Final

Water Quality Management Plan

For:

15550 Arrow Route

APN: 0232-051-29

Prepared for:

Old Dominion, Inc.

500 Old Dominion Way

Thomasville, NC 27360

(336) 882-1291

Prepared by:

JOSEPH E. BONADIMAN & ASSOCIATES, INC.
ENGINEERS • G.I.S. • SURVEYING • PLANNING

234 North Arrowhead Avenue

San Bernardino, CA 92408

(909) 885-3806

Approval Date: _____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Old Dominion, Inc. by Bonadiman & Associates, Inc. The WQMP is intended to comply with the requirements of the County of San Bernardino and the NPDES Area wide Stormwater Program requiring the preparation of a WQMP. 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 San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county 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):	PROJ-2020-00092	Grading Permit Number(s):	GRAD-2020-00206
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0232-051-29

Owner's Signature			
Owner: Old Dominion, Inc.			
Title	Owner		
Representative	Chip Overbey		
Address	500 Old Dominion Way, Thomasville, NC 27360		
Email	Chip.Overbey@odfl.com		
Telephone #	(336) 822-5402		
Signature		Date	10/1/20

Preparer's Certification

Project Data			
Permit/Application Number(s):	PROJ-2020-00092	Grading Permit Number(s):	GRAD-2020-00206
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0232-051-29

"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 Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: James T. Stanton		PE Stamp Below
Title	Vice President of Engineering	
Company	Joseph E. Bonadiman & Associates, Inc.	
Address	234 North Arrowhead Avenue San Bernardino, CA 92408	
Email	jts@bonadiman.com	
Telephone #	(909) 885-3806	
Signature		
Date	9-30-2020	

Table of Contents

Forms

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	15550 Arrow Route				
Project Owner Contact Name:	Chip Overbey				
Mailing Address:	500 Old Dominion Way Thomasville, NC 27360	E-mail Address:	Chip.Overbey@odfl.com	Telephone:	(336) 822-5402
Permit/Application Number(s):	PROJ-2020-00092		Tract/Parcel Map Number(s):		
Additional Information/ Comments:					
Description of Project:	The proposed project entails the construction and development of a trucking facility on approximately 371,703 SF in the unincorporated San Bernardino County. The site includes an office/ warehouse building, truck parking and trailer parking. Breakdown of lot: 153,515 SF (asphalt), 96,925 SF (concrete) , 35,268 SF (building), and 85,995 SF (landscape).				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.					

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☒ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☐ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more
☐ Hillside developments of 5,000 ft² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☒ Parking lots of 5,000 ft² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft² or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.

2 Project Area (ft2):	371,703	**3** Number of Dwelling Units:	0	**4** SIC Code:	4214 & 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.*

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

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:

Old Dominion, Inc. will be responsible for long-term maintenance of WQMP stormwater facilities.

Old Dominion. Inc.

Chip Overbey

500 Old Dominion Way.

Thomasville, NC 27360

(336) 822-5402

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 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 ☐	Potential sources include animal waste.
Phosphorous	E ☒	N ☐	Potential sources include fertilizers and eroded soils.
Nitrogen	E ☒	N ☐	Potential sources include fertilizers and eroded soils.
Sediment	E ☒	N ☐	Potential sources include eroded soils.
Metals	E ☒	N ☐	Potential sources include brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Potential sources include petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.
Trash/Debris	E ☒	N ☐	Potential sources include paper, plastic, polystyrene packing foam, and aluminum materials.
Pesticides / Herbicides	E ☒	N ☐	Potential sources include fertilizers and pest sprays.
Organic Compounds	E ☒	N ☐	Potential sources include solvents and cleaning compounds.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits

1 Project Types that Qualify for Water Quality Credits: *Select all that apply*

☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]

2 Total Credit % 0 *(Total all credit percentages up to a maximum allowable credit of 50 percent)*

Description of Water Quality Credit Eligibility (if applicable)	N/A

Section 3 Site and Watershed Description

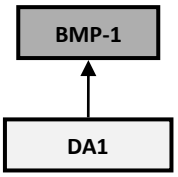
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed 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.***

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.10025	Longitude 117.46581	Thomas Bros Map page 604

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

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 to BMP-1	Site drains to underground infiltration BMP.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DA, provide the following characteristics	DA A	DA B	DA C	DA D
1 DA drainage area (ft^2)	371,703			
2 Existing site impervious area (ft^2)	26,573			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	I			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	A			
5 Longest flowpath length (ft)	963			
6 Longest flowpath slope (ft/ft)	1.640			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren & Commercial Landscaping			
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*	78 & 32			

Form 3-3 Watershed Description for Drainage Area 1

Receiving waters *Refer to Watershed Mapping Tool - http://sbcounty.permitrack.com/WAP See 'Drainage Facilities" link at this website*	West Fontana Channel San Sevaine Santa Ana River, Reach 3 Prado Reservoir Santa Ana River, Reach 2 Santa Ana River, Reach 1 Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	West Fontana Channel - None San Sevaine-pH and Total Nitrogen Santa Ana River, Reach 3 - Pathogens Prado Reservoir - None Santa Ana River, Reach 2 - None Santa Ana River, Reach 1 - None Pacific Ocean - None
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	West Fontana Channel - None San Sevaine-None Santa Ana River, Reach 3 - Copper, Lead & Pathogens Prado Reservoir - pH Santa Ana River, Reach 2 - None Santa Ana River, Reach 1 - None Pacific Ocean - None
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	Areas within 200': *NONE
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	West Fontana Channel
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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 information provided in Form 4.1.1 and 4.1.2 is based on section 7 of the TGD for WQMP (p.92-105) including table 7-3, CASQA BMP Handbooks and comments from the reviewing agency. The provided description of BMP implementation is a summary and not intended to be an all-inclusive list of actions. Refer to the appendix 6.3 of the approved WQMP for applicable CASQA handouts and manufacturer information.

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	☒	☐	The Property Owner will provide practical information materials to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially included in the approved WQMP. Thereafter such materials will be available through the local jurisdiction's stormwater education program.The current website is www.sbcountystormwater.org
N2	Activity Restrictions	☒	☐	Activity restrictions will be imposed by the owner to limit exposure of stormwater to potential pollutants listed above in table 2.3-1.Restrictions will include fertilizers and pesticides be applied by certified persons.
N3	Landscape Management BMPs	☒	☐	Owner will ensure landscaping and irrigation is properly maintained. Fertilizers and pesticides be applied by certified persons.
N4	BMP Maintenance	☒	☐	The property owner will provide the applicable BMP maintenance information to those who will be maintaining the non-structural and structural BMPs. See forms 4.1-1, 4.1-2 and 5-1 for BMP list as well as the WQMP O&M plan for maintenance activities.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waste storage is proposed for this project.
N6	Local Water Quality Ordinances	☒	☐	This project will comply with NPDES Permit No. CAS618036 by implementation of the approved WQMP.
N7	Spill Contingency Plan	☒	☐	The Spill Contingency Plan developed by the facility oporator shal include the following items. Chemical spill kit, similar to a ULine S-18303, with Absorption Capacity equal to or grater than the volume of chemicals stored on site. In the event of a spill call the San Bernardino County Fire Department Hazardous Materials Division 909-386-8401 for proper disposal of contaminated materials. Document the spill noting the time of occuarance, material, volume of spill and completed clean up. Restock spill material as needed.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed.

Form 4.1-1 Non-Structural Source Control BMPs

N9	Hazardous Materials Disclosure Compliance	☐	☒	Per San Bernardino County Fire, Hazardous Materials Division, the basic quantities for disclosure are: hazardous materials at or exceeding 55 gallons, 500 pounds, or 200 cubic feet at any time in the course of a year. The proposed use of this site does not meet this threshold.
N10	Uniform Fire Code Implementation	☐	☒	Project plans are reviewed for compliance by local fire protection agency based on determination by planning department. Article 80 of the Uniform Fire Code deals with storage of Hazardous Materials, which are not being stored on this site.
N11	Litter/Debris Control Program	☒	☐	Litter/Debris inspection and clean up will be made part of the regular grounds maintenance and house keeping. At-least once a week. When trash/debris is seen it will be cleaned up as soon as possible.
N12	Employee Training	☒	☐	Employees will be trained on the BMPs listed on form 5-1, 4.1-1, and 4.1-2. The training material will be innitially provided by the property owner per N1 above.
N13	Housekeeping of Loading Docks	☒	☐	Loading docks will be swept and trash picked up regularly to control litter, at least monthly. Loading and unloading equipments will checked regularly for leaks with repairs made as needed.
N14	Catch Basin Inspection Program	☒	☐	For privately maintained drainage systems, the owner is required to have at least 80 percent of drainage facilities inspected, cleaned and maintained on an annual basis with 100 percent of the facilities included in a two-year period. Cleaning should take place in the late summer/early fall prior to the start of the rainy season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	At a minimum paved parking areas of a business shall be swept, using a vacuum assisted sweeper, in late summer or early fall, prior to the start of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Project is not a public agency Priority Project and this is not required by the local jurisdiction.
N17	Comply with all other applicable NPDES permits	☒	☐	The proposed site will comply with current NPDES permit requirements through implementation of the site specific Storm Water Pollution Prevension Plan (SWPPP) BMPs. Refer to separate SWPPP document.

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 and catch basins being constructed or modified will be labeled. Stenciled labels shall be blue on a white background with lettering 2-1/2" in height and reading "No Dumping – Drains to River." In lieu of a stencil, a catch basin curb marker that is at least 4" in height or diameter and contains a similar message may be used. A painted circular stencil shall not be bigger than 8" in diameter. Catch basin labels will be inspected once annually and relabeled as necessary to maintain legibility. This information has been derived from information in CASQA handout SD-13, which is provided in appendix B of the O&M plan.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage is proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas will be designed in accordance with the reviewing juristiction development code and will provide secondary trash containment for the trash bins, as required by NPDES Permit No. CAS618036. Roof will be provided over trash enclosure per LUS comments.
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)	☒	☐	The landscaping and irrigation will be installed per the approved landscaping plans,which will incorporate rain-triggered shutoff devices and automatic irrigations controllers.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscape areas are designed with a minimum of 1 inch below adjacent impervious areas.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Slopes will be protected by vegetation/energy dissipation. Landscaping and rip rap locations have been referenced on WQMP exhibit in Appendix 6.1.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Loading dock areas will be covered and load equipment will checked regularly for leaks with repairs made as needed.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays are proposed.

Form 4.1-2 Structural Source Control BMPs				
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle washingis proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas are proposed.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment washing proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling is proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping proposed.
S14	Wash water control for food preparation areas	☐	☒	No food preparation proposed.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No car washing proposed.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. 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 Preventative LID 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: Impervious area has been minimized as much as possible for the proposed use of this site.80.16 percent of site will be impervious and 19.84 percent impervious.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Landscape and BMP areas will be marked with flagging tape or paint during construction to minimize compaction and maximize natural infiltration capacity.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Existing time of concentration will change due to the proposed development.Time of concentration for flows leaving the site will be longer in the developed condition because of the location of the underground infiltration system.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: The infiltration facilities will disconnect impervious areas before discharging offsite.
Protect existing vegetation and sensitive areas: Yes ☒ No ☐ Explanation: No sensitive areas exist on site. Existing vegitation is perennial and will not meet the landscaping requirements. See WQMP exhibit in appendix 6.1 for proposed landscaping locations.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Disturbed areas will be re-vegetated where possible, see site plan for proposed landscaping areas.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Stormwater BMP areas will be marked with flagging tape during construction to minimize compaction and maximize natural infiltration capacity.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Vegetated swales will not be used on this project due to grading constraints and elevation issues. LID BMP selected to meet target is underground infiltration.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscape areas will be marked with flagging tape during construction to minimize compaction and maximize natural infiltration capacity.

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the 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 of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program 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 HCOC 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): 371,703	**2** Imperviousness after applying preventative site design practices (Imp%): 79.34	**3** Runoff Coefficient (Rc): 0.592 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.570 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.844 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; 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): 30,360 *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 HCOC Assessment (DA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☐ No ☒

Go to: http://sbcounty.permitrack.com/WAP

If "Yes", then complete HCOC assessment of site hydrology for 2yr 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)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** *Form 4.2-3 Item 12*	**2** *Form 4.2-4 Item 13*	**3** *Form 4.2-5 Item 10*
Post-developed	**4** *Form 4.2-3 Item 13*	**5** *Form 4.2-4 Item 14*	**6** *Form 4.2-5 Item 14*
Difference	**7** 0 *Item 4 – Item 1*	**8** 0.00 *Item 2– Item 5*	**9** 0.00 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** % *Item 7 / Item 1*	**11** % *Item 8 / Item 2*	**12** % *Item 9 / Item 3*

Form 4.2-3 HCOC 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 2 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 HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-4 HCOC 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 HCOC requirement (min): $T_{C\text{-}HCOC}$ *= (Item 14 * 0.95) – Item 13*								

Form 4.2-5 HCOC 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 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (ft^2) *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 HCOC Requirement (cfs):		*$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the 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 MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

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 5.3.2.1 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 Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use 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 HSC 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 LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). **Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment**.

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 eight 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, Harvest and Use BMP. If no, then proceed to Item 9 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, Hydrologic Source Control 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, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC 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 HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC 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 HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control 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 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*	0	0	0
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 $V_{retention}$ *=Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (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)*	0	0	0
13 Runoff volume retention from on-lot infiltration (ft^3): 0 $V_{retention}$ *=Sum of Item 12 for all BMPs*			

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*	0	0	0
20 Runoff volume retention from evapotranspiration BMPs (ft^3): 0 *$V_{retention}$ =Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 20-2. If no, proceed to Item 24*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees	0	0	0
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*	0	0	0
25 Runoff volume retention from street tree BMPs (ft^3): 0 *$V_{retention}$ = Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrels/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-28; If no, proceed to Item 29*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns	0	0	0
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*	0	0	0
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): 0 *$V_{retention}$ =Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 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 D 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 5.5.1 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).

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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 HSC BMP (ft^3): 30360 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

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 BMP Type Underground Infiltration System	DA DMA BMP Type	DA 0 DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	10.80		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.63		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	4.10		
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*	8.00		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	8.00		
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*	3,895		
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*	0.00		
10 Amended soil porosity	0.00		
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*	1.00		
12 Gravel porosity	0.40		
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))]*	0		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	30,722		

16 Total Retention Volume from LID Infiltration BMPs: 30,722 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 101% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and 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.

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16*			
BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*	0	0	0
9 Total Retention Volume (ft^3) from Harvest and Use BMP: 0 *Sum of Item 8 for all harvest and use BMP included in plan*			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest and use BMPs? Yes ☐ No ☐ *If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.*			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. 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 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	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 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ 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): 0 *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): 0 *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 4.3-6 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))]*	0	0	0
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-7 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)*	0		0	
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 0 *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-8 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 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, 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 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 30,360 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 30,722 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

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

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

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide 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

8 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 HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, 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)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for HCOC performance criteria (ft^3): 0
*(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): *Sum of Form 4.3-9 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 HCOC volume reduction*

3 Remaining volume for HCOC volume capture (ft^3): *Item 1 – Item 2*

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC 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 or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- 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 ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC 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 or off-site retention BMPs ☐
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, 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 compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP 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, see CASQA and manufacturer handouts in O&M plan for more detailed BMP maintenance information, for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

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

BMP	Reponsible Party(s)	Inspection/Maintenance Activities Required	Minimum Frequency of Activities
Building & Grounds Maintenance	Property Owner	Inspect and clean site for trash and debris	Weekly
Underground Chambers	Property Owner	Inspect, clean, repair and maintain BMP.	Monthly
Education of Property Owners, Tenants & Occupants on Stormwater BMPs	Property Owner	The Property Owner will provide BMP educational information materials to all employees and coccupants of site.	As needed
Activity Restrictions	Property Owner	Inspect to ensure there is no littering. Maintenance includes cleaning site if trash and debris is found in inspection.	As needed
BMP Maintenance	Property Owner	Inspect, clean, repair and maintain BMP.	Monthly
Local Water Quality Ordinances	Property Owner	Local water quality ordinances shall be followed per local agency.	As needed
Uniform Fire Code Implementation	N/A	No hazardous material proposed on site.	N/A
Litter/Debris Control Program	Property Owner	Inspect and clean site for trash and debris	Weekly

Employee Training	Property Owner	Educational materials on general housekeeping practices for the protection of storm water quality shall be provided to employees.	As needed
Catch Basin Inserts	Property Owner	Inspect for trash, debris and damage	Monthly
Vacuum Sweeping	Property Owner	Parking lots shall be swept and vacuumed	Monthly
NPDES Permits	Property Owner	Approval and implementation of this WQMP and SWPPP.	On going
Provide storm drain system stenciling and signage	Property Owner	Inspect storm drain system stenciling and signage for clarity	Anually, repair as needed
Trash enclosure	Property Owner	Inspect trash enclosure for maintenace and repairs	Monthly
Use Efficient Irrigation System and Landscape Design	Property Owner	Install irrigation systems with timing devices to avoid overwatering. Inspect irrigation system and devices for damage, leakage, or other repairs needed.	Weekly with landscaping maintenace

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

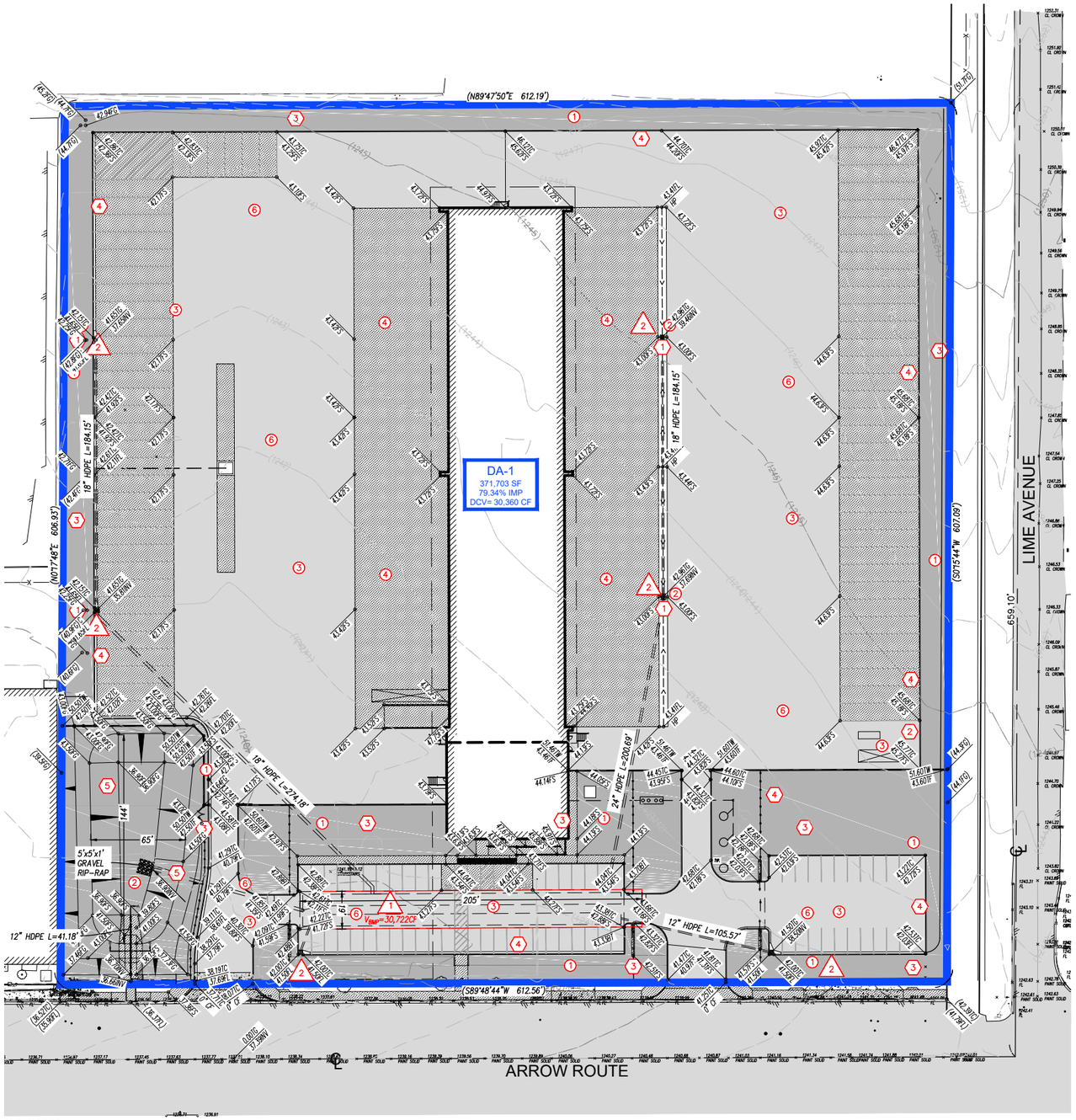
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

- O&M Plan
  - BMP Educational Materials
- Maintenance Agreement(s)
- Activity Restriction – C, C&R's & Lease Agreements

6.4 Other Supporting Documentation

- San Bernardino County Watershed Mapping Tool Data
- NOAA Rainfall Data
- Soils information

Appendix 6.1 – Site Plan and Drainage Plan



W.Q.M.P. NOTES:

1.) STRUCTURAL BMPS MAY BE SUBSTITUTED WITH EQUIVALENT PRODUCTS AT THE DISCRETION OF THE CONTRACTOR AND WITH APPROVAL FROM THE ENGINEER AND COUNTY OF SAN BERNARDINO BASED ON AVAILABILITY AT TIME OF CONSTRUCTION.

2.) TREATMENT CONTROL BMPS MAY BE SUBSTITUTED WITH EQUIVALENT PRODUCTS BASED ON AVAILABILITY AND WITH APPROVAL FROM THE ENGINEER AND COUNTY OF SAN BERNARDINO AT TIME OF CONSTRUCTION AND AS LONG AS THE MINIMUM DCV IS RETAINED AND MITIGATED AS INTENDED IN THE PROJECT SPECIFIC WQMP.

OWNER INFORMATION:

OLD DOMINION INC.
CONTACT: CRAIG KISER
500 OLD DOMINION WAY
THOMASVILLE, NC 27360
PHONE (336) 882-1291

STRUCTURAL SOURCE CONTROL BMPS (FORM 4.1-2):

1. PROVIDE STORM DRAIN SYSTEM STENCILLING AND SIGNAGE [S1] (CASQA SD-13)
2. DESIGN AND CONSTRUCT TRASH AND WASTE STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION [S3] (CASQA SD-32)
3. USE EFFICIENT IRRIGATION SYSTEMS & LANDSCAPE DESIGN, WATER CONSERVATION, SMART CONTROLLERS, AND SOURCE CONTROL [S4] (CASQA SD-12)
4. FINISH GRADE OF LANDSCAPED AREAS AT A MINIMUM OF 1-2 INCHES BELOW TOP OF CURB, SIDEWALK, OR PAVEMENT
5. PROTECT SLOPES AND CHANNELS AND PROVIDE ENERGY DISSIPATION [S6] (CASQA SD-10)

NON-STRUCTURAL SOURCE CONTROL BMPS (FORM 4.1-1):

- EDUCATION OF PROPERTY OWNERS, TENANTS AND OCCUPANTS ON STORMWATER BMPS [N1]
- ACTIVITY RESTRICTIONS [N2]
1. LANDSCAPE MANAGEMENT BMPS [N3]
2. BMP MAINTENANCE [N4]
- LOCAL WATER QUALITY ORDINANCES [N6]
- SPILL CONTINGENCY PLAN [N7] (CASQA SC-11)
3. LITTER/DEBRIS CONTROL PROGRAM [N11]
- EMPLOYEE TRAINING [N12]
4. HOUSEKEEPING OF LOADING DOCKS [N13] (CASQA SD-31)
5. CATCH BASIN INSPECTION PROGRAM [N14] (CASQA SC-44)
6. VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS [N15] (CASQA SC-43)
- COMPLY WITH ALL OTHER APPLICABLE NPDES PERMITS [N17]

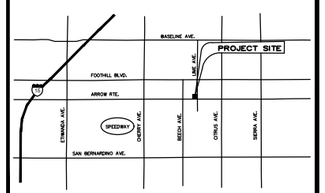
PROPOSED TREATMENT CONTROL BMP'S:

1. UNDERGROUND INFILTRATION SYSTEM
2. DRAIN INSERTS (MP-52)

LEGEND:

- W.Q.M.P DRAINAGE AREA
- PROPERTY LIMITS
- FLOW LINE
- PROPOSED LANDSCAPING AREAS
- PROPOSED CONCRETE PAVING AREAS
- PROPOSED A/C PAVING AREAS
- PROPOSED STRUCTURES

VICINITY MAP
NOT TO SCALE
UNINCORPORATED FONTANA



40 0 40 80 120
SCALE: 1"=40'

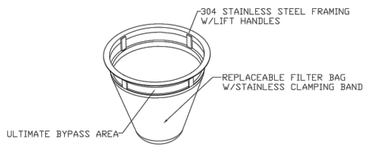
APN: 0232-051-29
FONTANA, CA 92335

BONADIMAN
TEL. (909) 595-9339

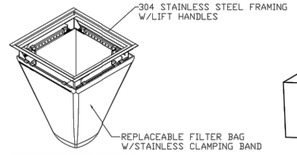
PREPARED FOR: OLD DOMINION					
DRAWN BY:	V.B.	SCALE:	1" = 40'	SHEET: 1 OF 3	
CHECKED BY:	C.R.	JOB NO:	194679		
DISREGARD PRINTS BEARING EARLIER REVISION DATES →		01-21-2021			

FLEXSTORM PURE FILTERS FOR PERMANENT INLET PROTECTION
PRODUCT SELECTION AND SPECIFICATION DRAWING

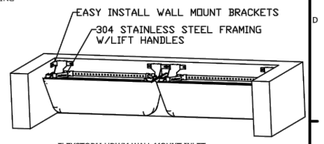
CALIFORNIA



FLEXSTORM PURE INLET FILTERS FOR ROUND OPENINGS



FLEXSTORM PURE INLET FILTERS FOR RECTANGULAR OPENINGS WITH GRATES

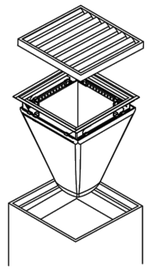


FLEXSTORM HDWM WALL MOUNT INLET FILTERS FOR OPEN THROAT GUTTERS

Product selection for FLEXSTORM PURE Filters (Permanent Inlet Protection)

Standard	Inlet Type	Grate Size	Clear Opening Size	Bag Cap. (ft³)	Flow Ratings (CFS)			PRICE			
					FX/FX+	PC/PC+	Bypass	FX	FX+	PC	PC+
36" Open Throat Inlet	Open Throat (WM)	N/A	**36**	2.5	1.9	1.4	N/A	62HDWM36FX	62HDWM36FXP	62HDWM36PC	62HDWM36PCP
42" Open Throat Inlet	Open Throat (WM)	N/A	**42**	3.0	2.5	1.7	N/A	62HDWM42FX	62HDWM42FXP	62HDWM42PC	62HDWM42PCP
48" Open Throat Inlet	Open Throat (WM)	N/A	**48**	3.3	2.5	1.7	N/A	62HDWM48FX	62HDWM48FXP	62HDWM48PC	62HDWM48PCP
60" Open Throat Inlet (2 piece)	Open Throat (WM)	N/A	**60**	4.2	2.5	1.7	N/A	62HDWM60FX	62HDWM60FXP	62HDWM60PC	62HDWM60PCP
84" Open Throat Inlet (2 piece)	Open Throat (WM)	N/A	**84**	5.8	2.5	1.7	N/A	62HDWM84FX	62HDWM84FXP	62HDWM84PC	62HDWM84PCP
48" Open Throat with Side Wings	Open Throat (WM)	N/A	**48 Winged**	5.1	2.7	1.7	N/A	62HDWM4818FX	62HDWM4818FXP	62HDWM4818PC	62HDWM4818PCP
12" x 12" precast	Concrete Box (HD)	15 x 15	**12 x 12**	0.9	1.0	0.7	2.4	62HD12FX	62HD12FXP	62HD12PC	62HD12PCP
18" x 18" precast	Concrete Box (HD)	21 x 18	**18 x 18**	2.0	1.5	1.0	3.7	62HD18FX	62HD18FXP	62HD18PC	62HD18PCP
21" Round Opening	Round (RD)	23	**21**	1.5	1.3	1.1	4.5	62HDR23FX	62HDR23FXP	62HDR23PC	62HDR23PCP
24" Round Opening	Round (RD)	26	**24**	1.9	1.5	1.3	4.9	62HDR21FX	62HDR21FXP	62HDR21PC	62HDR21PCP
24" x 24"	Concrete Box (HD)	27 x 24	**24 x 24**	3.2	1.9	0.8	6.1	62HD24FX	62HD24FXP	62HD24PC	62HD24PCP
24" x 24" (shallow)	Concrete Box (HD)	27 x 24	**24 x 24**	3.2	1.9	0.8	6.1	62HD24SFX	62HD24SFXP	62HD24SPC	62HD24SPCP
36" x 18" precast	Concrete Box (HD)	40 x 18	**36 x 18**	3.8	2.2	1.5	5.6	62HD3618FX	62HD3618FXP	62HD3618PC	62HD3618PCP
36" x 18" precast	Combination	40 x 18	**36 x 18**	3.5	2.1	1.5	6.9	62HDFCB3618F	62HDFCB3618FXP	62HDFCB3618P	62HDFCB3618PCP
36" x 24" precast	Concrete Box (HD)	40 x 24	**36 x 24**	3.9	2.5	1.7	6.5	62HD3624FX	62HD3624FXP	62HD3624PC	62HD3624PCP
36" X 24" Combination Inlet	Concrete Box (HD)	40 x 24	**36 x 32**	4.3	2.3	2.0	5.8	62HDFCB3624FX	62HDFCB3624FXP	62HDFCB3624PC	62HDFCB3624PCP
36" X 36" precast +	Concrete Box (HD)	40 x 36	**36 x 36**	7.2	4.4	3.2	9.6	62HD36FX	62HD36FXP	62HD36PC	62HD36PCP
48" X 48" precast+	Concrete Box (HD)	48 x 48	**48 x 48**	13.0	5.4	4.2	11.4	62HD48FX	62HD48FXP	62HD48PC	62HD48PCP

*FLOW RATINGS SHOWN ARE 50% MAXIMUM



INSTALLATION:

1. REMOVE GRATE
2. DROP FLEXSTORM INLET FILTER ONTO LOAD BEARING LIP OF CASTING OR CONCRETE STRUCTURE
3. REPLACE GRATE

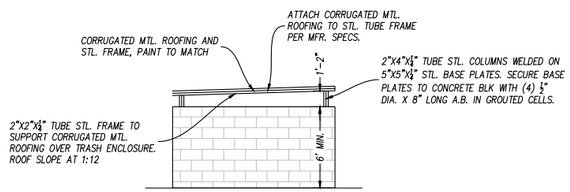
NOTES:
1. ALL FRAMING IS CONSTRUCTED OF 304 STAINLESS STEEL FOR 25 YEAR SERVICE LIFE RATING
2. TOTAL BYPASS CAPACITY WILL VARY WITH EACH SIZED DRAINAGE STRUCTURE. FLEXSTORM DESIGNS FRAMING BYPASS TO MEET OR EXCEED THE DESIGN FLOW OF THE PARTICULAR DRAINAGE STRUCTURE.
3. UPON ORDERING ADS P/N CONFIRMATION OF THE DOT CALLOUT, FLEXSTORM ITEM CODE, CASTING MAKE AND MODEL, OR DETAILED DIMENSIONAL FORMS MUST BE PROVIDED.
4. FOR WRITTEN SPECIFICATIONS AND MAINTENANCE GUIDELINES VISIT WWW.INLETFILTERS.COM

ALL PRODUCTS MANUFACTURED BY INLET & PIPE PROTECTION, INC
A DIVISION OF ADS, INC.
WWW.INLETFILTERS.COM
(866) 287-8655 PH
(630) 355-3477 FX
INFO@INLETFILTERS.COM

SIZE		DWG NO	REV
C		P-CA-SUBMIT	A

SCALE | SHEET 1 OF 1

1



2 TRASH ENCLOSURE ROOF DETAIL
NTS

APN: 0232-051-29
FONTANA, CA 92335

BONADIMAN

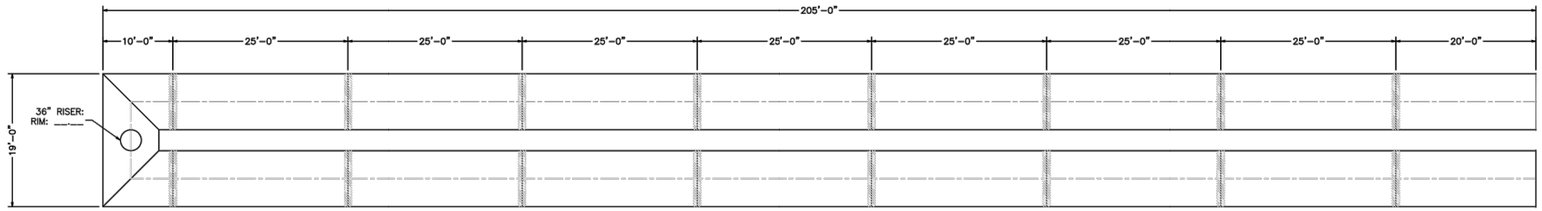
PREPARED FOR: OLD DOMINION

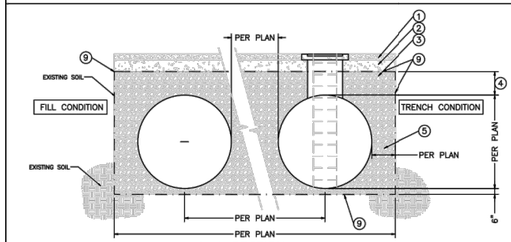
DRAWN BY: C.R.	SCALE: 1" = 40'	SHEET: 2 OF 3	
CHECKED BY:	JOB NO: 194679		
DISREGARD PRINTS BEARING EARLIER REVISION DATES →	01-21-2021		

1

DESIGN INFORMATION

- MATERIAL FINISH = ALZD. TYPE 2
- PIPE GAUGE = 16GA.
- PERFORATED = YES
- DIAMETER = 96"
- LOADING = H20/H25
- SYSTEM INV = __.__



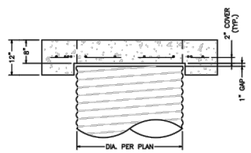


A–A SECTION
N.T.S.

NOTES:
1. RIGID OR FLEXIBLE PAVEMENT.
2. GRANULAR ROAD BASE.
3. NORMAL ROADWAY EMBANKMENT FILL PLACED IN 8" LIFTS AND COMPACTED TO MIN. 90% STANDARD DENSITY PER AASHTO T–99.
4. 12" MIN. FOR DIAMETERS THROUGH 96", 18" MIN. FOR DIAMETERS FROM 102" AND UP. MEASURE FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF PIPE TO TOP OF RIGID PAVEMENT.
5. FREE DRAINING ANGULAR WASHED STONE 3/4" – 2" AROUND PIPE ENVELOPE AS SHOWN OR OTHERWISE NOTED.
6. 5 x 1" CSP GAGE PER AASHTO SECTION12.
7. NOT USED
8. LISTED SPACING CHART IS FOR MULTIPLE PIPE INSTALLATION. FOR SINGLE RUN, THE TRENCH REQUIRES ONLY THE BOTTOM WIDTH OF THE PIPE'S SPAN, PLUS ROOM FOR COMPACTION EQUIPMENT.

SPACING CHART PER AISI AND NCSPA GUIDELINES	
DIAMETER	REQUIRED SPACING
UP TO 24"	12"
24" – 72"	1/2 PIPE DIA.
72" AND UP	36"

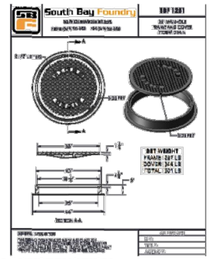
9. 4 oz. NON WOVEN GEOTEXTILE FABRIC.
10. RELATIVELY LOOSE GRANULAR BEDDING ROUGHLY SHAPED TO FIT BOTTOM OF PIPE, 4" TO 6" IN DEPTH. (#57 OR #8 OR OTHER SUITABLE GRANULAR).

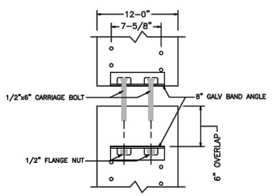


ACCESS RISER DETAIL
N.T.S.

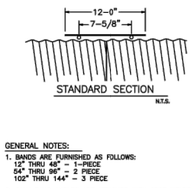
System Information

CSP Information	Qty:	U of M:	
Pipe Diameter	96.0	Inch	
Total Lineal Feet	413.0	Ft.	
End Area	50.3	Cu. Ft.	Pipe dia.* 3.14
Total Pipe Volume	20759.6	Cu. Ft.	Total Lineal FT.* End Area
Rock Void Info			
System Width	23.0	Ft.	
System Length	209.0	Ft.	
Pipe Height	96.0	Inch	
Cover	1.0	Ft.	
Base Fill	0.5	Ft.	
Total Height	9.5	Ft.	Base + Cover + Pipe
Total Area	4807.0..	Sq. Ft.	Width * Length
Total Rock Void	24906.9	Cu. Ft.	Total Area * Total Height - Total Pipe Vol.
40% Rock Void	9962.7	Cu. Ft.	Total Rock Void * 40%
Total Rock (Tons)	1522.09	Tons	Total Rock Void / Cu. Yd * 1.65
Geotextile 4oz (15'x360')	3.1	Rolls	
Total System Storage	30,722.39	Cu. Ft.	Total Pipe Vol. + 40% Rock Void



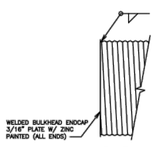


DIMPLE BAND DETAIL
N.T.S.



STANDARD SECTION
N.T.S.

GENERAL NOTES:
1. BANDS ARE FURNISHED AS FOLLOWS:
   12" THRU 48" – 1–PIECE
   54" THRU 96" – 2 PIECE
   102" THRU 144" – 3 PIECE
2. GALV BAND ANGLES ARE ATTACHED WITH SPOT WELDS, RIVETS OR HAND WELDED.
3. DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. DIMPLE BANDS FOR ARCHED PIPE ARE THE SAME AS FOR EQUIVALENT ROUND PIPE DIAMETER.



B–B
TYPICAL BULKHEAD

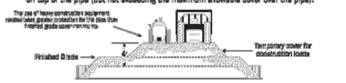
Table 7.8
General guidelines for minimum cover required for heavy off-road construction equipment

Pipe Span, in.	Minimum Cover (ft) for Indicted Axle Loads (kips)*			
	10-50	50-75	75- 110	110- 150
18-42	3.0	3.5	3.5	3.5
48-72	4.0	4.0	5.5	4.0
78-120	5.0	5.5	4.0	4.0
126-146	5.5	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. Maximum cover is measured from the top of the pipe to the top of the maintained construct on roadway surface.

HEAVY CONSTRUCTION

For temporary construction vehicle loads (100 kips/axle load), put at least four feet of compacted cover on top of the pipe (but not exceeding the maximum allowable cover over the pipe).



PACIFIC CORRUGATED PIPE CO.
13680 SLOVER AVENUE FONTANA, CA 92337
800.336.5858 * 909.829.4235
Fx: 909.829.8035
SOCAL@PCPIPE.COM

NOTE: THE SUITABILITY OF THE INFORMATION PRESENTED FOR USE ON ANY PARTICULAR PROJECT SHOULD BE DETERMINED BY THE ENGINEER RESPONSIBLE FOR THE DESIGN.

PROJECT NAME: BONADIMAN 15550 ARROW ROUTE
PROJECT #:

SIGN & DATE TO RELEASE FOR MANUFACTURE (SUBJECT TO PRICE VERIFICATION)
DATE _____ SIGNATURE _____

PLANS APPROVED
☐ (AS NOTED) ☐ (W/CHANGES)

REV.	DESCRIPTION	DATE
1		

DRAWN BY: M. PERRY
SCALE: AS NOTED
DATE: 01–19–21
SHEET NO: 1 OF 1

APN: 0232-051-29
FONTANA, CA 92335

BONADIMAN

PREPARED FOR: OLD DOMINION

DRAWN BY: C.R.	SCALE: 1" = 40'	SHEET: 3 OF 3			
CHECKED BY: C.R.	JOB NO: 194679				
DISREGARD PRINTS BEARING EARLIER REVISION DATES	03-01-2021				

Appendix 6.2 – Electronic Data Submittal

Note: A cd containing PDF versions of the WQMP documents will be included in this section during final engineering, when requested by the reviewing agency.

Appendix 6.3 – Post Construction

Note: As indicated in section 8.2.3 of the "Technical Guidance Document for Water Quality Management Plans", dated June 7, 2013, a maintenance agreement may be required by local jurisdiction for proposed BMPs. A maintenance agreement will be provided in this section if requested by the local jurisdiction.

Appendix 6.4 – Other Supporting Documentation

WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Monday, November 11, 2019

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s):	023205129
Project Site Acreage:	8.519
HCOC Exempt Area:	Yes. Verify that the project is completely with the HCOC exemption area.
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	**System Number** - 109 **Facility Name** - West Fontana Channel **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	EHM
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	No
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	A
Environmentally Sensitive Areas within 200':	None
Groundwater Depth (FT):	-507
Parcels with potential septic tanks within 1000':	Yes
Known Groundwater Contamination Plumes within 1000':	Yes
Studies and Reports Related to Project Site:	Chino Basin Recharge Master Plan Chino Basin Water Master 32nd Annual Report Summary Report Master Storm Drainage Plan Study Summary Report Master Storm Drainage Plan Map FONTANA MPD FEE STUDY Master SD Hydrology Calcs for Fontana Vol III Master SD Hydrology Calcs For Fontana Vol II Master SD Hydrology Calcs for Fontana Vol V Master SD Hydrology Calcs for Fontana Vol IV San Sevaine - Boyle Map 0001 San Sevaine - Boyle Map 0002 San Sevaine - Boyle Map 0003 SBCounty CSDP Project No.2 Volume 1 SBCounty CSDP Project No.2 Volume 2 Volume 2 Map SBCounty CSDP Project No.3 Volume I SBCounty CSDP Project No.3 Volume II West Fontana Channel Preliminary Basin Study

NOAA Atlas 14, Volume 6, Version 2
Location name: Fontana, California, USA*
Latitude: 34.0993°, Longitude: -117.4657°
Elevation: 1239.7 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	**0.114** (0.095-0.138)	**0.149** (0.124-0.181)	**0.198** (0.164-0.241)	**0.240** (0.197-0.295)	**0.299** (0.238-0.380)	**0.347** (0.270-0.451)	**0.398** (0.302-0.530)	**0.453** (0.334-0.621)	**0.532** (0.375-0.761)	**0.596** (0.406-0.885)
10-min	**0.163** (0.136-0.197)	**0.214** (0.178-0.260)	**0.284** (0.236-0.346)	**0.344** (0.283-0.422)	**0.429** (0.341-0.545)	**0.498** (0.387-0.646)	**0.571** (0.433-0.760)	**0.649** (0.478-0.890)	**0.762** (0.538-1.09)	**0.855** (0.582-1.27)
15-min	**0.197** (0.164-0.239)	**0.259** (0.215-0.314)	**0.344** (0.285-0.418)	**0.416** (0.342-0.511)	**0.519** (0.412-0.659)	**0.602** (0.468-0.782)	**0.690** (0.523-0.919)	**0.785** (0.578-1.08)	**0.922** (0.650-1.32)	**1.03** (0.704-1.53)
30-min	**0.294** (0.245-0.356)	**0.386** (0.321-0.469)	**0.512** (0.425-0.624)	**0.620** (0.510-0.761)	**0.773** (0.614-0.983)	**0.897** (0.698-1.17)	**1.03** (0.780-1.37)	**1.17** (0.862-1.61)	**1.37** (0.970-1.97)	**1.54** (1.05-2.29)
60-min	**0.434** (0.362-0.526)	**0.570** (0.475-0.693)	**0.757** (0.628-0.922)	**0.916** (0.754-1.13)	**1.14** (0.908-1.45)	**1.33** (1.03-1.72)	**1.52** (1.15-2.03)	**1.73** (1.27-2.37)	**2.03** (1.43-2.91)	**2.28** (1.55-3.38)
2-hr	**0.660** (0.550-0.801)	**0.857** (0.713-1.04)	**1.12** (0.928-1.36)	**1.34** (1.10-1.64)	**1.64** (1.30-2.08)	**1.88** (1.46-2.44)	**2.13** (1.61-2.83)	**2.39** (1.76-3.28)	**2.75** (1.94-3.94)	**3.05** (2.08-4.52)
3-hr	**0.849** (0.707-1.03)	**1.10** (0.912-1.33)	**1.42** (1.18-1.73)	**1.69** (1.39-2.07)	**2.06** (1.63-2.61)	**2.34** (1.82-3.04)	**2.64** (2.00-3.51)	**2.94** (2.17-4.03)	**3.36** (2.37-4.82)	**3.70** (2.52-5.49)
6-hr	**1.23** (1.03-1.49)	**1.59** (1.32-1.93)	**2.05** (1.70-2.50)	**2.42** (1.99-2.97)	**2.92** (2.32-3.71)	**3.30** (2.57-4.29)	**3.69** (2.79-4.91)	**4.08** (3.01-5.59)	**4.61** (3.25-6.60)	**5.03** (3.42-7.45)
12-hr	**1.65** (1.38-2.00)	**2.14** (1.78-2.60)	**2.77** (2.30-3.37)	**3.26** (2.68-4.00)	**3.91** (3.11-4.97)	**4.40** (3.42-5.71)	**4.88** (3.70-6.50)	**5.36** (3.95-7.36)	**6.01** (4.24-8.60)	**6.50** (4.42-9.63)
24-hr	**2.24** (1.98-2.58)	**2.95** (2.61-3.41)	**3.85** (3.39-4.45)	**4.55** (3.98-5.30)	**5.46** (4.62-6.58)	**6.13** (5.09-7.54)	**6.79** (5.50-8.56)	**7.45** (5.87-9.65)	**8.31** (6.28-11.2)	**8.95** (6.55-12.5)
2-day	**2.72** (2.41-3.13)	**3.67** (3.24-4.23)	**4.87** (4.29-5.63)	**5.82** (5.09-6.79)	**7.08** (5.99-8.53)	**8.01** (6.65-9.86)	**8.94** (7.24-11.3)	**9.88** (7.79-12.8)	**11.1** (8.41-15.0)	**12.1** (8.82-16.8)
3-day	**2.93** (2.60-3.38)	**4.02** (3.56-4.64)	**5.42** (4.78-6.27)	**6.55** (5.73-7.63)	**8.05** (6.82-9.70)	**9.19** (7.62-11.3)	**10.3** (8.37-13.0)	**11.5** (9.06-14.9)	**13.1** (9.88-17.6)	**14.3** (10.4-19.9)
4-day	**3.15** (2.79-3.63)	**4.37** (3.87-5.05)	**5.95** (5.25-6.89)	**7.23** (6.33-8.43)	**8.96** (7.58-10.8)	**10.3** (8.52-12.6)	**11.6** (9.40-14.6)	**13.0** (10.2-16.8)	**14.8** (11.2-20.0)	**16.2** (11.9-22.7)
7-day	**3.58** (3.17-4.12)	**5.06** (4.47-5.84)	**7.00** (6.17-8.10)	**8.58** (7.51-10.0)	**10.7** (9.09-12.9)	**12.4** (10.3-15.3)	**14.1** (11.4-17.8)	**15.9** (12.5-20.5)	**18.3** (13.8-24.6)	**20.1** (14.7-28.1)
10-day	**3.87** (3.43-4.46)	**5.53** (4.89-6.39)	**7.72** (6.81-8.94)	**9.52** (8.33-11.1)	**12.0** (10.2-14.5)	**13.9** (11.5-17.1)	**15.9** (12.9-20.0)	**18.0** (14.1-23.2)	**20.8** (15.7-28.0)	**23.0** (16.8-32.1)
20-day	**4.60** (4.07-5.30)	**6.65** (5.88-7.68)	**9.41** (8.30-10.9)	**11.7** (10.3-13.7)	**15.0** (12.7-18.0)	**17.5** (14.5-21.5)	**20.2** (16.4-25.4)	**23.0** (18.1-29.8)	**27.0** (20.4-36.4)	**30.2** (22.1-42.1)
30-day	**5.41** (4.79-6.24)	**7.82** (6.91-9.02)	**11.1** (9.78-12.8)	**13.9** (12.1-16.2)	**17.8** (15.1-21.4)	**20.9** (17.4-25.8)	**24.3** (19.7-30.6)	**27.9** (21.9-36.1)	**32.9** (24.9-44.4)	**37.1** (27.1-51.7)
45-day	**6.45** (5.71-7.43)	**9.17** (8.11-10.6)	**12.9** (11.4-15.0)	**16.2** (14.2-18.9)	**20.8** (17.6-25.1)	**24.6** (20.4-30.3)	**28.7** (23.2-36.1)	**33.1** (26.1-42.9)	**39.5** (29.9-53.3)	**44.8** (32.7-62.5)
60-day	**7.61** (6.73-8.76)	**10.6** (9.39-12.3)	**14.8** (13.1-17.2)	**18.5** (16.2-21.6)	**23.9** (20.2-28.7)	**28.3** (23.5-34.8)	**33.0** (26.8-41.6)	**38.3** (30.2-49.6)	**45.9** (34.8-62.0)	**52.4** (38.3-73.1)

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

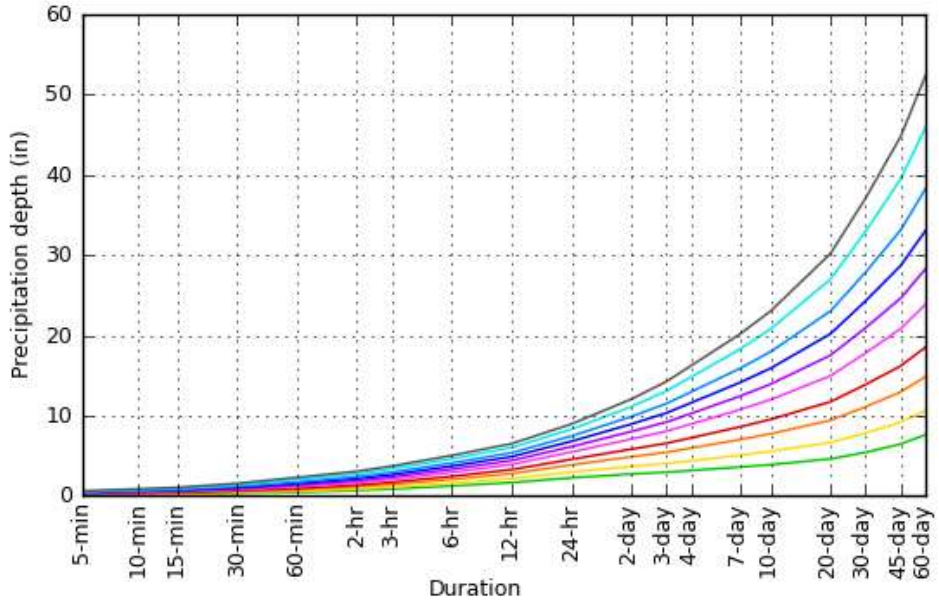
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

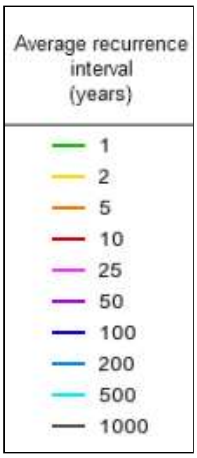
Please refer to NOAA Atlas 14 document for more information.

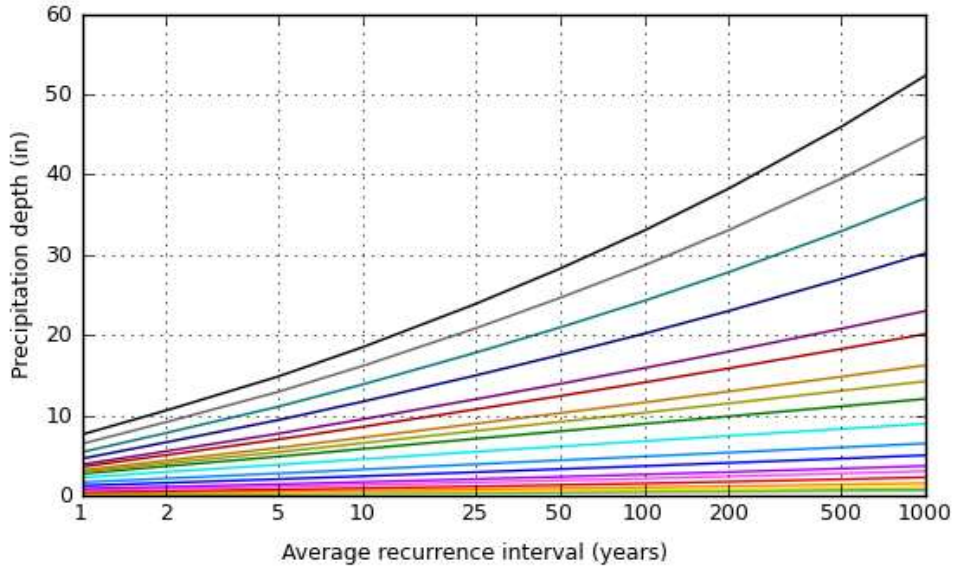
Back to Top

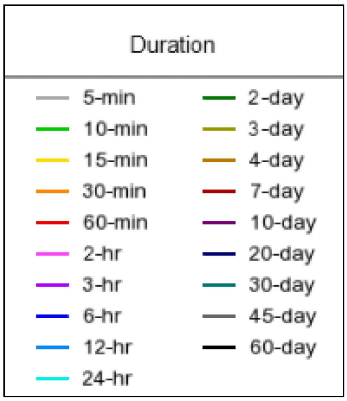
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.0993°, Longitude: -117.4657°









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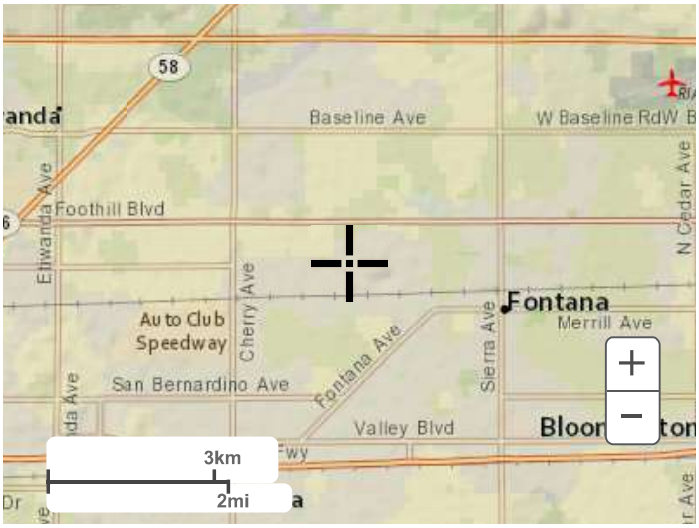
Created (GMT): Mon Nov 11 21:25:07 2019

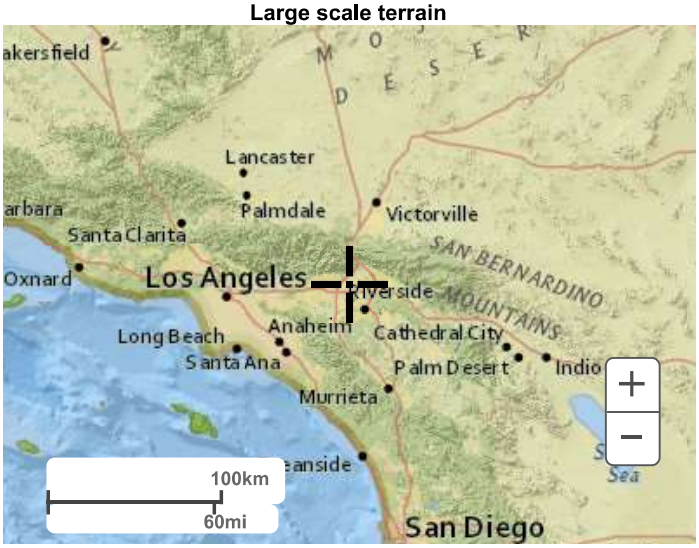
Back to Top

Maps & aerials

Small scale terrain



Large scale terrain



Large scale map

Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Geotechnical Engineering Report
Revision 1

Infiltration System Project
New ODFL Service Center
Fontana, San Bernardino County, California

January 4, 2021
Terracon Project No. CB185127A

Prepared for:

Old Dominion Freight Line, Inc.
Indianapolis, Indiana

Prepared by:

Terracon Consultants, Inc.
Colton, California

January 4, 2021

Old Dominion Freight Line, Inc.
3915 West Morris Street
Indianapolis, Indiana 46241

Attn: Jerry Canada – Manager of Construction
E: jerry.canada@odfl.com

Re: Geotechnical Engineering Report – Revision 1
Infiltration System Project
New ODFL Service Center
Northwest Corner of Arrow Route and Lime Avenue Intersection
Fontana, San Bernardino County, California
Terracon Project No. CB185127A

Dear Mr. Canada:

Terracon Consultants, Inc. (Terracon) prepared a geotechnical engineering report (Terracon Project No. CB185127, dated January 2, 2019) for the subject project which provided geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements.

This study was performed in general accordance with Terracon Task Order dated August 18, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning infiltration systems for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions or comments, please contact us at your earliest convenience.

Sincerely,
Terracon Consultants, Inc.

Ali Tabatabaei, Ph.D., G.E.
Geotechnical Project Engineer

REGISTERED PROFESSIONAL ENGINEER
SEYEDALI TABATABAEI
No. 3159
GEOTECHNICAL
STATE OF CALIFORNIA

Jay J. Martin, E.G. 1529
Principal Geologist

REPORT TOPICS

Note: This report was originally delivered in a web-based format. Orange Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the *GeoReport* logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report – Revision 1

Infiltration System Project
New ODFL Service Center
Northwest Corner of Arrow Route and Lime Avenue Intersection
Fontana, San Bernardino County, California

Terracon Project No. CB185127A
January 4, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed new Old Dominion Terminal infiltration system to be located Northwest Corner of Arrow Route and Lime Avenue Intersection in Fontana, San Bernardino County, California. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Recommendation for on-site infiltration rate

The geotechnical engineering Scope of Services for this project included the advancement of 6 test borings to depths ranging from approximately 8 to 26 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site is located at the northwest corner of Arrow Route and Lime Avenue, in Fontana, San Bernardino County, California. The approximate coordinates of the site are 34.1002° N, 117.4656° W (see **Site Location**)

Item	Description
Existing Improvements	The site is currently an asphalt paved lot with an existing building.
Current Ground Cover	Asphalt paved.
Existing Topography	Based on Google Earth, the project site slopes down toward the southwest. Ground surface elevations range from approximately 1,230 to 1,250 feet.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Proposed Development	The project includes infiltration chambers and basin for Low Impact Development purposes. The proposed bottom depth of infiltration chamber is approximately 11 ½ feet below ground surface (bgs). Invert depth of the basin is expected to be 3 feet below existing grades.
Grading Requirements	Grading is expected to be minimal.
Below Grade Structures	An infiltration chamber will be installed with a bottom depth of approximately 11 ½ feet bgs. Project also includes retention basin with associated storm drain lines.
Free-Standing Retaining Wall	Not anticipated

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides our geotechnical characterization.

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description [1]	Consistency/Density
Stratum I	0.02 to 0.27	Asphalt pavement, ¼ to 3 ¼ inches thick	---
Stratum II	8 to 26	Silty sand, poorly graded sand, poorly graded gravel, silty gravel, poorly graded sand with silt. Varying quantity of cobbles encountered.	Medium dense to very dense

1. The soil materials encountered are not expected to experience substantial volumetric changes (shrink/swell) with fluctuations in moisture content.

Groundwater Conditions

The borings were advanced using continuous flight auger drilling techniques that allow short-term groundwater observations to be made while drilling. **Groundwater seepage was not observed within the maximum depths of exploration during or at the completion of drilling.** Our review of historical information regarding groundwater levels indicates historical high groundwater at this site is expected deeper than 100 feet bgs.

Although we do not anticipate groundwater will affect construction at this project site, groundwater level fluctuations can occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

STORM WATER MANAGEMENT

Percolation tests were performed in general accordance with the San Bernardino County Stormwater Program Technical Guidance Document for Water Quality Management Plans, which states that percolation testing should follow the shallow percolation test method described in Section 2.3, of Riverside County LID BMP Handbook. Four in-situ infiltration tests (falling head borehole permeability) were performed at the site to the depths of about 3 to 8 and 11 to 16 feet bgs. Borings B-1 and B-2 were extended to 26 and 21 feet bgs, respectively to characterize the soils 10 feet below the proposed chamber bottom. The objective of the infiltration testing is to provide infiltration rates for designing the proposed infiltration system.

A 2-inch thick, 3/8-inch gravel layer was placed in the bottom of each boring used for percolation testing. Three-inch diameter perforated pipes were installed on top of the gravel layer. Gravel was used to backfill between the perforated pipes and the boring sidewall. The borings were then filled with water for a pre-soak period.

At the beginning of each test, the pipes were refilled with water and readings were taken at periodic time intervals as the water level dropped. The soil at the percolation test locations was classified in the field using a visual/manual procedure. The infiltration velocity is presented as the infiltration rate and is summarized in the following table. Please note the infiltration rates provided do not include safety factors.

Test Location	Test Depth (ft.) [1]	Test Depth Range (ft.) [1]	Soil Type	Water Head (ft)	Percolation Rate (in./hr.)	Infiltration Rate (in./hr.) [2]
Perc-1	16	11 to 16	Sand with silt and gravel	5	230.4	10.8
Perc-2	16	11 to 16	Sand with silt and gravel	5	357.6	25.7
Perc-3	8	3 to 8	Sand with silt and gravel and sandy gravel	5	152.6	6.1
Perc-4	8	3 to 8	Sand with silt and gravel	5	129.6	4.9

1. Below existing ground surface.
2. The correlated infiltration rates were calculated using the Porchet method.

The above infiltration rates determined by the shallow percolation test method are based on field test results utilizing clear water. Infiltration rates can be affected by silt buildup, debris, degree of soil saturation, site variability and other factors. The rate obtained at specific location and depth is representative of the location and depth tested and may not be representative of the entire site.

Application of an appropriate safety factor is prudent to account for limited number of infiltration tests, subsoil inconsistencies, possible compaction related to site grading, and potential silting of the percolating soils, depending on the application.

The design engineer should also check with the local agency for the limitation of the infiltration rate allowed in the design. If the maximum allowable design infiltration rate is lower

than the above recommended rate, the maximum allowable design infiltration rate should be used. The designer of the basins should also consider other possible site variability in the design.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Terracon conducted a total of six (6) soil-testing borings. These borings were planned to the following extended depths below existing grades.

Number of Borings	Boring Depth (feet) [1]	Location
B-1	26	Underground storm chamber
2 (Perc 1 and Perc 2)	16	Underground storm chamber
B-2	21	Proposed basin
2 (Perc 3 and Perc 4)	8	Proposed basin

1. Below ground surface.

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate elevations were obtained by interpolation from the Google Earth. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

Subsurface Exploration Procedures: We advance the borings with a truck-mounted drill rig using hollow-stem augers. Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a modified California ring-lined sampler (3-inch outer diameter and 2-3/8-inch inner diameter) are utilized in our investigation. The penetration resistance is recorded on the boring logs as the number of hammer blows used to advance the sampler in 6-inch increments (or less if noted). The samplers are driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow.

After the required seating, samplers are advanced up to 18 inches, providing up to three sets of blow counts at each sampling interval. The sampling depths, penetration distances, and other sampling information are recorded on the field boring logs. The recorded blows are raw numbers without any corrections for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. SPT sampler). Relatively undisturbed and bulk samples of the soils encountered are placed in sealed containers and returned to the laboratory for testing and evaluation.

We observe and record groundwater levels during drilling and sampling. For safety purposes, all borings are backfilled with auger cuttings after their completion. Our exploration team prepares field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs are prepared from the field logs.

The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Percolation Testing (Storm Water)

Terracon converted four borings with two to a depth of 16 feet (Perc 1 and Perc 2), and two to a depth of 8 feet (Perc 3 and Perc 4) into percolation tests. The tests were performed at the depth ranges of about 11 to 16 feet bgs for Perc 1 and Perc 2, and 3 to 8 feet bgs for Perc 3 and Perc 4, as tabulated in the following table:

Number of Test Borings	Boring Depth (feet) [1]	Test Range (feet)	Location
2 (Perc 1 and Perc 2)	16	11 to 16	Underground storm chamber
2 (Perc 3 and Perc 4)	8	3 to 8	Proposed basin

1. Below ground surface

The percolation tests were performed in general accordance with the San Bernardino County Stormwater Program Technical Guidance Document for Water Quality Management Plans, which indicates that the percolation testing should follow the shallow percolation test method described in Section 2.3, of Riverside County LID BMP Design Handbook (2011).

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- Water (Moisture) Content of Soil by Mass
- Laboratory Determination of Density (Unit Weight) of Soil Specimens
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION

Infiltration System Project ■ Fontana, San Bernardino County, California
January 4, 2021 ■ Terracon Project No. CB185127A

Terracon GeoReport

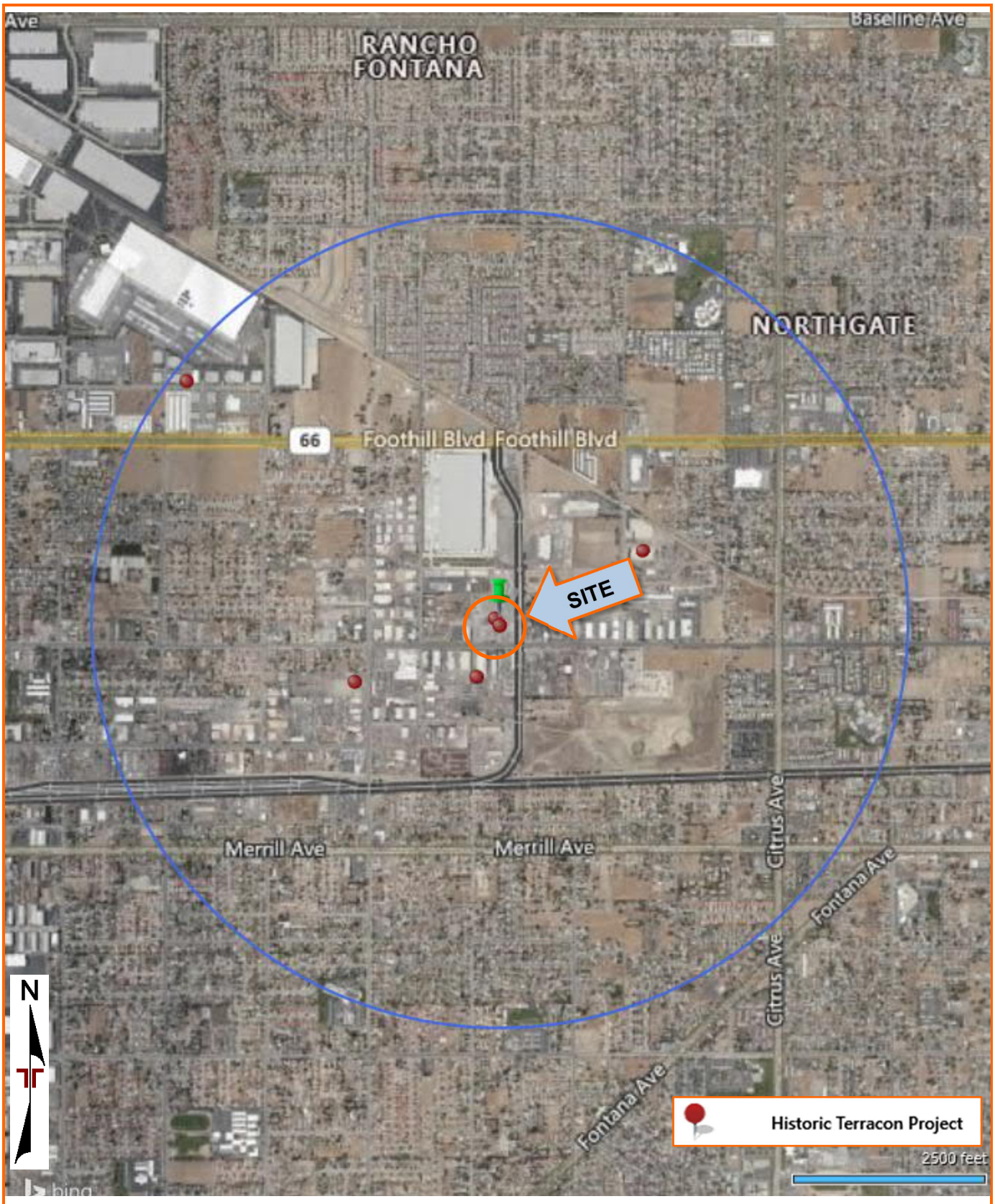


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

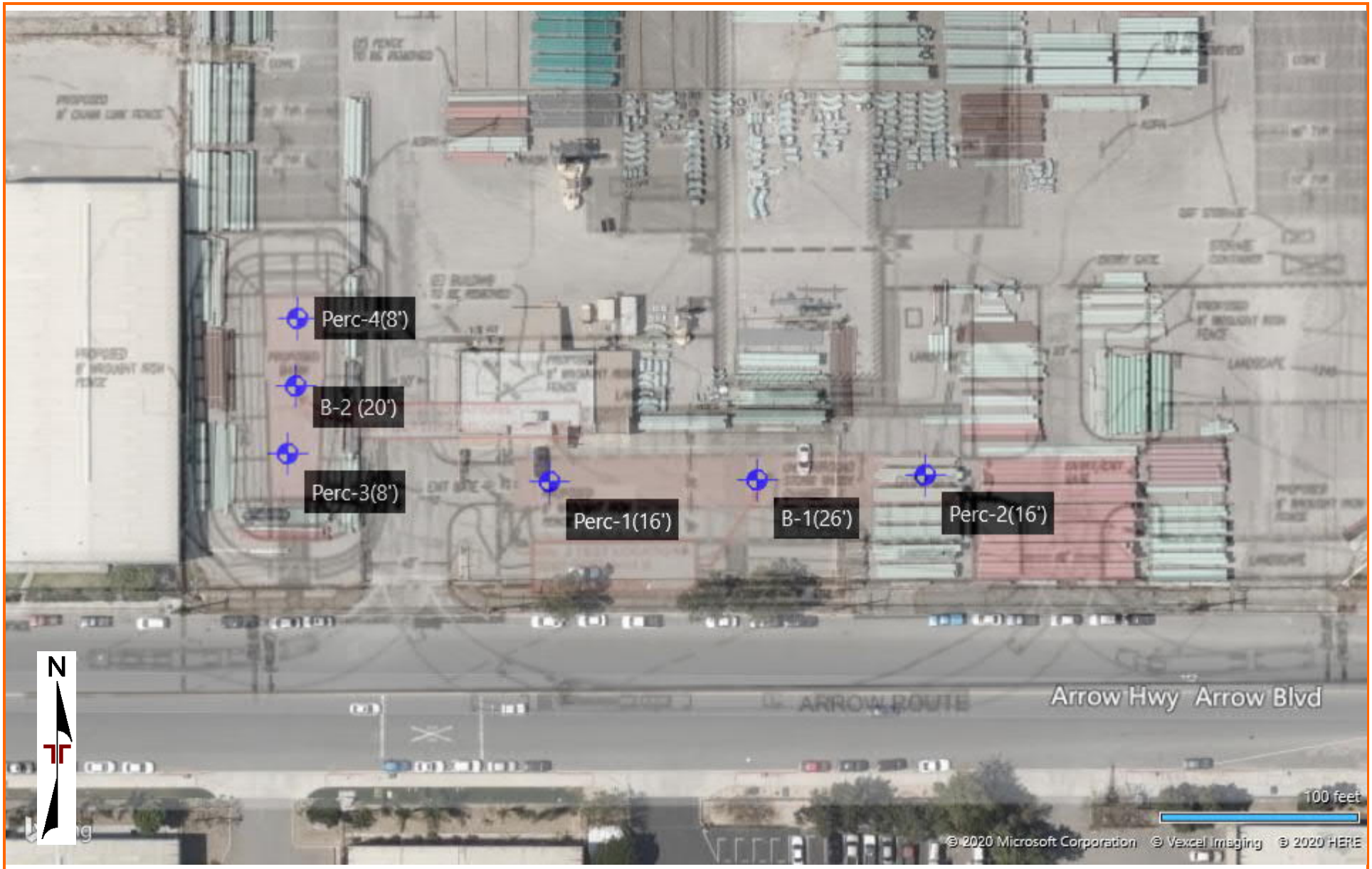


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. B-1

PROJECT: CB185127A

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

LOCATION See Exploration Plan

Latitude: 34.0996° Longitude: -117.4659°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
0.3		**ASPHALT**, Approximately 3 1/4-inch							
		SILTY SAND, dark tan, with gravel							
5.0		**POORLY GRADED SAND (SP)**, dark tan, with cobbles	5						
		dense	10			16-27-23			
15.0		**POORLY GRADED GRAVEL (GP)**, grayish tan, very dense, with cobbles	15			17-50/6"			
20.0		**POORLY GRADED SAND (SP)**, grayish tan, medium dense, with gravel and cobbles	20			20-21-32			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started:	Boring Completed:
Drill Rig: B-61	Driller: Calpac
Project No.: CB185127A	

BORING LOG NO. B-1

PROJECT: CB185127A

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 34.0996° Longitude: -117.4659° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	POORLY GRADED SAND (SP), grayish tan, medium dense, with gravel and cobbles *(continued)*							
	very dense	25			50/4"			
	26.0 ***Boring Terminated at 26 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started:	Boring Completed:
Drill Rig: B-61	Driller: Calpac
Project No.: CB185127A	

BORING LOG NO. Perc-1

PROJECT: CB185127A

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

LOCATION See Exploration Plan

Latitude: 34.0996° Longitude: -117.4662°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
0.3		**ASPHALT**, Approximately 3 1/4" thick							
		POORLY GRADED SAND WITH SILT (SP-SM), dark tan, with gravel							
5.0		**POORLY GRADED SAND WITH GRAVEL (SP)**, dark tan	5						
		very dense	10			16-48-16 N=64			
12.5		**SANDY GRAVEL (GP)**, dark tan							5
16.0		***Boring Terminated at 16 Feet***	15						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started:	Boring Completed:
Drill Rig: B-61	Driller: Calpac
Project No.: CB185127A	

BORING LOG NO. Perc-2

PROJECT: CB185127A

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

LOCATION See Exploration Plan

Latitude: 34.0996° Longitude: -117.4656°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
0.3								
	ASPHALT, approximately 3-inch thick							
	POORLY GRADED SAND WITH SILT (SP-SM), dark tan, with cobbles							
		5						
		10						
	dense				13-17-23 N=40			6
		15						
16.0								
	Boring Terminated at 16 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started:	Boring Completed:
Drill Rig: B-61	Driller: Calpac
Project No.: CB185127A	

BORING LOG NO. B-2

PROJECT: CB185127A

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

LOCATION See Exploration Plan

Latitude: 34.0996° Longitude: -117.4659°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
0.0		**ASPHALT**, 1/4-inch Asphalt							
		SILTY SAND (SM), brown to dark brown, trace of gravel							
5.0		**POORLY GRADED SAND (SP)**, tan to dark tan, trace of cobbles	5						
		dense				17-33-38			
			10						
		medium dense	15			16-12-16			
		very dense	20			31-50			
21.0		***Boring Terminated at 21 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started:	Boring Completed:
Drill Rig: B-61	Driller: Calpac
Project No.: CB185127A	

BORING LOG NO. Perc-3

PROJECT: CB185127A

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 34.0996° Longitude: -117.4667° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	0.0 **ASPHALT**, approximately 1/4" thick							
	POORLY GRADED SAND WITH SILT (SP-SM), dark tan, with gravel and cobbles							
	5.0	5						
	SANDY GRAVEL (GP), dark tan, with cobbles							7
	8.0							
	Boring Terminated at 8 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started:	Boring Completed:
Drill Rig: B-61	Driller: Calpac
Project No.: CB185127A	

BORING LOG NO. Perc-4

PROJECT: CB185127A

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

LOCATION See Exploration Plan

Latitude: 34.0998° Longitude: -117.4667°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	0.0	**ASPHALT**, approximately 1/4" thick							
		POORLY GRADED SAND WITH SILT (SP-SM), dark brown, with gravel	5						16
	8.0	***Boring Terminated at 8 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

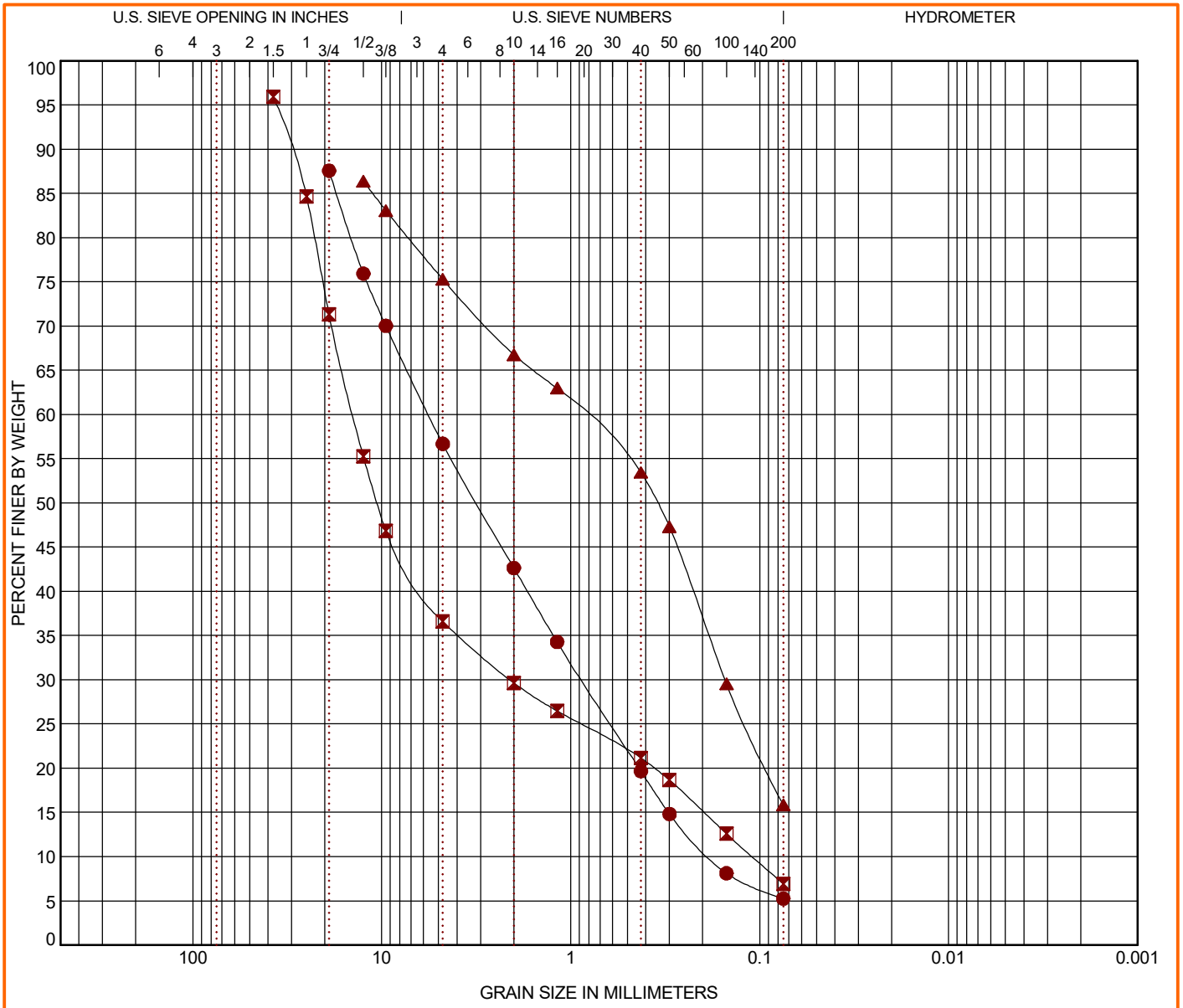
No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started:	Boring Completed:
Drill Rig: B-61	Driller: Calpac
Project No.: CB185127A	

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	Perc-1	11 - 15	Poorly Graded Sand with Gravel (SP)					0.74	30.95
⊠	Perc-3	3 - 8	Poorly Graded Sand with Silt (SP-SM)					2.84	129.53
▲	Perc-4	3 - 8	Poorly Graded Sand with Silt (SP-SM)						

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	Perc-1	11 - 15	19	5.642	0.875	0.182		30.9	51.4		5.3	
⊠	Perc-3	3 - 8	37.5	14.138	2.095	0.109		59.3	29.6		6.9	
▲	Perc-4	3 - 8	12.5	0.857	0.153			11.1	59.4		15.9	

PROJECT: CB185127A

PROJECT NUMBER: CB185127A

SITE: Arrow Road and Lime Avenue Intersection
Fontana, CA

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

CLIENT: Old Dominion Freight Line, Inc.
Indianapolis, IN

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 CB185127A CB185127A.GPJ TERRACON_DATATEMPLATE.GDT 9/15/20

Jon No.: CB185127A

PERCOLATION TEST DATA

BORING NUMBER: P-1
LOT No: N/A
TRACT No: N/A

CLIENT: ODFL
PROJECT: Fontana

DATE OF DRILLING: September 1, 2020
DATE OF TESTING: September 2, 2020
DRILLED BY: Calpac
TESTED BY: Daniel

DEPTH BEFORE (ft.): 16.0
DEPTH AFTER (ft.): 16.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

Presoaking

Time Interval (min)	Initial Water Level (ft)	Final Water Level (ft)	Change in Water Level (ft)
25	10.5	16	5.5
25	11.2	16	4.8

Time Interval (min.)	Total Elapsed Time (min.)	Initial Water Level (ft.)	(in.)	Final Water Level (ft.)	(in.)	Change in Water Level (ft.)	Initial Hole Depth (ft.)	Final Hole Depth (ft.)	Percolation Rate (in/hr)	Infiltration rate (Porchet Method) (in/hr)
10	10	10.70		14.10		3.40	16.0	16.0	244.80	10.83
10	20	10.35		14.25		3.90	16.0	16.0	280.80	12.10
10	30	11.00		14.22		3.22	16.0	16.0	231.84	10.86
10	40	11.00		14.22		3.22	16.0	16.0	231.84	10.86
10	50	10.95		14.05		3.10	16.0	16.0	223.20	10.15
10	60	11.00		14.20		3.20	16.0	16.0	230.40	10.77

Last 10 min reading: 230.40 10.8

BORING NUMBER: P-2
LOT No: N/A
TRACT No: N/A

CLIENT: ODFL
PROJECT: Fontana

DATE OF DRILLING: September 1, 2020
DATE OF TESTING: September 2, 2020
DRILLED BY: Calpac
TESTED BY: Daniel

DEPTH BEFORE (ft.): 16.0
DEPTH AFTER (ft.): 16.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

Presoaking

Time Interval (min)	Initial Water Level (ft)	Final Water Level (ft)	Change in Water Level (ft)
25	11.2	16	4.8
25	10.1	16	5.9

Time Interval (min.)	Total Elapsed Time (min.)	Initial Water Level (ft.)	(in.)	Final Water Level (ft.)	(in.)	Change in Water Level (ft.)	Initial Hole Depth (ft.)	Final Hole Depth (ft.)	Percolation Rate (in/hr)	Infiltration rate (Porchet Method) (in/hr)
4.50	4.5	13.60		15.70		2.10	16.0	16.0	336.00	36.92
6.82	11.31667	12.00		15.70		3.70	16.0	16.0	390.81	28.12
7.25	18.56667	12.00		15.70		3.70	16.0	16.0	367.45	26.44
7.45	26.01667	12.00		15.70		3.70	16.0	16.0	357.58	25.73
7.50	33.51667	12.00		15.70		3.70	16.0	16.0	355.20	25.55
7.45	40.96667	12.00		15.70		3.70	16.0	16.0	357.58	25.73

Last 10 min reading: 357.58 25.7

BORING NUMBER: P-3
LOT No: N/A
TRACT No: N/A

CLIENT: ODFL
PROJECT: Fontana

DATE OF DRILLING: September 1, 2020
DATE OF TESTING: September 1, 2020
DRILLED BY: Calpac
TESTED BY: Daniel

DEPTH BEFORE (ft.): 8.0
DEPTH AFTER (ft.): 8.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

Presoaking

Time Interval (min)	Initial Water Level (ft)	Final Water Level (ft)	Change in Water Level (ft)
25	3.4	8	4.6
25	3.2	8	4.8

Time Interval (min.)	Total Elapsed Time (min.)	Initial Water Level (ft.)	(in.)	Final Water Level (ft.)	(in.)	Change in Water Level (ft.)	Initial Hole Depth (ft.)	Final Hole Depth (ft.)	Percolation Rate (in/hr)	Infiltration rate (Porchet Method) (in/hr)
10	10	2.20		5.35		3.15	8.0	8.0	226.80	8.61
10	20	3.09		5.49		2.40	8.0	8.0	172.80	7.43
10	30	3.05		5.34		2.29	8.0	8.0	164.88	6.92
10	40	3.50		5.60		2.10	8.0	8.0	151.20	6.97
10	50	3.20		5.21		2.01	8.0	8.0	144.72	6.09
10	60	2.85		5.11		2.26	8.0	8.0	162.72	6.48
10	70	3.00		5.10		2.10	8.0	8.0	151.20	6.12
10	80	2.91		5.03		2.12	8.0	8.0	152.64	6.06

Last 10 min reading: 152.64 6.1

Jon No.: CB185127A

PERCOLATION TEST DATA

BORING NUMBER: P-4
LOT No: N/A
TRACT No: N/A

CLIENT: ODFL
PROJECT: Fontana

DATE OF DRILLING: September 1, 2020
DATE OF TESTING: September 1, 2020
DRILLED BY: Calpac
TESTED BY: Daniel

DEPTH BEFORE (ft.): 8.0
DEPTH AFTER (ft.): 8.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

Presoaking

Time Interval (min)	Initial Water Level (ft)	Final Water Level (ft)	Change in Water Level (ft)
25	3.7	8	4.3
25	3.5	8	4.5

Time Interval (min.)	Total Elapsed Time (min.)	Initial Water Level (ft.)	(in.)	Final Water Level (ft.)	(in.)	Change in Water Level (ft.)	Initial Hole Depth (ft.)	Final Hole Depth (ft.)	Percolation Rate (in/hr)	Infiltration rate (Porchet Method) (in/hr)
10	10	3.70		5.60		1.90	8.0	8.0	136.80	6.48
10	20	2.30		4.60		2.30	8.0	8.0	165.60	5.85
10	30	2.70		4.90		2.20	8.0	8.0	158.40	6.05
10	40	2.60		4.65		2.05	8.0	8.0	147.60	5.42
10	50	2.65		4.65		2.00	8.0	8.0	144.00	5.31
10	60	2.80		4.70		1.90	8.0	8.0	136.80	5.16
10	70	2.90		4.70		1.80	8.0	8.0	129.60	4.95

Last 10 min reading: 129.60 4.9

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
CB185127A ■ Fontana, CA
Terracon Project No. CB185127A

Terracon GeoReport

SAMPLING

- Auger Cuttings
- Modified California Ring Sampler
- Standard Penetration Test

WATER LEVEL

- **Water Initially Encountered**
- **Water Level After a Specified Period of Time**
- **Water Level After a Specified Period of Time**
- **Cave In Encountered**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	> 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM PORTRAIT

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

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

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

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

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

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

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

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

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

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

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

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

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

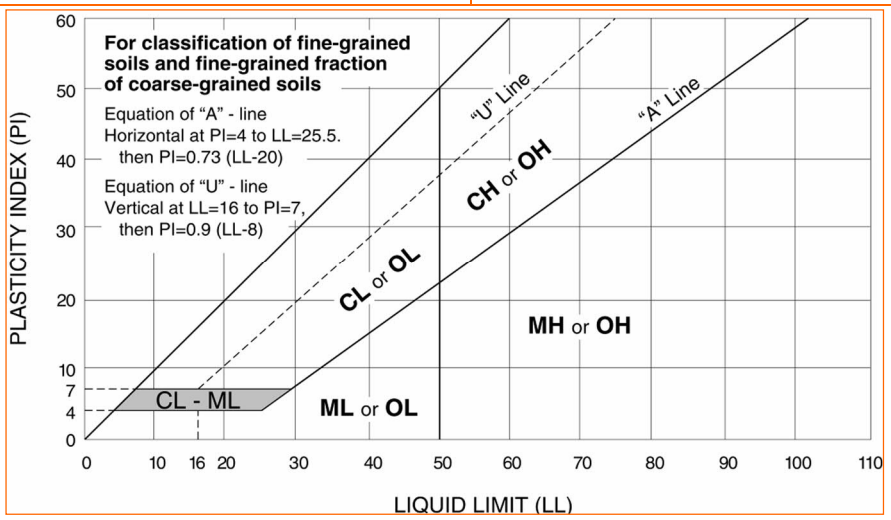
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

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

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

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.50
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.50
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.50
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	2	0.50
		Redundancy	0.25	2	0.50
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{Total} = S_A \times S_B$					2.63
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					10.80
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					4.11

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

See geotechnical report in Appendix 6.4

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.