installed in the drain.

Inspection

- Provide regular inspections:
  - Inspect storage areas regularly for leaks or spills.

- Conduct routine inspections and check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.

- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installations for loose fittings, poor welding, and improper or poorly fitted gaskets.

- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.

- Replace containers that are leaking, corroded, or otherwise deteriorating with ones in good condition. If the liquid chemicals are corrosive, containers made of compatible materials must be used instead of metal drums.

- Label new or secondary containers with the product name and hazards.

Training

- Train employees (e.g. fork lift operators) and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

- Train employees in proper storage measures.

- Use a training log or similar method to document training.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date, and implement accordingly.

- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.

- Collect all spilled liquids and properly dispose of them.

- Employees trained in emergency spill cleanup procedures should be present when dangerous waste, liquid chemicals, or other wastes are delivered.

- Operator errors can be prevented by using engineering safe guards and thus reducing accidental releases of pollutant.

- Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area.

- See Aboveground Tank Leak and Spill Control section of the Spill Prevention, Control & Cleanup fact sheet (SC-11) for additional information.

Other Considerations

- Storage sheds often must meet building and fire code requirements.
- The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.
- All specific standards set by federal and state laws concerning the storage of oil and hazardous materials must be met.
- Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code.
- Storage of oil and hazardous materials must meet specific federal and state standards including:
  - Spill Prevention Control and Countermeasure Plan (SPCC) Plan
  - Secondary containment
  - Integrity and leak detection monitoring
  - Emergency preparedness plans

Requirements

Costs

- Will vary depending on the size of the facility and the necessary controls, such as berms or safeguards against accidental controls.

Maintenance

- Conduct weekly inspection.
- Sweep and clean the storage area regularly if it is paved, do not hose down the area to a storm drain.

Supplemental Information

- The most common causes of unintentional releases are:
  - Installation problems,
  - Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves),
  - External corrosion and structural failure,
  - Spills and overfills due to operator error, and
  - Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Further Detail of the BMP

Dikes

One of the best protective measures against contamination of stormwater is diking. Containment dikes are berms or retaining walls that are designed to hold spills. Diking is an effective pollution prevention measure for above ground storage tanks and railcar or tank truck loading and unloading areas. The dike surrounds the area of concern and holds the spill, keeping spill materials separated from the stormwater side of the dike area. Diking can be used in any industrial or municipal facility, but it is most commonly used for controlling large spills or releases from liquid storage areas and liquid transfer areas.

- For single-wall tanks, containment dikes should be large enough to hold the contents of the storage tank for the facility plus rain water.
- For trucks, diked areas should be capable of holding an amount equal to the volume of the tank truck compartment. Diked construction material should be strong enough to safely hold spilled materials.
- Dike materials can consist of earth, concrete, synthetic materials, metal, or other impervious materials.
- Strong acids or bases may react with metal containers, concrete, and some plastics.
- Where strong acids or bases or stored, alternative dike materials should be considered. More active organic chemicals may need certain special liners for dikes.
- Dikes may also be designed with impermeable materials to increase containment capabilities.
- Dikes should be inspected during or after significant storms or spills to check for washouts or overflows.
- Regular checks of containment dikes to insure the dikes are capable of holding spills should be conducted.
- Inability of a structure to retain stormwater, dike erosion, soggy areas, or changes in vegetation indicate problems with dike structures. Damaged areas should be patched and stabilized immediately.
- Accumulated stormwater in the containment are should be analyzed for pollutants before it is released to surface waters. If pollutants are found or if stormwater quality is not determined, then methods other than discharging to surface waters should be employed (e.g., discharge to sanitary sewer if allowed).
- Earthen dikes may require special maintenance of vegetation such as mulching and irrigation.

Curbing

Curbing is a barrier that surrounds an area of concern. Curbing is similar to containment diking in the way that it prevents spills and leaks from being released into the environment. The curbing is usually small scaled and does not contain large spills like diking. Curbing is common at many facilities in small areas where handling and transfer liquid materials occur. Curbing can redirect stormwater away from the storage area. It is useful in areas where liquid materials are transferred from one container to another. Asphalt is a common material used for curbing; however, curbing materials include earth, concrete, synthetic materials, metal, or other impenetrable materials.

- Spilled materials should be removed immediately from curbed areas to allow space for future spills.
- Curbs should have manually-controlled pump systems rather than common drainage systems for collection of spilled materials.
- The curbed area should be inspected regularly to clear clogging debris.
- Maintenance should also be conducted frequently to prevent overflow of any spilled materials as curbed areas are designed only for smaller spills.
- Curbing has the following advantages:
  - Excellent runon control,
  - Inexpensive,
  - Ease of installment,
  - Provides option to recycle materials spilled in curb areas, and
  - Common industry practice.

Examples

The "doghouse" design has been used to store small liquid containers. The roof and flooring design prevent contact with direct rain or runoff. The doghouse has two solid structural walls and two canvas covered walls. The flooring is wire mesh about secondary containment. The unit has been used successfully at Lockheed Missile and Space Company in Sunnyvale.

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000
http://www.nalms.org/bclss/storage.html

King County Stormwater Pollution Control Manual –
http://dnr.metrokc.gov/wlr/dss/spcm.htm

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) - http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Outdoor Equipment Maintenance SC-32

Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, solid waste treatment and disposal, are examples of process operations that can lead to contamination of stormwater runoff. Source controls for outdoor process equipment operations and maintenance include reducing the amount of waste created, enclosing or covering all or some of the equipment, installing secondary containment, and training employees.

Approach

Pollution Prevention

- Perform the activity during dry periods.
- Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.

Suggested Protocols

- Consider enclosing the activity in a building and connecting the floor drains to the sanitary sewer.
- Cover the work area with a permanent roof.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (runon prevention). If allowed, connect process equipment area to public sewer.
- Dry clean the work area regularly.

Training

- Train employees to perform the activity during dry periods only and to use less or non-toxic materials.
- Train employee and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	

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SC-32 Outdoor Equipment Maintenance

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your spill prevention control and countermeasure (SPCC) plan up-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Space limitations may preclude enclosing some equipment.
- Storage sheds often must meet building and fire code requirements.

Requirements

Costs

- Costs vary depending on the complexity of the operation and the amount of control necessary for stormwater pollution control.
- Providing cover may be expensive.

Maintenance

- Conduct routine preventive maintenance, including checking process equipment for leaks.
- Clean the storm drain system regularly.

Supplemental Information

Further Detail of the BMP

Hydraulic/Treatment Modifications

In some cases it may be necessary to capture and treat polluted stormwater. If the municipality does not have its own process wastewater treatment system, consider discharging to the public sewer system. Use of the public sewer might be allowed under the following conditions:

- If the activity area is very small (less than a few hundred square feet), the local sewer authority may be willing to allow the area to remain uncovered with the drain connected to the public sewer.
- It may be possible under unusual circumstances to connect a much larger area to the public sewer, as long as the rate of stormwater discharges does not exceed the capacity of the wastewater treatment plant. The stormwater could be stored during the storm and then transferred to the public sewer when the normal flow is low, such as at night.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Stormwater Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Stormwater Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Spill Prevention, Control & Cleanup SC-11

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Spills and leaks, if not properly controlled, can adversely impact the storm drain system and receiving waters. Due to the type of work or the materials involved, many activities that occur either at a municipal facility or as a part of municipal field programs have the potential for accidental spills and leaks. Proper spill response planning and preparation can enable municipal employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

Targeted Constituents

Sediment	
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

- An effective spill response and control plan should include:
  - Spill/leak prevention measures;
  - Spill response procedures;
  - Spill cleanup procedures;
  - Reporting; and
  - Training
- A well thought out and implemented plan can prevent pollutants from entering the storm drainage system and can be used as a tool for training personnel to prevent and control future spills as well.

Pollution Prevention

- Develop and implement a Spill Prevention Control and Response Plan. The plan should include:

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- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
    - Assessment of the site and potential impacts
    - Containment of the material
    - Notification of the proper personnel and evacuation procedures
    - Clean up of the site
    - Disposal of the waste material and
    - Proper record keeping

- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

Suggested Protocols

Spill/Leak Prevention Measures

- If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.
- Properly label all containers so that the contents are easily identifiable.
- Berm storage areas so that if a spill or leak occurs, the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.
- Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

- Store, contain and transfer liquid materials in such a manner that if the container is ruptured or the contents spilled, they will not discharge, flow or be washed into the storm drainage system, surface waters, or groundwater.

- Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during the filling and unloading of containers. Any collected liquids or soiled absorbent materials should be reused/recycled or properly disposed of.

- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.

- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.

- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.

- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

Training

- Educate employees about spill prevention, spill response and cleanup on a routine basis.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.

- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.

- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

Spill Response and Prevention

- Identify key spill response personnel and train employees on who they are.

- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.

- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

SC-11 Spill Prevention, Control & Cleanup

- Follow the Spill Prevention Control and Countermeasure Plan if one is available.
- If a spill occurs, notify the key spill response personnel immediately. If the material is unknown or hazardous, the local fire department may also need to be contacted.
- If safe to do so, attempt to contain the material and block the nearby storm drains so that the area impacted is minimized. If the material is unknown or hazardous wait for properly trained personnel to contain the materials.
- Perform an assessment of the area where the spill occurred and the downstream area that it could impact. Relay this information to the key spill response and clean up personnel.

Spill Cleanup Procedures

- Small non-hazardous spills
  - Use a rag, damp cloth or absorbent materials for general clean up of liquids
  - Use brooms or shovels for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- Large non-hazardous spills
  - Use absorbent materials for general clean up of liquids
  - Use brooms, shovels or street sweepers for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.
- Chemical cleanups of material can be achieved with the use of absorbents, gels, and foams. Remove the adsorbent materials promptly and dispose of according to regulations.
- If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

Reporting

- Report any spills immediately to the identified key municipal spill response personnel.

- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)

- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.

- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour)

- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

Other Considerations

- A Spill Prevention Control and Countermeasure Plan (SPCC) is required for facilities that are subject to the oil pollution regulations specified in Part 112 of Title 40 of the Code of Federal Regulations or if they have a storage capacity of 10,000 gallons or more of petroleum. (Health and Safety Code 6.67)

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, if permitted to do so, prohibiting any hard connections to the storm drain.

Requirements

Costs

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of wastes, contaminated soil and water is very expensive

Maintenance

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and cleanup activities, and comply with legal requirements.

SC-11 Spill Prevention, Control & Cleanup

A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm drain.

These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Examples

The City of Palo Alto includes spill prevention and control as a major element of its highly effective program for municipal vehicle maintenance shops.

References and Resources

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Housekeeping Practices SC-60

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

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- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
http://www.nalms.org/bclss/bmphome.html#bmp

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Maintenance Bays & Docks SD-31

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.
- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.
- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.
- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.
- Other features may be comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Appendix H: References

- NOAA Precipitation
- Site Plan
- Grading Plan

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4333°, Longitude: -117.3783°
Elevation: 3464.34 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.083 (0.068-0.101)	0.118 (0.098-0.145)	0.166 (0.136-0.203)	0.204 (0.167-0.252)	0.257 (0.203-0.329)	0.299 (0.231-0.390)	0.341 (0.257-0.456)	0.385 (0.283-0.529)	0.445 (0.314-0.638)	0.493 (0.335-0.731)
10-min	0.118 (0.098-0.145)	0.170 (0.140-0.207)	0.237 (0.196-0.291)	0.293 (0.239-0.362)	0.369 (0.292-0.471)	0.428 (0.331-0.558)	0.488 (0.369-0.653)	0.552 (0.405-0.759)	0.638 (0.449-0.915)	0.706 (0.481-1.05)
15-min	0.143 (0.119-0.175)	0.205 (0.170-0.251)	0.287 (0.236-0.352)	0.354 (0.289-0.437)	0.446 (0.353-0.570)	0.517 (0.400-0.675)	0.591 (0.446-0.790)	0.667 (0.490-0.917)	0.772 (0.544-1.11)	0.854 (0.581-1.27)
30-min	0.217 (0.180-0.265)	0.311 (0.257-0.380)	0.435 (0.359-0.533)	0.537 (0.439-0.664)	0.677 (0.535-0.865)	0.785 (0.608-1.02)	0.896 (0.677-1.20)	1.01 (0.743-1.39)	1.17 (0.824-1.68)	1.30 (0.881-1.92)
60-min	0.302 (0.250-0.369)	0.433 (0.358-0.530)	0.606 (0.499-0.743)	0.747 (0.611-0.924)	0.942 (0.744-1.20)	1.09 (0.846-1.43)	1.25 (0.942-1.67)	1.41 (1.03-1.94)	1.63 (1.15-2.34)	1.80 (1.23-2.68)
2-hr	0.434 (0.359-0.530)	0.590 (0.488-0.722)	0.802 (0.661-0.983)	0.979 (0.800-1.21)	1.23 (0.971-1.57)	1.43 (1.11-1.86)	1.64 (1.24-2.19)	1.86 (1.36-2.55)	2.17 (1.53-3.11)	2.42 (1.64-3.58)
3-hr	0.548 (0.453-0.669)	0.733 (0.605-0.895)	0.985 (0.812-1.21)	1.20 (0.981-1.48)	1.51 (1.19-1.92)	1.75 (1.36-2.29)	2.01 (1.52-2.69)	2.29 (1.68-3.15)	2.69 (1.89-3.85)	3.01 (2.05-4.47)
6-hr	0.766 (0.634-0.935)	1.01 (0.838-1.24)	1.36 (1.12-1.67)	1.66 (1.35-2.05)	2.09 (1.65-2.66)	2.44 (1.89-3.18)	2.81 (2.12-3.76)	3.22 (2.37-4.43)	3.81 (2.69-5.46)	4.30 (2.93-6.38)
12-hr	0.980 (0.811-1.20)	1.34 (1.11-1.64)	1.84 (1.51-2.25)	2.27 (1.85-2.80)	2.88 (2.28-3.69)	3.39 (2.63-4.43)	3.93 (2.97-5.26)	4.53 (3.32-6.23)	5.38 (3.79-7.72)	6.09 (4.15-9.04)
24-hr	1.34 (1.19-1.54)	1.89 (1.68-2.18)	2.66 (2.35-3.08)	3.33 (2.91-3.88)	4.28 (3.63-5.16)	5.06 (4.20-6.22)	5.90 (4.78-7.43)	6.80 (5.36-8.81)	8.11 (6.13-11.0)	9.20 (6.72-12.8)
2-day	1.50 (1.33-1.72)	2.11 (1.87-2.44)	2.98 (2.63-3.44)	3.72 (3.26-4.34)	4.81 (4.08-5.80)	5.71 (4.74-7.03)	6.69 (5.42-8.42)	7.75 (6.10-10.0)	9.30 (7.03-12.6)	10.6 (7.74-14.8)
3-day	1.60 (1.42-1.84)	2.25 (1.99-2.60)	3.17 (2.80-3.66)	3.96 (3.47-4.62)	5.13 (4.35-6.18)	6.10 (5.06-7.50)	7.15 (5.79-9.01)	8.31 (6.54-10.8)	10.00 (7.56-13.5)	11.4 (8.34-15.9)
4-day	1.73 (1.53-1.99)	2.42 (2.15-2.79)	3.40 (3.00-3.93)	4.26 (3.73-4.96)	5.51 (4.67-6.63)	6.55 (5.43-8.05)	7.67 (6.22-9.67)	8.91 (7.02-11.5)	10.7 (8.11-14.5)	12.3 (8.96-17.1)
7-day	1.92 (1.70-2.21)	2.66 (2.36-3.07)	3.71 (3.28-4.29)	4.62 (4.05-5.38)	5.95 (5.04-7.16)	7.05 (5.85-8.66)	8.24 (6.67-10.4)	9.54 (7.52-12.4)	11.4 (8.65-15.4)	13.0 (9.53-18.2)
10-day	2.05 (1.82-2.36)	2.84 (2.52-3.27)	3.94 (3.48-4.55)	4.89 (4.28-5.70)	6.27 (5.31-7.55)	7.41 (6.15-9.11)	8.64 (7.00-10.9)	9.99 (7.87-12.9)	12.0 (9.04-16.1)	13.6 (9.93-19.0)
20-day	2.49 (2.21-2.87)	3.42 (3.03-3.94)	4.71 (4.16-5.44)	5.82 (5.10-6.78)	7.43 (6.30-8.95)	8.76 (7.27-10.8)	10.2 (8.25-12.8)	11.7 (9.25-15.2)	14.0 (10.6-18.9)	15.9 (11.6-22.2)
30-day	2.94 (2.60-3.38)	4.00 (3.54-4.61)	5.48 (4.84-6.33)	6.75 (5.91-7.87)	8.59 (7.28-10.3)	10.1 (8.39-12.4)	11.7 (9.50-14.8)	13.5 (10.6-17.5)	16.1 (12.2-21.7)	18.3 (13.4-25.5)
45-day	3.48 (3.08-4.00)	4.68 (4.14-5.39)	6.34 (5.60-7.33)	7.78 (6.81-9.06)	9.85 (8.35-11.9)	11.5 (9.59-14.2)	13.4 (10.8-16.9)	15.4 (12.1-20.0)	18.3 (13.9-24.8)	20.8 (15.2-29.1)
60-day	3.95 (3.50-4.55)	5.24 (4.64-6.03)	7.01 (6.19-8.11)	8.55 (7.48-9.96)	10.8 (9.12-13.0)	12.6 (10.4-15.5)	14.6 (11.8-18.3)	16.7 (13.2-21.7)	19.9 (15.1-26.9)	22.6 (16.5-31.6)

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

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

Please refer to NOAA Atlas 14 document for more information.

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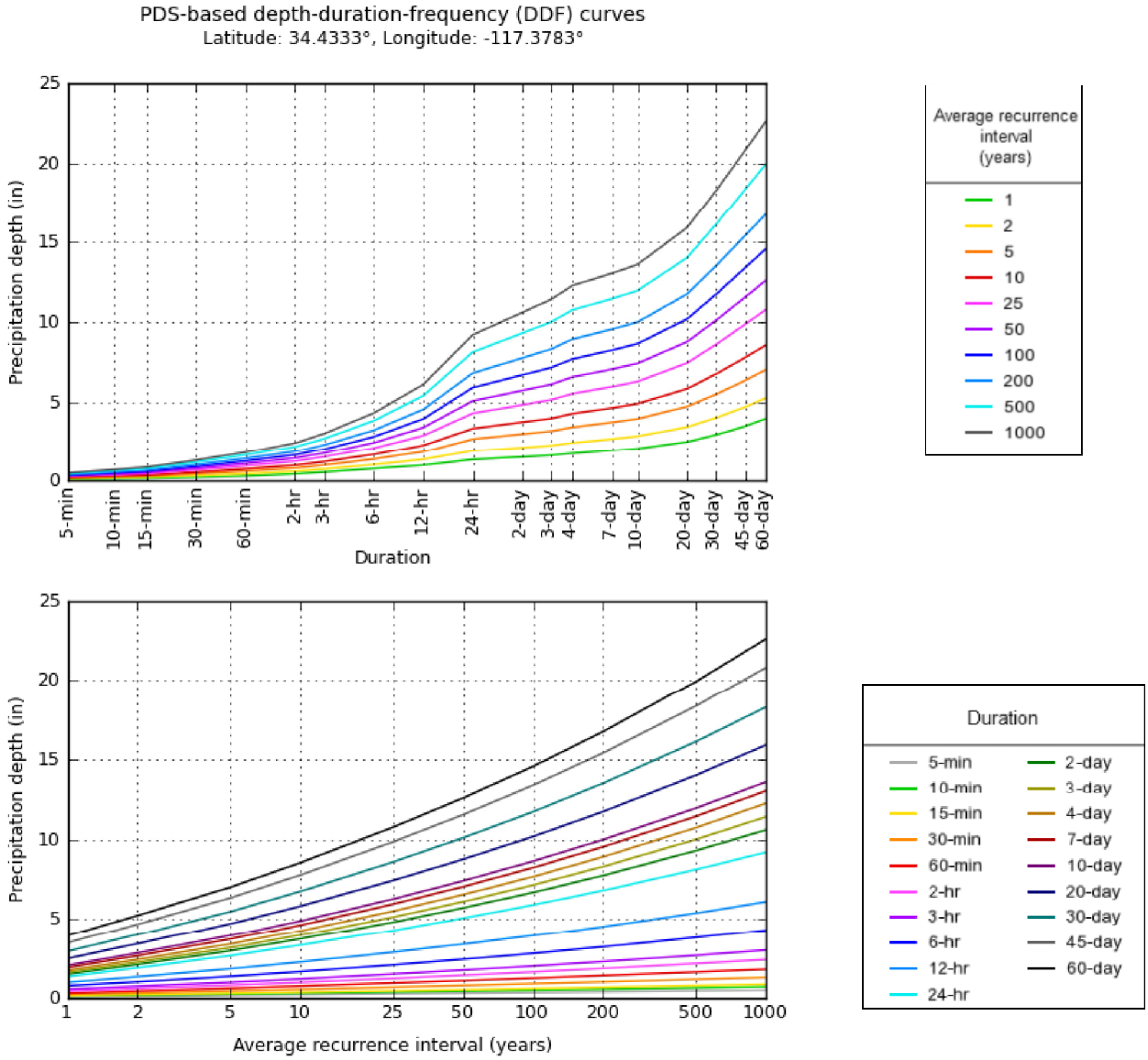
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Feb 20 22:00:25 2020

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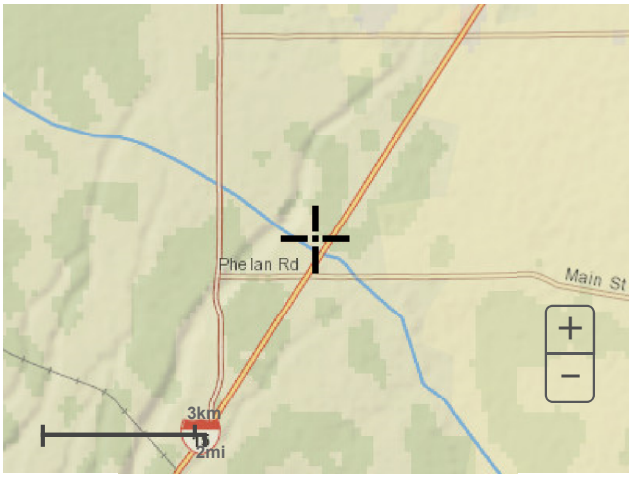
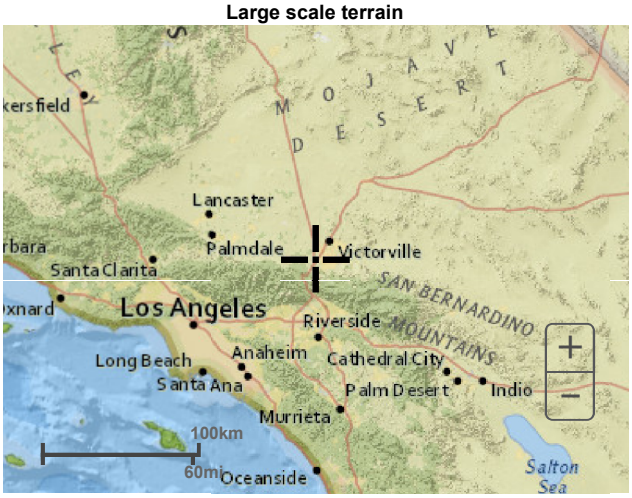
Maps & aerials

Small scale terrain



Large scale terrain



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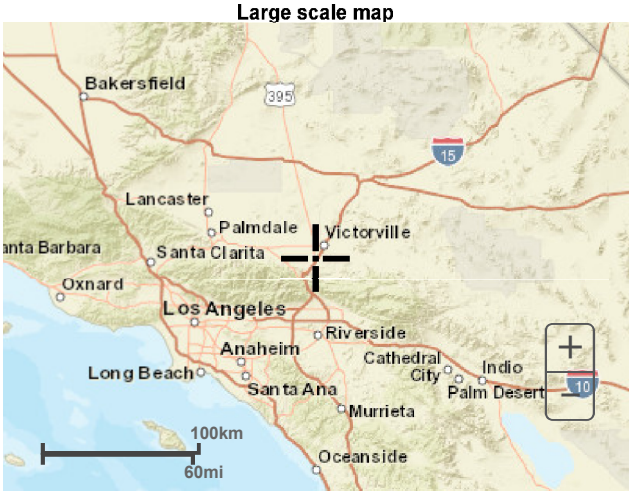

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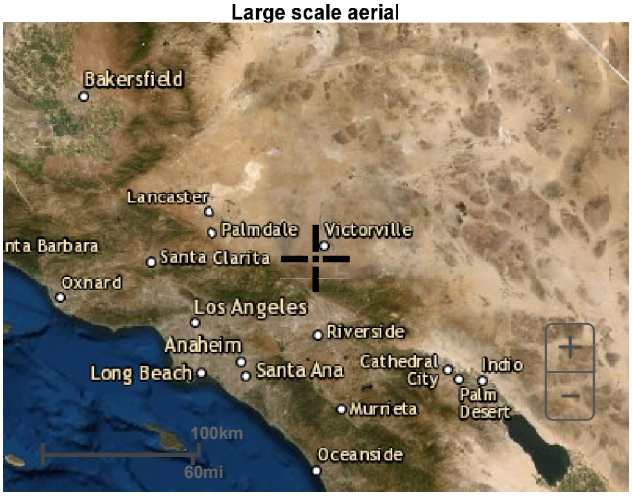

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