MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Newcastle-Hesperia

DEVELOPMENT FILE NO. CUP22-00004

Prepared for:

Newcastle Partners

4740 Green River, Suite 110

Corona, CA 92880

(951) 582-9800

Prepared by:

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27363 Via Industria

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(951) 683-3691

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Revision No. and Date: Insert No and Current Revision Date

Revision No. and Date: Insert No and Current Revision Date

Revision No. and Date: Insert No and Current Revision Date

Final Approval Date:_____

Project Owner's Certification

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

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

Project Data			
Permit/Application Number(s):	CUP22-00004	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	Parcel Map No. 14447	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 3064-581-02 & 3064-581-03

Owner's Signature			
Owner Name: Dennis Higgs			
Title	Founder and Managing Partner		
Company	Newcastle Partners		
Address	230 California Street, Suite 510, San Francisco, CA 94111		
Email	ddh@newcastlepartners.com		
Telephone #	(951) 582-9800		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	CUP22-00004	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	Parcel Map No. 14447	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 3064-581-02 & 3064-581-03

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

Engineer: Nobu Murakami		PE Stamp Below
Title	Water Resources Engineer	
Company	SDH & Associates, Inc.	
Address	27363 Via Industria, Temecula, CA 92590	
Email	nobu@sdhinc.net	
Telephone #	(951) 683-3691	
Signature		
Date		

Table of Contents

Forms

Section I – Introduction

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

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

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Newcastle-Hesperia				
Project Owner Contact Name:	Courtney Smith				
Mailing Address:	4740 Green River, Suite 110 Corona, CA 92880	E-mail Address:	courtney@newcastlepartners.com	Telephone:	(951) 582-9800
Permit/Application Number(s):	CUP22-00004		Tract/Parcel Map Number(s):	Parcel Map No. 14447	
Additional Information/ Comments:	Based on the direction from the City Engineer (Mr. Michael Thornton) provided in April 2022, it was recommended that the proposed BMP to be designed to drain storm water runoff in approximately 24 hours. As part of the storm water quality and flood control mitigation, an aboveground infitration basin (along with a supplemntal underground storage) is provided. The aboveground basin bottom will also have a proprietary drywell system in order to achieve the drawdown in approxiamtely 24 hours. Based on the project-specific geotechnical investigation report, the recommended field infiltration rate is approximately 16 inches/hour. With the factor of safety following the San Bernardino County guidelines, the design infiltration rate for the proposed aboveground basin bottom and drywell were determined to be 0.96 in/hr and 2.56 in/hr, respectively. It is understood that a 24-hour drawdown time is acceptable if supporting calculation is provided to show the full DCV can be infiltrated within 24 hours with the use of the applicable factor of safety. The project's DCV is approximately 37,128 C.F. First with the 24-hr DT, the proposed basin bottom (with a rate of 0.96 in/hr and proposed bottom footprint of 7,488 S.F.), approximately 14,377 C.F. could be infiltrated into the ground. That would leave with the remaining DCV of ~22,751 C.F. This backup calculation is shown below. This remaining DCV is expected to be infiltrated via the proposed drywell system, which is to be located near the northerly end of the proposed infiltration basin bottom. Remainig DCV (per basin bottom infiltration in 24 hours) = 37,128 C.F. - 7,488 S.F. * (0.96 in/hr / 12 in/ft) * 24 hrs = 22,751 C.F. This remaining DCV of 22,751 C.F. will be infiltrated via the proposed drywell system at the bottom of the basin. Supporting calculation showing that this remaining volume will be retained is provided in the Attachment of this report. Therefore, the use of 24-hour drawdown for this project is appropriate.				
Description of Project:	Newcastle Partners is proposing to develop an industrial tilt-up warehouse building and associated parking as part of this project, which is to be located at the southwest corner of Mesa Linda Street and Sultana Street, in the City of Corona, California. The site (parcel) is approximately 18.2 acres (gross area) with the drainage management area (DMA) of 17.5 acres. The proposed building footprint is approximately 408,997 square feet (S.F.). The project is required to have 220 auto parking stalls and the project will provide a minimum of 220 parking stalls. The project also includes 54 dock loading positions, and 57 trailer parking stalls. Approximately 15% of the site will be dedicated for landscape areas. The overall on-site impervious surface footprint anticipated for this project is approximately 646,272 S.F., which is approximately ~84% of the overall DMA. The existing site consists of vacant dirt lot.				

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	N/A

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

Form 2.1-1 Description of Proposed Project

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

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

☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) *Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.*

2 Project Area (ft2):	791,017 SF	**3** Number of Dwelling Units:	N/A	**4** SIC Code:	1541

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

Currently, Newcastle Partners is the property owner and is expected to be responsible for the long-term maintenance of the proposed on-site best management practice (BMP). Maintenance of the proposed on-site BMPs will be the sole responsibility of the owner / lessee. The owner may choose to contract out the maintenance of the proposed BMPs to a contractor with proper equipment. If the ownership changed in the future, then the long-term maintenance and funding responsibilities of WQMP storm water facilities will be transferred to the new owner.

2.3 Potential Stormwater Pollutants

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

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

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	In addition to the proposed dry extended detention basin, the project will provide proprietary media filters (as pre-treatment) at each of the proposed on-site catch basin locations.
Nutrients - Phosphorous	E ☐	N ☒	The proposed landscape area plans to provide drought-tolerant along with water efficient irrigation to the extent practicable (source control); therefore, nutrients runoff are minimized.
Nutrients - Nitrogen	E ☐	N ☒	The proposed landscape area plans to provide drought-tolerant along with water efficient irrigation to the extent practicable (source control); therefore, nutrients runoff are minimized.
Noxious Aquatic Plants	E ☐	N ☒	This is not anticipated from the proposed development and anticipated activities.
Sediment	E ☒	N ☐	In addition to the proposed dry extended detention basin, the project will provide proprietary media filters (as pre-treatment) at each of the proposed on-site catch basin locations.
Metals	E ☒	N ☐	In addition to the proposed dry extended detention basin, the project will provide proprietary media filters at each of the proposed on-site catch basin locations.
Oil and Grease	E ☒	N ☐	This will be addressed via the proposed dry extended detention basin.
Trash/Debris	E ☒	N ☐	This will be addressed via the proposed dry extended detention basin.
Pesticides / Herbicides	E ☐	N ☒	The proposed landscape area plans to provide drought-tolerant along with water efficient irrigation to the extent practicable (source control); therefore, nutrients runoff are minimized.
Organic Compounds	E ☒	N ☐	In addition to the proposed dry extended detention basin, the project will provide proprietary media filters (as pre-treatment) at each of the proposed on-site catch basin locations.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude N34° 25' 06.57"	Longitude W117° 23' 33.91"	Thomas Bros Map page
1 San Bernardino County climatic region: ☒ Desert			
2 Does the site have more than one drainage area (DA): Yes☐ No☒ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*			

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	
DA1 DMA B to Outlet 1	
DA2 to Outlet 2	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	764,154			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC I			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	840			
6 Longest flowpath slope (ft/ft)	0.022			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren, Fallow			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	Poor			

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

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	No TMDL data have been recorded by EPA for this waterbody.
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Toxic Inorganics, Salinity/Total Dissolved Solids/Chlorides/Sulfates
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	N/A
Hydromodification Assessment	☒ Yes *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal* ☐ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

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

4.1.1 Source Control BMPs

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

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	
N2	Activity Restrictions	☐	☒	Specific activity restrictions are not anticipated for this project.
N3	Landscape Management BMPs	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	This is not anticipated to be applicable for this project type.
N6	Local Water Quality Ordinances	☒	☐	
N7	Spill Contingency Plan	☐	☒	Dependent on tenan (end user). Currently, this is not anticipated to be applicable for this project type.
N8	Underground Storage Tank Compliance	☒	☐	
N9	Hazardous Materials Disclosure Compliance	☐	☒	Dependent on tenan (end user). Currently, hazardous material are not anticipated on-site.

Form 4.1-1 Non-Structural Source Control BMPs

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

Form 4.1-2 Structural Source Control BMPs

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

Form 4.1-2 Structural Source Control BMPs

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

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: The proposed improvements will be consistent with the intended use for the site. The impervious area has been minimized to the extent possible and provide close to the minimum required parking.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☐ No ☐ Explanation: Where applicable, runoff from the proposed hardscape area will be directed towards landscape area in an effort to promote incidental infiltration and preserve the infiltration capacity.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: In terms of drainage, the existing site generally drains in a southerly direction and eventually drains to the existing San Antonio Channel. In the post-project condition, the on-site drainage pattern and time of concentration will be maintained
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes ☒ No ☐ Explanation: As indicated above, runoff from the proposed hardscape area will be directed towards landscape area in an effort
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Porous pavement is not anticipated for this project as this type of surface improvement has tendency to clog over time and more challenging to maintain.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: In the existing condition, the site does not have much vegetation and it does not appear to have a sensitive area. Most of the native vegetation will be replaced by the proposed improvements and landscape areas.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: Landscape areas will be provided where applicable. Areas to be disturbed will be stabilized.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Where the infiltration BMPs are proposed, the compaction will be minimized to the extent practicable, in an effort to promote storm water infiltration.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Based on the project site layout and proposed parking areas, runoff from the site will be collected via catch basins and storm drain pipes and vegetated swales are not feasible for the site.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: The proposed landscape areas will be staked off after rough grading to help minimize excessive compaction and help promote incidental infiltration.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☐ Explanation: The use of rain barrels and cisterns are not practicable in this region. In most situations, there would not be adequate demand/use to drain the water quality volume and have the BMP ready for next storm (back to back storm event).
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: This is not applicable.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

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

4.2.1 Project Specific Hydrology Characterization

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

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

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft^2): 764,154	**2** Imperviousness after applying preventative site design practices (Imp%): 84%	**3** Runoff Coefficient (Rc): _0.65 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.458 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.567 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☒ 48-hrs ☐
7 Compute design capture volume, DCV (ft^3): 37,128 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

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

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

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 101,835 *Form 4.2-3 Item 12*	**2** 15.5 *Form 4.2-4 Item 13*	**3** 28.7 *Form 4.2-5 Item 10*
Post-developed	**4** 146,412 *Form 4.2-3 Item 13*	**5** 12.2 *Form 4.2-4 Item 14*	**6** 29.9 *Form 4.2-5 Item 14*
Difference	**7** *44,577* *Item 4 – Item 1*	**8** *3.3* *Item 2 – Item 5*	**9** *1.2* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *43.8%* *Item 7 / Item 1*	**11** *21.2%* *Item 8 / Item 2*	**12** *4.2%* *Item 9 / Item 3*

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

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type	Barren							
2a Hydrologic Soil Group (HSG)	A							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	764,154							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	78							
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	Industrial							
2b Hydrologic Soil Group (HSG)	A							
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	764,154							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	87							

5 Pre-Developed area-weighted CN: 78	**7** Pre-developed soil storage capacity, S (in): 2.82 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.56 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 87	**8** Post-developed soil storage capacity, S (in): 1.49 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.30 *I_a = 0.2 * Item 8*

11 Precipitation for 10 yr, 24 hr storm (in): 3.63
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 101,835
*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): 146,412
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet hydromodification requirement, (ft^3): 37,256
*Vhydro = (Item 13 * 0.95) – Item 12*

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

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

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*	840				1682			
2 Change in elevation (ft)	17.3				17.3			
3 Slope (ft/ft), *S_o = Item 2 / Item 1*	0.02				0.01			
4 Land cover	Barren				Paved			
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*	15.5				12.2			
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*	0				0			
7 Cross-sectional area of channel (ft^2)	8.7				7.1			
8 Wetted perimeter of channel (ft)	13.5				8.8			
9 Manning's roughness of channel (n)	0.025				0.012			
10 Channel flow velocity (ft/sec) *V_{fps} = (1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*	6.3				10.8			
11 Travel time to outlet (min) *T_t = Item 6 / (Item 10 * 60)*	0				0			
12 Total time of concentration (min) *T_c = Item 5 + Item 11*	15.5				12.2			

13 Pre-developed time of concentration (min): 15.5 *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): 12.2 *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet hydromodification requirement (min): 2.5 *$T_{C\text{-}Hydro}$ = (Item 13 * 0.95) – Item 14*

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

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.7 LOG Form 4.2-4 Item 5 /60)*		2.78			2.07		
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*		17.5			17.5		
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)*		1.0			0.16		
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*		0.66			1.04		
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)*		0.66			0.17		
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*		28.7			29.9		
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): 28.7 *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): 29.9 *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): 0 *$Q_{p\text{-}hydro}$ = (Item 14 * 0.95) – Item 10*

4.3 BMP Selection and Sizing

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

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

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

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

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

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

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

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

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive

with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☒ No ☐ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA 1 DMA A BMP Type Rooftop & Impervious Area Dispersion (northerly portion)	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	256,614		
3 Ratio of pervious area receiving runoff to impervious area	0.10		
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*	1,069		
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 1,069 $V_{retention}$ *=Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): 0 $V_{retention}$ *=Sum of Item 12 for all BMPs*			

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

14 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 14-18. If no, proceed to Item 19*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) $V_{retention}$ *= Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches*			
18 Runoff volume retention from street tree BMPs (ft^3): 0 $V_{retention}$ *= Sum of Item 17 for all BMPs*			
19 Total Retention Volume from Site Design BMPs: 1,069 *Sum of Items 5, 13 and 18*			

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

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

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

1 Remaining LID DCV not met by site design BMP (ft^3): 37,128 (conservative #) *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA A BMP Type Infiltration Basin w/ Drywell	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	2.1		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.1875		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.96		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	24		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	0.5		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	0.5		
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*	7,488		
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*	N/A		
10 Amended soil porosity	N/A		
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*	N/A		
12 Gravel porosity	N/A		
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))]*	14,376 (see Attachment)		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	22,943 (see attachment)		
16 Total Retention Volume from LID Infiltration BMPs: 37,128 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☐ No ☒ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.* Pathogens, sediment, metals, oil & grease, trash/debris, and organic compounds. Refer to Form 2.3-1 for additional information regarding the strategy/plan to address those aticipated pollutants.	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): 0 *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): N/A *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type N/A	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 *Sum of Item 14 for all volume-based BMPs included in this form*			

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

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

Form 4.3-7 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

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

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 37,128 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 1,069 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 37,128 *Copy Item 16 in Form 4.3-3*

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

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

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

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): 37,256 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): 38,197 *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): 0

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

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☒
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐

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

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐

4.4 Alternative Compliance Plan (if applicable)

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

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

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Pre-treatment catch basin filters (i.e. -FloGard Catch Basin Filters or equivalent)	Newcastle Partners	TBD - To be provided at the time of Final WQMP	TBD
Pre-treatment vegetated swale	Newcastle Partners	TBD - To be provided at the time of Final WQMP	TBD
Infiltration Basin (Aboveground)	Newcastle Partners	TBD - To be provided at the time of Final WQMP	TBD
Drywell (supplement to	Newcastle Partners	TBD - To be provided at the time of Final WQMP	TBD

Infiltration Basin)			
Supplemental Underground Storage (for FC purpose)	Newcastle Partners	TBD - To be provided at the time of Final WQMP	TBD
		Other relevant BMPs may be included here at the time of Final WQMP	

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

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

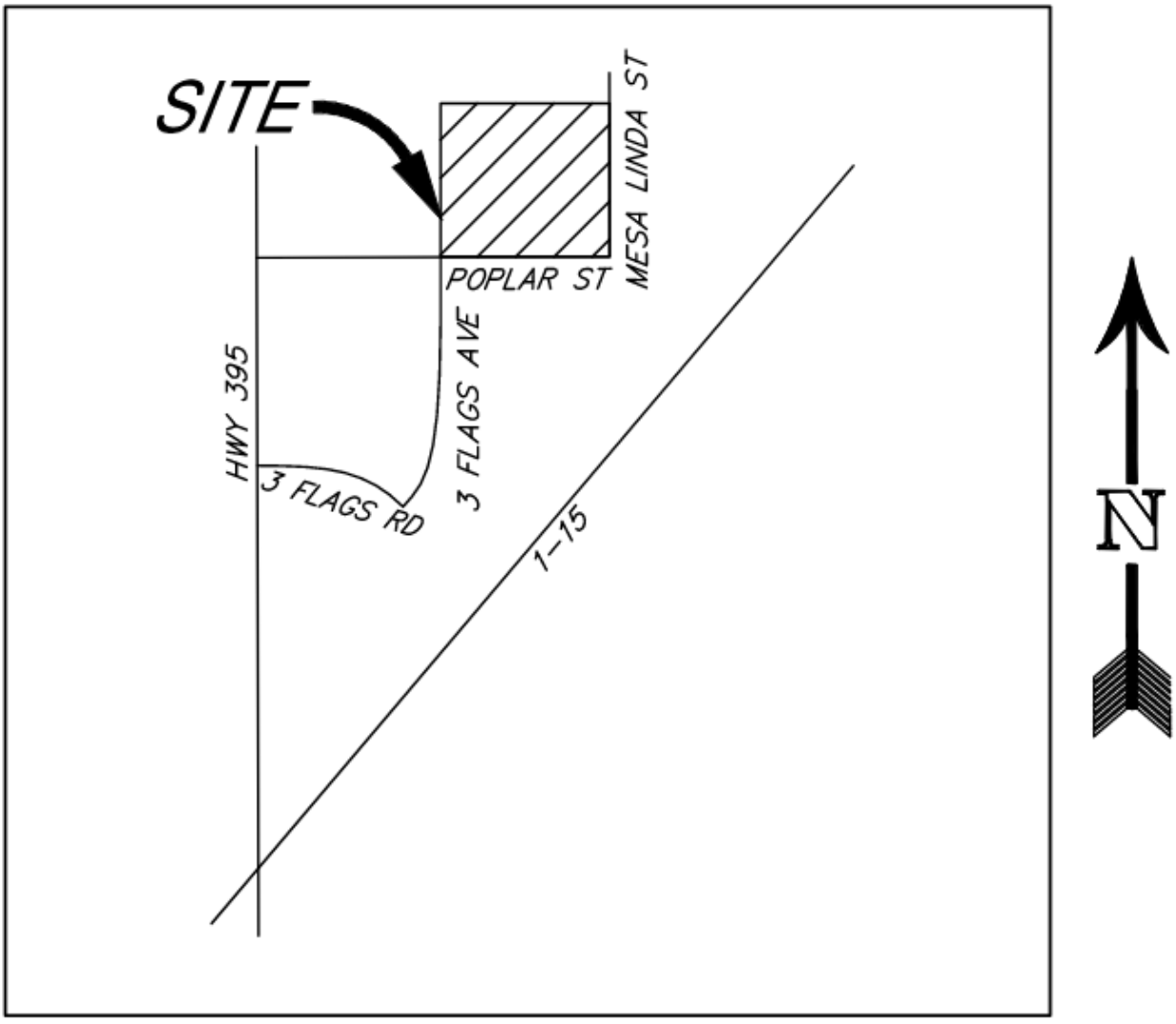
6.4 Other Supporting Documentation

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

Appendix 1:Vicinity Map, Precipitation Data, and WQMP Site Plan

1. *Vicinity Map*
2. *Precipitation Data*
3. *WQMP Site Plan*
4. *WQMP BMP Section Details*

Vicinity Map



VICINITY MAP
NOT TO SCALE

The project is located at the southwest corner of the intersection of Mesa Linda Street and Sultana Street in the City of Hesperia (San Bernardino County), California.

SUPPORTING MATERIALS - PROJECT'S PRECIPITATION DATA PER NOAA ATLANS 14

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4186°, Longitude: -117.3924°
Elevation: 3594.25 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	**0.087** (0.072-0.106)	**0.124** (0.102-0.151)	**0.172** (0.142-0.211)	**0.212** (0.173-0.262)	**0.267** (0.211-0.341)	**0.310** (0.240-0.404)	**0.354** (0.267-0.473)	**0.400** (0.294-0.550)	**0.464** (0.327-0.665)	**0.514** (0.350-0.762)
10-min	**0.125** (0.103-0.152)	**0.177** (0.147-0.217)	**0.247** (0.203-0.302)	**0.304** (0.248-0.375)	**0.383** (0.303-0.489)	**0.444** (0.344-0.579)	**0.507** (0.383-0.678)	**0.573** (0.421-0.788)	**0.664** (0.468-0.953)	**0.736** (0.501-1.09)
15-min	**0.151** (0.125-0.184)	**0.214** (0.177-0.262)	**0.298** (0.246-0.366)	**0.367** (0.300-0.454)	**0.463** (0.366-0.591)	**0.537** (0.416-0.700)	**0.613** (0.463-0.820)	**0.693** (0.509-0.953)	**0.804** (0.566-1.15)	**0.890** (0.606-1.32)
30-min	**0.228** (0.189-0.278)	**0.324** (0.268-0.396)	**0.451** (0.371-0.552)	**0.555** (0.454-0.686)	**0.699** (0.553-0.893)	**0.811** (0.628-1.06)	**0.927** (0.700-1.24)	**1.05** (0.769-1.44)	**1.21** (0.855-1.74)	**1.35** (0.915-2.00)
60-min	**0.323** (0.267-0.394)	**0.458** (0.379-0.560)	**0.637** (0.525-0.781)	**0.785** (0.642-0.970)	**0.989** (0.782-1.26)	**1.15** (0.888-1.50)	**1.31** (0.990-1.75)	**1.48** (1.09-2.04)	**1.72** (1.21-2.46)	**1.90** (1.30-2.82)
2-hr	**0.473** (0.391-0.577)	**0.641** (0.530-0.784)	**0.869** (0.716-1.07)	**1.06** (0.867-1.31)	**1.33** (1.05-1.70)	**1.54** (1.19-2.01)	**1.76** (1.33-2.36)	**2.00** (1.47-2.75)	**2.33** (1.64-3.34)	**2.59** (1.76-3.85)
3-hr	**0.596** (0.494-0.728)	**0.797** (0.659-0.974)	**1.07** (0.882-1.31)	**1.30** (1.06-1.61)	**1.63** (1.29-2.08)	**1.89** (1.46-2.46)	**2.16** (1.63-2.89)	**2.46** (1.81-3.38)	**2.87** (2.02-4.12)	**3.21** (2.19-4.77)
6-hr	**0.849** (0.702-1.04)	**1.12** (0.929-1.37)	**1.50** (1.24-1.84)	**1.82** (1.49-2.25)	**2.28** (1.81-2.92)	**2.66** (2.06-3.47)	**3.05** (2.31-4.08)	**3.48** (2.56-4.79)	**4.10** (2.89-5.87)	**4.60** (3.13-6.83)
12-hr	**1.11** (0.918-1.35)	**1.51** (1.24-1.84)	**2.05** (1.69-2.51)	**2.51** (2.05-3.10)	**3.17** (2.51-4.06)	**3.71** (2.87-4.84)	**4.28** (3.23-5.72)	**4.90** (3.60-6.73)	**5.78** (4.07-8.29)	**6.51** (4.43-9.66)
24-hr	**1.50** (1.33-1.73)	**2.11** (1.87-2.43)	**2.93** (2.59-3.39)	**3.63** (3.18-4.24)	**4.64** (3.93-5.58)	**5.45** (4.52-6.70)	**6.31** (5.11-7.94)	**7.23** (5.70-9.37)	**8.56** (6.47-11.6)	**9.65** (7.05-13.5)
2-day	**1.73** (1.54-2.00)	**2.43** (2.15-2.80)	**3.40** (3.00-3.93)	**4.23** (3.70-4.93)	**5.43** (4.60-6.54)	**6.41** (5.32-7.88)	**7.46** (6.04-9.40)	**8.61** (6.78-11.1)	**10.3** (7.76-13.9)	**11.6** (8.50-16.3)
3-day	**1.86** (1.65-2.14)	**2.61** (2.31-3.00)	**3.65** (3.22-4.21)	**4.55** (3.98-5.30)	**5.86** (4.96-7.05)	**6.94** (5.76-8.53)	**8.10** (6.56-10.2)	**9.37** (7.38-12.1)	**11.2** (8.49-15.2)	**12.8** (9.33-17.8)
4-day	**2.00** (1.78-2.31)	**2.81** (2.49-3.24)	**3.93** (3.47-4.54)	**4.91** (4.30-5.72)	**6.33** (5.36-7.62)	**7.50** (6.22-9.22)	**8.76** (7.10-11.0)	**10.1** (7.99-13.1)	**12.2** (9.20-16.4)	**13.9** (10.1-19.4)
7-day	**2.25** (1.99-2.59)	**3.13** (2.77-3.61)	**4.36** (3.85-5.04)	**5.42** (4.75-6.32)	**6.97** (5.90-8.39)	**8.24** (6.84-10.1)	**9.62** (7.79-12.1)	**11.1** (8.76-14.4)	**13.3** (10.1-18.0)	**15.1** (11.1-21.2)
10-day	**2.40** (2.13-2.77)	**3.34** (2.95-3.85)	**4.63** (4.09-5.35)	**5.75** (5.04-6.70)	**7.37** (6.25-8.88)	**8.71** (7.23-10.7)	**10.1** (8.22-12.8)	**11.7** (9.24-15.2)	**14.0** (10.6-18.9)	**15.9** (11.6-22.2)
20-day	**2.89** (2.56-3.32)	**3.99** (3.53-4.60)	**5.52** (4.87-6.38)	**6.84** (5.99-7.97)	**8.74** (7.41-10.5)	**10.3** (8.56-12.7)	**12.0** (9.72-15.1)	**13.8** (10.9-17.9)	**16.5** (12.5-22.3)	**18.8** (13.7-26.3)
30-day	**3.40** (3.02-3.92)	**4.68** (4.14-5.40)	**6.45** (5.69-7.45)	**7.96** (6.98-9.28)	**10.2** (8.61-12.2)	**12.0** (9.93-14.7)	**13.9** (11.3-17.5)	**16.1** (12.7-20.8)	**19.2** (14.5-25.9)	**21.8** (15.9-30.5)
45-day	**4.06** (3.60-4.67)	**5.51** (4.88-6.35)	**7.51** (6.63-8.68)	**9.24** (8.09-10.8)	**11.7** (9.95-14.1)	**13.8** (11.4-17.0)	**16.0** (13.0-20.2)	**18.5** (14.6-23.9)	**22.1** (16.7-29.8)	**25.1** (18.4-35.1)
60-day	**4.63** (4.11-5.33)	**6.19** (5.48-7.14)	**8.34** (7.37-9.64)	**10.2** (8.93-11.9)	**12.9** (10.9-15.5)	**15.1** (12.5-18.6)	**17.5** (14.2-22.0)	**20.2** (15.9-26.1)	**24.1** (18.2-32.6)	**27.5** (20.1-38.4)

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

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

Please refer to NOAA Atlas 14 document for more information.

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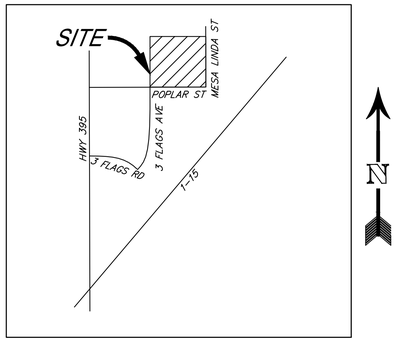
PF graphical

POST-CONSTRUCTION BMP SITE PLAN
NEWCASTLE-HESPERIA



VICINITY MAP
NOT TO SCALE

GENERAL NOTES

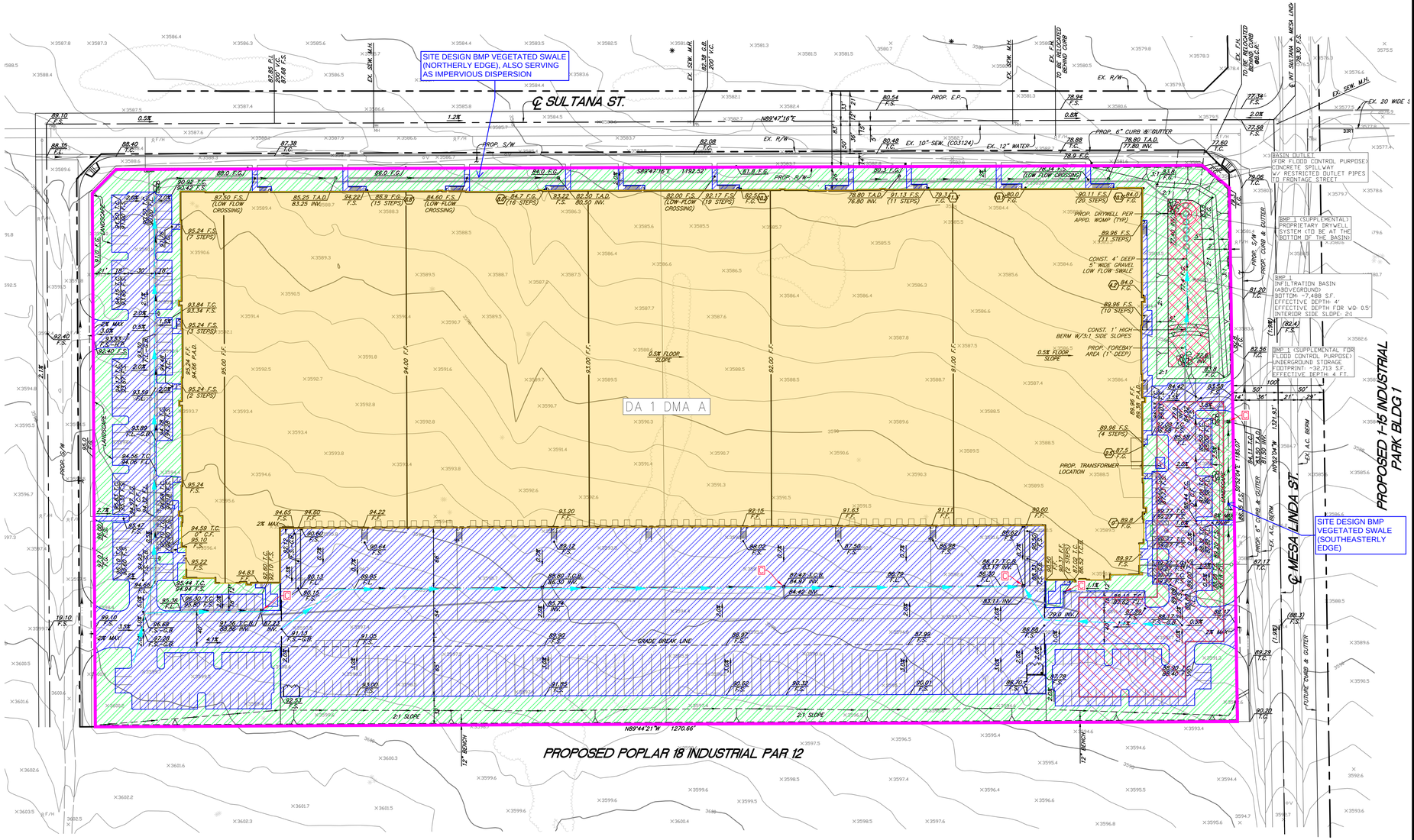
1. THE PROJECT WILL HAVE APPROXIMATELY 17.5 ACRES OF DRAINAGE MANAGEMENT AREA. IN THE EXISTING CONDITION, THERE IS AN OFFSITE RUN-ON FROM THE SOUTHERLY PARCEL; HOWEVER, IT IS OUR UNDERSTANDING THAT A PROPOSED DEVELOPMENT IN THE SOUTHERLY PARCEL APPEARS TO DIRECT THE OVERFLOWS TO THE FRONTAGE STREETS (EAST AND WEST). THEREFORE, MINOR RUN-ON MAY BE EXPECTED FROM THE SOUTHERLY PARCEL/DEVELOPMENT. THE PROPOSED PROJECT PLANS TO PROVIDE A PERIMETER DITCH TO PICK UP THE OFFSITE RUN-ON (IF ANY) FROM THE SOUTHERLY PARCEL/DEVELOPMENT AND DIRECT IT TOWARDS THE EASTERLY FRONTAGE STREET (MESA LINDA STREET).
2. BASED ON THE WEB SOIL SURVEY (ONLINE RESOURCE), THE PROJECT CONSISTS PRIMARILY OF HYDROLOGIC SOIL GROUP A. BASED ON THE SITE-SPECIFIC INFILTRATION TESTING BY THE GEOTECHNICAL ENGINEER, THE FIELD INFILTRATION RATE NEAR THE NORTHEASTERLY CORNER OF THE PROJECT (LOW POINT WHERE A PROPOSED BMP IS PROPOSED) IS APPROXIMATELY 0.1 INCH/HOUR. BASED ON THE MOJAVE RIVER WATERSHED WQMP TECHNICAL GUIDANCE DOCUMENT, THIS RATE WOULD NOT BE ADEQUATE TO RETAIN THE REQUIRED DESIGN CAPTURE VOLUME WITHIN A REASONABLE DRAWDOWN TIME AND AS SUCH AN INFILTRATION WOULD NOT BE FEASIBLE. IN ORDER TO ADDRESS THE REQUIRED DESIGN CAPTURE VOLUME, A COMBINATION OF PROPRIETARY UNDERGROUND STORAGE FACILITY AND MODULAR WETLAND SYSTEM (MWS) WILL BE PROVIDED, BASED ON A VOLUME-BASED APPROACH. THE UNDERGROUND STORAGE IS ALSO USED TO ADDRESS THE HYDROMODIFICATION MANAGEMENT REQUIREMENT.
3. THE PROJECT IS SITUATED WITHIN THE FEMA ZONE X; THEREFORE, PROCESSING THROUGH FEMA IS NOT EXPECTED TO BE REQUIRED FOR THIS PROJECT.
4. PRELIMINARY DETAILS FOR TRASH ENCLOSURE WITH COVER, STENCIL, AND ROOF DRAIN OUTLET LOCATION ARE PROVIDED ON THIS EXHIBIT; HOWEVER, THOSE DETAILS COULD BE REFINED FURTHER AT THE TIME OF FINAL WQMP.

PERMANENT SOURCE CONTROL BMPs

1. MARK ALL INLETS WITH THE WORDS "ONLY RAIN DOWN THE STORM DRAIN" OR SIMILAR
2. ENCLOSED REFUSE AREA WITH SIGNS POSTED NEARBY STATING "DO NOT DUMP HAZARDOUS MATERIALS HERE" OR SIMILAR
   - LANDSCAPING DESIGNED TO MINIMIZE IRRIGATION AND RUNOFF, TO PROMOTE SURFACE INFILTRATION WHERE APPROPRIATE, AND TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES THAT CAN CONTRIBUTE TO STORMWATER POLLUTION.

OPERATIONAL SOURCE CONTROL BMPs

- MAINTAIN LANDCAPING USING MINIMUM OR NO PESTICIDES
- PREVENT EROSION OF SLOPES BY PLANTING FAST-GROWING, DENSE GROUND COVERING PLANTS
- PLANT NATIVE VEGETATION TO REDUCE THE AMOUNT OF WATER, FERTILIZERS, AND PESTICIDES APPLIED TO THE LANDSCAPE
- DO NOT OVERWATER
- USE IRRIGATION PRACTICES SUCH AS DRIP IRRIGATION, SOAKER HOSES OR MICRO-SPRAY SYSTEMS
- PERIODICALLY INSPECT AND FIX LEAKS AND MISDIRECTED SPRINKLERS.
- DO NOT RAKE OR BLOW LEAVES, CLIPPINGS, OR PRUNING WASTE INTO THE STREET, GUTTER OR STORM DRAIN
- DISPOSE OF GREEN WASTE BY COMPOSTING, HAULING IT TO A PERMITTED LANDFILL, OR RECYCLING IT THROUGH YOUR CITY'S PROGRAM
- PROVIDE IPM INFORMATION TO NEW OWNERS, LESSEES AND OPERATORS
- PERIODIC INSPECTIONS FOR LEAKY, OVERFILLED, UNCOVERED, OR OTHER PROBLEMATIC CONDITIONS WILL OCCUR
- CORRECTIVE ACTION WILL BE MADE UPON DETECTION, AS CIRCUMSTANCES PERMIT
- DUMPING OF LIQUID OR HAZARDOUS WASTES WILL BE PROHIBITED
- SPILL CONTROL MATERIALS WILL BE AVAILABLE ON-SITE
- MOVE LOADED AND UNLOADED ITEMS INDOORS AS SOON AS POSSIBLE
- SWEEP PLAZAS, SIDEWALKS, AND PARKING LOTS REGULARLY TO PREVENT ACCUMULATION OF LITTER AND DEBRIS
- COLLECT DEBRIS FROM PRESSURE WASHING TO PREVENT ENTRY INTO THE STORM DRAIN SYSTEM
- COLLECT WASHWATER CONTAINING ANY CLEANING AGENT OR DEGREASER AND DISCHARGE TO THE SANITARY SEWER (NOT TO THE STORM DRAIN)



LID OPPORTUNITIES

1. PRESERVE EXISTING PERVIOUS AREA WHERE POSSIBLE.
2. LANDSCAPED AREAS DESIGNED TO BE SELF-RETAINING WHERE FEASIBLE.

DMA LEGEND AND AREAS

DA1 DMA's - DRAINING TO PERMANENT STRUCTURAL BMP

- DA1 DMA A-1 (ORNAMENTAL LANDSCAPING) - 117,882 S.F.
- DA1 DMA A-2 (CONCRETE OR ASPHALT) - 243,467 S.F.
- DA1 DMA A-3 (ROOFS) - 402,805 S.F.

TOTAL AREA = 764,154 S.F.

PERMANENT STRUCTURAL BMP

"BMP 1" - PROPOSED ABOVEGROUND INFILTRATION BASIN
- BOTTOM SURFACE FOOTPRINT PROVIDED: ~7,488 S.F.
- EFFECTIVE DEPTH: 4 FEET
- INTERIOR SIDE SLOPES (TYP.): 2:1
- VOLUME PROVIDED AT 4-FT DEPTH: ~37,464 C.F.

"BMP 1" - PROPOSED SUPPLEMENTAL PROPRIETARY DRYWELL
- TWO SETS OF: 1 PRIMARY SETTLING CHAMBER WITH 2 DRYWELLS

"BMP 1" - PROPOSED SUPPLEMENTAL UNDERGROUND STORAGE FACILITY
- UNDERGROUND FOOTPRINT PROVIDED: ~32,713 S.F.
- EFFECTIVE SYSTEM DEPTH: 4 FEET
- VOLUME PROVIDED AT 4-FT DEPTH: ~130,850 C.F. MIN.
  NOTE: SUPPLEMENTAL STORAGE TO ADDRESS WATER QUALITY, HYDROMODIFICATION MANAGEMENT, AND FLOOD CONTROL VOLUMES)

SITE DESIGN BMP / PRE-TREATMENT BMP

- PROPOSED CATCH BASIN INSERT FILTERS (FLOGARD CATCH BASIN FILTER INSERTS OR EQUIVALENT)
- PROPOSED VEGETATED SWALE (ALSO PROVIDING IMPERVIOUS AREA DISPERSION) SITE DESIGN BMP PRIOR TO REACHING THE PROPOSED CATCH BASIN DOWNSTREAM.

LEGEND

- DRAINAGE MANAGEMENT AREA
- TRACT BOUNDARY
- CENTERLINE
- CURB AND GUTTER
- 1280 EXISTING CONTOUR LINE
- SLOPE
- ROOF DRAIN LOCATION (TBD)
- DISCHARGE LOCATION
- PROPOSED STORM DRAIN
- GENERAL SURFACE FLOW PATH

N

0 30 60 120 180 240

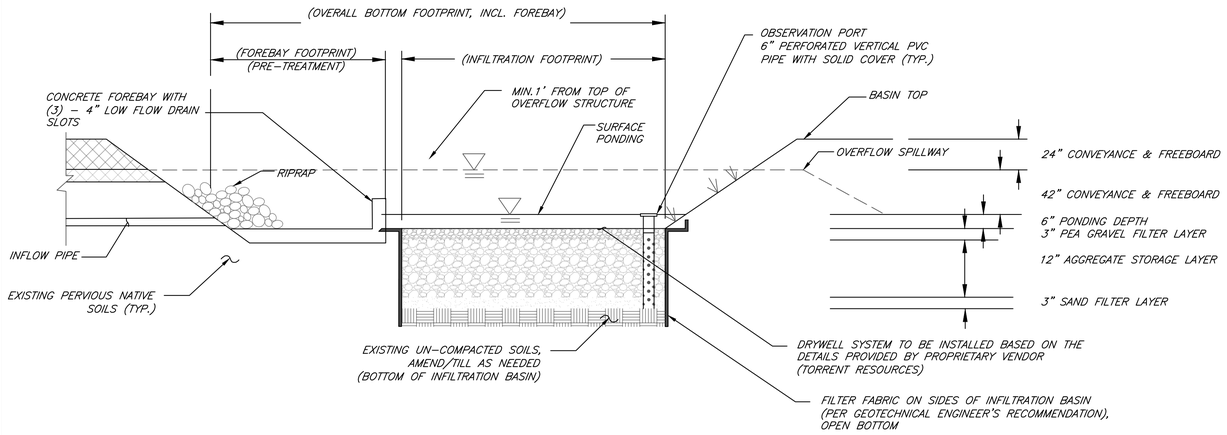
SCALE 1"=60'

REVISED: JUNE 2022

CITY OF HESPERIA	
POST-CONSTRUCTION BMP SITE PLAN:	1 OF 2 SHEETS
NEWCASTLE-HESPERIA	
(CITY CASE #: CUP22-00004)	
(SWC MESA LINDA ST & SULTANA ST)	

NOT FOR CONSTRUCTION - THIS POST-CONSTRUCTION BMP SITE PLAN IS FOR WQMP REVIEW PURPOSE

POST-CONSTRUCTION BMP SECTION DETAILS
NEWCASTLE-HESPERIA

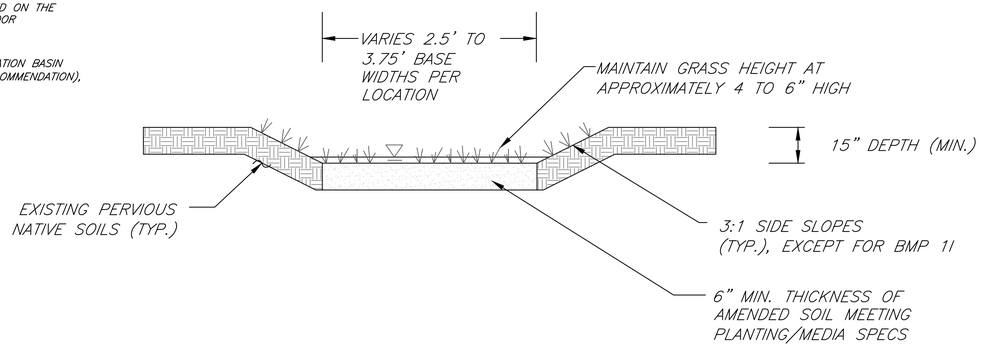


BMP 1 - INFILTRATION BASIN W/ DRYWELL SYSTEM - TYPICAL SECTION

NOT TO SCALE

GENERAL NOTES

1. THE PROPOSED INFILTRATION BASIN IS EXPECTED TO FOLLOW THE RELEVANT SPECIFICATION FROM THE COUNTY OF SAN BERNARDINO WQMP TECHNICAL GUIDANCE DOCUMENT FACT SHEET.
2. THERE WILL ALSO BE A SUPPLEMENTAL UNDERGROUND STORAGE FACILITY IMMEDIATELY UPSTREAM OF THE PROPOSED INFILTRATION BASIN. THE DETAIL FOR THE UNDERGROUND STORAGE FACILITY IS TO BE PROVIDED DURING FINAL STAGE. THIS IS PRIMARILY USED TO SUPPORT THE FLOOD CONTROL MITIGATION PURPOSE. FOR THE PURPOSE OF ANALYSIS, THE EFFECTIVE DEPTH OF THE SUPPLEMENTAL UNDERGROUND STORAGE IS APPROXIMATELY 4 FEET AND FOOTPRINT IS APPROXIMATELY 32,713 S.F.
3. THE PROPOSED LANDSCAPING/PLANTING (PLANT PALETTE) FOR THE INFILTRATION BASIN IS TO BE PROVIDED SEPARATELY BY THE PROJECT LANDSCAPE ARCHITECT.

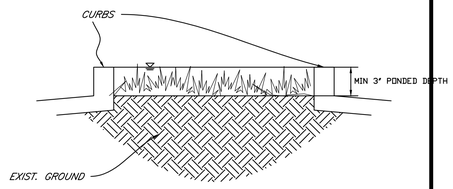


SITE DESIGN BMP: VEGETATED SWALE - TYP.

NOT TO SCALE

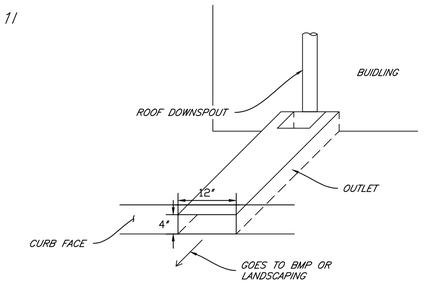
INLET PLACARD DETAIL (TYP.)

NOT TO SCALE



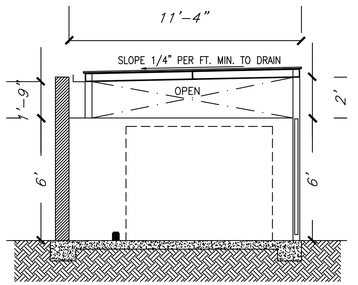
LANDSCAPED ISLAND DETAIL (TYP.)

NOT TO SCALE



ROOF DRAIN CURB OUTLET STRUCTURE DETAIL (TYP.)

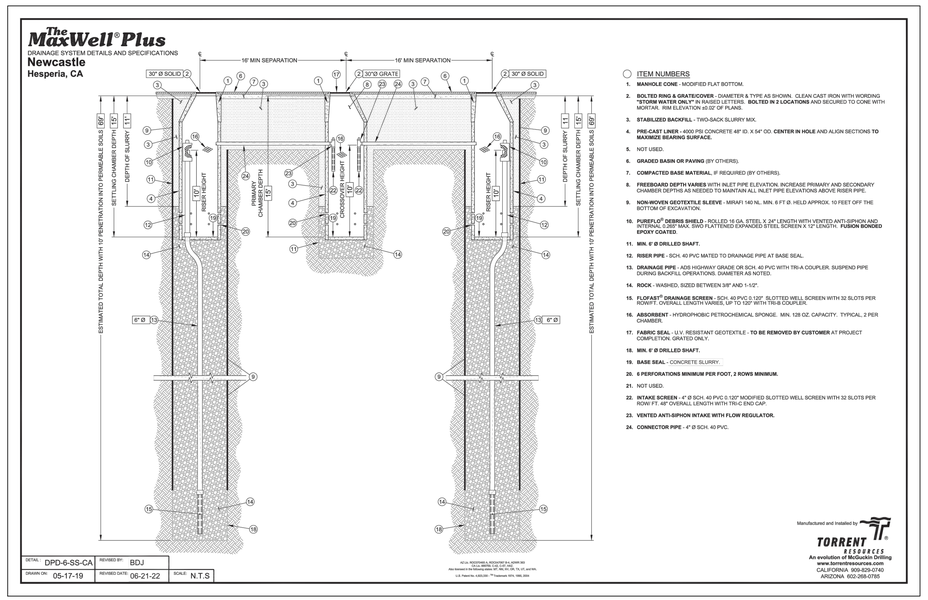
NOT TO SCALE



TRASH ENCLOSURE STRUCTURE DETAIL (TYP.)

NOT TO SCALE

REVISED: JUNE 2022



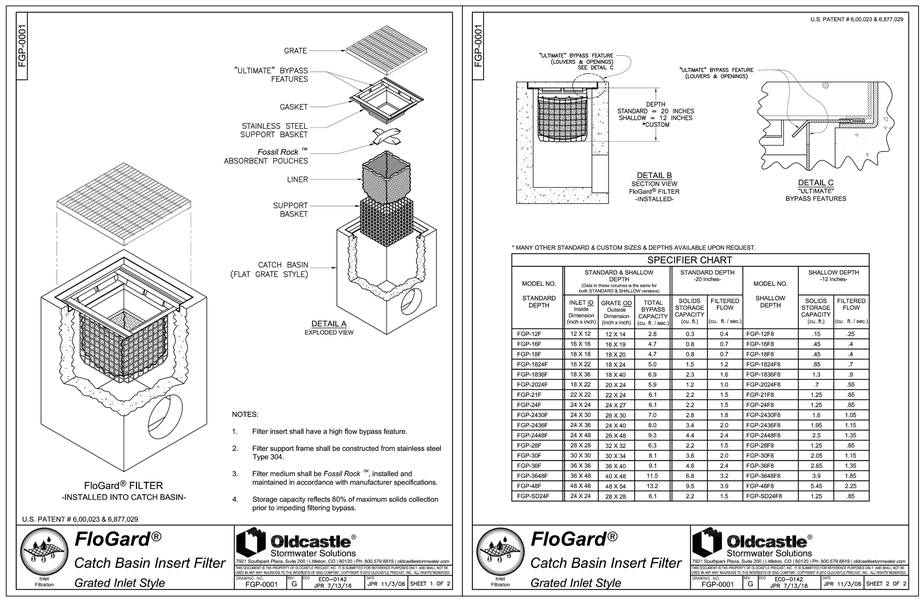
ITEM NUMBERS

1. **MANHOLE CONE** - MODIFIED FLAT BOTTOM.
2. **BOLTED RING & GRATE/COVER** - DIAMETER & TYPE AS SHOWN. CLEAN CAST IRON WITH WORDING **"STORM WATER ONLY"** IN RAISED LETTERS. **BOLTED IN 2 LOCATIONS** AND SECURED TO CONE WITH MORTAR. RIM ELEVATION AS DIRECTED BY OTHERS.
3. **STABILIZED BACKFILL** - TWO-SACK SLURRY MIX.
4. **PRE-CAST LINER** - 4000 PSI CONCRETE 48" ID, X 54" OD. **CENTER IN HOLE** AND ALIGN SECTIONS **TO MAXIMIZE BEARING SURFACE.**
5. NOT USED.
6. **GRADED BASIN OR PAVING** (BY OTHERS).
7. **COMPACTED BASE MATERIAL**, IF REQUIRED (BY OTHERS).
8. **FREEBOARD DEPTH VARIES** WITH INLET PIPE ELEVATION. INCREASE PRIMARY AND SECONDARY CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE RISER PIPE.
9. **NON-WOVEN GEOTEXTILE SLEEVE** - MIRAFI 140 NL, MIN. 6 FT Ø, HELD APPROX. 10 FEET OFF THE BOTTOM OF EXCAVATION.
10. **PUREFLO® DEBRIS SHIELD** - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL 0.265" MAX. SWG FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. **FUSION BONDED EPOXY COATED.**
11. **MIN. 6' Ø DRILLED SHAFT.**
12. **RISER PIPE** - SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
13. **DRAINAGE PIPE** - ADS HIGHWAY GRADE OR SCH. 40 PVC WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS. DIAMETER AS NOTED.
14. **ROCK** - WASHED, SIZED BETWEEN 3/8" AND 1-1/2".
15. **FLOFAST® DRAINAGE SCREEN** - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. OVERALL LENGTH VARIES, UP TO 120" WITH TRI-B COUPLER.
16. **ABSORBENT** - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL, 2 PER CHAMBER.
17. **FABRIC SEAL** - U.V. RESISTANT GEOTEXTILE - **TO BE REMOVED BY CUSTOMER** AT PROJECT COMPLETION. GRATED ONLY.
18. **MIN. 6' Ø DRILLED SHAFT.**
19. **BASE SEAL** - CONCRETE SLURRY.
20. **6 PERFORATIONS MINIMUM PER FOOT, 2 ROWS MINIMUM.**
21. NOT USED.
22. **INTAKE SCREEN** - 4" Ø SCH. 40 PVC 0.120" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/ FT. 48" OVERALL LENGTH WITH TRI-C END CAP.
23. **VENTED ANTI-SIPHON INTAKE WITH FLOW REGULATOR.**
24. **CONNECTOR PIPE** - 4" Ø SCH. 40 PVC.

Manufactured and Installed by
TORRENT RESOURCES
An evolution of McGuckin Drilling
www.torrentresources.com
CALIFORNIA 909-829-0740
ARIZONA 602-368-0785

BMP 1 - DRYWELL SYSTEM TO SUPPLEMENT INFILTRATION BASIN

NOT TO SCALE



NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter support frame shall be constructed from stainless steel Type 304.
3. Filter medium shall be *Fossil Rock* ™, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.

* MANY OTHER STANDARD & CUSTOM SIZES & DEPTHS AVAILABLE UPON REQUEST.

SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions) INLET ID Inside Dimension (inch x inch)	GRATE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	STANDARD DEPTH -20 Inches- SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)	MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches- SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	.25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	.4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1824F	18 X 22	18 X 24	5.0	1.5	1.2	FGP-1824F8	.85	.7
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-2024F	18 X 22	20 X 24	5.9	1.2	1.0	FGP-2024F8	.7	.55
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2430F	24 X 30	26 X 30	7.0	2.8	1.8	FGP-2430F8	1.6	1.05
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	26 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-29F	29 X 29	32 X 32	6.3	2.2	1.5	FGP-29F8	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 46	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-SD24F	24 X 24	28 X 28	6.1	2.2	1.5	FGP-SD24F8	1.25	.85

PRE-TREATMENT: PROPRIETARY FLOGARD CATCH BASIN INSERT FILTER - TYP.

NOT TO SCALE

CITY OF HESPERIA	
POST-CONSTRUCTION BMP SECTION DETAILS: NEWCASTLE-HESPERIA (CITY CASE #: CUP22-00004) (SWC MESA LINDA ST & SULTANA ST)	2 OF 2 SHEETS

NOT FOR CONSTRUCTION – THIS POST-CONSTRUCTION BMP SITE PLAN IS FOR WQMP REVIEW PURPOSE

Appendix 2: Soils Information

1. *Factor of Safety Summary for Design Infiltration Rates (Aboveground & Drywell)*
2. *Copies of Geotechnical Investigation Reports (Revised and Original)*

SUPPORTING MATERIAL - FACTOR OF SAFETY AND DESIGN INFILTRATION FOR PROPOSED BASIN BOTTOM (PART 1)

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	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	2	0.50
		Redundancy	0.25	1	0.25
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.1875
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					2.1 (based on B-2 from the orig. study)
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					0.96

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

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

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	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	2	0.50
		Redundancy	0.25	1	0.25
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.1875
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					5.6 (ave. of B-1, B-3, and B-4)
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					2.56

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

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

NorCal Engineering

Soils and Geotechnical Consultants
10641 Humbolt Street Los Alamitos, CA 90720
(562) 799-9469 Fax (562) 799-9459

June 17, 2022 Project Number 22884-21

Newcastle Partners
4740 Green River Road, Suite 118
Corona, California 92880

Attn: Ms. Courtney Smith

RE: **Updated Soil Infiltration Study** - Proposed Industrial Warehouse Development - Located at the at the Southwest Corner of Mesa Linda Street and Sultana Street, in the City of Hesperia, California

Dear Ms. Smith:

Pursuant to your request, this firm has performed an Updated Soil Infiltration Study for the above referenced project. The purpose of this study is to evaluate the feasibility of an on-site water disposal system for the proposed industrial warehouse development. The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration; 3) soil infiltration testing; 4) engineering analysis of field and laboratory data; and 5) preparation of a report.

Project Description

The 18.27-acre subject property is located at the southwest corner of Mesa Linda Street and Sultana Street, in the City of Hesperia. The generally rectangular-shaped parcel is elongated in an east to west direction with topography of the relatively level property descending slightly from a southwest to northeast direction on the order of a few feet. The site is undeveloped parcel covered with a moderate growth of natural grasses and weeds.

Project Description

It is proposed to construct an industrial warehouse development consisting of 398,100 square feet building as shown on the attached Site Plan. The proposed concrete tilt-up building will be supported by a conventional slab-on-grade foundation system with perimeter-spread footings and isolated interior footings. Other improvements will include asphalt and concrete pavement areas, hardscape and landscaping. It is assumed that the proposed grading for the development will include cut and fill procedures on the order of a few feet to achieve finished grade elevations. Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

An on-site storm water disposal system consisting of dry wells and been proposed within proposed pavement area in the northeast corner of the property as shown on the attached Site Plan. Infiltration tests were performed to provide preliminary infiltration rates for the purpose of planning and design of a storm water disposal system. Final building plans shall be reviewed by this firm prior to submittal for city/county approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

Field Exploration and Testing

A truck mounted Simco 2800 Drill Rig equipped with a hollow stem auger was used to excavate four (4) exploratory borings to depths of ranging between 20 and 50 feet below existing ground surface within the proposed infiltration areas. The site was found to be underlain by fill and alluvial deposits consisting predominantly of a brown to light brown, fine to coarse grained, silty to slightly silty SAND with occasional gravel with intermingled layers of brown, sandy SILT. These soils were noted to be medium dense/stiff to dense and damp to moist. The location of the exploratory borings are shown on the attached Site Plan. Detailed description of the subsurface soils is shown on the attached logs in Appendix A.

The borings consisted of six-inch diameter test holes. A three-inch diameter perforated PVC casing with solid end cap was installed in the borings and then surrounded with gravel materials to prevent caving. The infiltration holes were carefully filled with clean water and refilled after two initial readings.

Results of Field Infiltration Tests

Based upon the initial rates of infiltration at each location, test measurements were measured at selected maximum intervals thereafter. Measurements were obtained by using an electronic tape measure with 1/16-inch divisions and timed with a stopwatch. The field data sheets are provided in Appendix D.

Based upon the results of our testing, the soils encountered in the planned on-site drainage disposal system area exhibit the following field infiltration rates calculated using the Porchet Method (aka Inverse Borehole Method). The drainage disposal system shall utilize design infiltration rates based on the safety factor required by the county standard.

Boring/Test No.	Depth	Soil Classification	Field Infiltration Rate
B-1/TH-1	20'	Silty SAND	7.2 in/hr
B-2/TH-2	30'	Sandy SILT	1.9 in/hr
B-3/TH-3	40'	Silty SAND	5.0 in/hr
B-4/TH-4	50'	Silty SAND	4.6 in/hr

No groundwater was encountered to the depth of our borings to a maximum depth of 50 feet below existing ground surface. A nearby groundwater monitoring well located approximately 0.5 mile to the northwest from the subject site noted a groundwater depth at 657 feet below ground surface in March 2021.

It is recommended that foundations shall be setback a minimum distance of 10 feet from the drainage disposal system and the bottom of footing shall be a minimum of 10 feet from the expected zone of saturation. The boundary of the zone of saturation may be assumed to project downward from the top of the permeable portion of the disposal system at an inclination of 1 to 1 or flatter, as determined by the geotechnical engineer.

Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavation. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase.

This firm should have the opportunity to review the final plans to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

Scott D. Spensiero
Project Manager

References

1. California Department of Water Resources, Internet Website, http://www.water.ca.gov/waterdatalibrary/index.cfm.

2. NorCal Engineering Inc. - Geotechnical Engineering Investigation – Proposed Industrial Warehouse Development - Located at the Southwest Corner of Mesa Linda Street and Sultana Street, in the City of Hesperia, California, dated October 27, 2021.

3. San Bernardino County – Appendix VII - Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations dated May 19, 2011.

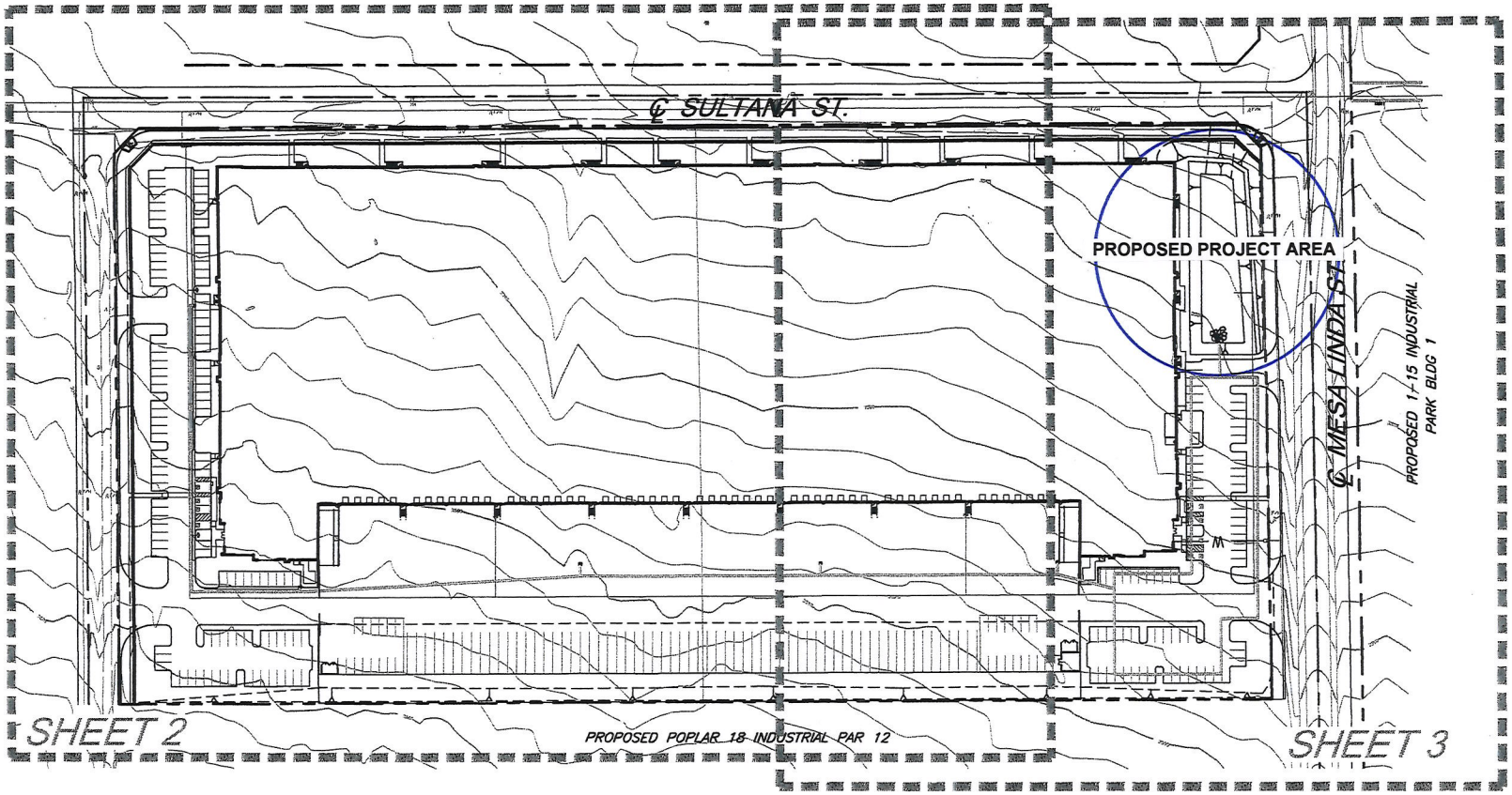


FIGURE 1

NORTH

1 INCH = 200 FEET

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT: 22884-22

DATE: JUNE 2022

SITE PLAN

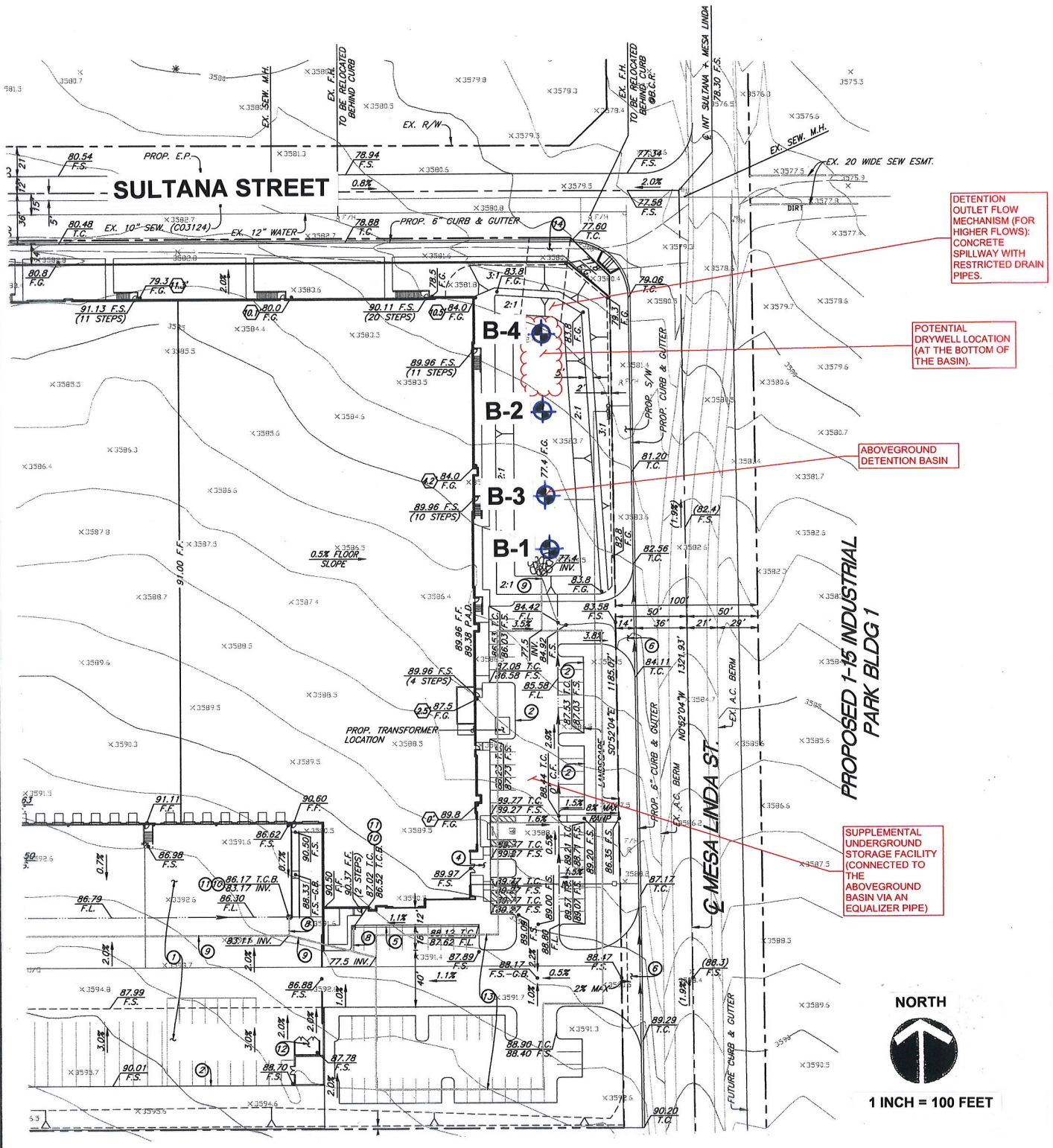


FIGURE 2

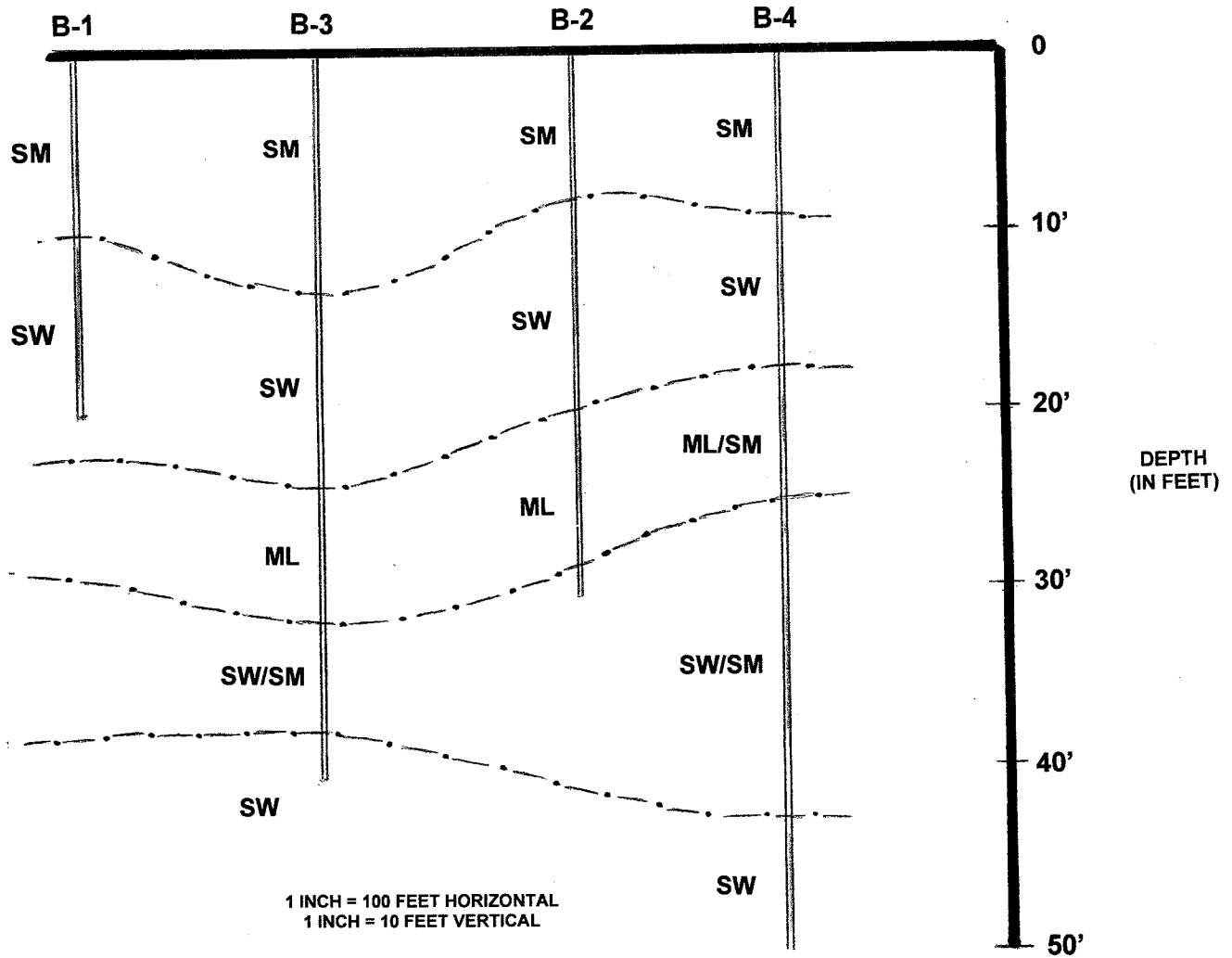
NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT:	22884-22	DATE:	JUNE 2022

SITE PLAN

APPROXIMATE LOCATION OF EXPLORATORY BORINGS



NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT: 23323-22

DATE: JUNE 2022

DETAIL SECTION

List of Appendices
(in order of appearance)

Appendix A
Log of Excavations

Newcastle Partners
22884-21

Log of Boring B-1

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 6/9/2022 | **Groundwater Depth:** None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTUEBD TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry; slightly clayey with gravel					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, damp; slightly clayey with occasional gravel					
5							
10		Silty (fine to coarse grained) SAND Light brown, dense, damp; slightly silty with occasional gravel					
15							
20		Boring completed at depth of 20'					
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\2288421-2.log Date: 6/13/2022

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22884-21

Log of Boring B-2

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 6/9/2022 | **Groundwater Depth:** None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTUEBD TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry; slightly clayey with gravel					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, damp; slightly clayey with occasional gravel					
5		GWT not encountered					
		Silty (fine to coarse grained) SAND Light brown, dense, damp; slightly silty with occasional gravel					
10							
15							
20		Sandy SILT Brown, medium stiff, moist					
25							
30		Boring completed at depth of 30'					
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\2288421-2.log Date: 6/15/2022

NorCal Engineering

Newcastle Partners
22884-21

Log of Boring B-3

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 6/9/2022 | Groundwater Depth: None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | Drop: 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTUEBD TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry; slightly clayey with gravel					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, damp; slightly clayey with occasional gravel					
5							
10							
15		Silty (fine to coarse grained) SAND Light brown, dense, damp; slightly silty with occasional gravel					
20							
25		Sandy SILT Brown, medium stiff, moist					
30							
		Silty (fine to coarse grained) SAND Brown, medium dense, moist; slightly clayey with gravel					
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\2288421-2.log Date: 6/13/2022

NorCal Engineering

Newcastle Partners
22884-21

Log of Boring B-3

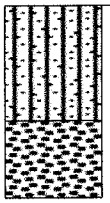
Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 6/9/2022 | **Groundwater Depth:** None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
35		Silty (fine to coarse grained) SAND Brown, medium dense, moist; slightly clayey with gravel					
		Silty (medium to coarse grained) SAND Light brown, dense, moist; slightly silty with gravel					
40		Boring completed at depth of 40'					
45							
50							
55							
60							
65							
70							

Newcastle Partners
22884-21

Log of Boring B-4

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 6/9/2022 | **Groundwater Depth:** None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTUEBD TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry; slightly clayey with gravel					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, damp; slightly clayey with occasional gravel					
5							
10		Silty (fine to coarse grained) SAND Light brown, dense, damp; slightly silty with occasional gravel					
15							
20		Silty (fine grained) SAND Brown, medium dense, moist; slightly clayey					
25		Silty (fine to coarse grained) SAND Brown, dense, slightly moist with occasional gravel					
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884421-2.log Date: 6/13/2022

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Newcastle Partners 22884-21	Log of Boring B-4

Boring Location: Mesa Linda and Sultana, Hesperia	
Date of Drilling: 6/9/2022	Groundwater Depth: None Encountered
Drilling Method: Simco 2800HS	
Hammer Weight: 140 lbs	Drop: 30"
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
35		Silty (fine to coarse grained) SAND Brown, dense, slightly moist with occasional gravel					
40							
45		Silty (fine to coarse grianed) SAND Light brown, dense, moist; slightly silty with occasional gravel					
50		Boring completed at depth of 50'					
55							
60							
65							
70							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\2288421-2.log Date: 6/13/2022

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Appendix B
Field Infiltration Data

SOIL INFILTRATION RATE CALCS ⇒ PORCHET METHOD

Location:	TH-1	TH-2	TH-3	TH-4
• Depth of Hole =	20'	30'	40'	50'
• Hole Radius =	3"	3"	3"	3"
• Drop = Δh	10"	3.5"	8"	7.5"
• Time = Δt Interval	10 min	10 min	10 min	10 min
• Initial Water Depth = H_o	16"	17"	17"	17"
• Final Water Depth = H_t	6"	13.5"	9"	9.5"
• Average Water Head = H_{avg}	11"	15.25"	13"	13.25"
• INFILTRATION RATE	7.2 in/hr	1.9 in/hr	5.0 in/hr	4.6 in/hr

$$\text{Infiltration Rate} = \frac{\Delta h\,(60)(r)}{\Delta t\,(r + 2 \cdot H_{avg})}$$

$$\text{Average Water Head} = \tfrac{1}{2}(H_t - H_o)$$

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SOILS AND GEOTECHNICAL CONSULTANTS

DATE

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SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Newcastle Partners	**Date:** 6/9/2022
Project No.: 22884-21	**Tested By:** J.S.
Test Hole: 1	**USCS Soil Classification:**
Depth of Test Hole: 20'	**Sides (if rectangular):**
Diameter of Test Hole: 6"	**Length:**
Sandy Soil Criteria Test*:	**Width:**

TRIAL NO.	START TIME	STOP TIME	TIME INTERVAL (MIN)	INITIAL DEPTH TO WATER (IN)	FINAL DEPTH TO WATER (IN)	CHANGE IN WATER LEVEL (IN)	GREATER THAN OR EQUAL TO 6"
1	8:20	8:24	4	225.0	240.0	15.0	
2	8:24	8:31	7	225.0	240.0	15.0	

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

TRIAL NO	START TIME	STOP TIME	ΔT TIME INTERVAL (MIN)	Do INITIAL DEPTH TO WATER (IN).	Df FINAL DEPTH TO WATER (IN)	ΔD CHANGE IN WATER LEVEL (IN)	PERCOLATION RATE (MIN/IN)
1	8:31	8:41	10	224.0	238.0	14.0	
2	8:41	8:51	10	225.0	237.0	12.0	
3	8:51	9:01	10	224.0	236.0	12.0	
4	9:01	9:11	10	224.0	236.0	12.0	
5	9:11	9:21	10	223.0	235.0	12.0	
6	9:21	9:31	10	224.0	234.0	10.0	
7							
8							
9							
10							
11							
12							
13							
14							
15							
COMMENTS:							

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Newcastle Partners	**Date:** 6/10/2022
Project No.: 22884-21	**Tested By:** J.S.
Test Hole: 2	**USCS Soil Classification:**
Depth of Test Hole: 30'	**Sides (if rectangular):**
Diameter of Test Hole: 6"	**Length:**
Sandy Soil Criteria Test*:	**Width:**

TRIAL NO.	START TIME	STOP TIME	TIME INTERVAL (MIN)	INITIAL DEPTH TO WATER (IN)	FINAL DEPTH TO WATER (IN)	CHANGE IN WATER LEVEL (IN)	GREATER THAN OR EQUAL TO 6"
1	8:55	9:20	25	343.0	355.0	12.0	
2	9:20	9:45	25	343.0	354.0	11.0	

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

TRIAL NO	START TIME	STOP TIME	ΔT TIME INTERVAL (MIN)	Do INITIAL DEPTH TO WATER (IN)	Df FINAL DEPTH TO WATER (IN)	ΔD CHANGE IN WATER LEVEL (IN)	PERCOLATION RATE (MIN/IN)
1	9:45	9:55	10	344.0	348.0	4.0	
2	9:55	10:05	10	345.0	349.0	4.0	
3	10:05	10:15	10	343.5	347.5	4.0	
4	10:15	10:25	10	345.0	348.5	3.5	
5	10:25	10:45	10	343.0	346.5	3.5	
6	10:45	10:55	10	344.5	348.0	3.5	
7							
8							
9							
10							
11							
12							
13							
14							
15							
COMMENTS:							

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Newcastle Partners	**Date:** 6/9/2022
Project No.: 22884-21	**Tested By:** J.S.
Test Hole: 3	**USCS Soil Classification:**
Depth of Test Hole: 40'	**Sides (if rectangular):**
Diameter of Test Hole: 6"	**Length:**
Sandy Soil Criteria Test*:	**Width:**

TRIAL NO.	START TIME	STOP TIME	TIME INTERVAL (MIN)	INITIAL DEPTH TO WATER (IN)	FINAL DEPTH TO WATER (IN)	CHANGE IN WATER LEVEL (IN)	GREATER THAN OR EQUAL TO 6"
1	11:57	12:10	13	465.0	480.0	15.0	
2	12:10	12:33	23	464.0	480.0	16.0	

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

TRIAL NO	START TIME	STOP TIME	ΔT TIME INTERVAL (MIN)	Do INITIAL DEPTH TO WATER (IN)	Df FINAL DEPTH TO WATER (IN)	ΔD CHANGE IN WATER LEVEL (IN)	PERCOLATION RATE (MIN/IN)
1	12:33	12:44	10	464.0	476.0	12.0	
2	12:44	12:54	10	463.0	473.0	10.0	
3	12:54	1:04	10	464.0	474.0	10.0	
4	1:04	1:14	10	463.0	471.0	8.0	
5	1:14	1:24	10	464.0	472.0	8.0	
6	1:24	1:34	10	465.0	473.0	8.0	
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS:

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Newcastle Partners	**Date:** 6/10/2022
Project No.: 22884-21	**Tested By:** J.S.
Test Hole: 4	**USCS Soil Classification:**
Depth of Test Hole: 50'	**Sides (if rectangular):**
Diameter of Test Hole: 6"	**Length:**
Sandy Soil Criteria Test*:	**Width:**

TRIAL NO.	START TIME	STOP TIME	TIME INTERVAL (MIN)	INITIAL DEPTH TO WATER (IN)	FINAL DEPTH TO WATER (IN)	CHANGE IN WATER LEVEL (IN)	GREATER THAN OR EQUAL TO 6"
1	10:57	11:13	16	583.0	600.0	17.0	
2	11:13	11:38	25	582.0	594.5	12.5	

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

TRIAL NO	START TIME	STOP TIME	ΔT TIME INTERVAL (MIN)	Do INITIAL DEPTH TO WATER (IN)	Df FINAL DEPTH TO WATER (IN)	ΔD CHANGE IN WATER LEVEL (IN)	PERCOLATION RATE (MIN/IN)
1	11:38	11:48	10	583.0	591.5	8.5	
2	11:48	11:58	10	582.5	590.5	8.0	
3	11:58	12:08	10	582.0	590.5	8.5	
4	12:08	12:18	10	583.0	591.0	8.0	
5	12:18	12:28	10	583.0	590.5	7.5	
6	12:28	12:38	10	583.0	590.5	7.5	
7							
8							
9							
10							
11							
12							
13							
14							
15							
COMMENTS:							

Geotechnical Engineering Investigation

Proposed Industrial Warehouse Development
SWC Mesa Linda Street and Sultana Street
Hesperia, California

Newcastle Partners
4740 Green River Road, Suite 118
Corona, California 92880

Attn: Ms. Courtney Smith

Project Number 22884-21
October 27, 2021

NorCal Engineering

NorCal Engineering

Soils and Geotechnical Consultants
10641 Humbolt Street Los Alamitos, CA 90720
(562) 799-9469 Fax (562) 799-9459

October 27, 2021 Project Number 22884-21

Newcastle Partners
4740 Green River Road, Suite 118
Corona, California 92880

Attn: Ms. Courtney Smith

RE: **Geotechnical Engineering Investigation** - Proposed Industrial Warehouse Development - Located at the Southwest Corner of Mesa Linda Street and Sultana Street, in the City of Hesperia, California

Dear Ms. Smith:

Pursuant to your request, this firm has performed a Geotechnical Engineering Investigation for the above referenced project in accordance with your approval of our proposal dated July 8, 2021. The purpose of this investigation is to evaluate the geotechnical conditions of the subject site and to provide recommendations for the proposed industrial warehouse development.

The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration and sampling; 3) laboratory testing; 4) soil infiltration testing; 5) engineering analysis of field and laboratory data; 5) preparation of a geotechnical engineering report. It is the opinion of this firm that the proposed development is feasible from a geotechnical standpoint provided that the recommendations presented in this report are followed in the design and construction of the project.

1.0 Project Description

It is proposed to construct an industrial warehouse development consisting of 398,100 square feet building as shown on the attached Site Plan. The proposed concrete tilt-up building will be supported by a conventional slab-on-grade foundation system with perimeter-spread footings and isolated interior footings. Other improvements will include asphalt and concrete pavement areas, hardscape and landscaping. It is assumed that the proposed grading for the development will include cut and fill procedures on the order of a few feet to achieve finished grade elevations. Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 Site Description

The 18.27-acre subject property is located at the southwest corner of Mesa Linda Street and Sultana Street, in the City of Hesperia. The generally rectangular-shaped parcel is elongated in an east to west direction with topography of the relatively level property descending slightly from a southwest to northeast direction on the order of a few feet. The site is undeveloped parcel covered with a moderate growth of natural grasses and weeds.

3.0 Site Exploration

The investigation consisted of the placement of fourteen (14) subsurface exploratory trenches by a backhoe to depths ranging between 5 and 20 feet below current ground elevations. The trenches were placed at accessible locations throughout the property. The explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached plan.

The exploratory trenches revealed the existing earth materials to consist of fill and natural soil. Detailed descriptions of the subsurface conditions are listed on the trench logs in Appendix A. It should be noted that the transition from one soil type to another as shown on the trench logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

Fill: A surficial fill/disturbed top soil classifying as a brown, fine to medium grained, silty SAND were encountered across the site to depths ranging from 1 to 1.5 feet below ground surface. These soils were noted to be loose and dry.

Natural: A natural undisturbed soil classifying as a brown, fine to medium grained, silty SAND with slight clay content and occasional gravel was encountered beneath the upper fill soils. The native soils as encountered were observed to be medium dense to dense and damp.

The overall engineering characteristics of the earth material were relatively uniform with each excavation. Groundwater was not encountered to the depth of our borings and no caving occurred.

4.0 Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one-inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

4.1 **Field Moisture Content** (ASTM: D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

4.2 **Maximum Density tests** (ASTM: D 1557) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

4.3 **Expansion Index tests** (ASTM: D 4829) were performed on remolded samples of the upper soils to determine expansive characteristics. Results of these tests are provided on Table II.

4.4 **Corrosion tests** consisting of sulfate, pH, resistivity and chloride analysis to determine potential corrosive effects of soils on concrete and underground utilities. Test results are provided on Table III.

4.5 **R-Value test** per California Test Method 301 was performed on a representative sample, which may be anticipated to be near subgrade to determine pavement design. Results are provided within the pavement design section of the report.

4.6 **Direct Shear tests** (ASTM: D 3080) were performed on undisturbed and/or remolded samples of the subsurface soils. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plates A and B.

4.7 **Consolidation tests** (ASTM: D 2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates C to F.

5.0 Seismicity Evaluation

The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered unlikely. The San Andreas Fault (San Bernardino) is located about 20 kilometers from the site and is capable of producing a Magnitude 7.4 earthquake. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults.

The seismic design parameters are provided on the following page and are based on the 2019 California Building Code (CBC) Standard ASCE/SEI 7-16. The data was obtained from the American Society of Civil Engineers (ASCE) website, https://asce7hazardtool.online/. The ASCE 7 Hazards Report is attached in Appendix C.

Seismic Design Acceleration Parameters

Latitude	34.418
Longitude	-117.393
Site Class	D
Risk Category	II
Mapped Spectral Response Acceleration	S_S = 1.500 S_1 = 0.600
Adjusted Maximum Acceleration	S_{MS} = 1.500
Design Spectral Response Acceleration Parameters	S_{DS} = 1.000
Peak Ground Acceleration	PGA_M = 0.554

6.0 Liquefaction Evaluation

The site is expected to experience ground shaking and earthquake activity that is typical of the Southern California area. It is during severe shaking that loose, granular soils below the groundwater table can liquefy. Based on review of the *County of San Bernardino County Land Use Plan – General Plan – Geologic Hazard Overlays (2009)*, the site lies outside a zone of "Suspected Liquefaction Susceptibility". Thus, the design of the proposed construction in conformance with the latest Building Code provisions for earthquake design is expected to provide mitigation of ground shaking hazards that are typical to Southern California.

7.0 Infiltration Characteristics

Infiltration tests within the site were performed to provide preliminary infiltration rates for the purpose of planning and design of an on-site water disposal system. The infiltration tests consisted of the double ring infiltration test per ASTM Method D 3385. The field infiltration rate was computed using a reduction factor – R_f based on the field measurements with our calculations given in Appendix D. Based upon the results of our testing, the soils encountered in the planned on-site drainage disposal system area exhibit the following infiltration rates.

Boring/Test No.	Depth	Soil Classification	Field Infiltration Rate
T-1/TH-1	5'	Silty SAND with slight clay	0.7 in/hr
T-2/TH-2	7.5'	Silty SAND	2.1 in/hr
T-3/TH-3	10'	Clayey SAND	0.1 in/hr

The correction factors CF_t, CF_v and CF_s are given below based on soils between 5 and 10 feet from our field tests.

a) $CF_t = Rf = 1.0$ for our double ring infiltration test holes.

b) $CF_v = 1.0$ based on uniform soils encountered in three trenches for infiltration tests.

c) $CF_s = 2.0$ for long-term siltation, plugging and maintenance. The subsurface soils are likely to have some plugging and regular maintenance of storm water discharge devices is required.

Based on the results of our field testing, the subsurface soils encountered in the proposed on-site drainage disposal system shall utilize the design infiltration rates based on the safety factor required by the county standard. All systems must meet the latest city and/or county specifications and the California Regional Water Quality Control Board (CRWQCB) requirements. A nearby groundwater monitoring well, located approximately 0.5 mile to the northwest from the subject site, noted a groundwater depth at 657 feet below ground surface in March 2021.

It is recommended that foundations shall be setback a minimum distance of 10 feet from the drainage disposal system and the bottom of footing shall be a minimum of 10 feet from the expected zone of saturation. The boundary of the zone of saturation may be assumed to project downward from the top of the permeable portion of the disposal system at an inclination of 1 to 1 or flatter, as determined by the geotechnical engineer.

8.0 Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent structures.

The following recommendations are based upon soil conditions encountered in our field investigation; these near-surface soil conditions could vary across the site. Variations in the soil conditions may not become evident until the commencement of grading operations for the proposed development and revised recommendations from the geotechnical engineer may be necessary based upon the conditions encountered. It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

8.1 Site Grading Recommendations

Any vegetation and/or demolition debris shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached *Specifications for Placement of Compacted Fill*.

8.1.1 Removal and Recompaction Recommendations

All disturbed soils and/or fill (about 1 to 1.5 feet below ground surface) shall be removed to competent native material, the exposed surface scarified to a depth of 12 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement. Grading shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

It is possible that isolated areas of undiscovered fill not described in this report are present on site; if found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction.

Any imported fill material should be preferably soil similar to the upper soils encountered at the subject site. All soils shall be approved by this firm prior to importing at the site and will be subjected to additional laboratory testing to assure concurrence with the recommendations stated in this report.

If placement of slabs-on-grade and pavement is not completed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the soils engineer as to the suitability of the supporting soils may be needed.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

8.1.2 Fill Blanket Recommendations

Due to the potential for differential settlement of foundations placed on compacted fill and native materials, it is recommended that all foundations including floor slab areas be underlain by a uniform compacted fill blanket at least two feet in thickness. This fill blanket shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

8.2 Shrinkage and Subsidence

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 5 to 10% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.2 feet die to earthwork operations. The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements, or topographic approximations.

Although these values are only approximate, they represent our best estimate of lost yardage, which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing the actual equipment and grading techniques should be conducted.

8.3 Temporary Excavations

Temporary unsurcharged excavations in the existing site materials may be made at vertical inclinations up to 4 feet in height unless cohesionless soils are encountered. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring or flatter excavations may be required. The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of the soils engineer, CAL-OSHA and other public agencies having jurisdiction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

8.4 Foundation Design

All foundations may be designed utilizing the following allowable bearing capacities for an embedded depth of 18 inches into approved engineered fill with the corresponding widths:

Allowable Bearing Capacity (psf)		
Width (feet)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2075	2575
4.0	2375	2875
6.0	2500	3000

The bearing value may be increased by 500 psf for each additional foot of depth in excess of the 18-inch minimum depth, up to a maximum of 4,000 psf. A one-third increase may be used when considering short-term loading and seismic forces. Any foundations located along property line may utilize an allowable bearing capacity of 1,500 psf and embedded into competent native soils. A modulus of subgrade reaction (k) of 200 pci may be used for design of slabs placed on engineered fill soils supporting sustained concentrated loads. A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

8.5 **Settlement Analysis**

Resultant pressure curves for the consolidation tests are shown on Plates B and C. Computations utilizing these curves and the recommended allowable soil bearing capacities reveal that the foundations will experience settlements on the order of ¾ inch and differential settlements of less than ¼ inch.

8.6 **Lateral Resistance**

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.40

Equivalent Passive Fluid Pressure = 250 lbs./cu.ft.

Maximum Passive Pressure = 2,500 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils or competent native materials.

8.7 **Retaining Wall Design Parameters**

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. An equivalent fluid pressure of 45 pcf may be utilized for the restrained wall condition with a level grade behind the wall.

The seismic-induced lateral soil pressure for walls greater than 6 feet may be computed using a triangular pressure distribution with the maximum value at the top of the wall. The maximum lateral pressure of (20 pcf) H where H is the height of the retained soils above the wall footing should be used in final design of retaining walls. Sliding resistance values and passive fluid pressure values may be increased by 1/3 during short-term wind and seismic loading conditions.

All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system. The granular backfill to be utilized immediately adjacent to retaining walls shall consist of an approved select granular soil with a sand equivalency greater than 30. This backfill zone of free draining material shall consist of a wedge beginning a minimum of one horizontal foot from the base of the wall extending upward at an inclination of no less than ¾ to 1 (horizontal to vertical).

8.8 Slab Design

All concrete slabs shall be a minimum of six inches in thickness in the proposed warehouse areas and four inches in office and hardscape and placed on approved subgrade soils. Additional reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon soils expansion potential and proposed loading conditions in the structures and should be evaluated further by the project engineers and/or architect.

A vapor retarder (10-mil minimum thickness) should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs.* The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs.*

The moisture retarder may be placed directly upon compacted subgrade soils conditioned to near optimum moisture levels, although one to two inches of sand beneath the membrane is desirable. The subgrade upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

8.9 Pavement Section Design

The table below provides a preliminary pavement design based upon an R-Value of 69 for the subgrade soils for the proposed pavement areas. Final pavement design may need to be based on R-Value testing of the subgrade soils near the conclusion of site grading to assure that these soils are consistent with those assumed in this preliminary design. The recommendations are based upon estimated traffic loads. *Client should submit any other anticipated traffic loadings to the geotechnical engineer, if necessary, so that pavement sections may be reviewed to determine adequacy to support the proposed loadings.*

Type of Traffic	Traffic Index	Asphalt (in.)	Base Material (in.)
Automobile Parking Stalls	4.0	3.0	4.0
Light Vehicle Circulation Areas	5.5	3.5	5.5
Heavy Truck Access Areas	7.0	4.0	8.0

Any concrete slab-on-grade in pavement areas shall be a minimum of seven inches in thickness and may be placed on approved subgrade soils. All pavement areas shall have positive drainage toward an approved outlet from the site. Drain lines behind curbs and/or adjacent to landscape areas should be considered by client and the appropriate design engineers to prevent water from infiltrating beneath pavement. If such infiltration occurs, damage to pavement, curbs and flow lines, especially on sites with expansive soils, may occur during the life of the project.

Any approved base material shall consist of a Class II aggregate or equivalent and should be compacted to a minimum of 95% relative compaction. All pavement materials shall conform to the requirements set forth by the City of Hesperia. The base material; and asphaltic concrete should be tested prior to delivery to the site and during placement to determine conformance with the project specifications. A pavement engineer shall designate the specific asphalt mix design to meet the required project specifications.

8.10 **Utility Trench and Excavation Backfill**

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded with clean sand having a sand equivalency rating of 30 or more. This bedding material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

8.11 **Corrosion Design Criteria**

Representative samples of the surficial soils, typical of the subgrade soils expected to be encountered within foundation excavations and underground utilities were tested for corrosion potential. The minimum resistivity value obtained for the samples tested is representative of an environment that may be severely corrosive to metals. The soil pH value was considered mildly alkaline and may not have a significant effect on soil corrosivity. Consideration should be given to corrosion protection systems for buried metal such as protective coatings, wrappings or the use of PVC where permitted by local building codes.

According to Table 4.3.1 of ACI 318 Building Code and Commentary, these contents revealed negligible sulfate concentrations. Therefore, a Type II cement according to latest CBC specifications may be utilized for building foundations at this time. It is recommended that additional sulfate tests be performed at the completion of site grading to assure that the as graded conditions are consistent with the recommendations stated in this design. Corrosion test results may be found on the attached Table IV.

8.12 **Expansive Soil**

If expansive soils are encountered, special attention should be given to the project design and maintenance. The attached *Expansive Soil Guidelines* should be reviewed by the engineers, architects, owner, maintenance personnel and other interested parties and considered during the design of the project and future property maintenance.

9.0 Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

Scott D. Spensiero
Project Manager

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low-density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Geotechnical Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure.

Material for Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Geotechnical Engineering firm a minimum of 72 hours prior to importation of site.

Placement of Compacted Fill Soils

The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Geotechnical Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Geotechnical Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24-hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Geotechnical Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.

EXPANSIVE SOIL GUIDELINES

The following expansive soil guidelines are provided for your project. The intent of these guidelines is to inform you, the client, of the importance of proper design and maintenance of projects supported on expansive soils. ***You, as the owner or other interested party, should be warned that you have a duty to provide the information contained in the soil report including these guidelines to your design engineers, architects, landscapers and other design parties in order to enable them to provide a design that takes into consideration expansive soils.***

In addition, you should provide the soil report with these guidelines to any property manager, lessee, property purchaser or other interested party that will have or assume the responsibility of maintaining the development in the future.

Expansive soils are fine-grained silts and clays which are subject to swelling and contracting. The amount of this swelling and contracting is subject to the amount of fine-grained clay materials present in the soils and the amount of moisture either introduced or extracted from the soils. Expansive soils are divided into five categories ranging from "very low" to "very high". Expansion indices are assigned to each classification and are included in the laboratory testing section of this report. *If the expansion index of the soils on your site, as stated in this report, is 21 or higher, you have expansive soils.* The classifications of expansive soils are as follows:

Classification of Expansive Soil*

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

*From Table 18A-I-B of California Building Code (1988)

When expansive soils are compacted during site grading operations, care is taken to place the materials at or slightly above optimum moisture levels and perform proper compaction operations. Any subsequent excessive wetting and/or drying of expansive soils will cause the soil materials to expand and/or contract. These actions are likely to cause distress of foundations, structures, slabs-on-grade, sidewalks and pavement over the life of the structure. ***It is therefore imperative that even after construction of improvements, the moisture contents are maintained at relatively constant levels, allowing neither excessive wetting or drying of soils.***

Evidence of excessive wetting of expansive soils may be seen in concrete slabs, both interior and exterior. Slabs may lift at construction joints producing a trip hazard or may crack from the pressure of soil expansion. Wet clays in foundation areas may result in lifting of the structure causing difficulty in the opening and closing of doors and windows, as well as cracking in exterior and interior wall surfaces. In extreme wetting of soils to depth, settlement of the structure may eventually result. Excessive wetting of soils in landscape areas adjacent to concrete or asphaltic pavement areas may also result in expansion of soils beneath pavement and resultant distress to the pavement surface.

Excessive drying of expansive soils is initially evidenced by cracking in the surface of the soils due to contraction. Settlement of structures and on-grade slabs may also eventually result along with problems in the operation of doors and windows.

Projects located in areas of expansive clay soils will be subject to more movement and "hairline" cracking of walls and slabs than similar projects situated on non-expansive sandy soils. There are, however, measures that developers and property owners may take to reduce the amount of movement over the life the development. The following guidelines are provided to assist you in both design and maintenance of projects on expansive soils:

- Drainage away from structures and pavement is essential to prevent excessive wetting of expansive soils. Grades should be designed to the latest building code and maintained to allow flow of irrigation and rain water to approved drainage devices or to the street. Any "ponding" of water adjacent to buildings, slabs and pavement after rains is evidence of poor drainage; the installation of drainage devices or regrading of the area may be required to assure proper drainage. Installation of rain gutters is also recommended to control the introduction of moisture next to buildings. Gutters should discharge into a drainage device or onto pavement which drains to roadways.

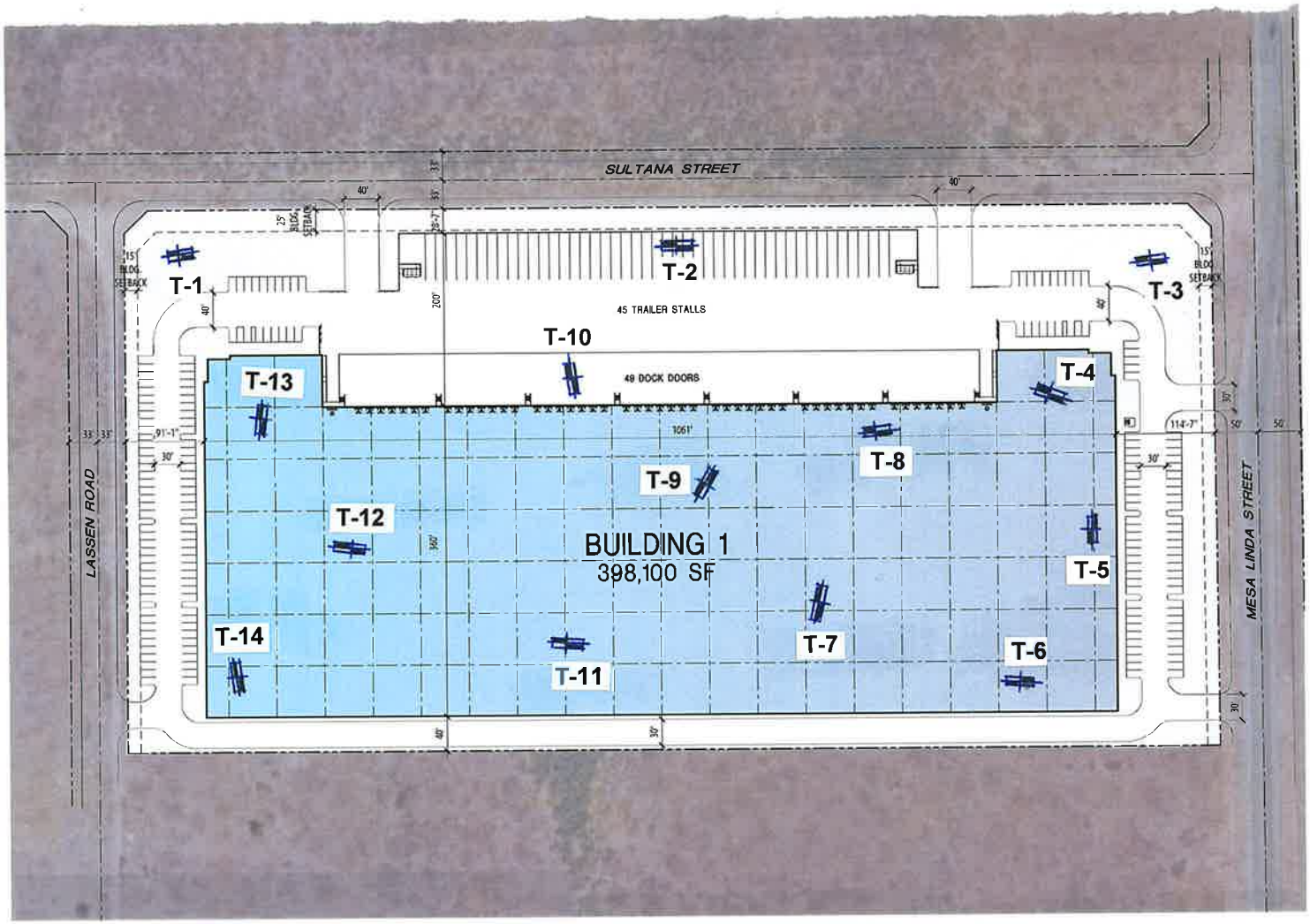
- Irrigation should be strictly controlled around building foundations, slabs and pavement and may need to be adjusted depending upon season. This control is essential to maintain a relatively uniform moisture content in the expansive soils and to prevent swelling and contracting. Over-watering adjacent to improvements may result in damage to those improvements. NorCal Engineering makes no specific recommendations regarding landscape irrigation schedules.

- Planting schemes for landscaping around structures and pavement should be analyzed carefully. Plants (including sod) requiring high amounts of water may result in excessive wetting of soils. Trees and large shrubs may actually extract moisture from the expansive soils, thus causing contraction of the fine-grained soils.

- Thickened edges on exterior slabs will assist in keeping excessive moisture from entering directly beneath the concrete. A six-inch thick or greater deepened edge on slabs may be considered. Underlying interior and exterior slabs with 6 to 12 inches or more of non-expansive soils and providing presaturation of the underlying clayey soils as recommended in the soil report will improve the overall performance of on-grade slabs.

- Increase the amount of steel reinforcing in concrete slabs, foundations and other structures to resist the forces of expansive soils. The precise amount of reinforcing should be determined by the appropriate design engineers and/or architects.

- Recommendations of the soil report should always be followed in the development of the project. Any recommendations regarding presaturation of the upper subgrade soils in slab areas should be performed in the field and verified by the Soil Engineer.



NORTH

1 INCH = 200 FEET

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

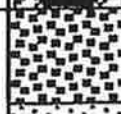
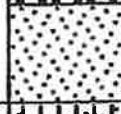
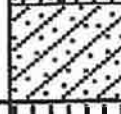
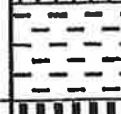
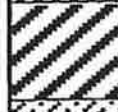
PROJECT: 22884-21

DATE: OCTOBER 2021

SITE PLAN

List of Appendices
(in order of appearance)

Appendix A
Log of Explorations

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL, SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

- ■ Indicates 2.5-inch Inside Diameter. Ring Sample.
- ⊠ Indicates 2-inch OD Split Spoon Sample (SPT).
- ⧅ Indicates Shelby Tube Sample.
- ◫ Indicates No Recovery.
- ◧ Indicates SPT with 140# Hammer 30 in. Drop.
- ⊠ Indicates Bulk Sample.
- ◩ Indicates Small Bag Sample.
- ◨ Indicates Non-Standard
- ⧓ Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Newcastle Partners 22884-21	Log of Trench T-1

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel					
5		GWT not encountered	☑		3.3		
		Trench completed at depth of 5'					
10							
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

NorCal Engineering

Newcastle Partners 22884-21	Log of Trench T-2
Boring Location: Mesa Linda and Sultana, Hesperia	
Date of Drilling: 10/12/2021	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel					
5		GWT not encountered					
			☑		3.9		
		Trench completed at depth of 7.5'					
10							
15							
20							
25							
30							
35							

Newcastle Partners 22884-21	Log of Trench T-3

Boring Location: Mesa Linda and Sultana, Hesperia	
Date of Drilling: 10/12/2021	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel					
5		GWT not encountered					
10		Trench completed at depth of 10'	☑		3.4		
15							
20							
25							
30							
35							

Newcastle Partners 22884-21	Log of Trench T-4

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry	■		2.5	112.1	
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel	■		3.2	106.3	
10		Silty (fine to coarse grained) SAND Light brown, dense, damp; slightly silty with occasional gravel	■		3.2	106.7	
15			■		4.5	120.4	
20		Trench completed at depth of 20'	■		2.0	107.3	
25							
30							
35							

GWT not encountered

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NorCal Engineering

Newcastle Partners 22884-21	Log of Trench T-5
Boring Location: Mesa Linda and Sultana, Hesperia	
Date of Drilling: 10/12/2021	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel	■		2.0	112.5	
5			■		2.3	114.0	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

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NorCal Engineering

Newcastle Partners
22884-21

Log of Trench T-6

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel	■		2.1	113.3	
10			■		2.9	112.0	
		Silty (medium to coarse grained) SAND Light brown, medium dense, damp; slightly silty with occasional gravel					
15		Trench completed at depth of 15'	■		2.1	118.2	
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

NorCal Engineering

Newcastle Partners
22884-21

Log of Trench T-7

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel	■		2.5	108.3	
5			■		3.1	115.6	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

Newcastle Partners 22884-21	Log of Trench T-8
Boring Location: Mesa Linda and Sultana, Hesperia	
Date of Drilling: 10/12/2021	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry	■		3.9	109.9	
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel	■		2.5	115.1	
5							
10		Trench completed at depth of 10'	■		3.1	111.3	
15							
20							
25							
30							
35							

GWT not encountered

Newcastle Partners
22884-21

Log of Trench T-9

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

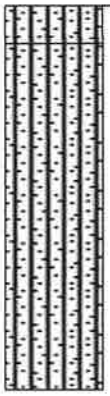
Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel	■		3.9	112.8	
10		Silty (medium to coarse grained) SAND Light brown, medium dense, damp; slightly silty with occasional gravel	■		1.7	112.9	
15		Trench completed at depth of 15'	■		3.8	113.8	
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

NorCal Engineering

Newcastle Partners 22884-21	Log of Trench T-10
Boring Location: Mesa Linda and Sultana, Hesperia	
Date of Drilling: 10/12/2021	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry	▽				
	NATURAL Silty (fine to medium grained) SAND Brown, dense, slightly damp; slightly clayey with occasional gravel	■		4.6	116.5	
5						
		■		3.0	115.7	
10	Trench completed at depth of 10'					
15						
20						
25						
30						
35						

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

NorCal Engineering

Newcastle Partners 22884-21	Log of Trench T-11

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry	■		2.9	107.5	
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel					
5		GWT not encountered					
			■		3.4	114.1	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

Newcastle Partners
22884-21

Log of Trench T-12

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, dense, slightly damp; slightly clayey with occasional gravel					
5			■		2.9	113.1	
10		Trench completed at depth of 10'	■		2.2	116.3	
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

NorCal Engineering

Newcastle Partners 22884-21	Log of Trench T-13
Boring Location: Mesa Linda and Sultana, Hesperia	
Date of Drilling: 10/12/2021	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry		2.6	112.3		
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense to dense, slightly damp; slightly clayey with occasional gravel		3.9	110.1		
5							
10				3.3	115.3		
15		Trench completed at depth of 15'					
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

NorCal Engineering

Newcastle Partners
22884-21

Log of Trench T-14

Boring Location: Mesa Linda and Sultana, Hesperia

Date of Drilling: 10/12/2021 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL/DISTURBED TOP SOILS Silty (fine to medium grained) SAND Brown, loose, dry	■		1.8	117.3	
		NATURAL Silty (fine to medium grained) SAND Brown, dense, slightly damp; slightly clayey with occasional gravel					
5			■		4.2	120.7	
10			■		5.3	119.8	
15		Trench completed at depth of 15'	■		3.5	109.5	
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22884-21.log Date: 10/20/2021

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Appendix B
Laboratory Tests

TABLE I
MAXIMUM DENSITY TESTS

Sample	Classification	Optimum Moisture (%)	Maximum Dry Density (lbs/cu.ft)
T-4 @ 2'	Silty SAND	8.5	130.0
T-10 @ 2'	Silty SAND	9.5	128.0
T-14 @ 2'	Silty SAND	9.0	133.0

TABLE II
EXPANSION TESTS

Sample	Classification	Expansion Index
T-4 @ 2'	Silty SAND	4
T-14 @ 2'	Silty SAND	3

TABLE III
CORROSION TESTS

Sample	pH	Electrical Resistivity	Sulfate (%)	Chloride (ppm)
T-3 @ 2'	7.1	3,245	0.002	163
T-14 @ 2'	7.2	2,168	0.004	223

% by weight
ppm – mg/kg

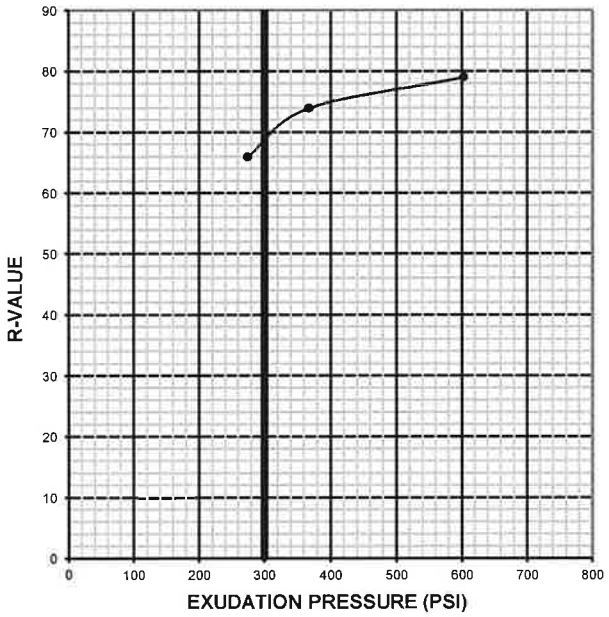
R-VALUE TEST REPORT

☑ CT-301 ☐ ASTM-D2844

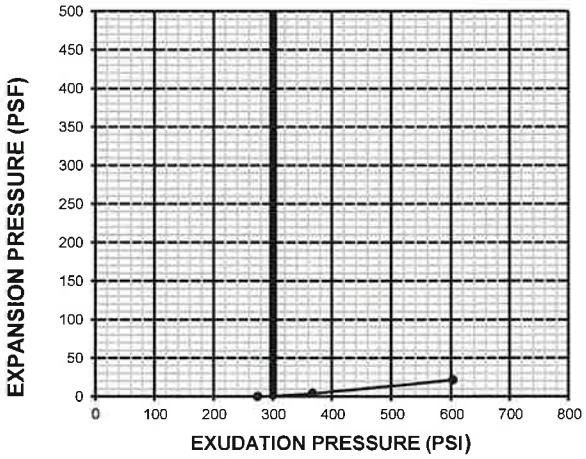
PROJECT NAME:	Norcal: Newcastle Partners	PROJECT NUMBER:	L-211001
SAMPLE LOCATION:	NWC at Polar St and Mesa Linda St, Hesperia. CA	SAMPLE NUMBER:	T1
SAMPLE DESCRIPTION:	SILTY SAND (SM), pale brown	SAMPLE DEPTH:	1'
SAMPLED BY:	Norcal: JS 10/12/21	TESTED BY:	ER
		DATE TESTED:	10/21/2021

TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	7.5	7.9	8.5
WEIGHT OF SAMPLE, grams	1169	1162	1187
HEIGHT OF SAMPLE, Inches	2.57	2.53	2.60
DRY DENSITY, pcf	128.4	129.1	127.6
COMPACTOR AIR PRESSURE, psi	350	350	350
EXUDATION PRESSURE, psi	603	367	274
EXPANSION, Inches x 10exp-4	5	1	0
STABILITY Ph 2,000 lbs (160 psi)	19	26	33
TURNS DISPLACEMENT	4.83	4.59	5.32
R-VALUE UNCORRECTED	79	74	64
R-VALUE CORRECTED	79	74	66
EXPANSION PRESSURE (psf)	21.6	4.3	0.0

R-VALUE VS. EXUDATION PRESSURE



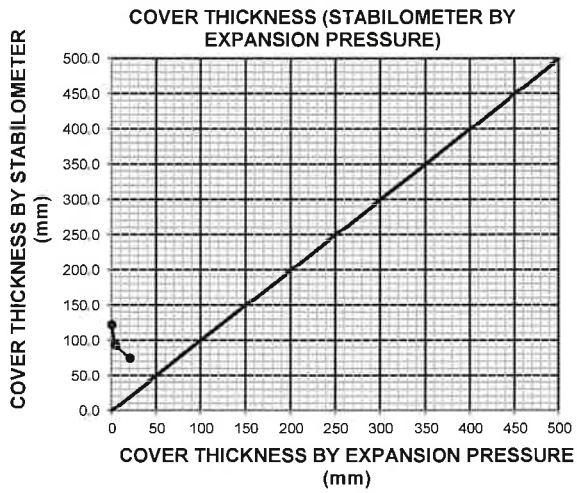
EXPANSION PRESSURE VS. EXUDATION PRESSURE



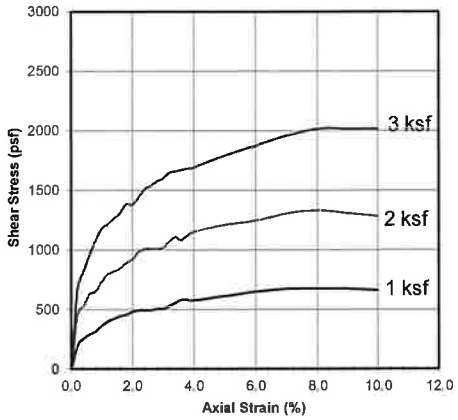
R-VALUE AT EQUILIBRIUM:	69

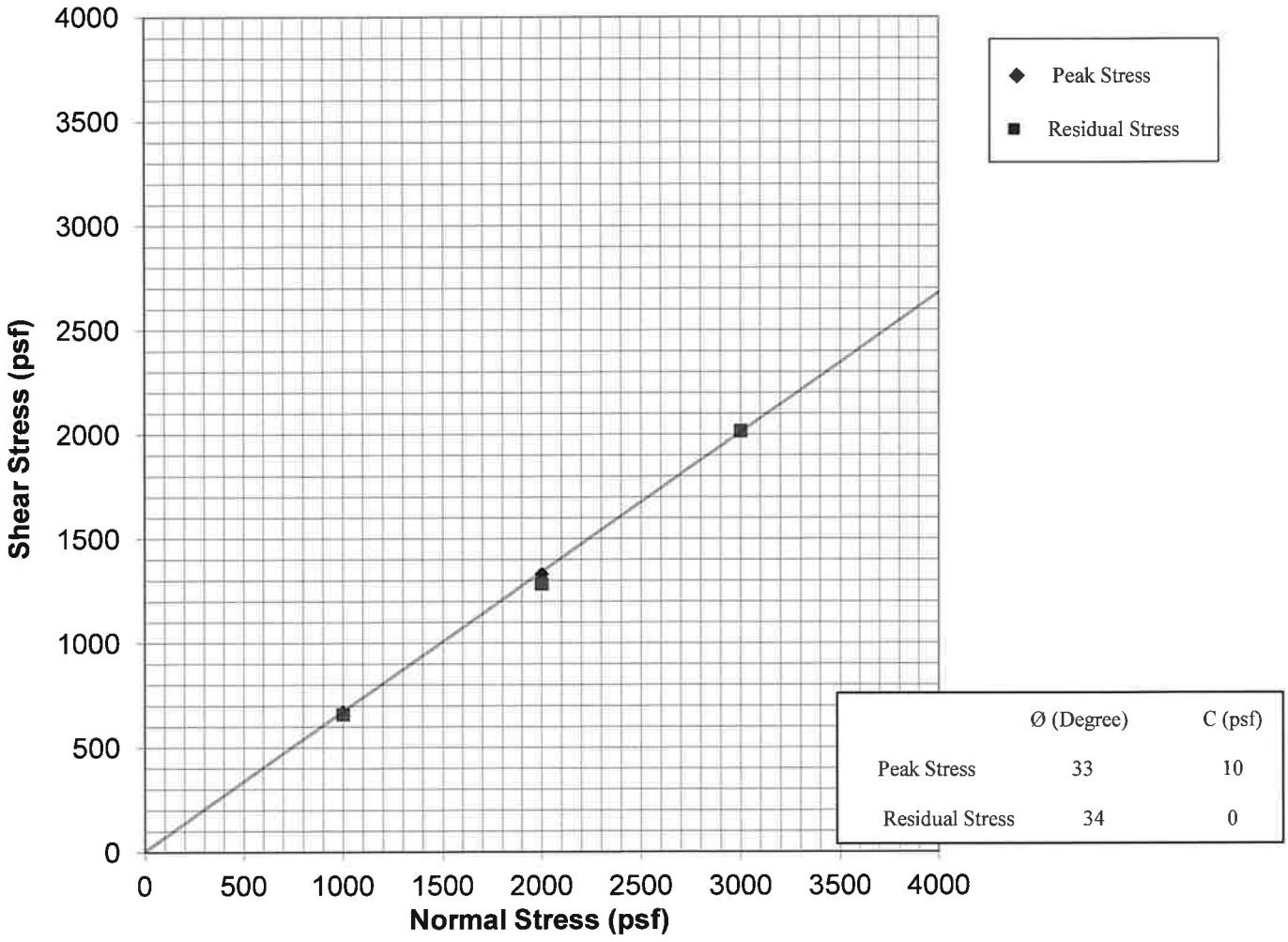
R-VALUE BY EXUDATION PRESSURE:	69
R-VALUE BY EXPANSION PRESSURE:	N.A.
EXPANSION PRESSURE AT 300 PSI EXUDATION:	0
TRAFFIC INDEX (Assumed):	5.5
GRAVEL FACTOR (Assumed):	1.5
UNIT MASS OF COVER MATERIAL, kg/m^3 (Assumed):	2100.0

COVER THICKNESS (STABILOMETER BY EXPANSION PRESSURE)



Sample No.		T4@2'		
Sample Type:		Undisturbed/Saturated		
Soil Description:		Fine-Coarse Grained Sand w/ Some Silt & Small Gravel		
		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	672	1332	2016
Displacement	(in)	0.175	0.200	0.200
Residual Stress	(psf)	660	1284	2016
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	112.1	112.1	112.1
In Situ Water Content	(%)	2.5	2.5	2.5
Saturated Water Content	(%)	18.6	18.6	18.6
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	33	10
Residual Stress	34	0

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SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

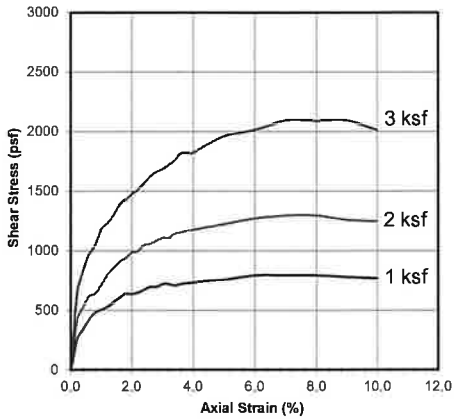
PROJECT NUMBER: 22884-21 DATE: 10/27/2021

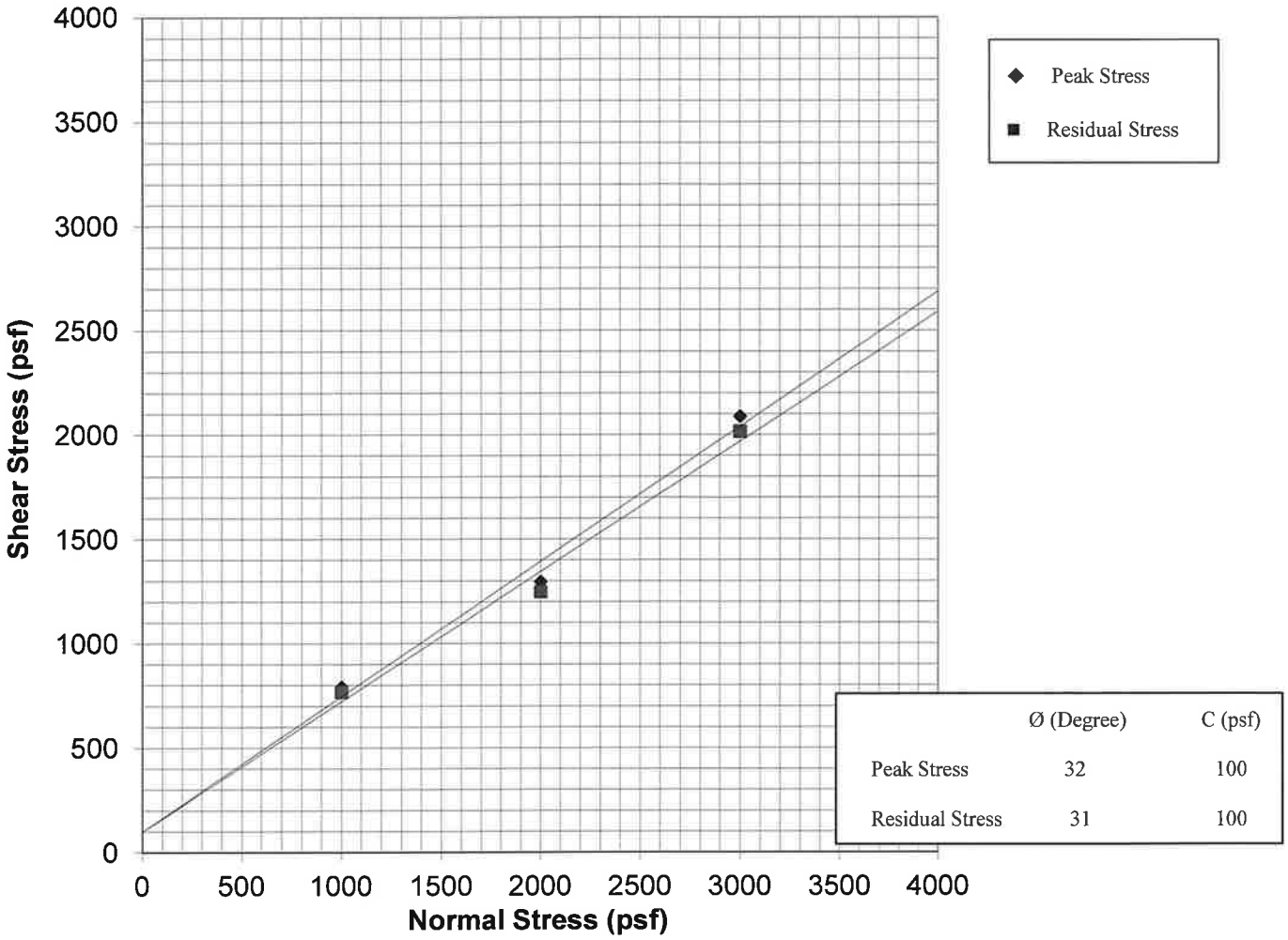
DIRECT SHEAR TEST

ASTM D3080

Plate A

Sample No.		T14@2'		
Sample Type:		Undisturbed/Saturated		
Soil Description:		Fine-Coarse Grained Sand w/ Some Silt & Small Gravel		
		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	792	1296	2088
Displacement	(in)	0.150	0.175	0.175
Residual Stress	(psf)	768	1248	2016
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	117.3	117.3	117.3
In Situ Water Content	(%)	1.8	1.8	1.8
Saturated Water Content	(%)	16.1	16.1	16.1
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	32	100
Residual Stress	31	100

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SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 22884-21 DATE: 10/27/2021

DIRECT SHEAR TEST

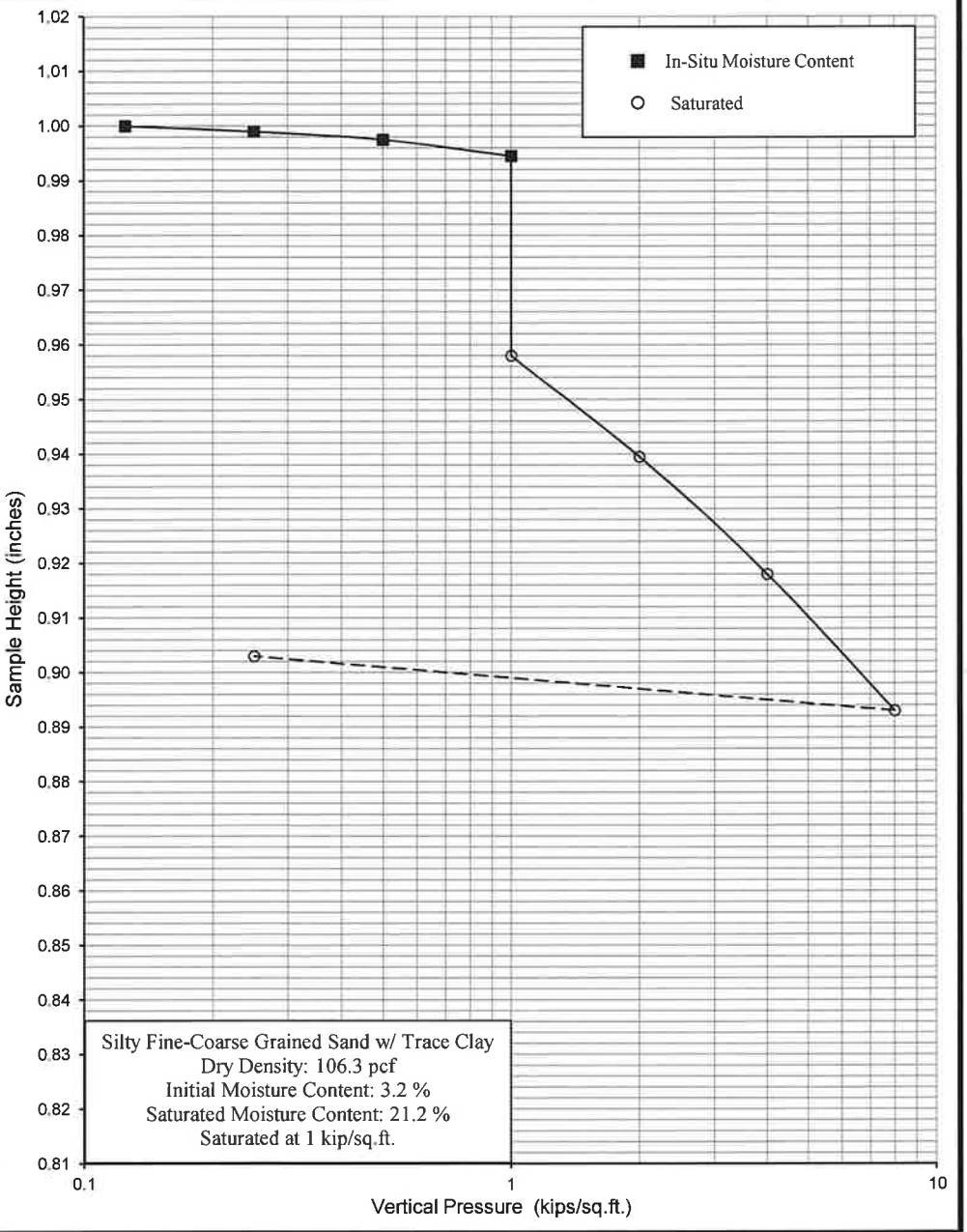
ASTM D3080

Plate B

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	
0.125	1.0000	0.0	
0.25	0.9990	0.1	
0.5	0.9975	0.2	
1	0.9945	0.6	
1	0.9580	4.2	Saturated
2	0.9395	6.1	
4	0.9180	8.2	
8	0.8930	10.7	
0.25	0.9030	9.7	

Date Tested:	**10/25/2021**
Sample:	**T4**
Depth:	**5'**

Sample No.	T4	Depth	5'	Date	10/27/2021



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SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 22884-21 DATE: 10/27/2021

CONSOLIDATION TEST

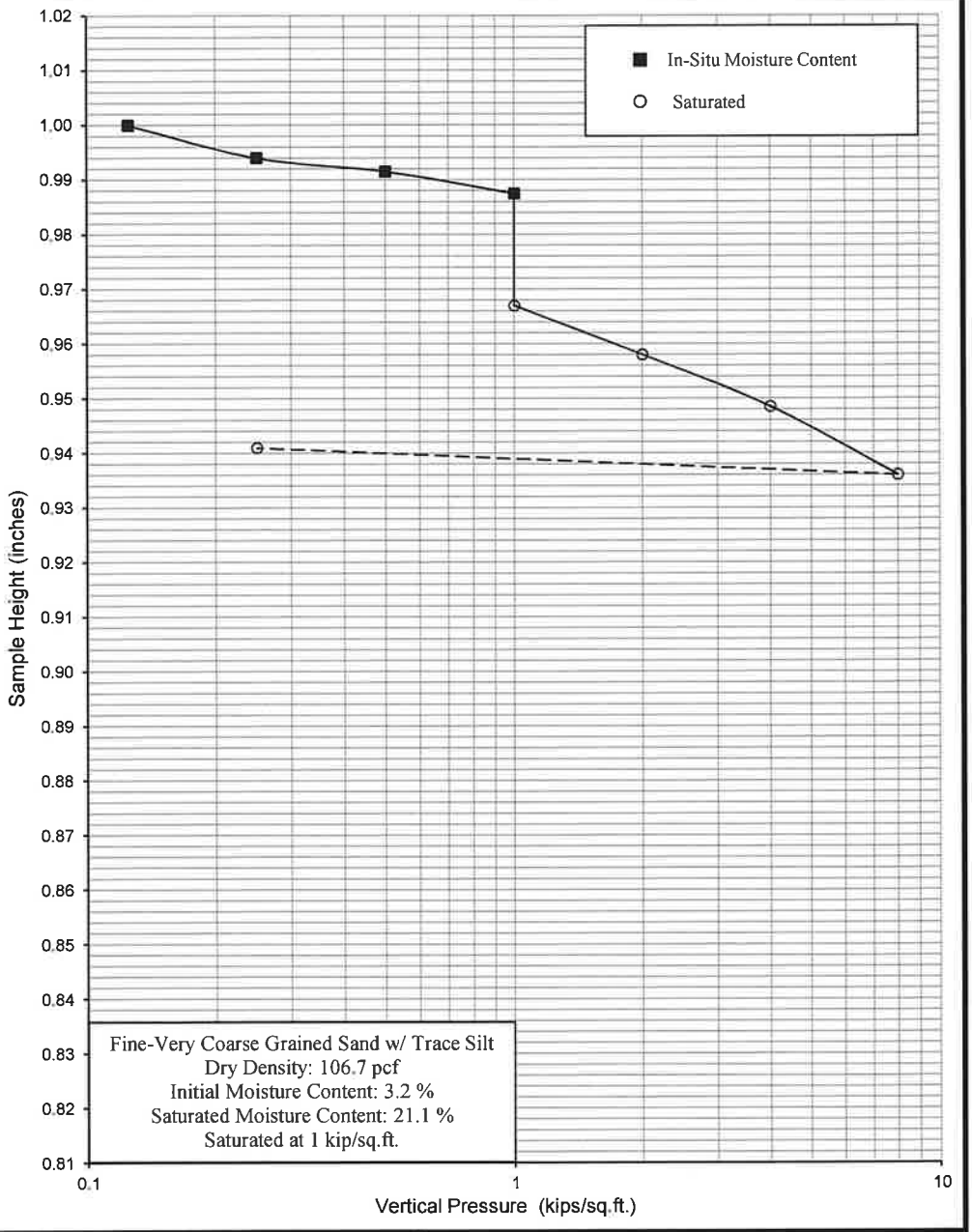
ASTM D2435

Plate C

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	
0.125	1.0000	0.0	
0.25	0.9940	0.6	
0.5	0.9915	0.8	
1	0.9875	1.3	
1	0.9670	3.3	Saturated
2	0.9580	4.2	
4	0.9485	5.2	
8	0.9360	6.4	
0.25	0.9410	5.9	

Sample No.	T4	Depth	10'	Date	10/27/2021

Date Tested: 10/25/2021
Sample: T4
Depth: 10'



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SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 22884-21 DATE: 10/27/2021

CONSOLIDATION TEST

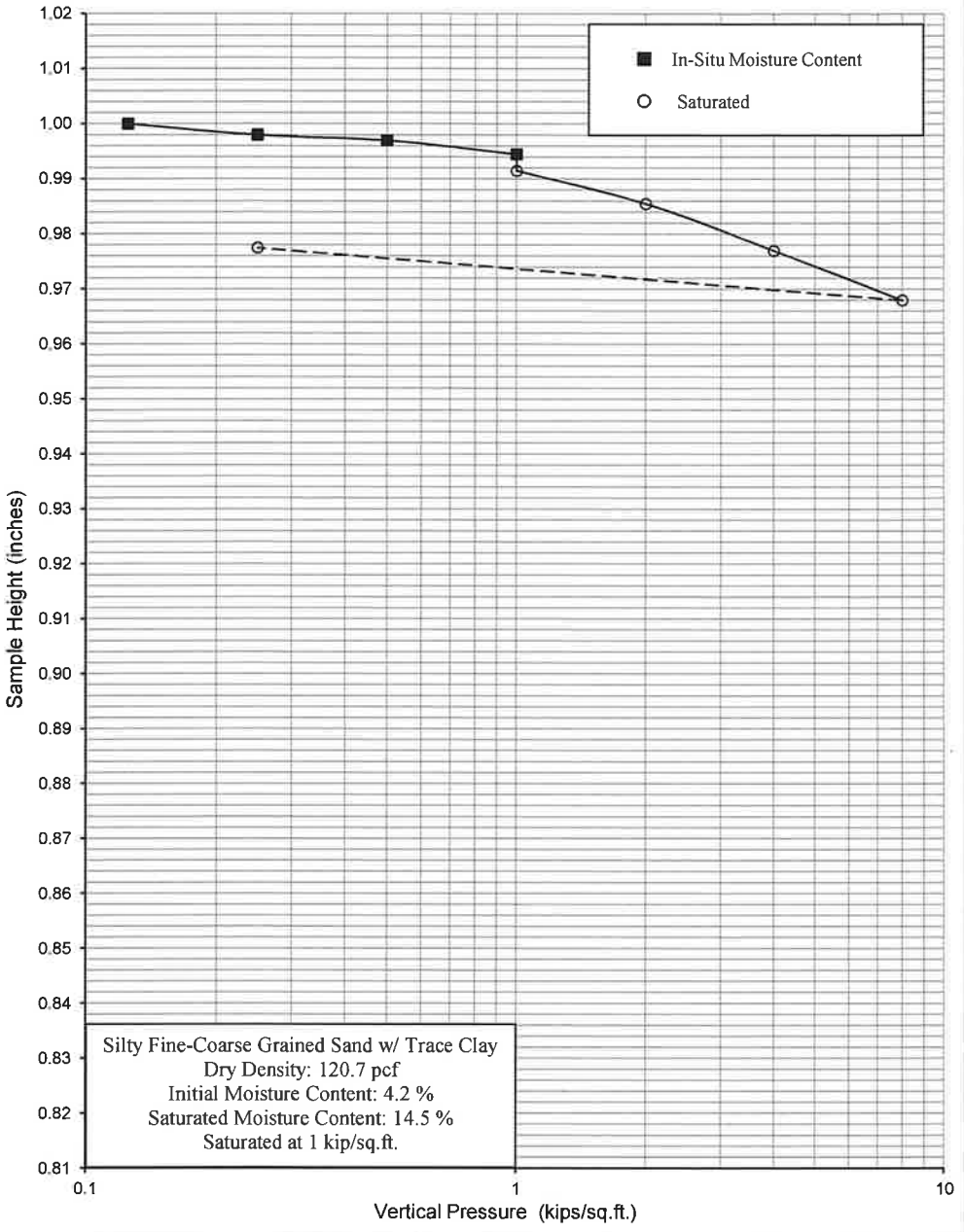
ASTM D2435

Plate D

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	
0.125	1.0000	0.0	
0.25	0.9980	0.2	
0.5	0.9970	0.3	
1	0.9945	0.6	
1	0.9915	0.8	
2	0.9855	1.5	
4	0.9770	2.3	
8	0.9680	3.2	
0.25	0.9775	2.3	Saturated

Date Tested:	**10/26/2021**
Sample:	**T14**
Depth:	**5'**

Sample No.	T14	Depth	5'	Date	10/27/2021



NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 22884-21 DATE: 10/27/2021

CONSOLIDATION TEST

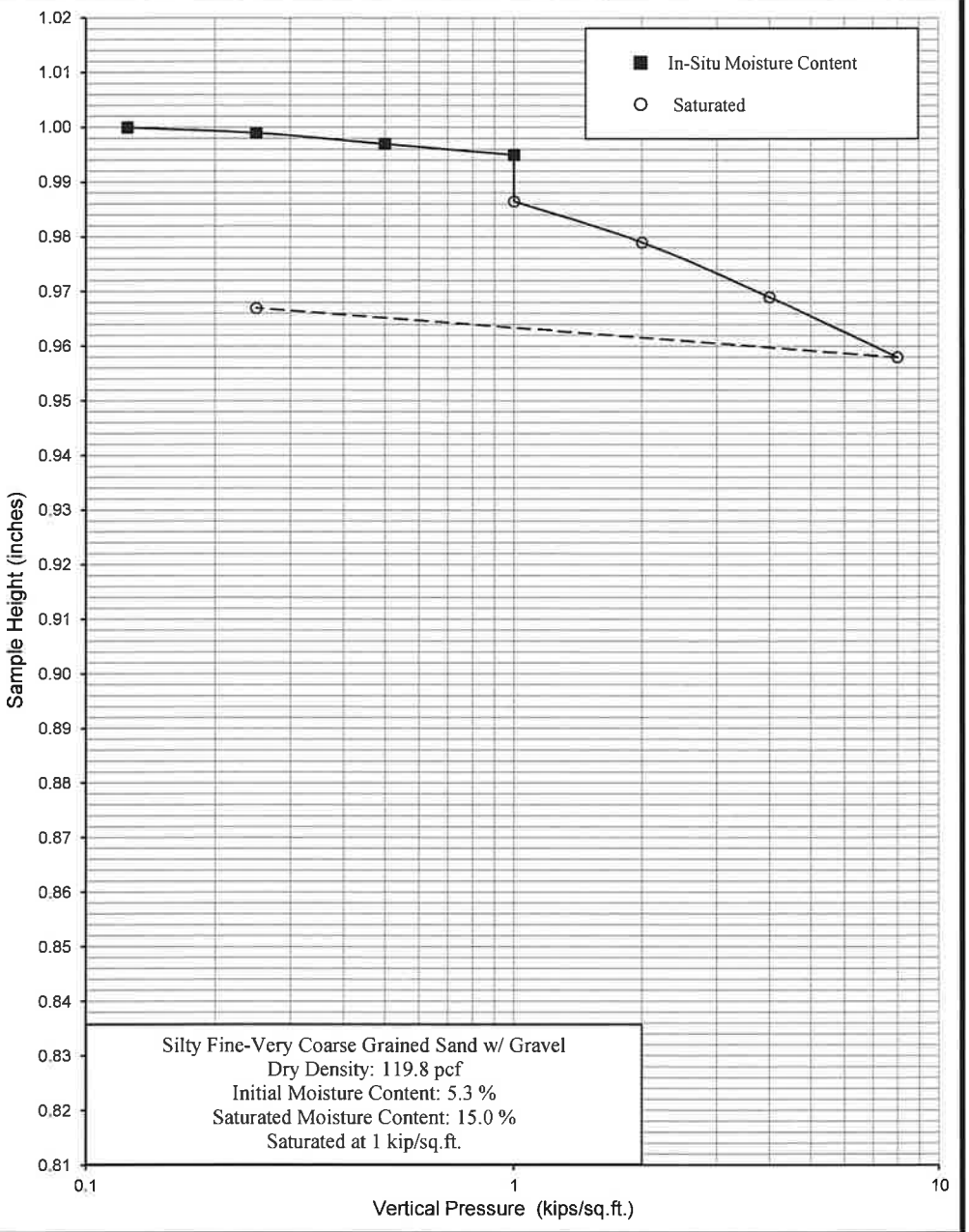
ASTM D2435

Plate E

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	
0.125	1.0000	0.0	
0.25	0.9990	0.1	
0.5	0.9970	0.3	
1	0.9950	0.5	
1	0.9865	1.4	
2	0.9790	2.1	
4	0.9690	3.1	
8	0.9580	4.2	Saturated
0.25	0.9670	3.3	

Sample No.	T14	Depth	10'	Date	10/27/2021

Date Tested: 10/26/2021
Sample: T14
Depth: 10'



NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 22884-21 DATE: 10/27/2021

CONSOLIDATION TEST

ASTM D2435

Plate F

Appendix C
Seismic Hazard Report

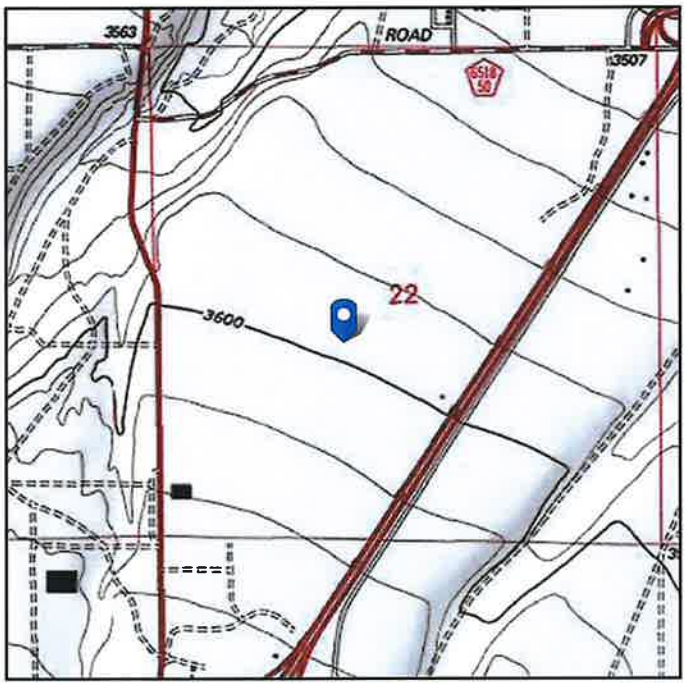
NorCal Engineering

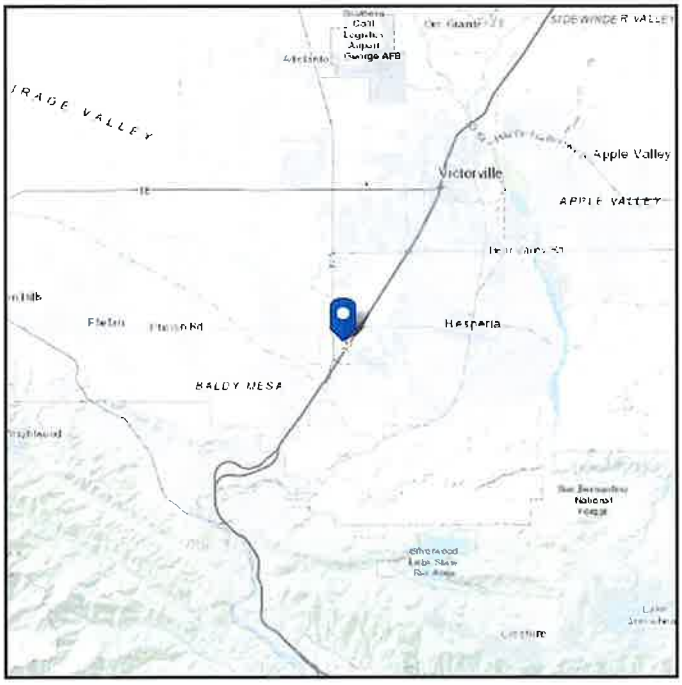
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Elevation: 3599.39 ft (NAVD 88)
Latitude: 34.418021
Longitude: -117.392799





ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.5	S_{D1} :	N/A
S_1 :	0.6	T_L :	12
F_a :	1	PGA :	0.503
F_v :	N/A	PGA_M :	0.554
S_{MS} :	1.5	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	1	C_v :	1.4

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Wed Oct 20 2021

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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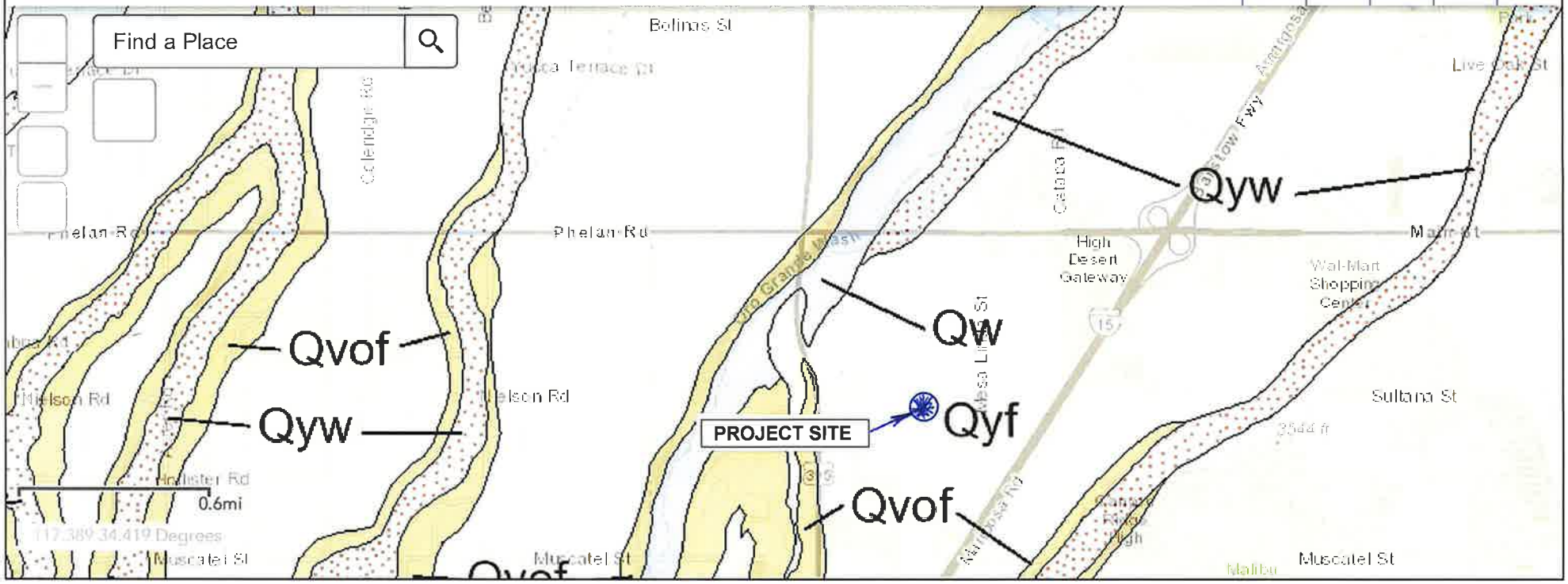
In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

California
Department of Conservation

Compilation of Quaternary Surficial Deposits



Appendix D
Soil Infiltration Data

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: Newcastle Partners
Project No.: 22884-21
Date: 10/12/2021
Test No. 1
Depth: 5'
Tested By: J.S. Jr.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
7:22			64.8			39.4					
7:37	15	15	66.2	1.4		40.5	1.1				
7:37			66.2			40.5					
7:52	15	30	67.3	1.1		41.4	0.9				
7:52			67.3			41.4					
8:07	15	45	68.3	1.0		42.0	0.6				
8:07			68.3			42.0					
8:22	15	60	68.9	0.6		42.5	0.5				
8:22			68.9			42.5					
8:37	15	75	69.5	0.6		43.0	0.5				
8:37			69.5			43.0					
8:52	15	90	70.2	0.7		43.6	0.6				
8:52			65.0			38.0					
9:07	15	105	65.6	0.6		38.8	0.8		2.4	3.2	
9:07			65.6			38.8					
9:22	15	120	66.0	0.4		39.5	0.7		1.6	2.8	
9:22			66.0			39.5					
9:37	15	135	66.4	0.4		40.0	0.5		1.6	2.0	
9:37			66.4			40.0					
9:52	15	150	66.8	0.4		40.5	0.5		1.6	2.0	
9:52			66.8			40.5					
10:07	15	165	67.3	0.5		41.0	0.5		2.0	2.0	
10:07			67.3			41.0					
10:22	15	180	67.6	0.3		41.4	0.4		1.2	1.6	

Average = 1.7 / 2.3 cm/hr

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: Newcastle Partners
Project No.: 22884-21
Date: 10/12/2021
Test No. 2
Depth: 7.5'
Tested By: J.S. Jr.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
7:55			98.8			37.7					
8:10	15	15	100.3	1.5		39.2	1.5				
8:10			100.3			39.2					
8:25	15	30	101.5	1.2		40.6	1.4				
8:25			101.5			40.6					
8:40	15	45	102.8	1.3		42.1	1.5				
8:40			102.8			42.1					
8:55	15	60	104.0	1.2		43.5	1.4				
8:55			104.0			43.5					
9:10	15	75	105.3	1.3		46.0	1.5				
9:10			105.3			46.0					
9:25	15	90	106.7	1.4		47.3	1.3				
9:25			106.7			47.3					
9:40	15	105	107.9	1.2		48.7	1.4		4.8	5.6	
9:40			99.0			38.5					
9:55	15	120	100.5	1.5		40.0	1.5		6.0	6.0	
9:55			100.5			40.0					
10:10	15	135	101.9	1.4		41.1	1.1		5.6	4.4	
10:10			101.9			41.1					
10:25	15	150	103.3	1.4		42.3	1.2		5.6	4.8	
10:25			103.3			42.3					
10:40	15	165	104.6	1.3		43.4	1.1		5.2	4.4	
10:40			104.6			43.4					
10:55	15	180	105.9	1.3		44.6	1.2		5.2	4.8	

Average = 5.4 / 5.0 cm/hr

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: Newcastle Partners
Project No.: 22884-21
Date: 10/12/2021
Test No. 3
Depth: 10'
Tested By: J.S. Jr.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
10:31			69.5			40.0					
10:46	15	15	69.6	0.1		40.0	0.0				
10:46			69.6			40.0					
11:01	15	30	69.6	0.0		40.1	0.1				
11:01			69.6			40.1					
11:16	15	45	69.7	0.1		40.2	0.1				
11:16			69.7			40.2					
11:31	15	60	69.8	0.1		40.2	0.0				
11:31			69.8			40.2					
11:46	15	75	69.8	0.0		40.2	0.0				
11:46			69.8			40.2					
12:01	15	90	69.9	0.1		40.3	0.1				
12:01			69.9			40.3					
12:16	15	105	70.0	0.1		40.4	0.1		0.4	0.4	
12:16			70.0			40.4					
12:31	15	120	70.1	0.1		40.5	0.1		0.4	0.4	
12:31			70.1			40.5					
12:46	15	135	70.1	0.0		40.6	0.1		0.0	0.4	
12:46			70.1			40.6					
1:01	15	150	7.1	0.0		40.6	0.0		0.0	0.0	
1:01			70.1			40.6					
1:16	15	165	70.2	0.1		40.7	0.1		0.4	0.4	
1:16			70.2			40.7					
1:31	15	180	70.3	0.1		40.7	0.0		0.4	0.0	

Average = 0.3 / 0.3 cm/hr

Appendix 3: BMP Supporting Materials

1. *Proposed Aboveground Basin Typical Section*
2. *Proposed Proprietary Drywell Detail and Supporting Volume Calculation*
3. *Proposed Site Design BMP Vegetated Swale Supporting Documents*
    a. *Excerpt – A copy of Drainage Study Exhibit*
    b. *Vegetated Swale Sizing Calculations – Residence Time and Required Swale Length*
4. *Proprietary FloGard Catch Basin Filter Inserts (Pre-treatment) Typical Details*

PROPOSED INFILTRATION BASIN - SUPPORTING CALCULATION

Proposed BMP: Aboveground Infiltration Basin w/ Drywell System

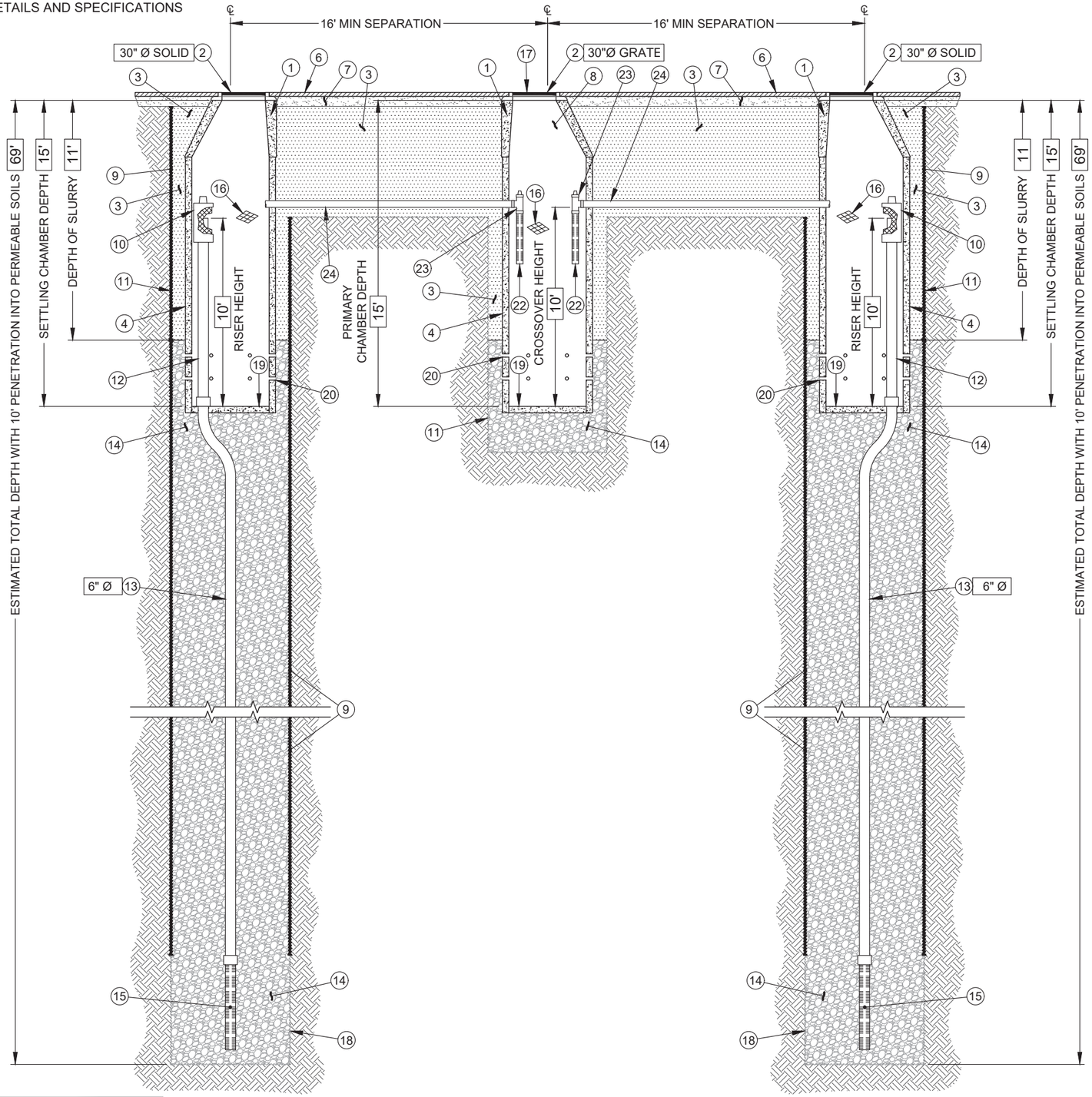
Overall Design Capture Volume (DCV) Required (ft^3):	**37,128**
Design Infiltration Rate, after Factor of Safety (inches/hour):	**0.96**
Design Infiltration Rate converted to feet/hour (feet/hour):	**0.0800**
Infiltration Basin Bottom Footprint (ft^2):	**7,488**
Drawdown Time Goal (hours):	**24**
DCV to be infiltrated via the Infiltration Basin Bottom within 24-hour period (ft^3):	**14,377**
Remaining DCV to be addressed via Proposed Drywell System (ft^3):	**22,751**

The MaxWell® Plus

DRAINAGE SYSTEM DETAILS AND SPECIFICATIONS

Newcastle

Hesperia, CA



ITEM NUMBERS

1. **MANHOLE CONE** - MODIFIED FLAT BOTTOM.
2. **BOLTED RING & GRATE/COVER** - DIAMETER & TYPE AS SHOWN. CLEAN CAST IRON WITH WORDING **"STORM WATER ONLY"** IN RAISED LETTERS. **BOLTED IN 2 LOCATIONS** AND SECURED TO CONE WITH MORTAR. RIM ELEVATION ±0.02' OF PLANS.
3. **STABILIZED BACKFILL** - TWO-SACK SLURRY MIX.
4. **PRE-CAST LINER -** 4000 PSI CONCRETE 48" ID. X 54" OD. **CENTER IN HOLE** AND ALIGN SECTIONS **TO MAXIMIZE BEARING SURFACE.**
5. NOT USED.
6. **GRADED BASIN OR PAVING** (BY OTHERS).
7. **COMPACTED BASE MATERIAL**, IF REQUIRED (BY OTHERS).
8. **FREEBOARD DEPTH VARIES** WITH INLET PIPE ELEVATION. INCREASE PRIMARY AND SECONDARY CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE RISER PIPE.
9. **NON-WOVEN GEOTEXTILE SLEEVE** - MIRAFI 140 NL. MIN. 6 FT Ø. HELD APPROX. 10 FEET OFF THE BOTTOM OF EXCAVATION.
10. **PUREFLO® DEBRIS SHIELD** - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL 0.265" MAX. SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. **FUSION BONDED EPOXY COATED**.
11. **MIN. 6' Ø DRILLED SHAFT.**
12. **RISER PIPE** - SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
13. **DRAINAGE PIPE** - ADS HIGHWAY GRADE OR SCH. 40 PVC WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS. DIAMETER AS NOTED.
14. **ROCK** - WASHED, SIZED BETWEEN 3/8" AND 1-1/2".
15. **FLOFAST® DRAINAGE SCREEN** - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. OVERALL LENGTH VARIES, UP TO 120" WITH TRI-B COUPLER.
16. **ABSORBENT** - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL, 2 PER CHAMBER.
17. **FABRIC SEAL** - U.V. RESISTANT GEOTEXTILE - **TO BE REMOVED BY CUSTOMER** AT PROJECT COMPLETION. GRATED ONLY.
18. **MIN. 6' Ø DRILLED SHAFT.**
19. **BASE SEAL** - CONCRETE SLURRY.
20. **6 PERFORATIONS MINIMUM PER FOOT, 2 ROWS MINIMUM.**
21. NOT USED.
22. **INTAKE SCREEN** - 4" Ø SCH. 40 PVC 0.120" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/ FT. 48" OVERALL LENGTH WITH TRI-C END CAP.
23. **VENTED ANTI-SIPHON INTAKE WITH FLOW REGULATOR.**
24. **CONNECTOR PIPE** - 4" Ø SCH. 40 PVC.

DETAIL : DPD-6-SS-CA	REVISED BY: BDJ		
DRAWN ON: 05-17-19	REVISED DATE: 06-21-22	SCALE: N.T.S	

Manufactured and Installed by

TORRENT RESOURCES

An evolution of McGuckin Drilling

www.torrentresources.com

CALIFORNIA 909-829-0740

ARIZONA 602-268-0785

Maxwell® Plus Drainage System Calculations Prepared on June 21, 2022
Project: **Newcastle - Hesperia, CA**
Contact: Nobu Murakami at SDH - Temecula, CA

Given:

Measured Infiltration Rate	5.60	in/hr
Safety Factor	2.19	
Design Infiltration Rate	2.56	in/hr
Mitigated Volume	22,751	ft^3
Required Drawdown Time	24	hours
Depth to Emergency Overflow	0	ft
Min. Depth to Infiltration	0	ft
Groundwater Depth for Design	657	ft

(Total - Volume Infiltrated in Basin = 37,128 CF - 14,377 CF = 22,751 CF)

Proposed:

Drywell Rock Shaft Diameter	6	ft
Primary Chamber Depth	15	ft
Drywell Chamber Depth	15	ft
Rock Porosity	40	%
Depth to Infiltration	11	ft
Drywell Bottom Depth	69	ft

Apply Safety Factor to get Design Rate.

$5.60 \ \frac{in}{hr} \div 2.19 = 2.56 \ \frac{in}{hr}$

Convert Design Rate from in/hr to ft/sec.

$2.56 \ \frac{in}{hr} \times \frac{1 \ ft}{12 \ in} \times \frac{1 \ hr}{3600 \ sec} = 0.000059 \ \frac{ft}{sec}$

A 6 foot diameter drywell provides 18.85 SF of infiltration area per foot of depth, plus 28.27 SF at the bottom.

For a 69 foot deep drywell, infiltration occurs between 11 feet and 69 feet below grade. This provides 58 feet of infiltration depth in addition to the bottom area. Infiltration area per drywell is calculated below.

$58 \ ft \times 18.85 \frac{ft^2}{ft} + 28.27 \ ft^2 = 1122 \ ft^2$

Combine design rate with infiltration area to get flow (disposal) rate for each drywell.

$0.000059 \ \frac{ft}{sec} \times 1122 \ ft^2 = 0.06639 \ \frac{ft^3}{sec}$

Volume of disposal for each drywell based on various time frames are included below.

24 hrs: 0.0664 CFS x 24 hours x $\frac{3600 \ sec}{1 \ hr}$ = 5,736 cubic feet of retained water disposed of.

Chamber diameter = 4 feet. Drywell rock shaft diameter = 6 feet.
Volume provided in each primary settling chamber with depth of 15 feet.

$15 \ ft \times 12.57 \ ft^2 = 188 \ ft^3$

Volume provided in each drywell with chamber depth of 15 feet.

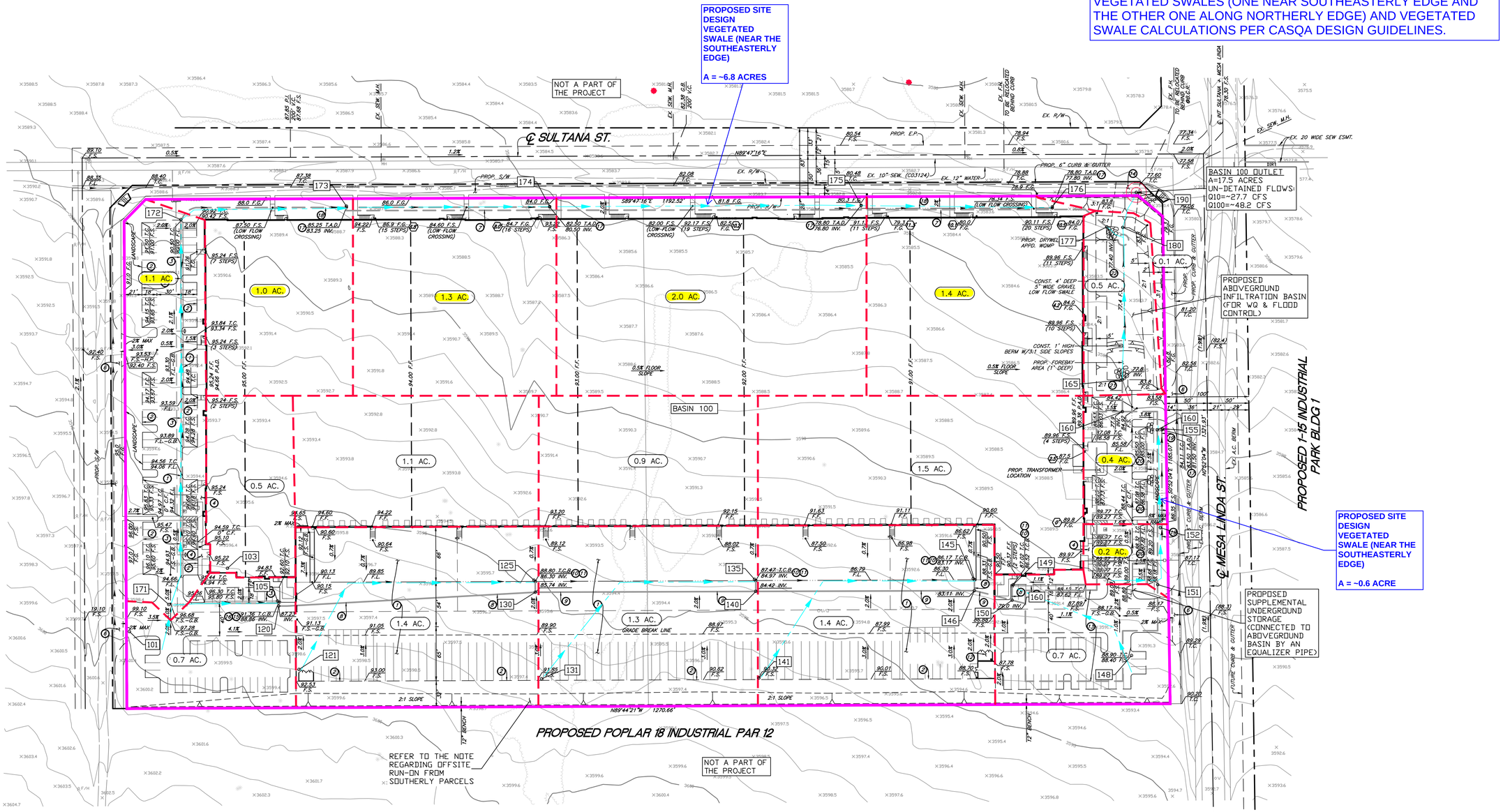
$15 \ ft \times 12.57 \ ft^2 + 54 \ ft \times 28.27 \ ft^2 \times 40 \ \% = 799 \ ft^3$

The MaxWell System is composed of 4 drywell(s) and 2 primary chamber(s).
Total volume provided = 3572 ft^3
Total 24 hour infiltration volume = 22,943 ft^3
Total infiltration flowrate = 0.26555 $\frac{ft^3}{sec}$

For any questions, please contact Bill De Jong at 909-915-9490 or via email at BDejong@TorrentResources.com

Torrent Resources (CA) Incorporated
9950 Alder Avenue
Bloomington, CA 92316
Phone 909-829-0740

REFERENCE MATERIAL - SUPPORTING EXHIBIT (EXCERPT) FROM DRAINAGE STUDY (HYDROLOGY & HYDRAULCS REPORT), IN SUPPORT OF TRIBUTARY AREAS DRAINING TO SITE DESIGN BMP VEGETATED SWALES (ONE NEAR SOUTHEASTERLY EDGE AND THE OTHER ONE ALONG NORTHERLY EDGE) AND VEGETATED SWALE CALCULATIONS PER CASQA DESIGN GUIDELINES.



NOTES:

1. THIS DRAINAGE STUDY MAP IS PREPARED IN SUPPORT OF THE ON-SITE PRELIMINARY HYDROLOGIC CALCULATIONS AND STORM DRAIN SIZING.
2. THE SITE IS SITUATED ON HYDROLOGIC SOIL GROUPS A. FOR THE PURPOSE OF HYDROLOGIC CALCULATION, SOIL GROUP A WAS USED IN THE CALCULATION FOR THE PERVIOUS AREAS.
3. AS SIMILAR TO THE EXISTING CONDITION DRAINAGE CHARACTERISTICS, RUNOFF FROM THE PROPOSED DEVELOPMENT WILL BE DIRECTED IN A NORTHEASTERLY DIRECTION TOWARDS A PROPOSED STORM WATER MANAGEMENT SYSTEM FOR FLOOD CONTROL MITIGATION AND WATER QUALITY TREATMENT PURPOSES PRIOR TO OUTLETTING TOWARDS SULTANA STREET / MESA LINDA STREET. THE PROPOSED STORM WATER MANAGEMENT SYSTEM WILL INCLUDE A COMBINATION OF AN ABOVEGROUND INFILTRATION BASIN WITH DRYWELL AND A SUPPLEMENTAL UNDERGROUND STORAGE TO ADDRESS REQUIREMENTS OF THE STORM WATER QUALITY MANAGEMENT, HYDROLOGIC CONDITION OF CONERN (HYDROMODIFICATION), AND FLOOD CONTROL MITIGATION. FROM THE PROJECT OUTLET POINT, RUNOFF WILL BE CONVEYED IN A NORTHEASTERLY DIRECTION IN A SIMILAR FASHION AS THE EXISTING CONDITION AND EVENTUALLY DISCHARGE INTO THE MOJAVE RIVER. THE OVERALL PARCEL AREA IS APPROXIMATELY 18.2 ACRES WITH APPROXIMATELY 17.5 ACRES OF ON-SITE DRAINAGE MANAGEMENT. IN THE EXISTING CONDITION, THERE MAY BE MINOR OFFSITE RUN-ON FROM THE SOUTHERLY PARCELS; HOWEVER, BASED ON OUR UNDERSTANDING, THE SOUTHERLY OFFSITE PARCELS ARE TO BE DEVELOPED BY OTHERS AND THEIR PRELIMINARY SITE PLAN APPEARS TO SHOW THE OVERFLOW WILL BE DIRECTED TOWARDS THE TWO FRONTAGE STREETS (MESA LINDA STREET AND LASSEN ROAD). THEREFORE, OFFSITE RUN-ON ALONG THE SOUTHERLY EDGE IS EXPECTED TO BE INSIGNIFICANT. HOWEVER, TO ADDRESS POTENTIAL CONCERN, THE PROJECT PROPOSES A CONCRETE V-DITCH ALONG THE SOUTHERLY EDGE OF THE PROJECT AND OUTLET TO MESDA LINDA STREET.
4. THE PROJECT IS SITUATED WITHIN "ZONE X" BASED ON THE FEMA FLOOD INSURANCE MAP NUMBER 06071C6475H, EFFECTIVE AUGUST 28, 2008. THEREFORE, NO FEMA SUBMITTAL/PROCESSING ARE EXPECTED FOR THIS PROJECT.

LEGEND

- TRACT BOUNDARY
- MAJOR DRAINAGE BOUNDARY
- SUB BASIN BOUNDARY
- SURFACE FLOW PATH
- DRAINAGE ACREAGE — X.X AC.
- BASIN NODE ID — XXX
- DISCHARGE LOCATION

DRAINAGE STUDY MAP FOR NEWCASTLE-HESPERIA (POST-PROJECT)

JN 2127 REVISED: 6/24/2022

S:\SDH DRAWINGS\NEWCASTLE-HESPERIA\MR\WORK Exhibit Post.dwg 2022-06-23 - 12:22PM - SDH

NOT FOR CONSTRUCTION – EXHIBIT FOR PRELIMINARY DRAINAGE STUDY ONLY

Channel Report

SUPPORTING CALCULATION FOR PROPOSED SITE DESIGN BMP - VEGETATED SWALE (NEAR SOUTHEASTERLY EDGE)

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jun 24 2022

Site Design BMP: Vegetated Swale (Southeasterly Edge)

Trapezoidal

Bottom Width (ft)	= 2.50
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.25
Invert Elev (ft)	= 100.00
Slope (%)	= 1.86
N-Value	= 0.250

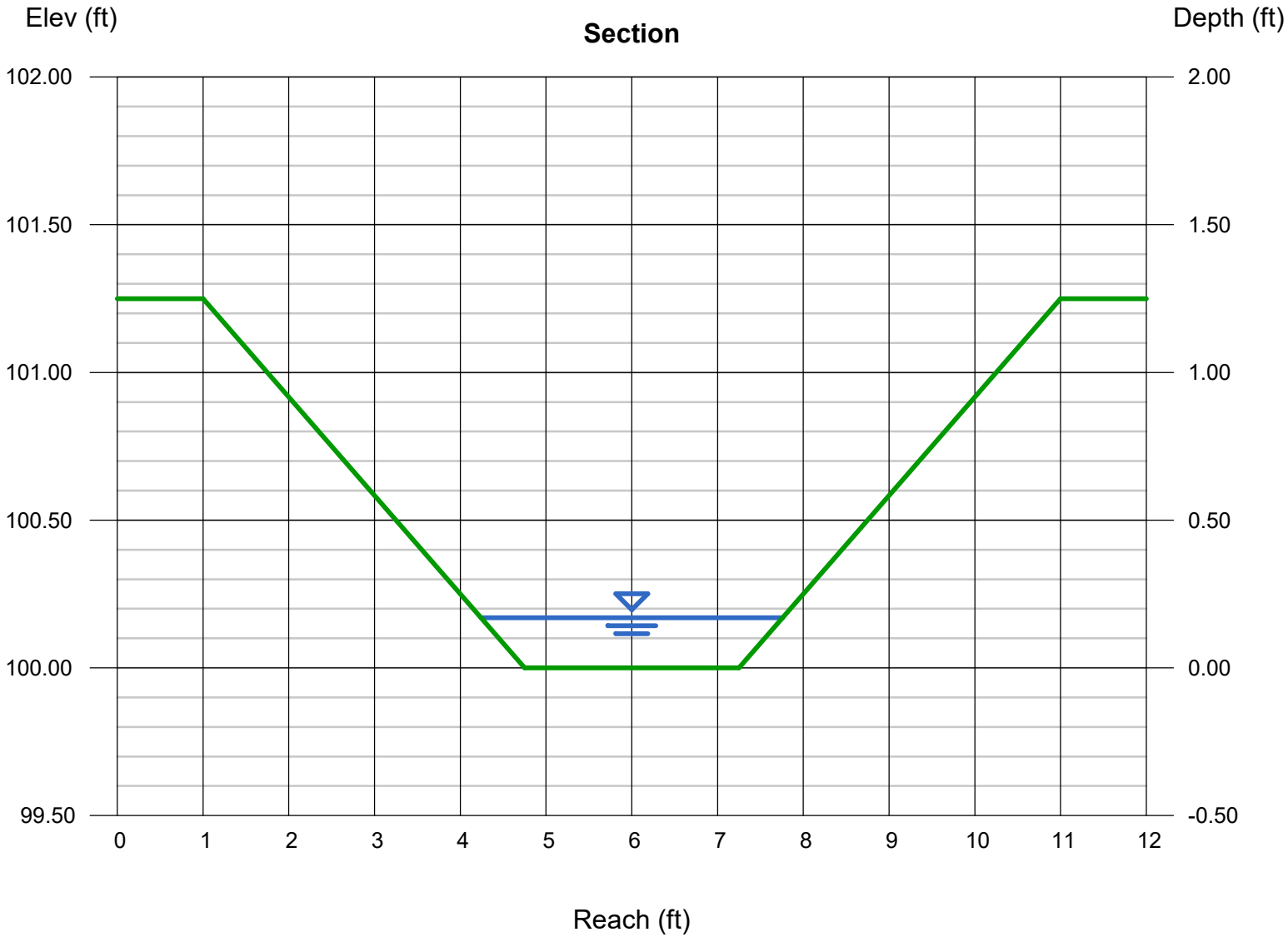
Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.11

Highlighted

Depth (ft)	= 0.17
Q (cfs)	= 0.110
Area (sqft)	= 0.51
Velocity (ft/s)	= 0.21
Wetted Perim (ft)	= 3.58
Crit Depth, Yc (ft)	= 0.04
Top Width (ft)	= 3.52
EGL (ft)	= 0.17

BASED ON THE DRAINAGE STUDY ANALYSIS EXHIBIT, THERE IS APPROXIMATELY 0.6 ACRES DRAINING TO SOUTHEASTERLY VEGETATED SWALE. THEREFORE, THE LOW-FLOW FLOW RATE IS:
Q(t)=CiA=0.90*(0.2 IN/HR)*(0.6 ACRE)=~0.11 CFS.
BASED ON THE RESULT, VELOCITY IS 0.21 FPS.
BASED ON THE CASQA DESIGN HANDBOOK, THE MINIMUM RESIDENCE (CONTACT) TIME IS 7 MINUTES. TO MEET THIS RESIDENCE TIME, THE PROPOSED SWALE LENGTH SHOULD BE:
MIN. LENGTH OF SWALE = 0.21 FT/S * (7 MIN.) * (60 SEC/MIN) = 88 FEET.
THE PROPOSED SITE DESIGN VEGETATED SWALE BY SOUTHEASTERLY EDGE WILL HAVE APPROXIMATELY 184 FEET, WHICH IS MORE THAN THE REQUIRED LENGTH. THEREFORE, OK.



Channel Report

SUPPORTING CALCULATION FOR PROPOSED SITE DESIGN BMP - VEGETATED SWALE (ALONG NORTHERLY EDGE)

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jun 24 2022

Site Design BMP: Vegetated Swale Northerly Edge)

Trapezoidal

Bottom Width (ft)	= 3.75
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.25
Invert Elev (ft)	= 100.00
Slope (%)	= 1.10
N-Value	= 0.250

Calculations

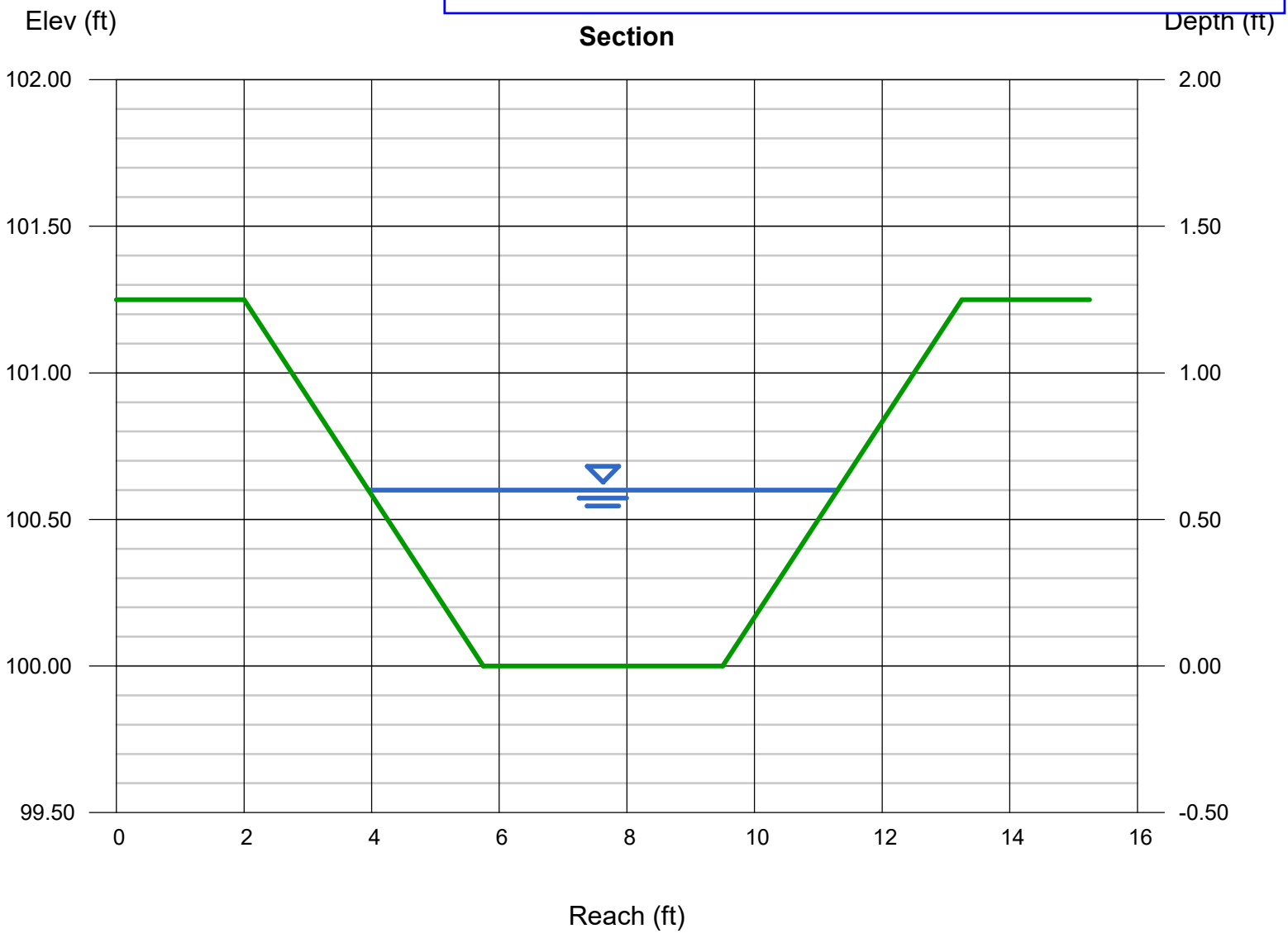
Compute by:	Known Q
Known Q (cfs)	= 1.20

Highlighted

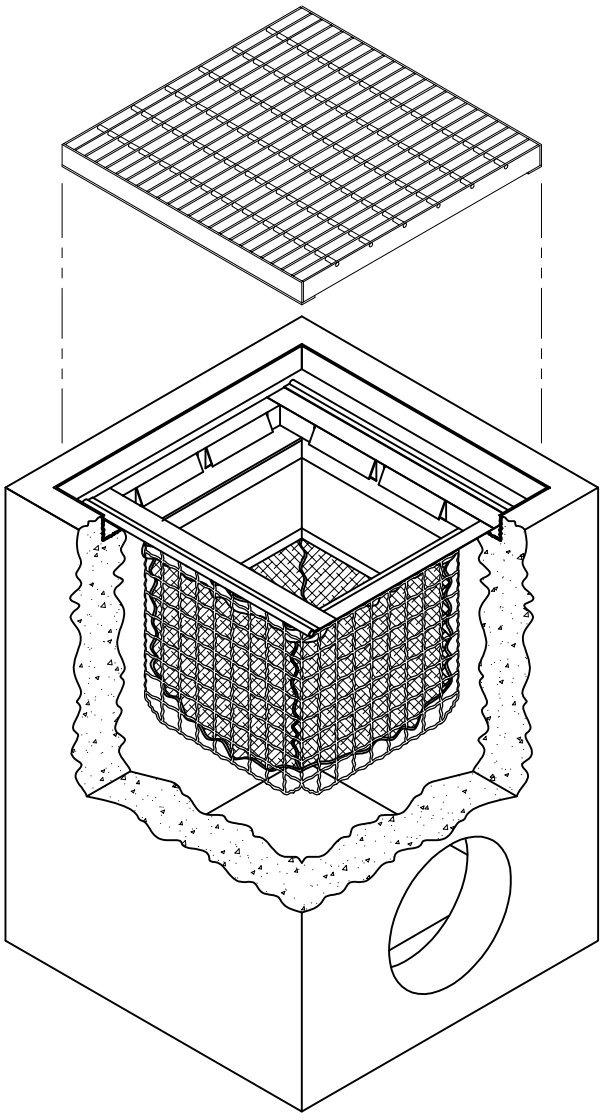
Depth (ft)	= 0.60
Q (cfs)	= 1.200
Area (sqft)	= 3.33
Velocity (ft/s)	= 0.36
Wetted Perim (ft)	= 7.54
Crit Depth, Yc (ft)	= 0.15
Top Width (ft)	= 7.35
EGL (ft)	= 0.60

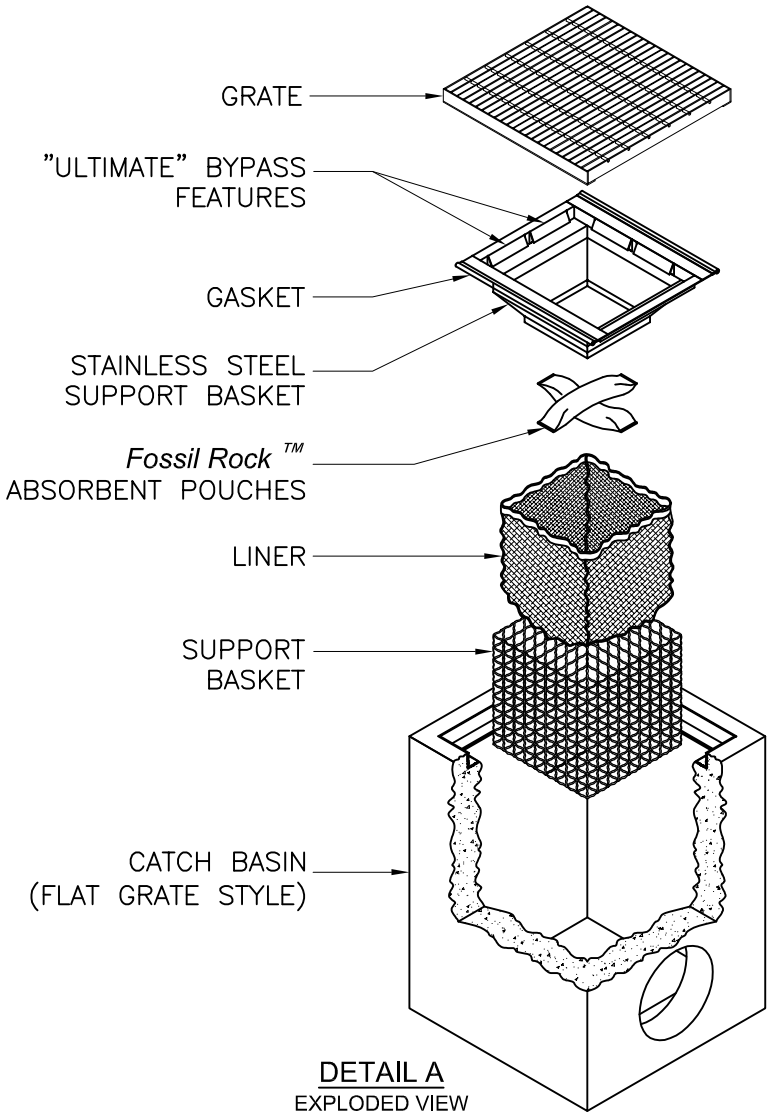
BASED ON THE DRAINAGE STUDY ANALYSIS EXHIBIT, THERE IS APPROXIMATELY 6.8 ACRES DRAINING TO NORTHERLY VEGETATED SWALE. THEREFORE, THE LOW-FLOW FLOW RATE IS: Q(t)=CiA=0.90*(0.2 IN/HR)*(6.8 ACRE)=~1.2 CFS.
BASED ON THE RESULT, VELOCITY IS 0.36 FPS.
BASED ON THE CASQA DESIGN HANDBOOK, THE MINIMUM RESIDENCE (CONTACT) TIME IS 7 MINUTES. TO MEET THIS RESIDENCE TIME, THE PROPOSED SWALE LENGTH SHOULD BE:
MIN. LENGTH OF SWALE = 0.36 FT/S * (7 MIN.) * (60 SEC/MIN) = 151 FEET.
THE PROPOSED SITE DESIGN VEGETATED SWALE ALONG NORTHERLY EDGE WILL HAVE MORE THAN 1,000 FEET, WHICH IS WELL ABOVE THE REQUIRED LENGTH. THEREFORE, OK.

THIS VEGETATED SWALE WILL ALSO ALLOW FOR "IMPERVIOUS DISPERSION" (SITE DESIGN BMP) FOR RUNOFF FROM THE ROOFTOP AND SURFACE PARKING AREA.



FGP-0001





DETAIL A
EXPLODED VIEW

FloGard® FILTER
-INSTALLED INTO CATCH BASIN-

U.S. PATENT # 6,00,023 & 6,877,029

NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter support frame shall be constructed from stainless steel Type 304.
3. Filter medium shall be *Fossil Rock* ™, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.

Inlet Filtration

FloGard®

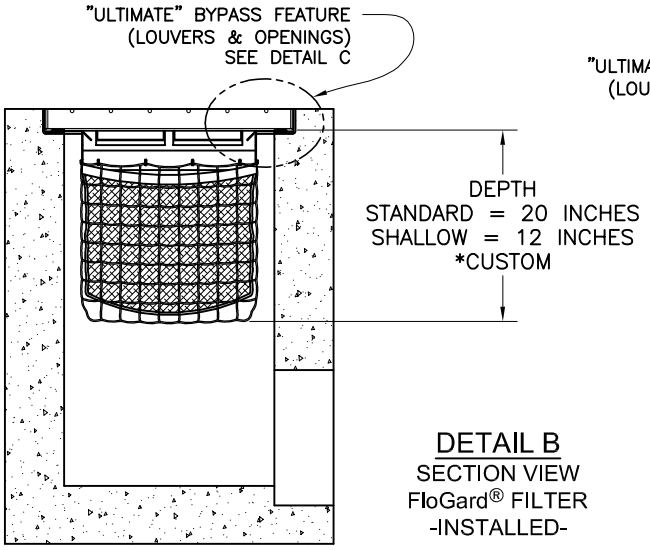
Catch Basin Insert Filter

Grated Inlet Style

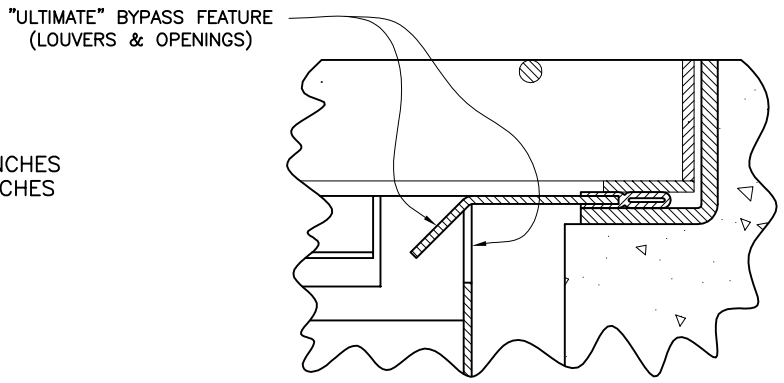
Oldcastle® Stormwater Solutions
7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

DRAWING NO.	REV	ECO	DATE	
FGP-0001	G	ECO-0142 JPR 7/13/16	JPR 11/3/06	SHEET 1 OF 2

U.S. PATENT # 6,00,023 & 6,877,029



DETAIL B
SECTION VIEW
FloGard® FILTER
-INSTALLED-



DETAIL C
"ULTIMATE"
BYPASS FEATURES

* MANY OTHER STANDARD & CUSTOM SIZES & DEPTHS AVAILABLE UPON REQUEST.

SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data In these columes Is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRATE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	.25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	.4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1824F	16 X 22	18 X 24	5.0	1.5	1.2	FGP-1824F8	.85	.7
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-2024F	18 X 22	20 X 24	5.9	1.2	1.0	FGP-2024F8	.7	.55
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2430F	24 X 30	26 X 30	7.0	2.8	1.8	FGP-2430F8	1.6	1.05
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	26 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-28F	28 X 28	32 X 32	6.3	2.2	1.5	FGP-28F8	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-SD24F	24 X 24	28 X 28	6.1	2.2	1.5	FGP-SD24F8	1.25	.85

Inlet Filtration

FloGard®

Catch Basin Insert Filter

Grated Inlet Style

Oldcastle® Stormwater Solutions
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DRAWING NO.	REV	ECO	DATE	
FGP-0001	G	ECO-0142 JPR 7/13/16	JPR 11/3/06	SHEET 2 OF 2