Appendix J
Preliminary Water Quality Management Plan

Preliminary Water Quality Management Plan

For:

Rialto Jurupa and Willow Industrial

JURUPA AVE & S. WILLOW AVE, RIALTO, CA

Prepared for:

DP South Jurupa, LLC

100 Wilshire Blvd., Suite 250

Santa Monica, CA 90401

(323) 981-8293

Prepared by:

Kimley-Horn & Associates

1100 Town & County Road, Suite 700

Orange, CA 92868

(714) 939-1030

Submittal Date: 10/31/22

Revision Date: _____

Approval Date:_____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for DP South Jurupa, LLC by Kimley-Horn & Associates. The WQMP is intended to comply with the requirements of the City of Rialto and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

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

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APNs: 0258-111-32, 0258-111-31

Owner's Signature			
Owner Name:			
Title			
Company	DP South Jurupa, LLC		
Address	100 Wilshire Blvd., Suite 250 Santa Monica, CA 90401		
Email			
Telephone #	(323) 981-8293		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APNs: 0258-111-32, 0258-111-31

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: Jacob Glaze, PE		PE Stamp Below
Title	Project Manager	
Company	Kimley-Horn & Associates	
Address	1100 W. Town & Country Rd, Suite 700, Orange, CA 92868	
Email	jacob.glaze@kimley-horn.com	
Telephone #	714-939-1030	
Signature		
Date		

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Rialto Jurupa and Willow Industrial				
Project Owner Contact Name:					
Mailing Address:	100 Wilshire Blvd., Suite 250 Santa Monica, CA 90401	E-mail Address:		Telephone:	(323) 981-8293
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s): APNs: 0258-111-32, 0258-111-31	TBD	
Additional Information/ Comments:	N/A				
Description of Project:	The project site is located on the northwest corner of Jurupa Avenue and South Willow Avenue and is bounded by existing structures to the west, an industrial development to the north, South Willow Avenue to the east, and Jurupa Avenue to the South. The entire project site measures approximately 6.97 acres and is intended to be developed into a new industrial complex. The existing project site is vacant, undeveloped land with poor coverage. The soils have a hydrologic soil group classification of "A", and the topography along the project site shows that runoff within the site primarily drains towards the south of the site onto Jurupa Avenue where it will enter into the public storm drain system. The proposed site is considered an industrial development and intends to develop approximately 6.97 acres into one industrial building, parking areas, loading docks, drive aisles, and landscape areas. Stormwater runoff will be collected by nearby catch basins and conveyed to an Underground 96" CMP System where it will infiltrate into the soil. Prior to entering the underground infiltration system, stormwater runoff will enter a hydrodynamic separator for pretreatment. When the required water quality volume is captured within the underground system, excess runoff will be routed offsite where it will connect to the public storm drain system. Refer to the Post-Development Exhibit in Section 6.1 for more information. Due to the curb and gutter along Jurupa Avenue and South Willow Avenue, the northern industrial development, and the existing topography, no offsite runon is anticipated to enter the project site.				

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

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

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

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

2 Project Area (ft2):	285,990	**3** Number of Dwelling Units:	N/A	**4** SIC Code:	4225

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

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

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management

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

All proposed BMP's for the project site will be maintained by Donlon Builders with shared maintenance responsibilities with the future parcel owners. Long term maintenance of the property, which will include maintenance of all stormwater BMPs and facilities will be memorialized through a CC&R to be prepared as part of this project.

Maintenance of the WQMP facilities will be the responsibility of the property owner:

DP South Jurupa LLC
100 Wilshire Blvd., Suite 250
Santa Monica, CA 90401
Phone: (323) 981-8293

The owner may choose to contract the appropriate employers for the maintenance of stormwater to whom will provide the proper equipment if the current owners do not have the proper equipment and/or knowledge to do so.

Any future property owner(s) will succeed DP South Jurupa, LLC as the entity responsible for long term maintenance.

No infrastructure will be transferred to a public agency after completion.

2.3 Potential Stormwater Pollutants

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

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Wild Bird and Pet Waste, Garbage
Nutrients - Phosphorous	E ☒	N ☐	Fertilizers, Food Waste, & Garbage
Nutrients - Nitrogen	E ☒	N ☐	Fertilizer & Waste
Noxious Aquatic Plants	E ☐	N ☒	The proposed development does not include any areas where water will be standing long enough to allow the growth of aquatic plants.
Sediment	E ☒	N ☐	Driveways, Rooftops, Sidewalks, Paved Areas, & Landscape
Metals	E ☒	N ☐	Cars, Trucks, & Parking Areas
Oil and Grease	E ☒	N ☐	Leaking Vehicles & Parking Areas
Trash/Debris	E ☒	N ☐	Poorly managed trash containers & parking areas
Pesticides / Herbicides	E ☒	N ☐	Landscape Areas
Organic Compounds	E ☒	N ☐	Cars & Trucks
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits

1 Project Types that Qualify for Water Quality Credits: *Select all that apply*			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)	N/A		

Section 3 Site and Watershed Description

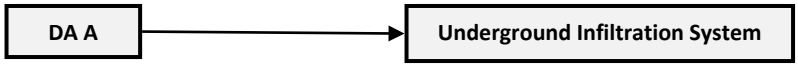
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.04909	Longitude -117.37536	Thomas Bros Map page Thomas Bros Map page 645

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

2 Does the site have more than one drainage area (DA): Yes☐ No☒ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*



Conveyance	Sub-area drainage will be conveyed via sheet flow to their respective permeable pavement.
DA A to Underground Cultec Infiltration System	Stormwater runoff sheet flows into nearby catch basins and is routed to an underground infiltration/detention basin.

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)	285,990			
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 II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	580.90			
6 Longest flowpath slope (ft/ft)	0.042			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Undeveloped (Annual Grass, Poor)			
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 3-3 Watershed Description for Drainage Area 1

Receiving waters *Refer to Watershed Mapping Tool -* *http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Rialto Channel Santa Ana River, Reach 4 Santa Ana River, Reach 3
Applicable TMDLs *Refer to Local Implementation Plan*	**Rialto Channel** N/A **Santa Ana River, Reach 4** N/A **Santa Ana River, Reach 3** Indicator Bacteria
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	**Rialto Channel** N/A **Santa Ana River, Reach 4** Indicator Bacteria **Santa Ana River, Reach 3** Copper, Indicator Bacteria, Lead
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	**Environmentally Sensitive Areas within 200':** DELHI SANDS
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	Portion of Rialto Channel and Santa Ana River downstream of project discharge.
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No *Project is within an HCOC Exempt Area*

Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	The current owner/developer and future owners and their POA shall be familiar with the contents of this WQMP and County & City ordinances and brochures and furnish copies of these documents to all future property owners.
N2	Activity Restrictions	☒	☐	Property owners and their tenants or occupants shall not be allowed to discharge chemicals, chemical residues, wastewater or other prohibited discharges listed in the City Stormwater Ordinance, to the outside, paved areas of the site, or store chemicals or other pollutant sources in non-spill containers or covered facilities as stipulated in the CC&Rs.
N3	Landscape Management BMPs	☒	☐	The POA and their landscape maintenance contractor shall inspect the irrigation system, plant health, and erosion problems after each landscape procedure and shall report all repairs and problems to the POA.
N4	BMP Maintenance	☒	☐	The POA shall inspect for standing water in underground chamber systems, 48 hours after significant storm events. BMP maintenance shall be performed per the schedule in Form 5-1, as needed to restore free drainage and maintain all other Source Control BMPs.
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	The POA will file appropriate hazardous material disclosures, if any storage is conducted, and must comply with all Title 22 CCR, Chapter 29 regulations.
N6	Local Water Quality Ordinances	☒	☐	The POA shall ensure that all maintenance activities at the site comply with the City Stormwater Ordinance, through the implementation of BMPs.
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials on site for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc.
N8	Underground Storage Tank Compliance	☐	☒	The proposed development does not include underground storage of materials.

Form 4.1-1 Non-Structural Source Control BMPs				
N9	Hazardous Materials Disclosure Compliance	☐	☒	The current owner and the future POA shall prohibit the storage of hazardous materials.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	The current owners or future POA shall require all fire code requirements to be implemented at this project site.
N11	Litter/Debris Control Program	☒	☐	The property owners, POA and their contractor shall pick up litter and sweep and clean the existing trash enclosure weekly. The trash enclosures is designed to divert all flows around the dumpsters and shall be roofed. The HOA shall contract with a refuse company to have the dumpsters emptied on a weekly basis, at a minimum.
N12	Employee Training	☒	☐	The POA shall require all maintenance contractors to train their employees in stormwater BMP implementation.
N13	Housekeeping of Loading Docks	☒	☐	Dock areas shall be swept regularly with litter control and cleanup procedures eliminating the use of water.
N14	Catch Basin Inspection Program	☒	☐	The on-site catch basins shall be inspected monthly during the rainy season (October-May) and before and after each storm to ensure proper operation. The HOA shall contract with a qualified landscape contractor to inspect and clean out accumulation of trash, litter, and sediment and check for evidence of illegal dumping of waste materials into on-site storm drains.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The paved areas and common open areas of the project site shall be swept and cleaned weekly by the POA's contractor.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	This development is not a part of a Public Agency Project.

Form 4.1-1 Non-Structural Source Control BMPs				
N17	Comply with all other applicable NPDES permits	☒	☐	The developer of this site shall comply with all BMP implementation requirements of the City for stormwater discharge during construction of this project and shall file for a permit coverage under the Statewide General Construction Stormwater Permit, prior to beginning construction/grading activities at this site. Following occupancy, owners, tenants, and POA shall comply with SB County MS4 Permit requirements, enforced by the City.

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)	☒	☐	A painted message "No Dumping-Drains to River" shall be placed on each catch basin by the developer. The message shall be inspected annually & repainted as necessary by the POA.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Stormwater flows are diverted away from the trash enclosure. All dumpsters shall have working lids which shall be kept closed at all times. Trash enclosures shall comply with CASQA SD-32 and shall have doors and a solid roof.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	The irrigation system will include devices to prevent low head drainage, overspray, and run off through the use of pressure regulating devices, check valves, rain shutoff valves, flow sensors, pressure drop sensors, proper spacing, low precipitation emissions devices and ET or weather-based controllers. Landscape and irrigation shall be consistent with the State Model Water Efficient Landscape Ordinance and the City landscape development standards. Plants installed will be arranged according to similar hydrozones and meet the required water budget for the site. Shade trees shall be used to intercept rainwater and reduce heat gain on paving.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	All landscaped areas shall comply with depressed grading requirements by finish grading to a minimum of 1" below pavement grades or top of curb.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	All slopes shall be hard lined, rip-rapped or vegetated to provide erosion protection and prevent sediment transport.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Unloading of truck trailers at docks will occur under the cover of the building. It is not feasible to cover the entire loading area as it would be cost prohibitive. Project will incorporate dock high rollup doors and sweeping activites at the outside of the building.

S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Maintenance bays are not proposed as a part of this development, and no maintenance activities will be allowed on site.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Vehicle wash areas are not provided as part of this development and outdoor vehicle/equipment washing shall be prohibited by the owners and their POA..
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	Outdoor processing is not associated with the proposed development.

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)	☐	☒	Outdoor equipment is not associated with the proposed development.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	Fueling areas are not included as part of the proposed development.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillsides will require re-vegetation as part of the proposed development.
S14	Wash water control for food preparation areas	☐	☒	The proposed development does not include food preparation areas.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	The proposed development does not include community car wash areas.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: Impervious areas will be minimized to the maximum extent practicable. The proposed development requires large areas for loading docks and the building footprint.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: All pervious areas will be below adjacent impervious areas to maximize natural infiltration, and the project site utilizes underground infiltration chambers to maximize natural infiltration.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Most of the existing drainage patterns are preserved, but alteration of the existing grading was necessary to design the proposed development. The land cover changed to mostly impervious, but the time of concentration was preserved to the maximum extent practicable via underground infiltration chambers.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Most areas are run through landscape areas prior to entering the storm drain system. Roof areas will be conveyed through adjacent landscaping, where feasible.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: Native vegetation has already been mostly removed, and the existing undeveloped area will not be preserved.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Any remaining areas that are disturbed will be stabilized with landscaping, prior to project completion.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Landscaping areas will be staked off after rough grading has been completed to prevent excessive compaction. The areas under the infiltration BMPs shall be native, uncompacted material.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Utilization of vegetated drainage swales is not feasible for the proposed development due to the proposed site plan and grading.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscaping areas will be staked off after rough grading has been completed to prevent excessive compaction.

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA A)

1 Project area DA 1 (ft^2): 285,990	**2** Imperviousness after applying preventative site design practices (Imp%): 84.2	**3** Runoff Coefficient (Rc): 0.650 *$R_c = 0.858(Imp\%)^{3} - 0.78(Imp\%)^{2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.508 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.752 *P_6 = Item 4 * C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 22,884 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

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

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

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

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

The project is located within an HCOC Exempt Area, and no HCOC's are anticipated for the project. See Section 6.4.2 for more information.

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

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

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

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Feasibility Criterion – Complete evaluation for each DA on the Project Site

[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒
Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒
(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

[3] Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒
See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 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, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.

[9] All answers to Item 1 through Item 6 are "No":
Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

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

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

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

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

4.3.2 Infiltration BMPs

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

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

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

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 22,884 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA A BMP Type Permeable Pavement	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 D of the TGD for WQMP for minimum requirements for assessment methods*	17.23		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	8.61		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	8		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	8		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	5,670		
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*	0.5		
12 Gravel porosity	0.40		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	N/A		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	N/A		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	22,946		

16 Total Retention Volume from LID Infiltration BMPs: 22,946 *(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.

4.3.3 Harvest and Use BMP

Harvest and use BMP were not considered since the full LID DCV is met through infiltration BMPs.

Form 4.3-4 Harvest and Use BMPs (Entire Site)

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

4.3.4 Biotreatment BMP

Biotreatment BMPs were not considered since the full LID DCV is met through infiltration BMPs.

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (Entire Site)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (Entire Site)

1 Total LID DCV for the Project DA-1 (ft^3): 22,884 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 22,884 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

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

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

The project is located within an HCOC Exempt Area. Therefore, no HCOCs are anticipated for the project, and this form is left blank.

Form 4.3-10 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for HCOC performance criteria (ft^3): N/A *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

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

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

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

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

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

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Onsite storm drain catch basins	Property Owner	Onsite catch basins shall be inspected quarterly for debris buildup and evidence of illegal dumping and shall be cleaned whenever debris/sediment accumulates. Removal can be accomplished by vac-truck or other equally effective methods.	Quarterly
Underground Infiltration System	Property Owner	Regular inspections of system to oberserve sediment build up and infiltration capacity. Cleaning of accumulated trash, debris, and sediments as determined by inspections. Cleaning is recommended during dry weather. See manufacturer recommendations for additional maintenance activities.	Monthly and within 48 hours following a significant storm event to verify there is no standing water in the chambers
Hydrodynamic Separator	Property Owner	Visual inspection and debris removed quarterly per manufacturer recommendations.	Quarterly
Landscape Maintenance	Property Owner	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharge of landscape maintenance waste into storm drains.	Weekly
Litter Control	Property Owner	Maintain roofed waste collection areas and vacuum-sweep drive aisles and parking areas to remove potential stormwater contamination before anticipated storm events.	Weekly/Monthly
Anti-Dumping Stenciling & Signage	Property Owner	Visual inspection and replacement of damaged or illegible stenciling and signage over on-site catch basins	Annually

Vacuum Sweep Private Streets and Parking Lots	Property Owner	Streets, parking areas and alleyways within the project shall be vacuum swept at a minimum frequency monthly.	Monthly
Trash Enclosure Design and Maintenance	Property Owner	Trash enclosure shall be constructed with a solid, canopy style roof and shall be set on a raised concrete pad, to prevent stormwater runon and the enclosure shall be swept at least once per week. Maintain area clean of trash and debris at all times.	Weekly
Irrigation System	Property Owner	Check and repair the irrigation system. Verify there are no leaks or runoff from landscaped areas. Adjust irrigation heads and system run times as necessary to prevent overwater of vegetation, overspray or run-off from landscape areas and to ensure the health and aesthetic quality of the landscape.	Weekly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

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

6.4 Other Supporting Documentation

- 6.4.1 Vicinity Map
- 6.4.2 WAP Report
- 6.4.3 NOAA Precipitation Data
- 6.4.4 BMP Sizing Calculations
- 6.4.5 Geotechnical Report
- 6.4.6 Education Materials
- 6.4.7 Construction Plans
- 6.4.8 Preliminary WQMP

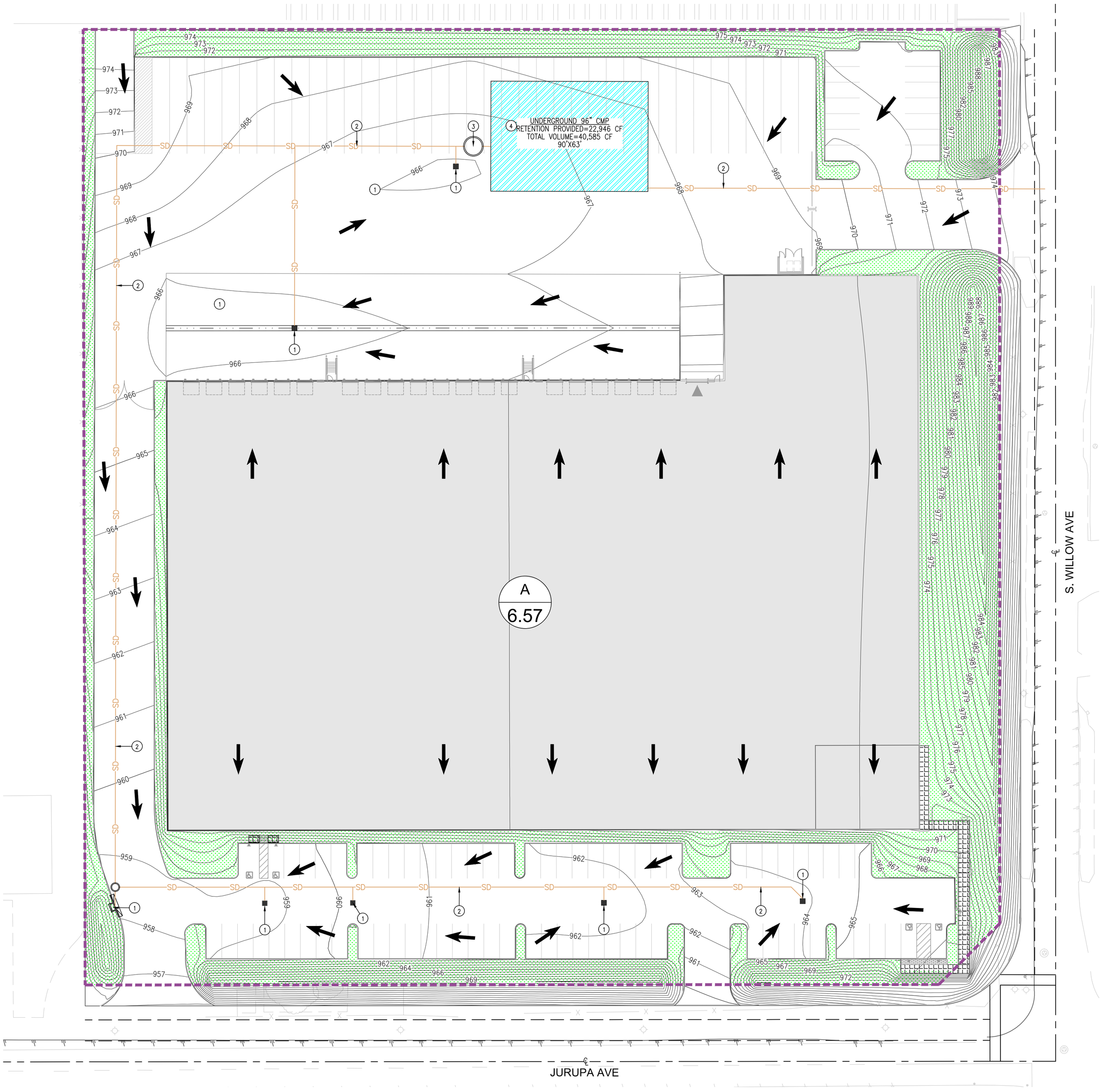
Section 6.1 Site and Drainage Plan

CITY OF RIALTO

POST-DEVELOPMENT WQMP EXHIBIT

FOR

JURUPA AND WILLOW INDUSTRIAL



HYDROLOGY INFORMATION

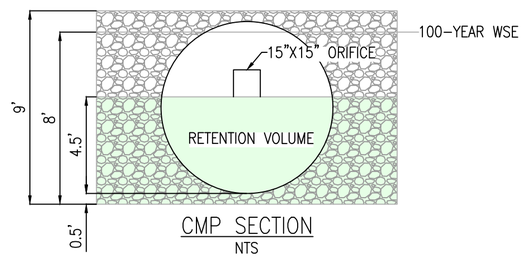
SITE AREA:	6.57 ACRES	
SOIL TYPE:	A	(NRCS WEB SOIL SURVEY)
IMPERVIOUS:	84%	(PER CALCULATIONS)
ISOHYETALS:	0.508 INCH	(2–YEAR STORM EVENT)
	1.24 INCH	(100–YEAR STORM EVENT)
CURVE NUMBER	32	(SOIL GROUP A)
FREQUENCY:	2–YEAR	(FOR STORMWATER QUALITY)
	100–YEAR	(FOR STORM DRAIN DESIGN)
METHOD:	SAN BERNARDINO COUNTY HYDROLOGY MANUAL	

LEGEND:

- DRAINAGE AREA BOUNDARY
- STORM DRAIN
- PROPOSED FLOW DIRECTION ARROW
- X — DRAINAGE AREA DESIGNATION
- X.XX — AREA (AC)

DRAINAGE NOTES:

1. PROPOSED CATCH BASIN
2. PROPOSED STORM DRAIN PIPE PRIVATE MAINTAINED
3. PROPOSED BMP – HYDRODYNAMIC SEPARATOR
4. PROPOSED BMP – UNDERGROUND INFILTRATION BASIN



CMP SECTION

NTS

WQMP SUMMARY							
DRAINAGE AREA NO.	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO	RUNOFF COEFFICIENT	DCV (CF)	ΔV_{100} (CF)	RETENTION PROVIDED (CF)
A	285,990	6.57	0.84	0.65	22,884	17,733	22,946 (UNDERGROUND 96" CMP)

NORTH

GRAPHIC SCALE IN FEET

0 15 30 60

PREPARED BY:

Kimley»Horn

© 2021 KIMLEY–HORN AND ASSOCIATES, INC.

1100 W TOWN AND COUNTRY ROAD,SUITE 700,
ORANGE, CA 92868
PHONE: 714–939–1030 FAX: 714–938–9488
WWW.KIMLEY–HORN.COM

JURUPA AND WILLOW INDUSTRIAL

POST-DEVELOPMENT WQMP EXHIBIT

JURUPA AVE AND WILLOW AVE

CITY OF RIALTO

DATE: OCT 2022

SHEET 1 OF 1

10/29/2022

K:\DPLA_LJDOV\DESIGN\JURUPA AND WILLOW – INDUSTRIAL\REPORTS\WQMP\EXHIBITS\PALTO\JURUPA POST WQMP EXHIBIT.DWG (10-29-22 03:11 PM) Plotted by: Ivan.Thieu

Section 6.2 Electronic Data Submittal

To be prepared in Final Engineering

Section 6.3 Post Construction

To be prepared in Final Engineering

Section 6.4 Other Supporting Documentation

- 6.4.1 Vicinity Map
- 6.4.2 WAP Report
- 6.4.3 NOAA Precipitation Data
- 6.4.4 BMP Sizing Calculations
- 6.4.5 Geotechnical Report
- 6.4.6 Educational Materials
- 6.4.7 Construction Plans
- 6.4.8 Preliminary WQMP

Section 6.4.1 Vicinity Map


Vicinity Map
Project Site
S Willow Ave
S Willow Ave
S Willow Ave
Jurupa Ave
Jurupa Ave
S Willow Ave & Jurupa Ave
N
Google Earth

Section 6.4.2 WAP Report



WQMP Project Report

County of San Bernardino Stormwater Program

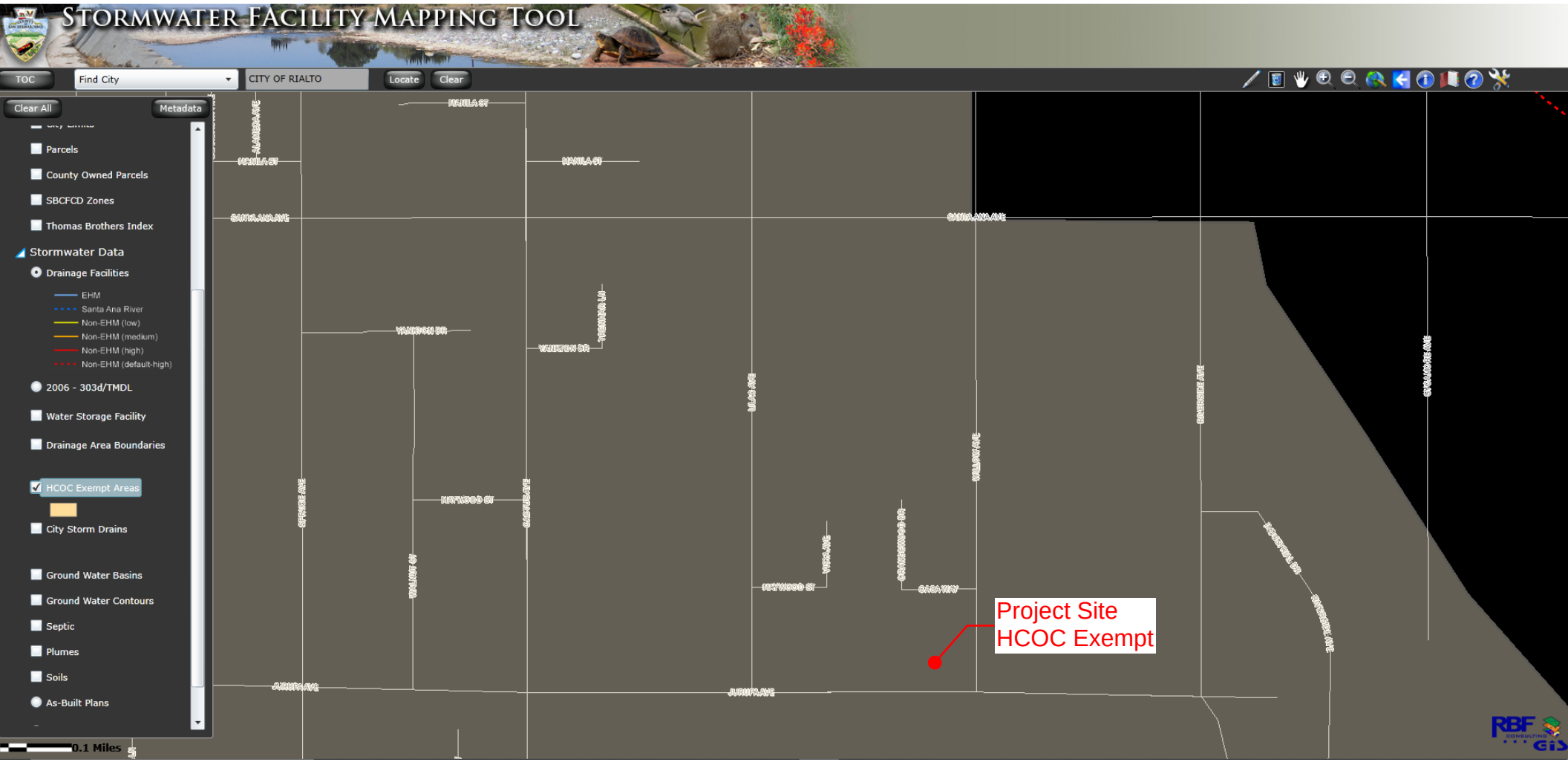
Santa Ana River Watershed Geodatabase

Tuesday, October 25, 2022

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

Project Site Parcel Number(s):	025812101, 025811118, 025811115, 025812148, 025811129, 025802130, 025803111, 025810214, 025817131, 025810219, 025817153, 025817152, 025812143, 025817130, 025812142, 025817148, 025817136, 025810220, 025810253, 025817155, 025812144, 025810208, 025811140, 025812145, 025811135, 025811131, 025811134, 025812119, 025811122, 025811112, 025811113, 025810249, 026001140, 026001108, 026001101, 026001125, 026001102, 026001144, 026001109, 026001127, 025811121, 025811130, 025811116, 025810258, 025811136, 025811137, 025811138, 025811120, 025804132, 025803110, 025804133, 025810215, 025817147, 025812146, 025817129, 025817151, 025817137, 025810252, 025817149, 025810261, 025810267, 025811139, 025811105, 025810213, 025812149, 025811132, 025811133, 025811128, 025811114, 025817150, 025810250, 025812102, 026001115, 026001141, 026001126, 026001136, 026001135, 025817146, 025810248, 026001129, 026001132
Project Site Acreage:	216.793
HCOC Exempt Area:	Yes. Verify that the project is completely with the HCOC exemption area.
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	**System Number** - 120 **Facility Name** - Rialto Channel **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	High
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	Yes
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	A, B
Environmentally Sensitive Areas within 200':	DELHI SANDS
Groundwater Depth (FT):	-208
Parcels with potential septic tanks within 1000':	Yes
Known Groundwater Contamination Plumes within 1000':	Yes
Studies and Reports Related to Project Site:	Cactus Basin CSDP 3-3 Rialto Channel Drainage Area Volume I CSDP 3-3 Rialto Channel Drainage Area Volume II CSDP 3-3 Rialto Channel Drainage Area Volume III CSDP 3-3 Rialto Channel Drainage Area Volume I CSDP 3-3 Rialto Channel Drainage Area Volume IV CSDP 3-3 Rialto Channel Drainage Area Volume V CSDP 3-4 100yr Hydrology Update CSDP 3-4 Engineers Report Volume 1 CSDP 3-4 Hydrology Study West Portion Only CSDP 3-4 Hydrology Study East Portion CSDP 3 CALC SHEET FOR HYDRO CSDP 3-3 Rialto Channel Drain Area Draft Hydrology Study Project 3-4 East Portion Hydrology Study Project 3-4 West portion Only Project #3-4 100yr Hydrology Update Sept1997

Rialto MPD Vol1
Rialto MPD Vol II
RS-Rialto Map Book-FINAL Layout2
SBVMWD High Groundwater / Pressure Zone Area


STORMWATER FACILITY MAPPING TOOL
TOC
Find City
CITY OF RIALTO
Locate
Clear
Clear All
Metadata
Parcels
County Owned Parcels
SBCFCD Zones
Thomas Brothers Index
Stormwater Data
Drainage Facilities
EHM
Santa Ana River
Non-EHM (low)
Non-EHM (medium)
Non-EHM (high)
Non-EHM (default-high)
2006 - 303d/TMDL
Water Storage Facility
Drainage Area Boundaries
HCOC Exempt Areas
City Storm Drains
Ground Water Basins
Ground Water Contours
Septic
Plumes
Soils
As-Built Plans
0.1 Miles
MANILA ST
SANTA ANA AVE
JURUPA AVE
HAYWOOD ST
Project Site
HCOC Exempt

Section 6.4.3 NOAA Precipitation Data

NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, USA*
Latitude: 34.0483°, Longitude: -117.3746°
Elevation: 964.08 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	0.105 (0.087-0.127)	0.135 (0.112-0.164)	0.176 (0.146-0.214)	0.209 (0.172-0.257)	0.256 (0.203-0.325)	0.292 (0.227-0.379)	0.329 (0.250-0.439)	0.369 (0.272-0.506)	0.424 (0.299-0.607)	0.468 (0.319-0.695)
10-min	0.150 (0.125-0.182)	0.194 (0.161-0.235)	0.252 (0.209-0.306)	0.300 (0.247-0.368)	0.366 (0.291-0.465)	0.418 (0.325-0.543)	0.472 (0.358-0.629)	0.529 (0.390-0.725)	0.608 (0.429-0.870)	0.671 (0.457-0.996)
15-min	0.181 (0.151-0.220)	0.234 (0.195-0.284)	0.304 (0.253-0.370)	0.363 (0.298-0.445)	0.443 (0.352-0.563)	0.506 (0.394-0.657)	0.571 (0.433-0.761)	0.640 (0.471-0.877)	0.735 (0.519-1.05)	0.812 (0.553-1.20)
30-min	0.271 (0.226-0.328)	0.350 (0.291-0.425)	0.455 (0.378-0.554)	0.542 (0.446-0.665)	0.662 (0.526-0.841)	0.756 (0.588-0.982)	0.854 (0.648-1.14)	0.956 (0.705-1.31)	1.10 (0.776-1.57)	1.21 (0.827-1.80)
60-min	0.393 (0.328-0.477)	0.508 (0.423-0.617)	0.661 (0.548-0.804)	0.787 (0.648-0.966)	0.961 (0.764-1.22)	1.10 (0.854-1.43)	1.24 (0.940-1.65)	1.39 (1.02-1.90)	1.60 (1.13-2.28)	1.76 (1.20-2.61)
2-hr	0.570 (0.475-0.691)	0.730 (0.608-0.886)	0.941 (0.781-1.15)	1.11 (0.917-1.37)	1.35 (1.07-1.72)	1.54 (1.19-1.99)	1.72 (1.31-2.30)	1.92 (1.42-2.63)	2.19 (1.55-3.14)	2.41 (1.64-3.57)
3-hr	0.706 (0.588-0.856)	0.902 (0.750-1.09)	1.16 (0.962-1.41)	1.37 (1.13-1.68)	1.66 (1.32-2.10)	1.88 (1.46-2.44)	2.10 (1.60-2.80)	2.34 (1.72-3.21)	2.66 (1.88-3.81)	2.92 (1.99-4.33)
6-hr	0.990 (0.825-1.20)	1.26 (1.05-1.54)	1.62 (1.35-1.98)	1.92 (1.58-2.35)	2.31 (1.84-2.94)	2.62 (2.03-3.40)	2.93 (2.22-3.90)	3.25 (2.39-4.45)	3.68 (2.60-5.27)	4.02 (2.74-5.97)
12-hr	1.32 (1.10-1.60)	1.69 (1.41-2.05)	2.17 (1.80-2.64)	2.56 (2.11-3.15)	3.09 (2.46-3.93)	3.50 (2.72-4.54)	3.91 (2.97-5.21)	4.34 (3.19-5.94)	4.91 (3.47-7.03)	5.36 (3.65-7.95)
24-hr	1.75 (1.55-2.02)	2.27 (2.01-2.62)	2.94 (2.59-3.40)	3.48 (3.05-4.06)	4.22 (3.57-5.08)	4.78 (3.97-5.88)	5.35 (4.33-6.74)	5.93 (4.68-7.68)	6.72 (5.09-9.06)	7.34 (5.37-10.2)
2-day	2.13 (1.89-2.46)	2.81 (2.48-3.24)	3.69 (3.25-4.27)	4.41 (3.86-5.14)	5.39 (4.56-6.49)	6.14 (5.10-7.56)	6.91 (5.60-8.70)	7.70 (6.07-9.97)	8.78 (6.65-11.8)	9.63 (7.04-13.4)
3-day	2.28 (2.02-2.63)	3.05 (2.70-3.52)	4.06 (3.58-4.70)	4.90 (4.28-5.71)	6.04 (5.11-7.28)	6.93 (5.75-8.52)	7.84 (6.35-9.87)	8.78 (6.92-11.4)	10.1 (7.63-13.6)	11.1 (8.12-15.5)
4-day	2.45 (2.17-2.82)	3.31 (2.93-3.82)	4.44 (3.92-5.14)	5.38 (4.71-6.28)	6.67 (5.65-8.04)	7.68 (6.37-9.45)	8.72 (7.06-11.0)	9.80 (7.72-12.7)	11.3 (8.54-15.2)	12.5 (9.12-17.4)
7-day	2.80 (2.48-3.23)	3.83 (3.39-4.42)	5.19 (4.57-6.00)	6.31 (5.52-7.36)	7.86 (6.66-9.47)	9.07 (7.53-11.2)	10.3 (8.37-13.0)	11.6 (9.18-15.1)	13.5 (10.2-18.2)	14.9 (10.9-20.8)
10-day	3.04 (2.69-3.51)	4.18 (3.70-4.83)	5.70 (5.02-6.59)	6.95 (6.08-8.11)	8.68 (7.35-10.5)	10.0 (8.33-12.4)	11.5 (9.28-14.4)	12.9 (10.2-16.7)	15.0 (11.3-20.2)	16.6 (12.2-23.2)
20-day	3.69 (3.27-4.26)	5.12 (4.53-5.91)	7.02 (6.19-8.13)	8.61 (7.53-10.0)	10.8 (9.16-13.0)	12.6 (10.4-15.4)	14.4 (11.6-18.1)	16.3 (12.8-21.1)	19.0 (14.4-25.6)	21.1 (15.5-29.5)
30-day	4.38 (3.88-5.05)	6.08 (5.37-7.01)	8.35 (7.36-9.66)	10.2 (8.96-11.9)	12.9 (10.9-15.5)	15.0 (12.4-18.4)	17.2 (13.9-21.7)	19.6 (15.4-25.3)	22.9 (17.3-30.8)	25.5 (18.7-35.6)
45-day	5.25 (4.64-6.05)	7.22 (6.38-8.33)	9.88 (8.71-11.4)	12.1 (10.6-14.1)	15.2 (12.9-18.4)	17.7 (14.7-21.8)	20.4 (16.5-25.7)	23.2 (18.3-30.1)	27.2 (20.6-36.7)	30.5 (22.3-42.5)
60-day	6.13 (5.43-7.07)	8.36 (7.39-9.65)	11.4 (10.0-13.1)	13.9 (12.2-16.2)	17.5 (14.8-21.0)	20.3 (16.9-25.0)	23.3 (18.9-29.4)	26.6 (21.0-34.5)	31.3 (23.7-42.2)	35.1 (25.7-48.9)

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

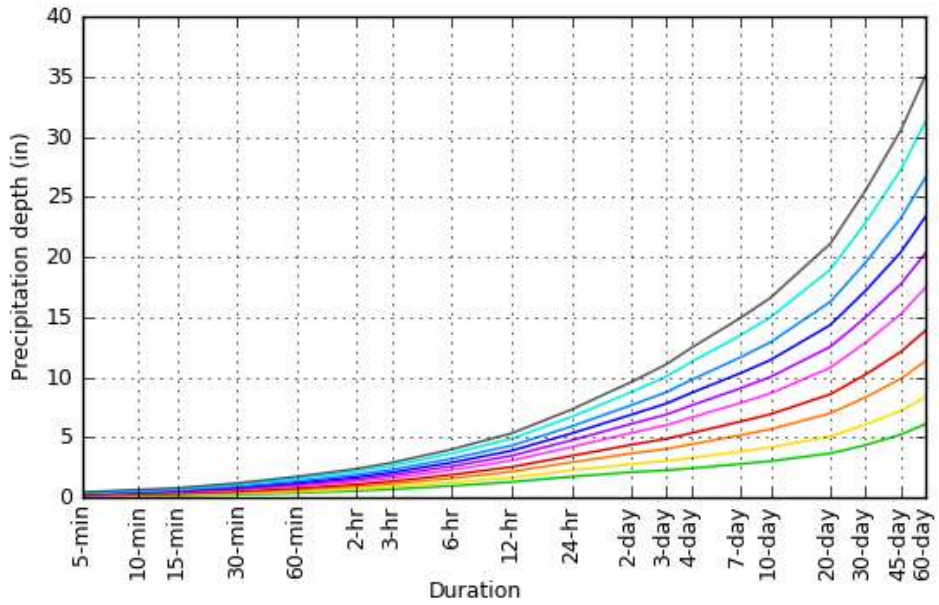
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

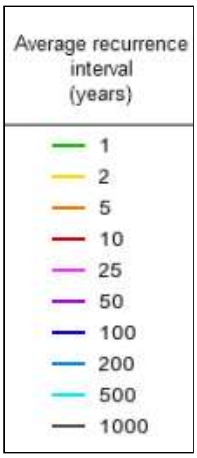
Please refer to NOAA Atlas 14 document for more information.

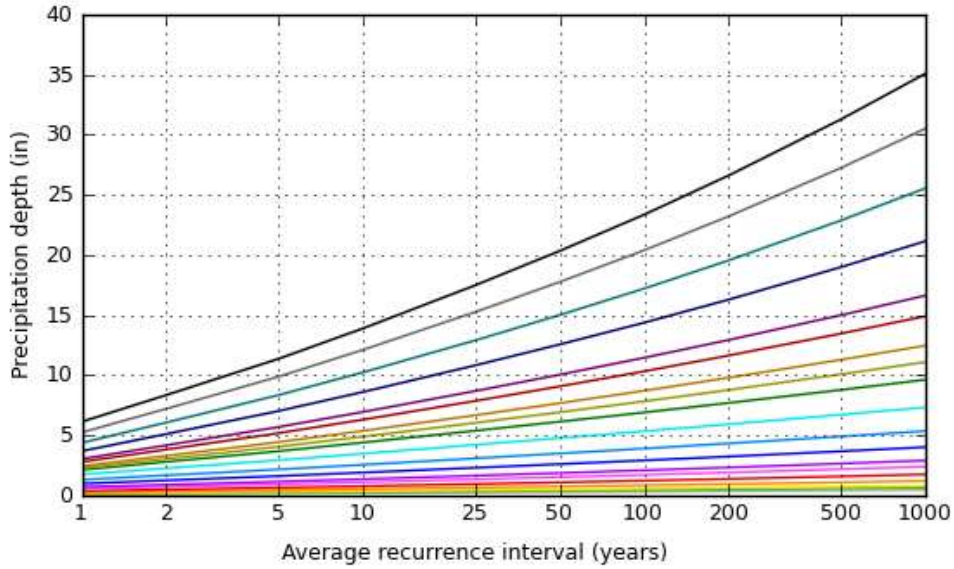
Back to Top

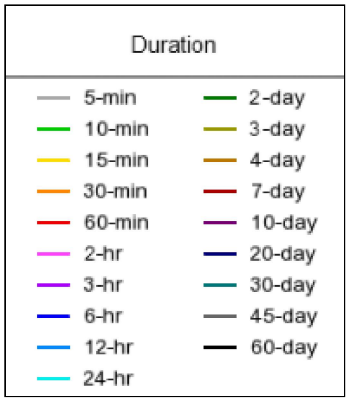
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.0483°, Longitude: -117.3746°







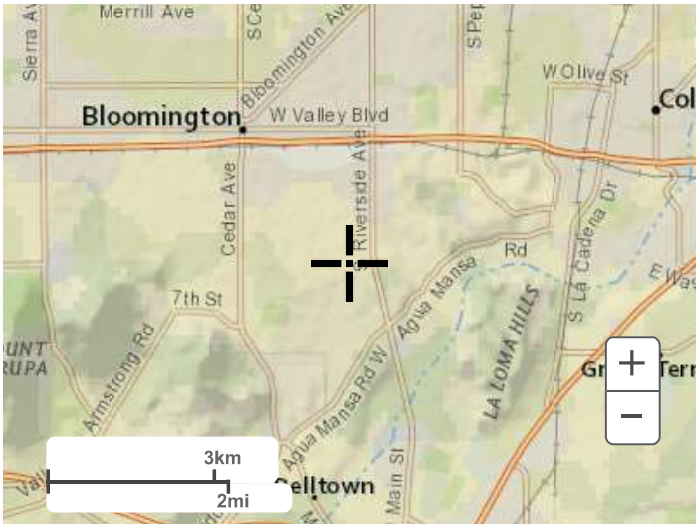


NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Tue Oct 25 23:27:12 2022

Back to Top

Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



Back to Top

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

Disclaimer

Section 6.4.4 BMP Sizing Calculations

CONTECH ENGINEERED SOLUTIONS

Date: 7/18/2021
Project Name: Underground Infiltration CMP #1 - 7614 (7-18-2021 0-14-3

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System
Storage Volume Estimation

=Adjustable Input Cells

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

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	90.0	Backfill Porosity (%):	40%	System Diameter (in):	96
Out-to-out width (ft):	63.0	Depth Above Pipe (in):	6.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	6.0	Incremental Analysis (in):	2
Number of Barrels (ea):	6.0	Width At Ends (ft):	3.0	System Invert (Elevation):	0
		Width At Sides (ft):	3.0		

Storage Volume Estimation

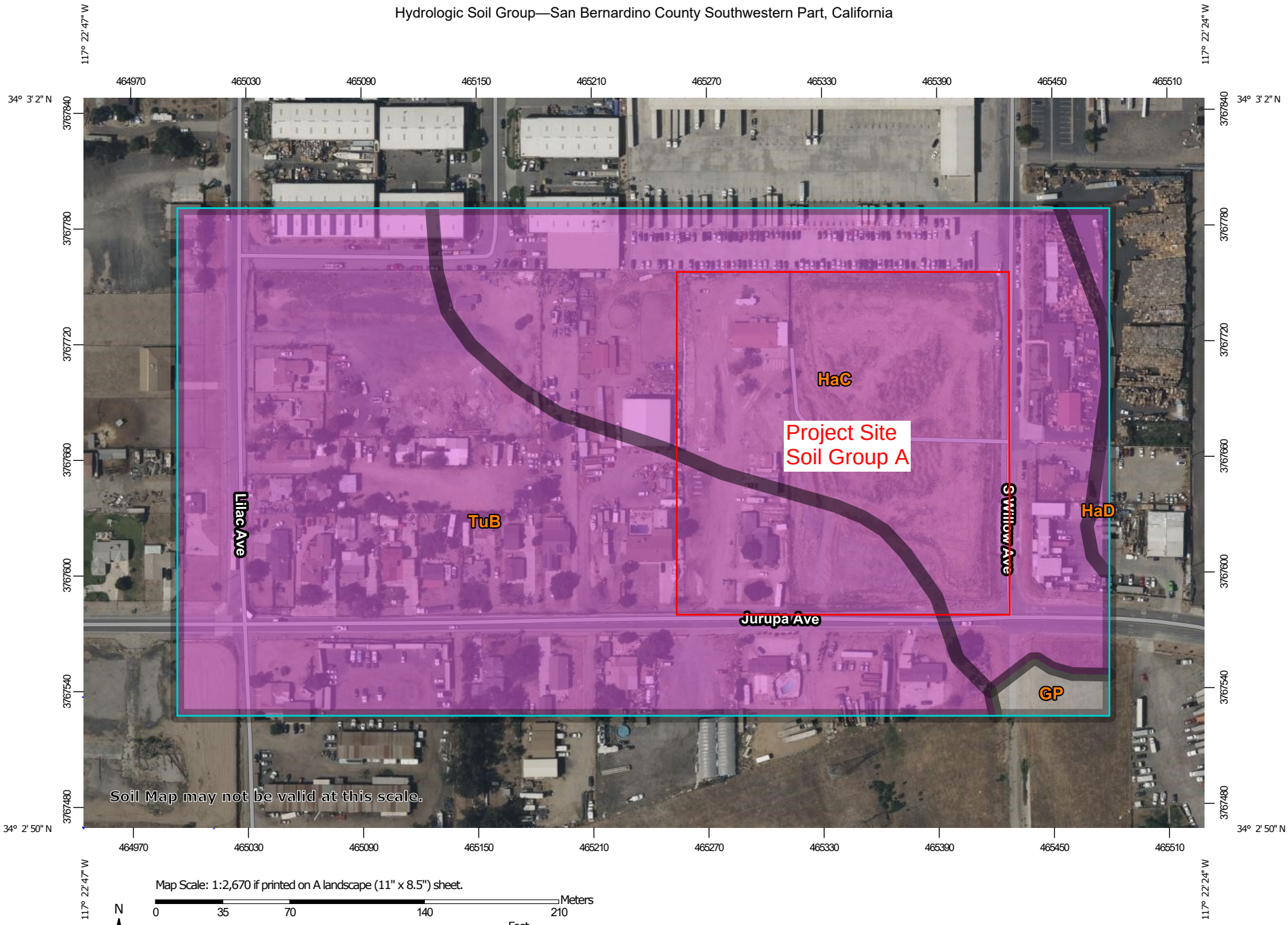
System		Pipe		Stone		Total System		Miscellaneous		
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Open Storage (%)	Ave. Surface Area (sf)	
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	2,649.6	
0.17	0.16	0.0	0.0	441.6	441.6	441.6	441.6	0.0%	2,649.6	
0.33	0.33	0.0	0.0	441.6	883.2	441.6	883.2	0.0%	2,649.6	
0.50	0.50	0.0	0.0	441.6	1,324.8	441.6	1,324.8	0.0%	2,649.6	
0.67	0.66	141.5	141.5	385.0	1,709.8	526.5	1,851.3	7.6%	3,410.6	
0.83	0.83	256.2	397.7	339.1	2,048.9	595.3	2,446.6	16.3%	3,714.3	
1.00	1.00	328.2	726.0	310.3	2,359.2	638.5	3,085.2	23.5%	3,939.3	
1.17	1.16	384.4	1,110.4	287.8	2,647.0	672.3	3,757.4	29.6%	4,122.2	
1.33	1.33	431.1	1,541.5	269.2	2,916.2	700.3	4,457.7	34.6%	4,277.2	
1.50	1.50	471.2	2,012.7	253.1	3,169.3	724.3	5,182.0	38.8%	4,411.7	
1.67	1.66	506.2	2,518.9	239.1	3,408.4	745.3	5,927.4	42.5%	4,530.1	
1.83	1.83	537.2	3,056.2	226.7	3,635.1	763.9	6,691.3	45.7%	4,635.2	
2.00	2.00	564.9	3,621.0	215.7	3,850.8	780.5	7,471.8	48.5%	4,729.2	
2.17	2.16	589.6	4,210.6	205.8	4,056.6	795.3	8,267.2	50.9%	4,813.4	
2.33	2.33	611.7	4,822.3	196.9	4,253.5	808.6	9,075.8	53.1%	4,888.9	
2.50	2.50	631.6	5,454.0	189.0	4,442.4	820.6	9,896.4	55.1%	4,956.7	
2.67	2.66	649.4	6,103.4	181.8	4,624.2	831.3	10,727.6	56.9%	5,017.3	
2.83	2.83	665.3	6,768.7	175.5	4,799.7	840.8	11,568.4	58.5%	5,071.3	
3.00	3.00	679.5	7,448.2	169.8	4,969.5	849.3	12,417.7	60.0%	5,119.2	
3.17	3.16	692.0	8,140.2	164.8	5,134.3	856.8	13,274.5	61.3%	5,161.2	
3.33	3.33	702.9	8,843.1	160.4	5,294.8	863.3	14,137.8	62.5%	5,197.8	
3.50	3.50	712.3	9,555.4	156.7	5,451.5	869.0	15,006.8	63.7%	5,229.0	
3.67	3.66	720.2	10,275.6	153.5	5,605.0	873.7	15,880.6	64.7%	5,255.1	
3.83	3.83	726.8	11,002.4	150.9	5,755.8	877.7	16,758.3	65.7%	5,276.3	
4.00	4.00	732.0	11,734.5	148.8	5,904.6	880.8	17,639.1	66.5%	5,292.7	
4.17	4.16	735.9	12,470.4	147.2	6,051.8	883.2	18,522.2	67.3%	5,304.3	
4.33	4.33	738.5	13,208.9	146.2	6,198.0	884.7	19,406.9	68.1%	5,311.3	
4.50	4.50	739.8	13,948.7	145.7	6,343.7	885.5	20,292.4	68.7%	5,313.6	
4.67	4.66	739.8	14,688.5	145.7	6,489.4	885.5	21,177.9	69.4%	5,311.3	
4.83	4.83	738.5	15,427.0	146.2	6,635.6	884.7	22,062.6	69.9%	5,304.3	
5.00	5.00	735.9	16,162.9	147.2	6,782.8	883.2	22,945.7	70.4%	5,292.7	Retention Volume
5.17	5.16	732.0	16,894.9	148.8	6,931.6	880.8	23,826.5	70.9%	5,276.3	
5.33	5.33	726.8	17,621.7	150.9	7,082.5	877.7	24,704.2	71.3%	5,255.1	
5.50	5.50	720.2	18,342.0	153.5	7,236.0	873.7	25,578.0	71.7%	5,229.0	
5.67	5.66	712.3	19,054.3	156.7	7,392.7	869.0	26,447.0	72.0%	5,197.8	
5.83	5.83	702.9	19,757.1	160.4	7,553.1	863.3	27,310.3	72.3%	5,161.2	
6.00	6.00	692.0	20,449.1	164.8	7,718.0	856.8	28,167.1	72.6%	5,119.2	
6.17	6.16	679.5	21,128.6	169.8	7,887.8	849.3	29,016.4	72.8%	5,071.3	

These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.

6.33	6.33	665.3	21,793.9	175.5	8,063.2	840.8	29,857.2	73.0%	5,017.3
6.50	6.50	649.4	22,443.4	181.8	8,245.0	831.3	30,688.4	73.1%	4,956.7
6.67	6.66	631.6	23,075.0	189.0	8,434.0	820.6	31,509.0	73.2%	4,888.9
6.83	6.83	611.7	23,686.7	196.9	8,630.9	808.6	32,317.6	73.3%	4,813.4
7.00	7.00	589.6	24,276.3	205.8	8,836.7	795.3	33,113.0	73.3%	4,729.2
7.17	7.16	564.9	24,841.2	215.7	9,052.3	780.5	33,893.5	73.3%	4,635.2
7.33	7.33	537.2	25,378.4	226.7	9,279.0	763.9	34,657.4	73.2%	4,530.1
7.50	7.50	506.2	25,884.6	239.1	9,518.1	745.3	35,402.8	73.1%	4,411.7
7.67	7.66	471.2	26,355.8	253.1	9,771.3	724.3	36,127.1	73.0%	4,277.2
7.83	7.83	431.1	26,787.0	269.2	10,040.4	700.3	36,827.4	72.7%	4,122.2
8.00	8.00	384.4	27,171.4	287.8	10,328.2	672.3	37,499.6	72.5%	3,939.3
8.17	8.16	328.2	27,499.6	310.3	10,638.6	638.5	38,138.2	72.1%	3,714.3
8.33	8.33	256.2	27,755.8	339.1	10,977.7	595.3	38,733.5	71.7%	3,410.6
8.50	8.50	141.5	27,897.3	385.0	11,362.7	526.5	39,260.0	71.1%	2,649.6
8.67	8.66	0.0	27,897.3	441.6	11,804.3	441.6	39,701.6	70.3%	2,649.6
8.83	8.83	0.0	27,897.3	441.6	12,245.9	441.6	40,143.2	69.5%	2,649.6
9.00	9.00	0.0	27,897.3	441.6	12,687.5	441.6	40,584.8	68.7%	2,649.6

These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.

Section 6.4.5 Geotechnical Report



Map Scale: 1:2,670 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 14, Sep 6, 2022

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GP	Quarries and Pits soils		0.3	1.1%
HaC	Hanford coarse sandy loam, 2 to 9 percent slopes	A	13.2	41.5%
HaD	Hanford coarse sandy loam, 9 to 15 percent slopes	A	0.4	1.2%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	A	17.8	56.2%
Totals for Area of Interest			**31.7**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

May 13, 2022 Project No. 22041-01

Mr. Benjamin Horning
Dedeaux Properties
1430 South Eastman Avenue
Commerce, CA 90023

Subject: ***Geotechnical Subsurface Due Diligence Evaluation, Proposed Industrial Development, Northwest of the Intersection of Jurupa Avenue and South Willow Avenue, Rialto, California***

In accordance with your request, LGC Geotechnical, Inc. is providing this geotechnical subsurface due diligence report for the proposed industrial development, located northwest of the intersection of Jurupa Avenue and South Willow Avenue in the City of Rialto, California. The purpose of our study was to evaluate the existing onsite geotechnical conditions and to confirm that the site can be developed from a geotechnical perspective.

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

Respectfully,

LGC Geotechnical, Inc.

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Vice President

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DJB/BPP/klr

Distribution: (1) Addressee (electronic copy)

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Appendix B – Boring Logs & Infiltration Test Data
Appendix C – Laboratory Test Results

1.0 INTRODUCTION

1.1 Purpose and Scope of Services

This report presents the results of our geotechnical due-diligence level report for the proposed industrial development located at the northwest corner of Jurupa Avenue and South Willow Avenue in the City of Rialto, California (see Site Location Map, Figure 1).

The purpose of our study was to evaluate the existing onsite geotechnical conditions and to confirm that the site can be developed from a geotechnical perspective. As part of this report, we have: 1) reviewed available geotechnical reports and geologic maps pertinent to the site (Appendix A); 2) performed a limited subsurface geotechnical evaluation of the site consisting of the excavation of eight small-diameter borings ranging in depth from approximately 25 to 50 feet below existing ground surface; 3) performed 6 exploratory test pits from approximately 6.5 to 12 feet below existing ground surface; 4) performed laboratory testing of select soil samples obtained during our subsurface evaluation; and 5) prepared this due-diligence level geotechnical evaluation report presenting our findings, conclusions and preliminary recommendations as it relates to the proposed development.

The findings and conclusions presented herein should be considered preliminary and will need to be re-evaluated once the project plans are available as part of a plan review report to be provided at a later date. It should be noted that LGC Geotechnical does not provide environmental consulting services.

1.2 Project Description and Background

The approximately 14.5-acre site is bound to the north by industrial buildings and vacant land, to the east by South Willow Avenue, to the south by Jurupa Avenue and west by various structures. The site is primarily comprised of one existing building in the north with associated parking and vacant land with a stockpile on the south.

Review of historic aerial photographs indicate that the current configuration of the buildings on the north was constructed by 2005. Previously, the site was undeveloped farmland until 1959 when a structure was built at the southeast corner of the site. The grading and stockpiling operation at the southern portion of the site started in 2016 (Historic Aerials, 2022).

Based on the provided information and conceptual site plans (GAA, 2022), the proposed industrial development will consist of one 94,000 square foot warehouse and associated parking. The proposed industrial building is anticipated to be an at-grade concrete tilt-up structure with estimated maximum column and wall loads of approximately 150 kips and 10 kips per linear foot, respectively. Please note no structural loads or preliminary grading plans were provided to us at the time of this report.

The preliminary recommendations given in this report are based upon the proposed layout and estimated structural loading information above. We understand that the project plans are currently being developed at this time; LGC Geotechnical should be provided with updated

project plans and the actual structural loads when they become available, in order to either confirm or modify the recommendations provided herein. This may include but is not limited to additional subsurface explorations, laboratory testing and analysis to provide a design level geotechnical report.



LGC Geotechnical, Inc.

FIGURE 1
Site Location Map

PROJECT NAME	Dedeaux - Willow Avenue, Rialto
PROJECT NO.	22041-01
ENG. / GEOL.	DJB
SCALE	Not to Scale
DATE	May 2022

1.3 Subsurface Exploration

A geotechnical field evaluation was performed by LGC Geotechnical. This program consisted of drilling and sampling eight small-diameter borings. The borings were drilled by CalPac Drilling under subcontract to LGC Geotechnical. The depth of the borings ranged from approximately 25 to 50 feet below existing grade. An LGC Geotechnical representative observed the drilling operations, logged the borings, and collected soil samples for laboratory testing. The borings were performed using a truck-mounted drill rig equipped with 6-inch diameter hollow-stem augers. Driven soil samples were collected by means of the Standard Penetration Test (SPT) and Modified California Drive (MCD) sampler. The MCD is a split-barrel sampler with a tapered cutting tip and lined with a series of 1-inch-tall brass rings. The SPT sampler (1.4-inch ID) and MCD sampler (2.4-inch ID, 3.0-inch OD) were driven using a 140-pound automatic hammer falling 30 inches to advance the sampler a total depth of 18 inches or until refusal. The raw blow counts for each 6-inch increment of penetration were recorded on the boring logs. Bulk samples were also collected and logged for laboratory testing at select depths. At the completion of drilling, the borings were backfilled with cuttings and where applicable the surface was capped with quick-crete.

Boring logs are presented in Appendix B and their approximate locations are depicted on Figure 2.

1.4 Laboratory Testing

Representative driven and bulk samples were retained for laboratory testing during our field evaluation. Laboratory testing included in-situ unit weight and moisture content, collapse, laboratory compaction, expansion index, and corrosion (sulfate, chloride, pH, and minimum resistivity).

The following is a summary of the laboratory test results.

- Dry density of the samples collected ranged from approximately 98 pounds per cubic foot (pcf) to 128 pcf, with an average of 113 pcf. Field moisture contents ranged from approximately 2 percent to 18 percent, with an average of 5 percent.
- Three collapse tests were performed. The stress vs. deformation plots are provided in Appendix C.
- Two Expansion Index (EI) tests were performed. Results were EI values of 0 and 3, corresponding to “Very Low” expansion potential.
- Two laboratory compaction tests of near surface samples indicate a maximum dry density ranging from 130 to 135 pcf and an optimum moisture content ranging from 6.0 to 8.5 percent.
- Corrosion testing indicated soluble sulfate contents of approximately 0.01 percent, chloride content of 40 parts per million (ppm), pH value of 8.01, and minimum resistivity value of 3,400 ohm-cm.

A summary of the laboratory test results is presented in Appendix C.

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional Geology

The subject site is generally located in the northeastern portion of the broad San Bernardino Basin that is bound to the north by the San Gabriel Mountains and to the south by the Santa Ana Mountains. Regional topography is dominated by the presence of the northwest trending faults that define the mountains and hills of the Southern California region. Structurally, the site is located on the northeastern portion of the 'Perris block' of the Peninsular Ranges Geomorphic Province of Southern California. The 'Perris block' is an area of relatively low relief, consisting of a block of basement rock bounded by the Elsinore fault zone to the southwest and the San Jacinto fault zone to the northeast (USGS, 2003). The Santa Ana River flows southwest from the San Gabriel Mountains, less than a mile from the site.

2.2 Site-Specific Geology

Based on our subsurface exploration and review of pertinent geologic literature and maps, the site is generally underlain by undocumented artificial fill soils and Quaternary-aged old alluvial fan deposits (USGS, 2003). The alluvial fan deposit emanated from the San Gabriel Mountains, locally dissected by tributary drainage to the nearby Santa Ana River.

It should be noted that geotechnical explorations are only representative of the location where they are performed, and varying subsurface conditions may exist outside of each location. In addition, subsurface conditions can change over time. The soil descriptions provided above should not be construed to mean that the subsurface profile is uniform, and that soil is homogeneous within the project area. A brief description of the materials encountered during drilling is presented in the following section, and the approximate boring locations are depicted on the Boring Location Map (Figure 2). For details on the stratigraphy at the exploration locations, refer to the boring logs provided in Appendix B.

2.2.1 Undocumented Artificial Fill (Map Symbol – afu)

Undocumented artificial fill was observed in the field explorations up to approximately 15 feet below existing grade in our borings. The stockpiled fill was observed to consist of dry to moist sand with varying amounts of silt and gravel.

2.2.2 Quaternary Old Alluvial Fan Deposits (Map Symbol – Qof)

Quaternary Old Alluvial Fan deposits, generally dated Late to Middle Pleistocene, were encountered at the site below the undocumented artificial fill. Where observed, the fan deposits generally consisted of medium dense to very dense sands with varying amounts of silt and gravel, to the maximum explored depth of approximately 50 feet below existing grade.

2.3 Groundwater

Groundwater was not encountered in our borings to an approximate depth of 50 feet below existing grade. Wells present at nearby sites show groundwater being present at depth greater than 100 feet below existing grade (WDL, 2022). High groundwater is estimated at 100 feet below existing grade.

It should be noted that higher localized and seasonal perched groundwater conditions may accumulate below the surface and should be expected throughout the design life of the proposed improvements. In general, groundwater conditions below any given site may vary over time depending on numerous factors including seasonal rainfall and local irrigation, among others.

2.4 Seismic Design Parameters

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2019 California Building Code (CBC) and applicable portions of ASCE 7-16 which has been adopted by the CBC. Please note that the following seismic parameters are only applicable for code-based acceleration response spectra and are not applicable for where site-specific ground motion procedures are required by ASCE 7-16. Representative site coordinates of latitude 34.051314 degrees north and longitude -117.374863 degrees west were utilized in our analyses. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class D are provided in Table 1. The structural designer should contact the geotechnical consultant if structural conditions (e.g., number of stories, seismically isolated structures, etc.) require site-specific ground motions.

TABLE 1

Seismic Design Parameters

Selected Parameters from 2019 CBC, Section 1613 - Earthquake Loads	**Seismic Design Values**	**Notes/Exceptions**
Distance to applicable faults classifies the site as a "Near-Fault" site.		Section 11.4.1 of ASCE 7
Site Class	D*	Chapter 20 of ASCE 7
Ss (Risk-Targeted Spectral Acceleration for Short Periods)	1.661g	From SEAOC, 2022
S_1 (Risk-Targeted Spectral Accelerations for 1-Second Periods)	0.647g	From SEAOC, 2022
F_a (per Table 1613.2.3(1))	1.000	For Simplified Design Procedure of Section 12.14 of ASCE 7, F_a shall be taken as 1.4 (Section 12.14.8.1)
F_v (per Table 1613.2.3(2))	1.7	Value is only applicable per requirements/exceptions per Section 11.4.8 of ASCE 7
S_{MS} for Site Class D [Note: $S_{MS} = F_aS_S$]	1.661g	-
S_{M1} for Site Class D [Note: $S_{M1} = F_vS_1$]	1.010g	Value is only applicable per requirements/exceptions per Section 11.4.8 of ASCE 7
S_{DS} for Site Class D [Note: $S_{DS} = (^2/_3)S_{MS}$]	1.107g	-
S_{D1} for Site Class D [Note: $S_{D1} = (^2/_3)S_{M1}$]	0.733g	Value is only applicable per requirements/exceptions per Section 11.4.8 of ASCE 7
C_{RS} (Mapped Risk Coefficient at 0.2 sec)	0.925	ASCE 7 Chapter 22
C_{R1} (Mapped Risk Coefficient at 1 sec)	0.899	ASCE 7 Chapter 22
*Since site soils are Site Class D and S_1 is greater than or equal to 0.2, the seismic response coefficient Cs is determined by Eq. 12.8-2 for values of $T \leq 1.5T_s$ and taken equal to 1.5 times the value calculated in accordance with either Eq. 12.8-3 for $T_L \geq T > T_s$, or Eq. 12.8-4 for $T > T_L$. Refer to ASCE 7-16.		

A deaggregation of the PGA based on a 2,475-year average return period (MCE) indicates that an earthquake magnitude of 7.19 at a distance of approximately 10.38 km from the site would contribute the most to this ground motion. A deaggregation of the PGA based on a 475-year average return period (Design Earthquake) indicates that an earthquake magnitude of 6.93 at a distance of approximately 12.34 km from the site would contribute the most to this ground motion (USGS, 2014).

Section 1803.5.12 of the 2019 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for liquefaction potential. The PGA_M for the site is equal to 0.774g (SEAOC, 2022). The design PGA is equal to 0.516g (2/3 of PGA_M).

2.5 Faulting

The subject site is not located within a State of California Earthquake Fault Zone (i.e., Alquist-Priolo Earthquake Fault Act Zone) and no active faults are known to cross the site (CDMG, 1977; CGS, 2018). A fault is considered "active" if evidence of surface rupture in Holocene time (the last approximately 11,000 years) is present. The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site. The closest known active faults that may impact the site include the San Jacinto, San Andreas, Cucamonga, and Elsinore Faults, among others.

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

2.5.1 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that loose, saturated, near surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction (Bray & Sancio, 2006). Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures. Dynamic settlement of dry sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

Based on our review of the San Bernardino County Land Use Plan for liquefaction susceptibility (San Bernardino, 2007), the site is not located within a zone that is considered susceptible to liquefaction. Due to the lack of groundwater in the upper 50 feet the potential for liquefaction is considered very low.

2.5.2 Lateral Spreading

Lateral spreading is a type of liquefaction induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a

subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures.

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

2.6 Expansion Potential

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

3.0 CONCLUSIONS

Based on the results of our subsurface geotechnical evaluation, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint, provided that the recommendations contained in the following sections are incorporated during site grading and development. A summary of our geotechnical conclusions are as follows:

- From a geotechnical perspective, onsite soils are anticipated to be suitable for use as general compacted fill, provided they are screened of construction debris, significant organics and any oversized material (8 inches in greatest dimension).
- Groundwater was not encountered in our field evaluation. Records indicate groundwater levels recorded in the area are at depths greater than 100 feet below the ground surface.
- The subject study area is not located within a mapped State of California Earthquake Fault Zone (i.e., Alquist-Priolo Act Earthquake Fault Zone), and based upon our review of published geologic mapping, no known active or potentially active faults are known to exist within or in the immediate vicinity of the site. Therefore, the potential for ground rupture as a result of faulting is considered very low.
- The main seismic hazard that may affect the site is ground shaking from one of the active regional faults. The subject site will likely experience strong seismic ground shaking during its design life.
- Site soils are generally not susceptible to liquefaction due to a lack of groundwater and dense to very dense alluvial soils in the upper 50 feet. The site is also not located in an area with soils that are susceptible to liquefaction according to the San Bernardino County Use Plan (San Bernardino, 2007).
- Based on the results of preliminary laboratory testing, site soils are anticipated to have "Very Low" expansion potential. Final design expansion potential must be determined at the completion of grading.
- Based on the corrosion test results, soils are not considered corrosive per the Caltrans criteria (Caltrans, 2021). This should be confirmed after grading has been completed.
- Oversized material (material larger than 8 inches in maximum dimension) should be anticipated during site grading. Recommendations are provided for appropriate handling of oversized materials in Appendix E.
- Undocumented fill (existing stockpiles) and 5 feet of the underlying native soils shall be temporarily removed and placed as engineered fill. Temporary removal and recompaction will range from approximately 10 to 20 feet across the entire site. Where space is available, the envelope for removal and recompaction should extend laterally a minimum distance equal to the depth of removal and recompaction.
- Excavations into the existing site soils should be feasible with heavy construction equipment in good working order.
- From a geotechnical perspective, the proposed industrial building can be supported on a slab on grade and shallow foundation system provided recommended earthwork removal and re-compaction is performed. Additional field work, laboratory testing and analysis may have to be performed once actual building loads are known to further evaluate and confirm this.

- On-site soils will most likely be suitable for backfill of site retaining walls. Soils that will be used for retaining wall backfill should be tested and approved by the geotechnical consultant prior to the backfill of site walls.
- Based on our preliminary study, we recommend performing additional field work consisting of infiltration testing be performed.
- Final design level recommendations utilizing the site plans and structure loads should be provided as part of a comprehensive geotechnical report.

4.0 RECOMMENDATIONS

The following recommendations are to be considered preliminary and should be confirmed upon completion of grading and earthwork operations. In addition, they should be considered minimal from a geotechnical viewpoint, as there may be more restrictive requirements from the architect, structural engineer, building codes, governing agencies, or the owner.

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

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

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of required earthwork removals, grading and construction of the proposed new improvements, including the industrial structures, subsurface utilities, and vehicular pavement areas.

We recommend that earthwork onsite be performed in accordance with the following recommendations, future grading plan review report(s), the 2019 CBC/City of Rialto requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix E. In case of conflict, the following recommendations shall supersede those included in Appendix E. The following recommendations may be revised within future grading plan review reports or based on the actual conditions encountered during site grading.

4.1.1 Site Preparation

Prior to grading, areas to be developed should undergo the stripping and clearing of vegetation and clearing of surface obstructions from the site. Vegetation and debris

should be removed and properly disposed of offsite. Holes resulting from removals of buried obstructions, which extend below proposed remedial and/or finish grades, should be replaced with suitable compacted fill material.

If cesspools or septic systems are encountered they should be removed in their entirety. The resulting excavation should be backfilled with properly compacted fill soils. As an alternative, cesspools can be backfilled with lean sand-cement slurry. Any encountered wells should be properly abandoned in accordance with regulatory requirements.

4.1.2 Removal and Recompaction Depths and Limits

In order to provide a relatively uniform bearing condition for the planned improvements, we recommend the site soils be temporarily removed and recompacted according to the criteria outlined below. Updated recommendations may be required based on additional field work, changes to building layouts and actual structural loads.

Existing Northern Re-Development (Hollywood Delivery Service Building)

It is our understanding that the office portion of the existing industrial building in the northern portion of the site will be demolished, and new parking stalls will be created. Within pavement and hardscape areas, removal and recompaction should extend to a depth of at least 2 feet below the existing grade or 1 feet below finished subgrade (i.e., below planned aggregate base/asphalt concrete), whichever is deeper. In general, the envelope for removal and recompaction should extend laterally a minimum distance of 2 feet beyond the edges of the proposed pavement and hardscape improvements.

New Southern Development

Undocumented fill (existing stockpile) and 5 feet of the underlying native soils shall be temporarily removed prior to placement of engineered fill. Therefore, temporary removal and recompaction will range from approximately 10 to 20 feet across the entire southern site. Where space is available, the envelope for removal and recompaction should extend laterally a minimum distance equal to the depth of removal and recompaction below finish grade or 5 feet beyond the edges of the proposed building improvements, whichever is larger. See Figure 2.

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

4.1.3 Temporary Excavations

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

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

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

4.1.4 Subgrade Preparation

In general, areas to receive compacted fill should be scarified to a minimum depth of 6 inches, brought to a near-optimum moisture condition (generally within optimum and 2 percent above optimum moisture content), and re-compacted per project requirements. Removal bottoms and areas to receive fill should be observed and accepted by the geotechnical consultant prior to subsequent fill placement.

4.1.5 Material for Fill

From a geotechnical perspective, the onsite soils are generally considered suitable for use as general compacted fill, provided they are screened of organic materials, construction debris and any oversized material (8 inches in greatest dimension).

From a geotechnical viewpoint, import soils for general fill (i.e., non-retaining wall backfill) should consist of clean, granular soils of Very Low expansion potential (expansion index of 20 or less based on ASTM D4829). Import for retaining wall backfill should meet the criteria outlined in the paragraph below. Source samples should be

provided to the geotechnical consultant for laboratory testing a minimum of three working days prior to any planned importation.

Retaining wall backfill should consist of sandy soils with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) Test Method D1140 (or ASTM D6913/D422) and a Very Low expansion potential (EI of 20 or less per ASTM D4829). Soils should also be screened of organic materials, construction debris, and any material greater than 3 inches in maximum dimension. The majority of the on-site soils should be suitable for retaining wall backfill due to their low fines content (i.e., silt and clay content) and very low expansion potential. Samples of retaining wall backfill should be sampled prior to construction to confirm the findings of the investigation.

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

The placement of demolition materials in compacted fill is acceptable from a geotechnical viewpoint provided the demolition material is broken up into pieces not larger than approximately 2 to 4 inches in maximum dimension and well blended into fill soils with essentially no resulting voids. Demolition material placed in fills must be free of construction debris (wood, organics, etc.) and reinforcing steel. If asphalt concrete fragments will be incorporated into the demolition materials, approval from an environmental viewpoint may be required and is not the purview of the geotechnical consultant. From our previous experience, we recommend that asphalt concrete fragments be limited to fill areas within planned asphalt areas (i.e., not within building pad areas).

4.1.6 Placement and Compaction of Fills

Material to be placed as fill should be brought to near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content) and recompacted to at least 90 percent relative compaction (per ASTM D1557). Moisture conditioning of site soils will be required in order to achieve adequate compaction. Soils are present that will require additional moisture in order to achieve the required compaction. Drying and/or mixing the very moist soils may also be required prior to reusing the materials in compacted fills. Generally, soils are present that will require additional moisture in order to achieve the required compaction.

The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances and with observation and testing by LGC Geotechnical. Oversized material as previously defined should be removed from site fills, if encountered.

During backfill of excavations, the fill should be properly benched into firm and competent soils of temporary backcut slopes as it is placed in lifts.

Aggregate base material should be compacted to a minimum of 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction, or in accordance with the City of Rialto requirements, per ASTM D1557 at near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content), unless otherwise noted in the pavement recommendations section (see Sections 4.5 & 4.6).

If gap-graded ¾-inch rock is used for backfill (around storm drain storage chambers, retaining wall backfill, etc.) it will require compaction. Rock shall be placed in thin lifts (typically not exceeding 6 inches) and mechanically compacted with vibration with observation by geotechnical consultant. Backfill rock shall meet the requirements of ASTM D2321. Gap-graded rock is required to be wrapped in filter fabric (Mirafi 140N or approved alternative) to prevent the migration of fines into the rock backfill.

4.1.7 Trench and Retaining Wall Backfill and Compaction

The onsite soils may generally be suitable as trench backfill, provided the soils are screened of rocks and other material greater than 6 inches in diameter and organic matter. If trenches are shallow or the use of conventional equipment may result in damage to the utilities, sand having a sand equivalent (SE) of 30 or greater (per California Test Method [CTM] 217) may be used to bed and shade the pipes. Sand backfill within the pipe bedding zone may be densified by jetting or flooding and then tamping to ensure adequate compaction. Subsequent trench backfill should be compacted in uniform thin lifts by mechanical means to at least the recommended minimum relative compaction (per ASTM D1557).

Retaining wall backfill should consist of sandy soils as outlined in preceding Section 4.1.5. The limits of select sandy backfill should extend at minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater, refer to Figure 3 (rear of text). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to at least 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted.

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

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

4.1.8 Shrinkage and Subsidence

Volumetric changes in earth quantities will occur when excavated onsite earth materials are replaced as properly compacted fill. The following is an estimate of shrinkage factors for the various soil types found onsite. These estimates are based on in-place densities of the various materials and on the estimated average degree of relative compaction that will be achieved during grading.

TABLE 2

Estimated Shrinkage

Soil Type	Allowance	Estimated Range
Alluvium	Shrinkage	0 to 10 %
Undocumented Fill (Stockpile)	Shrinkage	0 to 15%

Subsidence due to earthwork equipment is expected to be on the order of 0.1 feet. It should be stressed that these values are only estimates and that actual shrinkage factors are extremely difficult to predict. These values are estimates only and exclude losses due to removal of vegetation or debris. The effective change in volume of onsite soils will depend primarily on the type of compaction equipment, method of compaction used onsite by the contractor, and accuracy of the topographic survey. The above shrinkage estimates are intended as an aid for others in determining preliminary earthwork quantities. However, these estimates should be used with some caution since they are not absolute values. A balance area should be considered if export/import is either economically prohibitive or restricted by the governing agency.

4.2 Preliminary Foundation Recommendations

The proposed structures may be supported on spread or continuous footings and conventional slabs, provided earthwork is performed in accordance with the recommendations presented in this report. Since the site soils are anticipated to be "Very Low" expansion potential (EI of 20 or less per ASTM D4829), special design considerations from a geotechnical perspective are not anticipated, however, this must be verified based on as-graded conditions. Footings should be supported on properly compacted fill. Please note that the following foundation recommendations are preliminary and must be confirmed by LGC Geotechnical at the completion of grading.

Preliminary foundation recommendations are provided in the following sections. The foundation design must be performed by the structural engineer based on the following geotechnical parameters and minimum values provided.

4.2.1 Slab Design and Construction

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

The foundation designer may use a modulus of vertical subgrade reaction (k) of 200 pounds per cubic inch (pounds per square inch per inch of deflection). This value is for a 1-foot by 1-foot square loaded area and should be adjusted by the structural designer for the area of the proposed footing using the following formula:

$k = 200 \times [(B+1)/2B]^2$
k = modulus of vertical subgrade reaction, pounds per cubic inch (pci)
B = foundation width (feet)

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

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

4.2.2 Foundation Design Parameters

For the proposed industrial warehouse structures, minimum continuous wall and column footing widths are to be 12 inches and 24 inches, respectively, minimum foundation embedment is to extend a minimum of 18 inches below the adjacent exterior grade, and interior column footings should be embedded a minimum of 12 inches beneath the

adjacent subgrade. The following allowable bearing pressures for both continuous and column spread footings presented in Table 3 below are recommended for corresponding footing widths and embedments.

TABLE 3

Allowable Soil Bearing Pressures

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

* Refers to minimum depth measured below lowest adjacent grade.

These allowable bearing values indicated above (exclusive of the weight of the footings) are for total dead loads and frequently applied live loads and may be increased by ⅓ for short duration loading (i.e., wind or seismic loads). The allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only.

In utilizing the above-mentioned allowable bearing capacity and provided our earthwork recommendations are implemented, foundation settlement due to structural loads is anticipated to be on the order of 1-inch or less. Differential static settlement may be taken as half of the static settlement (i.e., ½-inch over a horizontal span of 40 feet).

4.2.3 Foundation Construction

The foundation is to be excavated into competent compacted artificial fill placed during grading operations. It is recommended that the foundation subgrade soils be evaluated by the geotechnical engineer prior to steel and/or concrete placement.

4.2.4 Lateral Load Resistance

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. For concrete/soil frictional resistance, an allowable coefficient of friction of 0.35 may be assumed with dead-load forces. An allowable passive lateral earth pressure of 250 psf per foot of depth (or pcf) to a maximum of 2,500 psf may be used for the sides of footings poured against properly compacted fill. Allowable passive pressure may be increased to 340 pcf (maximum of 3,400 psf) for short duration seismic loading. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions. Frictional resistance and passive pressure may be used in combination without reduction. We recommend that the upper foot of passive

resistance be neglected if finished grade will not be covered with concrete or asphalt. The provided allowable passive pressures are based on a factor of safety of 1.5 and 1.1 for static and seismic loading conditions, respectively.

4.3 Lateral Earth Pressures for Retaining Walls

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

The following lateral earth pressures are presented on Table 4 for approved select granular soils with a maximum of 35 percent fines (passing the No. 200 sieve per ASTM D-421/422) and Very Low expansion potential (EI of 20 or less per ASTM D4829). Retaining wall backfill should also be limited to fill material not exceeding 3 inches in greatest dimension. The wall designer should clearly indicate on the retaining wall plans the required sandy soil backfill criteria. Most of the onsite soils should be suitable for retaining wall backfill due to the low fines content and very low expansion potential.

TABLE 4

Lateral Earth Pressures – On-site or Imported Sandy Backfill

Conditions	**Equivalent Fluid Unit Weight (pcf)**	**Equivalent Fluid Unit Weight (pcf)**
	Level Backfill	**2:1 Sloped Backfill**
	Approved Soils	**Approved Soils**
Active	35	55
At-Rest	55	70

If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the earth pressure will be higher. The equivalent fluid pressure values assume free-draining conditions. If conditions other than those assumed above are anticipated, the equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical consultant.

If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the earth pressure will be higher. The equivalent fluid pressure values assume free-draining conditions. Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed (Refer to Figure 3). Please note that waterproofing and outlet systems are not the purview of the geotechnical consultant. If conditions other than those assumed above are anticipated, the

equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical consultant.

Surcharge loading effects from any adjacent structures should be evaluated by the retaining wall designer. In general, structural loads within a 1:1 (horizontal to vertical) upward projection from the bottom of the proposed retaining wall footing will surcharge the proposed retaining structure. In addition to the recommended earth pressure, retaining walls adjacent to streets should be designed to resist vehicular traffic if applicable. Uniform surcharges may be estimated using the applicable coefficient of lateral earth pressure using a rectangular distribution. A factor of 0.35 and 0.5 may be used for the active and at-rest conditions, respectively. The vertical traffic surcharge may be determined by the structural designer. The retaining wall designer should contact the geotechnical engineer for any required geotechnical input in estimating any applicable surcharge loads.

If required, the retaining wall designer may use a seismic lateral earth pressure increment of 12.5 pcf for level backfill conditions. This increment should be applied in addition to the provided static lateral earth pressure using a "normal" triangular distribution with the resultant acting at H/3 in relation to the base of the retaining structure (where H is the retained height). For the restrained, at-rest condition, the seismic increment may be added to the applicable active lateral earth pressure (in lieu of the at-rest lateral earth pressure) when analyzing short duration seismic loading. Per Section 1803.5.12 of the 2019 CBC, the seismic lateral earth pressure is applicable to structures assigned to Seismic Design Category D through F for retaining wall structures supporting more than 6 feet of backfill height. This seismic lateral earth pressure is estimated using the procedure outlined by the Structural Engineers Association of California (Lew, et al, 2010).

Soil bearing and lateral resistance (friction coefficient and passive resistance) are provided in Section 4.2. Earthwork considerations (temporary backcuts, backfill, compaction, etc.) for retaining walls are provided in Section 4.1 (Site Earthwork) and the subsequent earthwork related sub-sections.

4.4 Corrosivity to Concrete and Metal

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

Corrosion testing of near-surface bulk samples indicated soluble sulfate contents of approximately 103 ppm, chloride content of approximately 40 parts per million (ppm), pH value of approximately 8.0, and minimum resistivity value of 3,400 ohm-cm. Based on Caltrans Corrosion Guidelines (2021), soils are considered corrosive if the pH is 5.5 or less, or the chloride concentration is 500 ppm or greater, or the sulfate concentration is 1,500 ppm (0.15 percent) or greater. Based on the test results, soils are not considered corrosive using Caltrans criteria.

Based on laboratory sulfate test results, the near surface soils are designated to a class "S0" per ACI 318, Table 19.3.1.1 with respect to sulfates. Concrete in direct contact with the onsite soils can be designed according to ACI 318, Table 19.3.2.1 using the "S0" sulfate classification.

Laboratory testing may need to be performed at the completion of grading by the project corrosion engineer to further evaluate the as-graded soil corrosivity characteristics. Accordingly, revision of the corrosion potential may be needed, should future test results differ substantially from the conditions reported herein. The client and/or other members of the development team should consider this during the design and planning phase of the project and formulate an appropriate course of action.

4.5 Preliminary Asphalt Concrete Pavement Sections

For the purposes of these preliminary recommendations, we have assumed a preliminary design R-value of 40 and calculated pavement sections for Traffic Indices of 5.0 (or less), 6.0 and 7.0. R-value testing of the street and parking subgrade will need to be performed to confirm our preliminary testing results/assumptions once the asphalt areas have been graded to finish subgrade elevations and the final Traffic Index is determined by the Civil Engineer. Determination of the Traffic Index is not the purview of the geotechnical consultant. Final street sections should be confirmed by the project civil engineer based upon the projected design Traffic Index. If requested, LGC Geotechnical will provide sections for alternate TI values.

TABLE 5

Preliminary Asphalt Concrete Pavement Sections

Assumed Traffic Index	5.0 (or less)	6.0	7.0
R -Value Subgrade	40	40	40
AC Thickness	4.0 inches	4.0 inches	4.0 inches
CAB Thickness	6.0 inches	6.0 inches	8.0 inches

Increasing the thickness of asphalt or adding additional base material will reduce the likelihood of the pavement experiencing distress during its service life. The above recommendations are based on the assumption that proper maintenance and irrigation of the areas adjacent to the roadway will occur through the design life of the pavement. Failure to maintain a proper maintenance and/or irrigation program may jeopardize the integrity of the pavement.

Aggregate base material (crushed aggregate base and crushed miscellaneous base) should be compacted to a minimum of 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction, or the City of Rialto specifications, at or slightly above optimum moisture content per ASTM D1557. Earthwork recommendations are provided in Section 4.1 "Site Earthwork" and the related sub-sections of this report.

4.6 Preliminary Portland Cement Concrete Pavement Sections

For the purposes of these preliminary recommendations, we have assumed a preliminary design R-value of 40. Preliminary minimum Portland Cement Concrete (PCC) pavement street sections are provided in Table 6 for Traffic Indices of 5.0 (or less), 6.0, and 7.0 and may be utilized in the design of the truck parking/circulation areas or loading docks. These recommendations must be confirmed with R-value testing of representative near-surface soils at the completion of grading and after underground utilities have been installed and backfilled. Final PCC sections should be confirmed by the project civil engineer based upon the projected design Traffic Index. If requested, LGC Geotechnical will provide sections for alternate TI values. The appropriate paving section must be selected by the project civil engineer/client based on design traffic indexes.

TABLE 6

Preliminary PCC Pavement Sections

Provided Traffic Index	5.0 (or less)	6.0	7.0
R -Value Subgrade	40	40	40
PCC Thickness	5.5 inches	6.5 inches	7.5 inches
95% Compacted Subgrade	12.0 inches	12.0 inches	12.0 inches

For preliminary planning purposes, the PCC pavement sections may consist of a minimum of concrete over subgrade soils compacted to 95 percent relative compaction (see Table 7 for section thicknesses). The concrete should have a minimum compressive strength of 3,500 psi and a minimum flexural strength of 530 psi at the time the pavement is subjected to traffic. To reduce the potential (but not eliminate) for cracking, paving should provide control joints at regular intervals not exceeding 15 feet in each direction, depth of ⅓ the concrete thickness. Contraction and construction joints should include a joint filler/sealer to prevent migration of water into the subgrade soils. The type of joint sealer and filler material should be specified by the pavement designer and should be maintained throughout the life of the pavement. The above section does not include steel reinforcement. If desired, steel reinforcement should be determined by the structural engineer.

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

Subgrade below the PCC pavement should be compacted to a minimum of 95 percent relative compaction per ASTM D1557 near optimum moisture content (generally within optimum and 2 percent above optimum moisture content). Earthwork recommendations are provided in Section 4.1 “Site Earthwork” and the related sub-sections of this report.

4.7 Nonstructural Concrete Flatwork

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

Nonstructural and non-vehicular concrete flatwork placed on compacted subgrade may be a 4-inches (nominal) in thickness with crack control joints spaced 8 feet apart for flatwork slabs and 6 feet apart for flatwork sidewalks. Crack control joints should be sawcut or deep open tool joint to a minimum of 1/3 the concrete thickness. The compacted subgrade below the nonstructural and non-vehicular concrete flatwork should be wet down prior to placing concrete.

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

4.8 Control of Surface Water and Drainage Control

From a geotechnical perspective, we recommend that finished grade adjacent to proposed structures be sloped away from the proposed structures and towards an approved drainage device or unobstructed swale, so that it will prevent ponding within 5 feet of the foundation. Code compliance of grades is not the purview of the geotechnical consultant.

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

4.9 Geotechnical Plan Review

Project plans (grading, foundation, retaining wall, etc.) should be reviewed by this office prior to construction to verify that our geotechnical recommendations have been incorporated. Additional or modified geotechnical recommendations may be required based on the proposed layout.

4.10 Geotechnical Observation and Testing

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

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

- During grading (removal bottoms, fill placement, etc.);
- During retaining wall backfill and compaction;
- During utility trench backfill and compaction;
- During precise grading;
- Preparation of building pads and other concrete-flatwork subgrades, and prior to placement of aggregate base or concrete;
- After building and wall footing excavation and prior to placement of steel reinforcement and/or concrete;
- Preparation of pavement subgrade and placement of aggregate base; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

5.0 LIMITATIONS

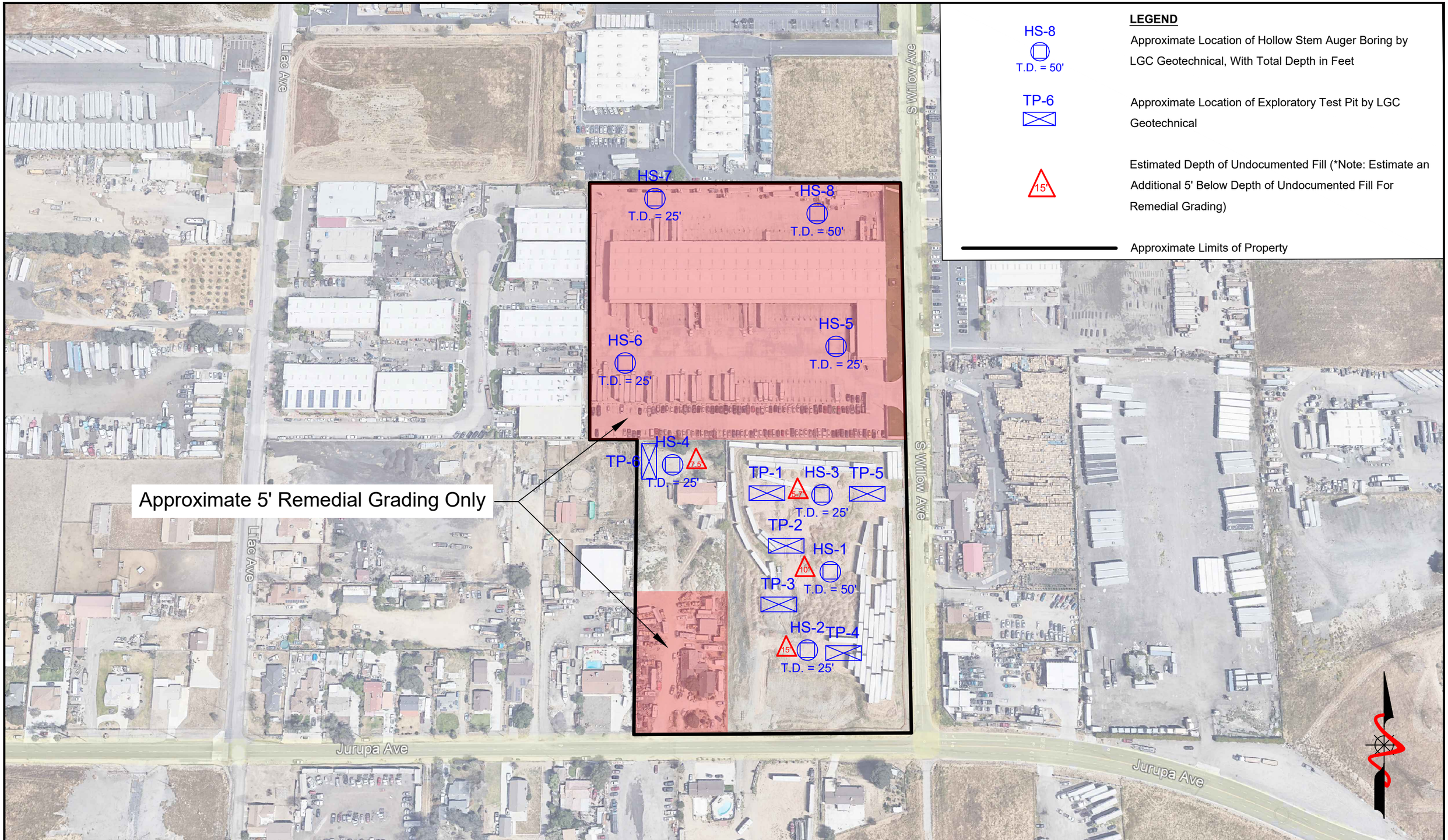
Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is based on data obtained from limited observations of the site, which have been extrapolated to characterize the site. While the scope of services performed is considered suitable to adequately characterize the site geotechnical conditions relative to the proposed development, no practical evaluation can completely eliminate uncertainty regarding the anticipated geotechnical conditions in connection with a subject site. Variations may exist and conditions not observed or described in this report may be encountered during construction.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the other consultants and incorporated into the plans. The contractor should properly implement the recommendations during construction and notify the owner if they consider any of the recommendations presented herein to be unsafe, or unsuitable.

The findings of this report are valid as of the present date. However, changes in the conditions of a site can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. The findings, conclusions, and recommendations presented in this report can be relied upon only if LGC Geotechnical has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site. This report is intended exclusively for use by the client, any use of or reliance on this report by a third party shall be at such party's sole risk.

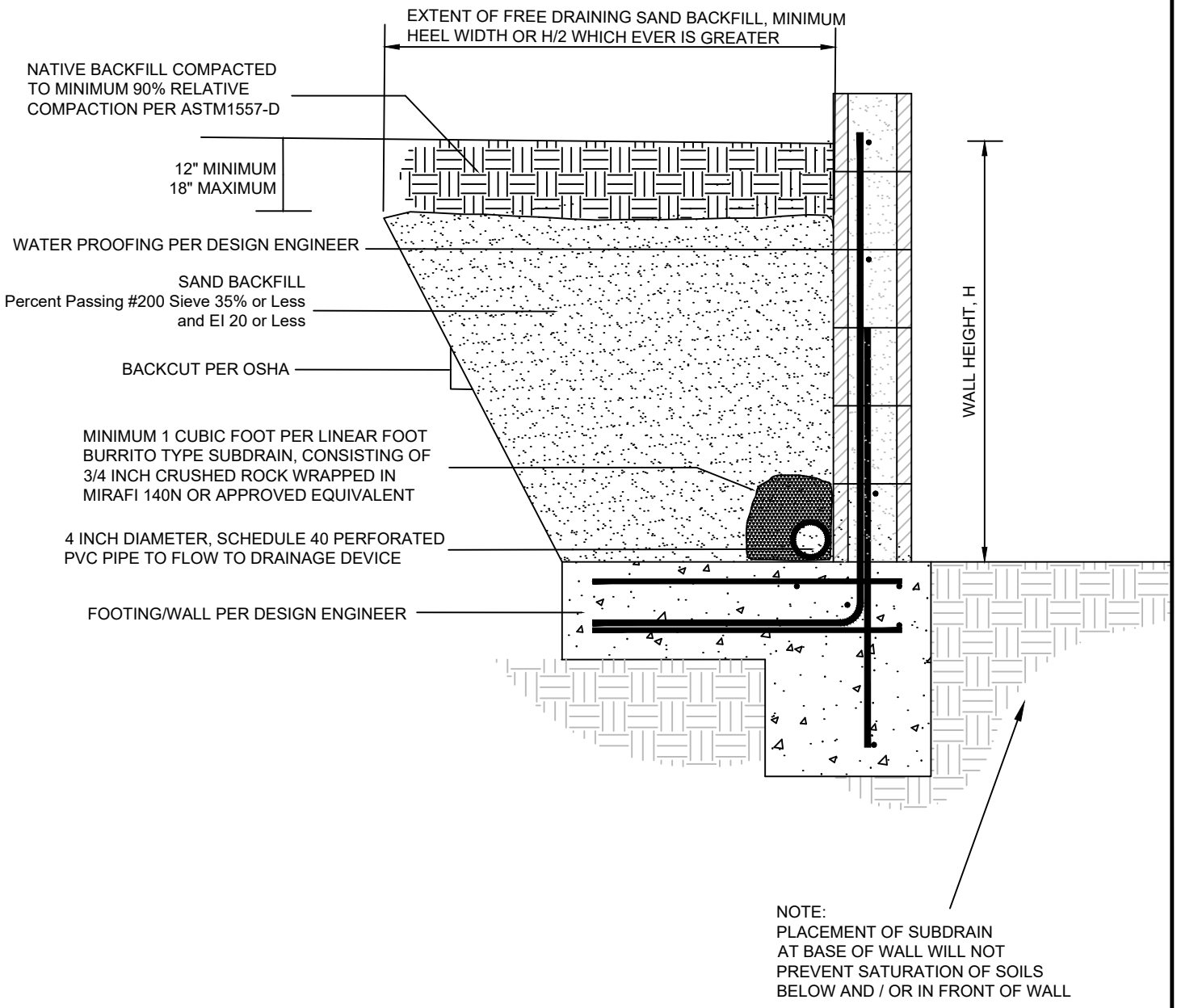
In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification.



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FIGURE 2
Geotechnical Exploration Location Map

PROJECT NAME	Dedeaux - Willow Avenue, Rialto
PROJECT NO.	22041-01
ENG. / GEOL.	DJB
SCALE	Not to Scale
DATE	May 2022



LGC Geotechnical, Inc.

FIGURE 3
Retaining Wall Backfill Detail

PROJECT NAME	Dedeaux - Willow Avenue, Rialto
PROJECT NO.	22041-01
ENG. / GEOL.	DJB
SCALE	Not to Scale
DATE	May 2022

Appendix A
References

APPENDIX A

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Appendix B
Boring and Trench Logs

Geotechnical Boring Log Borehole HS-1

Date: 3/24/2022	**Drilling Company:** Cal Pac Drilling
Project Name: Dedeaux - Rialto	**Type of Rig:** Truck Mounted
Project Number: 22041-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~971' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 2

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
970	0							**@0' to 10' - <u>Undocumented Artificial Fill (afu):</u>** @0' - SAND with Silt: light brown, dry; rootlets	
			R-1	4 13 14	108.7	6.1	SM	@2.5'- Silty SAND: brown, slightly moist, medium dense	
965	5	B-1	R-2	5 6 10	108.4	4.0		@5'- Silty SAND: brown, dry, medium dense	
			R-3	8 7 8	102.7	2.7		@7.5'- Silty SAND: brown, dry, medium dense	
960	10		R-4	7 10 11	105.1	1.5	SM	**@10' to T.D. - <u>Old Alluvial-Fan Deposits (Qof):</u>** @10'- Silty SAND with Gravel: brown, dry, medium dense	
955	15		SPT-1	11 18 19		1.7	SP-SM	@15'- SAND with Silt and Gravel: grayish brown, dry, dense	
950	20		R-5	10 20 20	101.2	15.0		@20'- Silty SAND: brown, very moist, dense	
945	25		SPT-2	6 8 9		5.0		@25'- Silty SAND: grayish brown, slightly moist, medium dense	
	30								

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

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

TEST TYPES:

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

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-1

Date: 3/24/2022	**Drilling Company:** Cal Pac Drilling
Project Name: Dedeaux - Rialto	**Type of Rig:** Truck Mounted
Project Number: 22041-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~971' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 2 of 2

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
940	30		R-6	7 16 23	103.8	6.2	SM	@30'- Silty SAND: grayish brown, slightly moist, dense	
935	35		SPT-3	10 7 10		9.3		@35'- Silty SAND with Gravel: grayish brown, moist, medium dense	
930	40		R-7	20 27 26		6.3		@40'- Disturbed Sample: Silty SAND: grayish brown, slightly moist, dense	
925	45		SPT-4	16 15 16		18.0	ML	@45'- Silty CLAY: olive brown, very moist, hard	
920	50		R-8	12 21 24	98.4	8.9	SM	@50'- Silty SAND: grayish brown, moist, dense	
915	55							Total Depth = 50' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	
	60								

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CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole HS-2

Date: 3/24/2022 | **Drilling Company:** Cal Pac Drilling

Project Name: Dedeaux - Rialto | **Type of Rig:** Truck Mounted

Project Number: 22041-01 | **Drop:** 30" | **Hole Diameter:** 6"

Elevation of Top of Hole: ~972' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
970	0							**@0' to 15' - Undocumented Artificial Fill (afu):** @0'- SAND: light brown, dry; rootlets	
			R-1	4 6 8	109.5	7.2	SM	@2.5'- Silty SAND: brown, slightly moist, medium dense	
	5	B-1	R-2	6 8 8	109.2	6.2		@5'- Silty SAND: brown, slightly moist, medium dense	
965			R-3	8 8 4	99.6	5.8		@7.5'- Silty SAND: brown, slightly moist, loose	
	10		R-4	4 8 13	107.0	7.0		@10'- Silty SAND: brown, slightly moist, medium dense	
960								**@15' to T.D. - Old Alluvial-Fan Deposits (Qof):**	
	15		R-5	8 12 16	109.4	1.6	SP-SM	@15'- SAND with Silt and Gravel: grayish brown, dry, medium dense	
955									
	20		SPT-1	10 17 19		1.5		@20'- SAND with Silt and Gravel: grayish brown, dry, dense	
950									
	25		R-6	8 15 18				@25'- No Recovery	
945								Total Depth = 25' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	
	30								

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▽	GROUNDWATER TABLE

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S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-3

Date: 3/24/2022 | **Drilling Company:** Cal Pac Drilling

Project Name: Dedeaux - Rialto | **Type of Rig:** Truck Mounted

Project Number: 22041-01 | **Drop:** 30" | **Hole Diameter:** 6"

Elevation of Top of Hole: ~974' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map |

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							**@0' to 5' - Undocumented Artificial Fill (afu):**	
								@0'- Silty SAND: light brown, dry; rootlets	
			R-1	8 8 8	111.0	8.0	SM	@2.5'- Silty SAND: brown, moist, medium dense	
970									
	5	B-1	R-2	6 5 6	104.9	5.2	SM	**@5' to T.D. - Old Alluvial-Fan Deposits (Qof):** @5'- Silty SAND: brown, slightly moist, loose	
			R-3	11 13 11	111.5	2.5		@7.5'- Silty SAND: brown, dry, medium dense	
965									
	10		R-4	7 9 9	110.2	3.2		@10'- Silty SAND: olive brown, dry, medium dense	CO
960									
	15		SPT-1	7 16 19		1.8	SP-SM	@15'- SAND with Silt and Gravel: grayish brown, dry, dense	
955									
	20		R-5	14 33 50/6"	118.4	1.5		@20'- SAND with Silt and Gravel: grayish brown, dry, very dense	
950									
	25		SPT-2	9 17 18		1.8		@25'- SAND with Silt and Gravel: grayish brown, dry, dense	
								Total Depth = 25' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	
945									
	30								

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

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
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EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-4

Date: 3/24/2022	**Drilling Company:** Cal Pac Drilling
Project Name: Dedeaux - Rialto	**Type of Rig:** Truck Mounted
Project Number: 22041-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~970' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							**@0' to 7.5' - Undocumented Artificial Fill (afu):**	
								@0'- SAND with Gravel: yellowish brown, dry	
			R-1	7 9 10	115.1	2.4	SM	@2.5'- Silty SAND with Gravel: brown, dry, medium dense	
965	5	B-1	R-2	7 12 10	114.1	1.8		@5'- Silty SAND with Gravel: grayish brown, dry, medium dense	
								@7.5' to T.D. - Old Alluvial-Fan Deposits (Qof):	
			R-3	8 10 14	113.3	1.9	SP-SM	@7.5'- SAND with Silt and Gravel: grayish brown, dry, medium dense	
960	10		R-4	9 17 17	103.6	2.3		@10'- SAND with Silt and Gravel: grayish brown, dry, medium dense	
955	15		R-5	11 23 31	115.4	1.8		@15'- SAND with Silt and Gravel: grayish brown, dry, dense	
950	20		SPT-1	10 24 20		1.7		@20'- SAND with Silt and Gravel: grayish brown, dry, very dense	
945	25		R-6	19 50/6"	109.9	2.0		@25'- SAND with Silt and Gravel: grayish brown, dry, very dense	
								Total Depth = 25' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	
	30								

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

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G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

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

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-5

Date: 4/4/2022 | **Drilling Company:** Cal Pac Drilling

Project Name: Dedeaux - Rialto | **Type of Rig:** Truck Mounted

Project Number: 22041-01 | **Drop:** 30" | **Hole Diameter:** 6"

Elevation of Top of Hole: ~975' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map |

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1						**@0' to 5' - Undocumented Artificial Fill (afu):** @0'- 5" of Concrete with Rebar; Silty SAND: yellowish brown, dry	
970	5		R-1	5 9 11	121.1	14.7	SM	**@5' to T.D. - Old Alluvial-Fan Deposits (Qof):** @5'- Silty SAND: brown, very moist, medium dense	
			R-2	6 10 15	114.5	3.6		@7.5'- Silty SAND: yellowish brown, dry, medium dense	CO
965	10		R-3	7 17 32	122.4	1.9	SP-SM	@10'- SAND with Silt and Gravel: grayish brown, dry, dense	
960	15		R-4	15 28 28	120.3	2.6		@15'- SAND with Silt and Gravel: grayish brown, dry, dense	
955	20		SPT-1	17 50/6"		1.9		@20'- SAND with Silt and Gravel: grayish brown, dry, very dense	
950	25		R-5	10 20 30	121.3	4.2		@25'- SAND with Silt and Gravel: grayish brown, dry, dense	
	30							Total Depth = 25' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
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G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

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

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-6

Date: 4/4/2022 | **Drilling Company:** Cal Pac Drilling

Project Name: Dedeaux - Rialto | **Type of Rig:** Truck Mounted

Project Number: 22041-01 | **Drop:** 30" | **Hole Diameter:** 6"

Elevation of Top of Hole: ~976' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
975	0							**@0' to 5' - <u>Undocumented Artificial Fill (afu):</u>** @0'- 8" of Concrete with Rebar; Silty SAND: reddish brown, dry	CR EI MD
970	5		R-1	4 5 9	114.4	7.9	SM	**@5' to T.D. - <u>Old Alluvial-Fan Deposits (Qof):</u>** @5'- Silty SAND: brown, moist, medium dense	
			R-2	7 12 18	119.5	3.5	SP-SM	@7.5'- SAND with Silt: light olive brown, dry, medium dense	CO
965	10		R-3	9 14 24	115.8	2.0		@10'- SAND with Silt and Gravel: grayish brown, dry, medium dense	
960	15		SPT-1	6 11 17		3.0		@15'- SAND with Silt: grayish brown, dry, dense	
955	20		R-4	5 10 24	115.5	16.9	SM	@20'- Silty SAND: grayish brown, very moist, medium dense	
950	25		SPT-2	11 20 25		2.1	SP-SM	@25'- SAND with Silt and Gravel: grayish brown, dry, very dense	
	30							Total Depth = 25' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

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

TEST TYPES:

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

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-7

Date: 4/4/2022	**Drilling Company:** Cal Pac Drilling
Project Name: Dedeaux - Rialto	**Type of Rig:** Truck Mounted
Project Number: 22041-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~976' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
975	0	B-1						**@0' to 5' - Undocumented Artificial Fill (afu):** @0'- 10" of Concrete with no Rebar; Silty SAND with Gravel: reddish brown, dry, loose	
970	5		R-1	4 8 20	121.4	4.1	SP-SM	**@5' to T.D. - Old Alluvial-Fan Deposits (Qof):** @5'- SAND with Silt and Gravel: grayish brown, dry, medium dense	
			R-2	12 23 46	122.1	3.0		@7.5'- SAND with Silt and Gravel: grayish brown, dry, very dense	
965	10		R-3	16 30 50/6"	127.9	1.7		@10'- SAND with Silt and Gravel: grayish brown, dry, very dense	
960	15		R-4	8 11 17	104.7	3.0	SM	@15'- Silty SAND: grayish brown, dry, medium dense	
955	20		SPT-1	15 13 16		2.5	SP-SM	@20'- SAND with Silt and Gravel: grayish brown, dry, dense	
950	25		R-5	19 30 50/3"	121.8	2.3		@25'- SAND with Silt and Gravel: grayish brown, dry, very dense	
	30							Total Depth = 25' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	

LGC Geotechnical, Inc.

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SAMPLE TYPES:

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

TEST TYPES:

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

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-8

Date: 4/4/2022 | **Drilling Company:** Cal Pac Drilling

Project Name: Dedeaux - Rialto | **Type of Rig:** Truck Mounted

Project Number: 22041-01 | **Drop:** 30" | **Hole Diameter:** 6"

Elevation of Top of Hole: ~975' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1						**@0' to 5' - Undocumented Artificial Fill (afu):** @0'- 9.5" of Concrete with Rebar; Silty SAND: brown, dry	EI MD
			R-1	3 5 7	116.5	5.1	SM	@3'- Silty SAND: brown, slightly moist, loose	
970	5		R-2	4 6 13	121.3	8.1	SM	**@5' to T.D. - Old Alluvial-Fan Deposits (Qof):** @5'- Silty SAND: brown, moist, medium dense	
			R-3	6 18 26	111.4	2.2	SP-SM	@7.5'- SAND with Silt and Gravel: grayish brown, dry, dense	
965	10		R-4	15 23 30	123.9	1.9	SP	@10'- SAND with Gravel: grayish brown, dry, dense	
960	15		SPT-1	8 9 11		4.0	SP-SM	@15'- SAND with Silt and Gravel: grayish brown, dry, medium dense	
955	20		R-5	7 11 20	114.4	13.8	SM	@20'- Silty SAND: olive gray, very moist, medium dense	
950	25		SPT-2	11 17 18		2.3	SP-SM	@25'- SAND with Silt and Gravel: grayish brown, dry, dense	
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
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SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
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SA	SIEVE ANALYSIS
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EI	EXPANSION INDEX
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CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/3/2022

Geotechnical Boring Log Borehole HS-8

Date: 4/4/2022	**Drilling Company:** Cal Pac Drilling
Project Name: Dedeaux - Rialto	**Type of Rig:** Truck Mounted
Project Number: 22041-01	**Drop:** 30" **Hole Diameter:** 6"
Elevation of Top of Hole: ~975' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 2 of 2

Logged By JMN
Sampled By JMN
Checked By DJB

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	30		R-6	21 25 50/6"	121.8	1.6	SP-SM	@30'- SAND with Silt and Gravel: grayish brown, dry, very dense	
945	35		SPT-3	14 26 37		2.1		@35'- SAND with Silt and Gravel: grayish brown, dry, very dense	
940	40		R-7	25 50/6"	114.9	2.3		@40'- SAND with Silt: grayish brown, dry, very dense	
935	45		SPT-4	8 16 18		11.0	ML	@45'- SILT with Sand: grayish brown, moist, hard	
930	50		R-8	10 19 32	105.2	9.6		@50'- SILT: olive brown, slightly moist, hard	
925	55							Total Depth = 50' Groundwater Not Encountered Backfilled with Cuttings on 3/24/2022	
	60								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

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

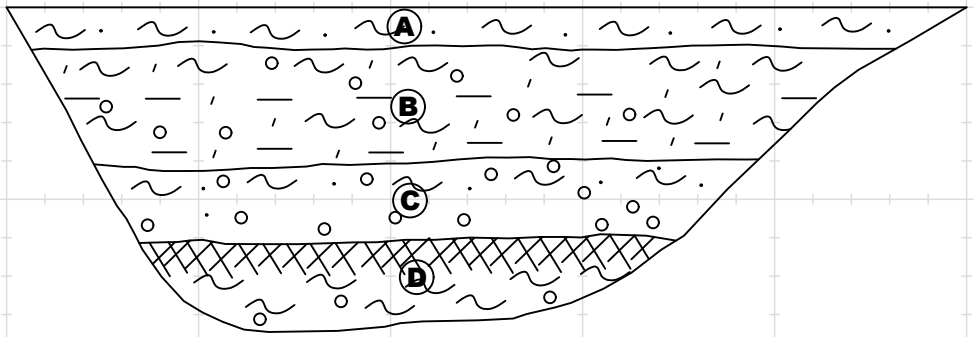
TEST TYPES:

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

Project Name: Willow Ave, Rialto	Logged By: JMO	Trench No.: TP-1	LGC Geotechnical, Inc.
Project Number: 22041-01	Date: 3/29/2022	Engineering Properties:	
Equipment: Backhoe	Location:		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
		@ 0' to 6' - Undocumented Artificial Fill:	Afu		B-1 @ 0-2'		
	A	@ 0 - 1' Sandy SILT - yellowish brown, slightly moist to moist,		ML			
	B	@ 1 - 4' - Gravelly SAND: yellowish orange brown, dry		SP			
	C	@ 4 - 6' - Sandy Silt with Gravel: gray-orange brown, dry to slightly moist; trace Clay		ML			
	D	@ 6' to T.D. - Old Alluvial-Fan Deposits: @ 6 - 8' - Sandy SILT: brown/gray, dry, stiff with gravels over orange silt, slightly moist; trace Clay	Qof	ML	B-2 @ 7-8'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 975' MSL** **Trend: E-W**



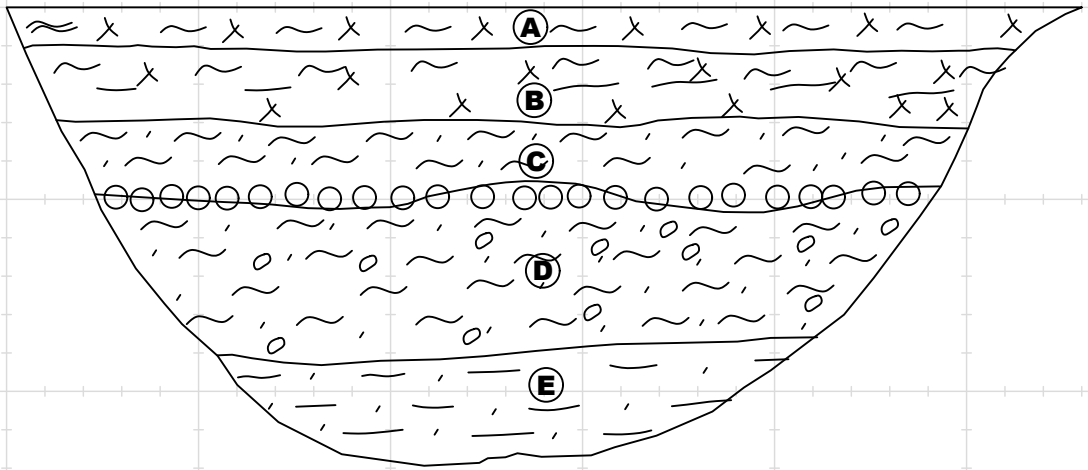
Total Depth: 8'
Groundwater: N/A
Backfilled: 3/29/22

scale: 1in = 5 ft

Project Name: Willow Ave, Rialto	Logged By: JMO	Trench No.: TP-2	LGC Geotechnical, Inc.
Project Number: 22041-01	Date: 3/29/2022	Engineering Properties:	
Equipment: Backhoe	Location:		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	@ 0' to 9' - Undocumented Artificial Fill:	Afu				
	B	@ 1 - 3' - Silty SAND with Gravel: lighter brown, dry to slightly moist, trace Clay		SM	B-1 @ 2-4'		
	C	@ 3 - 5' - Sandy SILT with Clay: darker brown, moist; rootlets		ML			
	D	@ 5 - 9' - Sandy SILT with Clay: orange brown, slightly moist; some Gravel			B-2 @ 4-6'		
	E	@ 9' to T.D. - Old Alluvial-Fan Deposits:	Qof		B-3 @ 8-10'		
		@ 9 - 12' - SAND with Gravel: yellowish gray, slightly moist; medium to coarse grained		SP			

GRAPHICAL REPRESENTATION BELOW: **Elevation: 974' MSL** **Trend: N-S**



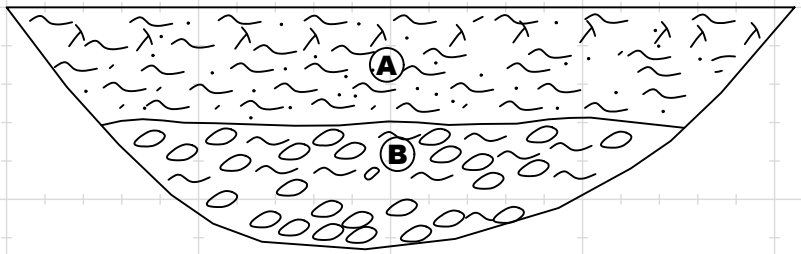
Total Depth: 12'
Groundwater: N/A
Backfilled: 3/29/22

scale: 1in = 5 ft

Project Name: Willow Ave, Rialto	Logged By: JMO	Trench No.: TP-3	
Project Number: 22041-01	Date: 3/29/2022	Engineering Properties:	
Equipment: Backhoe	Location:		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
		@ 0' to T.D. - Undocumented Artificial Fill:	Afu				
	A	@ 0 - 3' - Sandy SILT: yellowish brown, slightly moist gravel and asphalt chunks; rootlets; trace Clay		ML	B-1 @ 2-4'		
	B	@ 3' - 6.5' - Silty SAND with Gravel: gray, dry; miscellaneous trash		SM			

GRAPHICAL REPRESENTATION BELOW: **Elevation: 970' MSL**



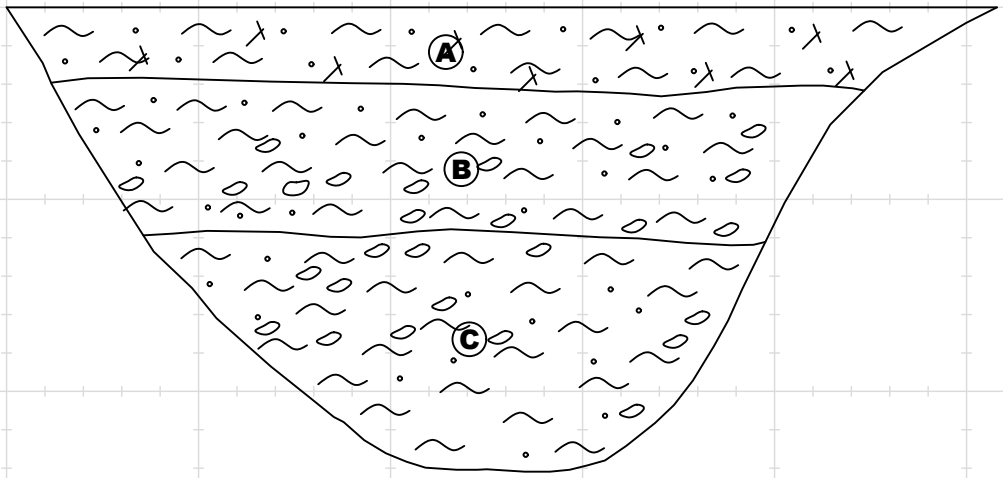
Total Depth: 6.5'
Groundwater: N/A
Backfilled: 3/29/22

scale: 1in = 5 ft

Project Name: Willow Ave, Rialto	**Logged By: JMO**	**Trench No.: TP-4**	LGC Geotechnical, Inc.
Project Number: 22041-01	**Date: 3/29/2022**	**Engineering Properties:**	
Equipment: Backhoe	**Location:**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
		@ 0' to T.D. - Undocumented Artificial Fill:	Afu				
	A	**@ 0 - 2' - Sand SILT with Clay: red-brown to brown, slightly moist, many gravels; miscellaneous trash; rootlets**		ML			
	B	**@ 2 - 6' - Sandy SILT with Clay: dark brown, slightly moist, stiff, many gravels, miscellaneous trash**			B-1 @ 5-6'		
	C	**@ 6 - 12' - Sandy SILT with Clay: dark gray to brown, slightly moist; miscellaneous trash**			B-2 @ 10-12'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 972' MSL** **Trend: E-W**



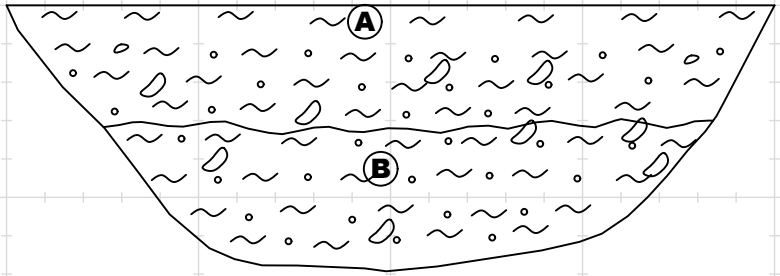
Total Depth: 12'
Groundwater: N/A
Backfilled: 3/29/22

scale: 1in = 5 ft

Project Name: Willow Ave, Rialto	Logged By: JMO	Trench No.: TP-5	LGC Geotechnical, Inc.
Project Number: 22041-01	Date: 3/29/2022	Engineering Properties:	
Equipment: Backhoe	Location:		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
		@ 0' to 3' - Undocumented Artificial Fill:	Afu		B-1 @ 0-2'		
	A	@ 0 - 3' - Sandy SILT with Gravels: light brown to yellowish brown, very dry; trace Clay		ML			
	B	@ 3' to T.D. - Old Alluvial-Fan Deposits:	Qof		B-2 @ 2-4'		
		@ 3 - 6.5' - Sandy SILT with Gravels: light brown to yellowish brown, very dry; caliche; trace Clay		ML			

GRAPHICAL REPRESENTATION BELOW: **Elevation: 972' MSL** **Trend: N-S**



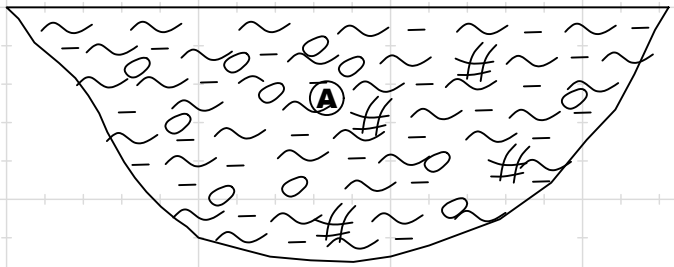
Total Depth: 6.5
Groundwater: N/A
Backfilled: 3/29/22

scale: 1in = 5 ft

Project Name: Willow Ave, Rialto	**Logged By: JMO**	**Trench No.: TP-6**	LGC Geotechnical, Inc.
Project Number: 22041-01	**Date: 3/29/2022**	**Engineering Properties:**	
Equipment: Backhoe	**Location:**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	@ 0' to T.D. - Undocumented Artificial Fill: @ 0 - 6.5' - Silty SAND with Gravel: dark brown, slightly moist; miscellaneous trash	Afu	SM	B-1 @ 4-6'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 971' MSL**



Total Depth: 6.5'
Groundwater: N/A
Backfilled: 3/29/22

scale: 1in = 5 ft

Appendix C
Laboratory Test Results

ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS

ASTM D 4546

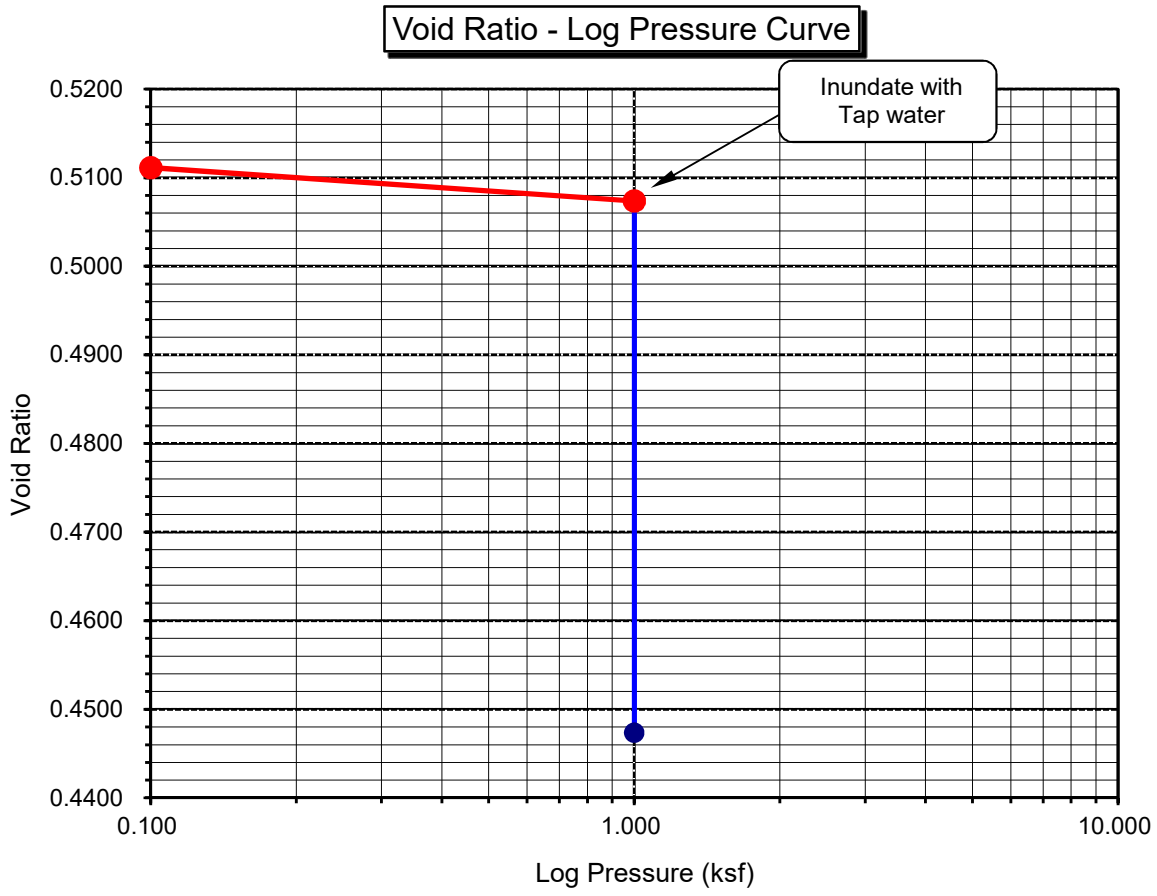
Project Name:	Dedeaux - Rialto	Tested By:	G. Bathala	Date:	04/13/22
Project No.:	22041-01	Checked By:	J. Ward	Date:	05/02/22
Boring No.:	HS-3	Sample Type:	Ring		
Sample No.:	R-4	Depth (ft.)	10.0		
Sample Description:	Olive brown silty sand (SM)				

Initial Dry Density (pcf):	111.5
Initial Moisture (%):	3.17
Initial Length (in.):	1.0000
Initial Dial Reading:	0.2716
Diameter(in):	2.415

Final Dry Density (pcf):	116.5
Final Moisture (%) :	13.0
Initial Void Ratio:	0.5113
Specific Gravity(assumed):	2.70
Initial Saturation (%)	16.7

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.2715	0.9999	0.00	-0.01	0.5111	-0.01
1.000	0.2661	0.9945	0.29	-0.55	0.5074	-0.26
H2O	0.2264	0.9548	0.29	-4.52	0.4474	-4.23

Percent Swell (+) / Settlement (-) After Inundation = -3.98



ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS

ASTM D 4546

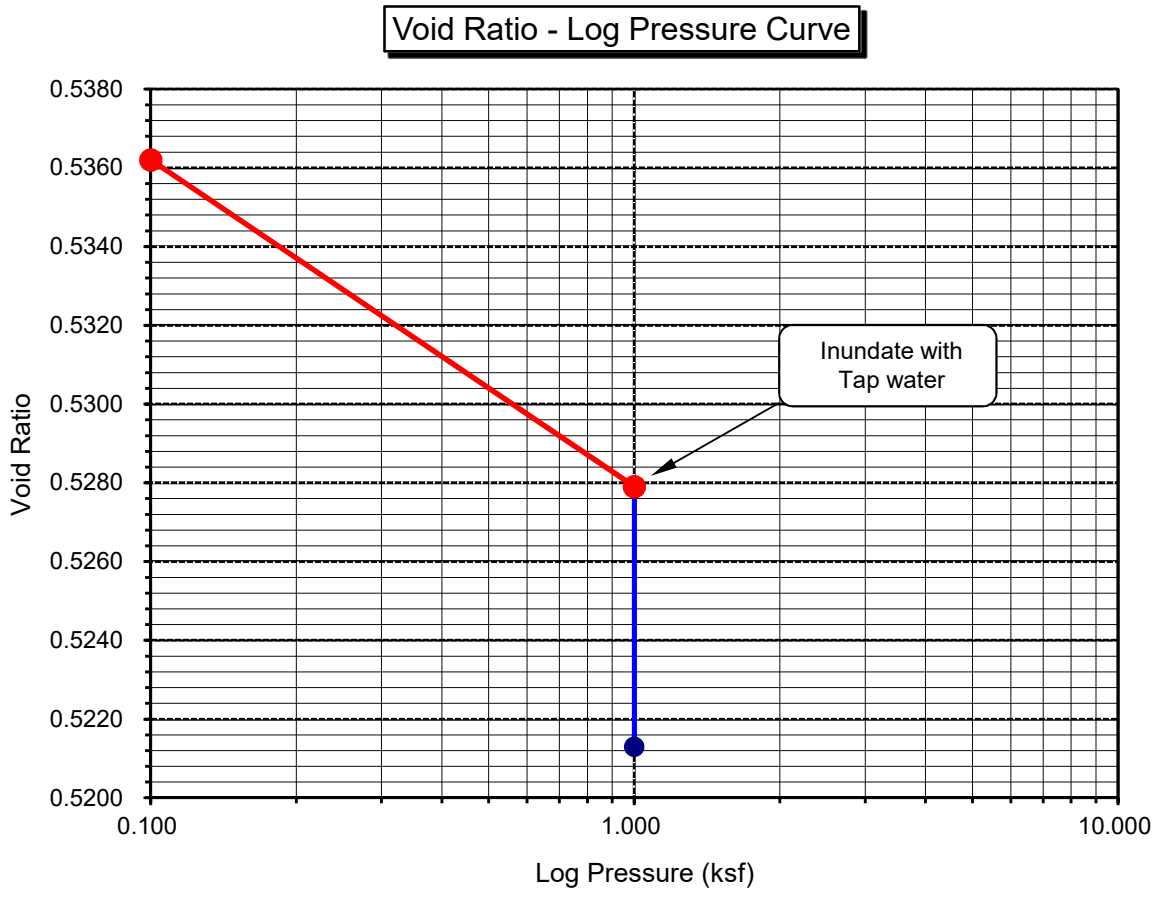
Project Name:	Dedeaux - Rialto	Tested By:	G. Bathala	Date:	04/13/22
Project No.:	22041-01	Checked By:	J. Ward	Date:	05/02/22
Boring No.:	HS-5	Sample Type:	Ring		
Sample No.:	R-2	Depth (ft.)	7.5		
Sample Description:	Yellowish brown silty sand (SM)				

Initial Dry Density (pcf):	109.7
Initial Moisture (%):	3.56
Initial Length (in.):	1.0000
Initial Dial Reading:	0.3628
Diameter(in):	2.415

Final Dry Density (pcf):	110.8
Final Moisture (%) :	14.8
Initial Void Ratio:	0.5362
Specific Gravity(assumed):	2.70
Initial Saturation (%)	17.9

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.3628	1.0000	0.00	0.00	0.5362	0.00
1.000	0.3567	0.9939	0.07	-0.61	0.5279	-0.54
H2O	0.3524	0.9896	0.07	-1.04	0.5213	-0.97

Percent Swell (+) / Settlement (-) After Inundation = -0.43



ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS

ASTM D 4546

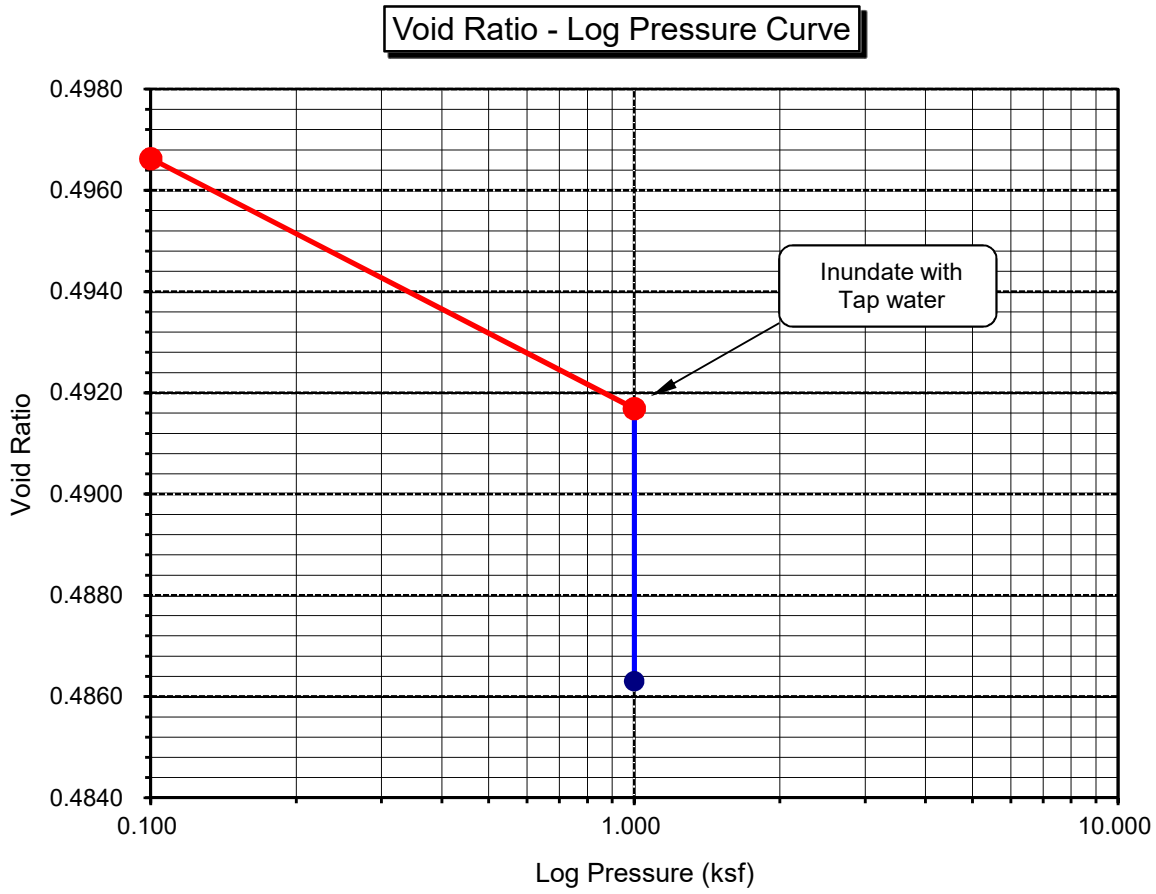
Project Name:	Dedeaux - Rialto	Tested By:	G. Bathala	Date:	04/13/22
Project No.:	22041-01	Checked By:	J. Ward	Date:	05/02/22
Boring No.:	HS-6	Sample Type:	Ring		
Sample No.:	R-2	Depth (ft.)	7.5		
Sample Description:	Light olive brown poorly-graded sand with silt (SP-SM)				

Initial Dry Density (pcf):	112.6
Initial Moisture (%):	3.49
Initial Length (in.):	1.0000
Initial Dial Reading:	0.2982
Diameter(in):	2.415

Final Dry Density (pcf):	113.4
Final Moisture (%) :	13.3
Initial Void Ratio:	0.4966
Specific Gravity(assumed):	2.70
Initial Saturation (%)	19.0

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.2982	1.0000	0.00	0.00	0.4966	0.00
1.000	0.2922	0.9940	0.27	-0.60	0.4917	-0.33
H2O	0.2886	0.9904	0.27	-0.96	0.4863	-0.69

Percent Swell (+) / Settlement (-) After Inundation = -0.36



Sladden Engineering

45090 Golf Center Parkway, Suite F, Indio, CA. 92201 (760) 863-0713 Fax (760) 863-0847
6782 Stanton Avenue, Suite C, Buena Park, CA. 90621 (714) 523-0952 Fax (714) 523-1369
450 Egan Avenue, Beaumont, CA. 92223 (951) 845-7743 Fax (951) 845-8863
www.sladdenengineering.com

July 22, 2022

Project No. 644-22039
22-07-098

Donlon Builders, Inc.
2681 Saturn Street
Brea, California 92821

Project: Proposed Warehouse/Industrial Building
NWC Jurupa Avenue & Willow Avenue
Rialto, California

Subject: Percolation/Infiltration Testing for On-Site Stormwater Management

In accordance with your request, we have performed percolation testing on the subject site to evaluate the infiltration potential of the near surface soil to assist in stormwater management system design. It is our understanding that on-site stormwater retention including infiltration is proposed for the project.

Percolation testing was performed on July 20, 2022, within two (2) shallow tests bores excavated on the site. Testing was performed at a depth of approximately 5.0 feet below existing grade. The approximate locations of the test holes are presented on the attached Test Location Plan (Figure 1). Testing was performed by placing water within the test holes and recording the drop in the water surface with time. Testing was performed in general accordance with the *United States Bureau of Reclamation (BOR) Procedure 7300-89 (1999)*. Test results are summarized in the following table.

PERCOLATION TEST RESULTS

Test No.	Depth (Ft)	USCS	Percolation Rate (in/hr)	Infiltration Rate (in/hr)
P-1	5.0	SM/SW	113.25	18.03
P-2	5.0	SM/SW	107.25	16.42

The percolation rates determined represent the ultimate field rates that do not include a safety factor. The corresponding infiltration rates were calculated using the Porchet Method.

An appropriate safety factor should be incorporated into stormwater management system design to account for long-term saturation and potential "silting" of the surface soil. The safety factor should be determined with consideration to other factors considered in the storm water retention system design (specifically storm water volume estimates) and the safety factors associated with the related design components.

Based on our review of groundwater levels within the vicinity of the site, it is our professional opinion that groundwater should not be a controlling factor in on-site stormwater retention/infiltration system design.

If you have any questions regarding this memo or the testing summarized herein, please contact the undersigned.

Respectfully submitted,
SLADDEN ENGINEERING

Brett L. Anderson
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
BRETT L. ANDERSON
No. C45389
CIVIL ENGINEERING
STATE OF CALIFORNIA

Copies: 2/Addressee

TEST LOCATION PLAN

LEGEND

P-2 Approximate Percolation/Infiltration Test Location



TABULATIONS

SITE AREA			BUILDING
SF			282,566
Acres			6.49
BUILDING AREA			
	Ground Floor Office		2,500
	Warehouse		89,100
Total Building Footprint			91,600
	Mezzanine		2,500
TOTAL BUILDING AREA			94,100
PARKING REQUIRED			
Office		1/250	20
Warehouse			
	0 - 10,000 sf	1/1000	10
	10,000 sf +	1/2000	40
TOTAL PARKING REQUIRED			70
PARKING PROVIDED			76
PARKING RATIO			
DOCK DOORS			21
GRADE DOORS			1
TRAILER STALLS			74

JURUPA AVENUE AND WILLOW AVENUE WAREHOUSE - RIALTO, CA

DEDEAUX PROPERTIES

SCHEME C CONCEPTUAL SITE PLAN

GAA

NORTH

Sladden Engineering

TEST LOCATION PLAN

Project Number:	644-22039
Report Number:	22-07-098
Date:	July 22, 2022

FIGURE

1

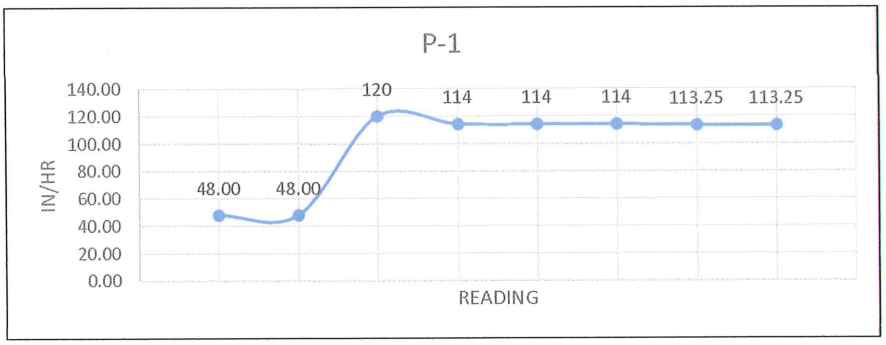
PERCOLATION/INFILTRATION TEST DATA SHEETS

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	NWC Jurupa Ave. & Willow Ave., Rialto	Depth (ft):	5.00
Job No. :	644-22039	USCS Soil Class:	SM/SW
Date:	7/19/2022	Sandy Soil:	S.D.
Test Hole #:	P-1	Tested By:	S.D.

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
A	25.00	5.00	20	0	20	48.00
B	25.00	5.00	20	0	20	48.00

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
1	10.00	5.00	20	0	20	120
2	10.00	5.00	20	1	19	114
3	10.00	5.00	20	1	19	114
4	10.00	5.00	20	1	19	114
5	10.00	5.00	20	1 1/8	18 7/8	113.25
6	10.00	5.00	20	1 1/8	18 7/8	113.25



PERCOLATION RATE CONVERSION (PORCHET METHOD)

$$I_{t=} \quad \frac{\Delta H\ 60\ R}{\Delta t(r+2H_{avg})}$$

Δt =	10.00
D_f =	58.88
r =	4.00
D_0 =	40
D_t =	60.00
H_0 =	20
H_f =	1.125
ΔH =	18.88
H_{avg} =	10.56

Δt (minutes)
D_f (Final Depth to water)
r (hole radius in inches)
D_0 (Initial Depth to water)
D_t (Total Depth of test hole)
H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

H_{avg} (average head height over the time interval)

$$H_{avg} = (H_0 + H_f)/2$$

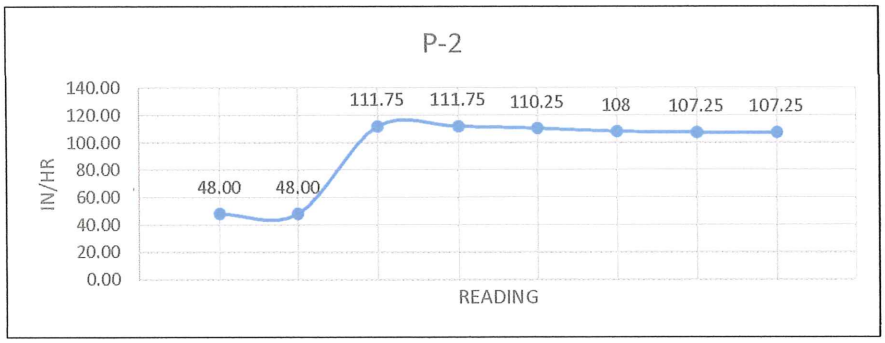
Field Rate:	113.25 in/hr
Infiltration Rate:	18.03 in/hr

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	NWC Jurupa Ave. & Willow Ave., Rialto	Depth (ft):	5.00
Job No. :	644-22039	USCS Soil Class:	SM/SW
Date:	7/19/2022	Sandy Soil:	S.D.
Test Hole #:	P-2	Tested By:	S.D.

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
A	25.00	5.00	20	0	20	48.00
B	25.00	5.00	20	0	20	48.00

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
1	10.00	5.00	20	1 3/8	18 5/8	111.75
2	10.00	5.00	20	1 3/8	18 5/8	111.75
3	10.00	5.00	20	1 5/8	18 3/8	110.25
4	10.00	5.00	20	2	18	108
5	10.00	5.00	20	2 1/8	17 7/8	107.25
6	10.00	5.00	20	2 1/8	17 7/8	107.25



PERCOLATION RATE CONVERSION (PORCHET METHOD)

$$I_{t=} \quad \frac{\Delta H\ 60\ R}{\Delta t(r+2H_{avg})}$$

Δt =	10.00
D_f =	57.88
r =	4.00
D_0 =	40
D_t =	60.00
H_0 =	20
H_f =	2.125
ΔH =	17.88
H_{avg} =	11.06

Δt (minutes)
D_f (Final Depth to water)
r (hole radius in inches)
D_0 (Initial Depth to water)
D_t (Total Depth of test hole)
H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

H_{avg} (average head height over the time interval)

$$H_{avg} = (H_0 + H_f)/2$$

Field Rate: 107.25 in/hr
Infiltration Rate: 16.42 in/hr

Section 6.4.6 Educational Materials

CONTECH®
ENGINEERED SOLUTIONS

Corrugated Metal Pipe
Detention & Infiltration

Corrugated Metal Pipe
The “Go To” Material for Stormwater Detention



For the majority of applications, corrugated metal pipe (CMP) is the “go to” material for stormwater detention and infiltration. With its low cost, a wide variety of diameters, layout configurations and coatings, no other material can match CMP’s flexibility and versatility.

- NCSPA service life guidance of 75+ years for certain materials in recommended environments. Please refer to the Corrugated Metal Pipe Detention Design Guide for additional information.
- Various pipe coatings and materials are available to accommodate site-specific needs: Aluminized Steel Type 2 (ALT2), Galvanized, CORLIX® Aluminum, and Polymeric.
- Wide range of gages, corrugations, and shapes, diameters 12”– 144”
- Pipe can be fully or partially perforated for infiltration or groundwater recharge applications
- Custom risers and manifolds provide direct access for maintenance
- Outlet control devices can be incorporated within the system, eliminating the need for a separate structure
- Customizable - a variety of fittings allow CMP to match most layout configurations
- May be designed for heavy loading and high maximum cover
- Contributes to LEED points
- Available locally; quick turnaround time
- The most economical installed solution

No other material can match the flexibility and versatility of CMP

Service Life for Corrugated Metal Pipe

The durability of steel ...

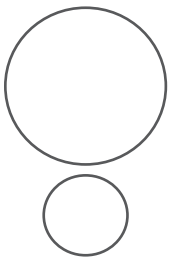


Some engineers are hesitant to use corrugated metal pipe (CMP) for infiltration because they have heard about CMP drainage culverts that have corroded due to abrasion. Factors affecting longevity differ between culvert and infiltration applications. Culverts experience high velocity flows carrying abrasive sediment, which can wear off galvanized coatings used in older CMP culverts. Infiltration systems are designed for storage rather than conveyance, so velocity and abrasive forces are minimized. In addition, improved CMP coatings, such as Aluminized Type 2 (ALT2), are more abrasion resistant and have demonstrated superior in-ground performance against abrasion in long-term durability studies. Field studies also have indicated that ALT2 coating may extend service life in wider pH and resistivity ranges than galvanized coatings. Confirming and maintaining recommended environmental conditions helps ensure system longevity projected by the long term studies. Finally, properly designed infiltration systems include pretreatment, flow control and a stone backfill envelope that can reduce exposure to abrasion

Learn More:
www.ncspa.org

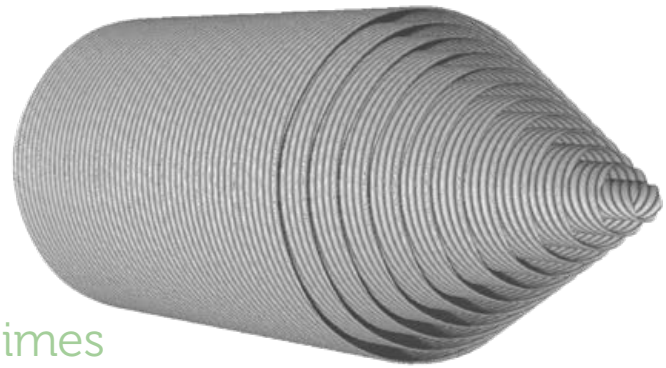
Maximizing Vertical Space: Every Inch Counts

One of the most overlooked advantages of CMP is its ability to maximize vertical storage space. Increasing the depth of a CMP infiltration system allows for more water storage in the same footprint. For example, doubling the diameter of pipe yields four times as much storage volume in the pipe. This provides a significant cost savings per cubic foot of storage. In addition, more vertical storage space means a smaller footprint, less excavation, and lower project costs.



96" diameter - 50.2 ft^3/ft

48" diameter - 12.5 ft^3/ft



Twice the diameter provides four times the storage space.

System Sizing



APPLICATION TIPS

- Use the largest diameter pipe possible to maximize vertical storage space and minimize the overall footprint. Doing so will reduce material, excavation, and backfill costs.
- Single manifold systems are most cost effective as they reduce the amount of fabrication needed.
- Incorporating flow controls into the CMP system can reduce costs by eliminating the need for additional concrete structures.
- The Contech MOBILE PIPE® mill can be delivered to remote locations and assembled on-site for fast and cost effective steel pipe manufacturing.

DIAMETER (IN)	VOLUME (FT^3/FT)	MIN. COVER HEIGHT
6	0.20	12″
8	0.35	12″
10	0.55	12″
12	0.78	12″
15	1.22	12″
18	1.76	12″
21	2.40	12″
24	3.14	12″
30	4.90	12″
36	7.10	12″
42	9.60	12″
48	12.60	12″
54	15.90	12″
60	19.60	12″
66	23.80	12″
72	28.30	12″
78	33.20	12″
84	38.50	12″
90	44.20	12″
96	50.30	12″
102	56.80	18″
108	63.60	18″
114	70.90	18″
120	78.50	18″
126	86.60	18″
132	95.00	18″
138	103.90	18″
144	113.10	18″

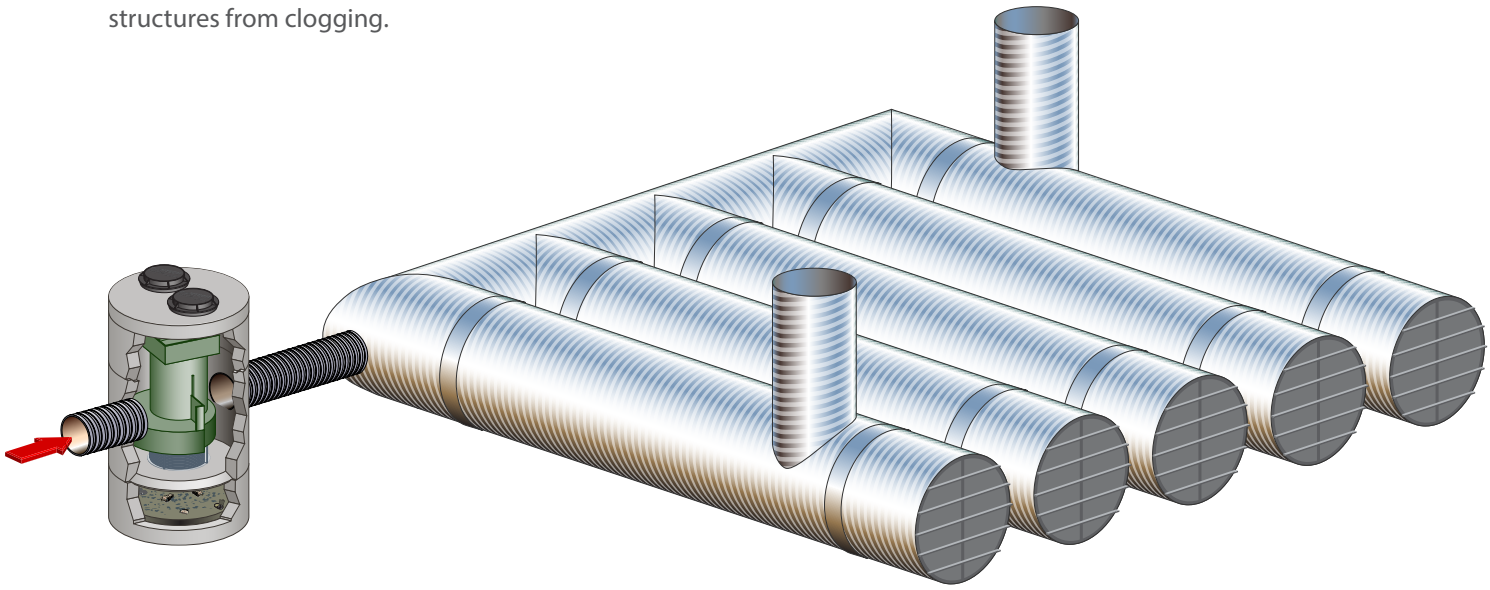
Because of its low cost and flexible configurations, CMP is the ‘go to’ material for stormwater detention and filtration.

Contech’s CMP Detention systems maximize vertical storage space

The Need for Effective Pretreatment

Infiltration systems have multiple components, and one of the most important is pretreatment. The purpose of a pretreatment device is to prolong the life of the infiltration system by removing debris and sediment that can collect on the invert and within the stone backfill voids. Pretreatment will maintain the efficiency of an infiltration system as well as extend the life cycle, therefore preventing a premature replacement. Pretreatment also offers these additional benefits:

- Easier to clean and maintain compared to the infiltration system itself.
- Cost savings due to the extended service life of the system.
- Removing trash and debris protects downstream outlet control structures from clogging.



Pretreatment systems that are easy to maintain and do not rely on the use of geotextile fabric are preferred.

Pretreatment Design Considerations

When choosing a pretreatment system, consider the following ...

- Downstream outlet control structures may require protection from a pretreatment device that screens trash and debris.
- Pretreatment system selection depends on pollutant targets. Trash, debris, and larger particles can be removed with hydrodynamic separators. Removing high percentages of fine particles and associated heavy metals and nutrients requires filtration.
- Reduced long term maintenance or replacement cost of the infiltration system can help justify pretreatment construction costs.
- Inlet and pipe layout will influence the number and type of pretreatment systems used. A combination of different systems may be appropriate for the various inlet locations and flows.



The CDS® provides direct access to cleaning, using a combination of swirl concentration and indirect screening.



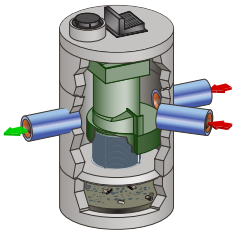
Learn More:
www.ContechES.com/cmp-detention

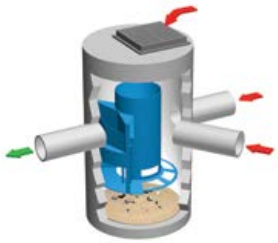
Reduce long term maintenance of an infiltration system with pretreatment.

Pretreatment options extend the life of subsurface infiltration

Pretreatment Options

Contech offers a number of pretreatment options, all of which will extend the life of subsurface infiltration systems and improve water quality. The type of system chosen will depend on a number of factors including footprint, soil conditions, local regulations, and the desired level of pretreatment.





Hydrodynamic Separation

Hydrodynamic Separation (HDS) provides a basic level of pretreatment by capturing and retaining trash and debris, sediment, and oil from stormwater runoff.

CDS®

CDS provides superior trash and sediment removal, and is much easier to clean and maintain compared to the infiltration system itself.

Cascade Separator™

The Cascade Separator uses advanced sediment capture technology to provide the highest sediment removal efficiency to protect the stone backfill voids of infiltration systems, thus extending the life of the system.







Filtration

Filtration provides a higher level of pretreatment and improved water quality by removing trash and debris, oil, fine solids, and dissolved pollutants such as metals, hydrocarbons, and nutrients.

Filterra® Bioretention System

Filterra is an engineered bioretention system that has been optimized for high volume/flow treatment and high pollutant removal.

The Stormwater Management StormFilter®

The StormFilter system is comprised of a structure that houses rechargeable, media-filled cartridges. The media can be customized to target site-specific pollutants.

Jellyfish® Filter

The Jellyfish filter uses membrane filtration in a compact footprint to remove a high level and a wide variety of stormwater pollutants such as fine particulates, oil, trash and debris, metals, and nutrients.

Alternative Materials for Subsurface Infiltration



There may be instances where alternative materials are needed for subsurface infiltration due to site specific needs ...

Plastic Chambers

Plastic chambers are best suited to shallow depth applications; minimum cover is 18 inches, and maximum cover is 96 inches. Some benefits of chambers are:

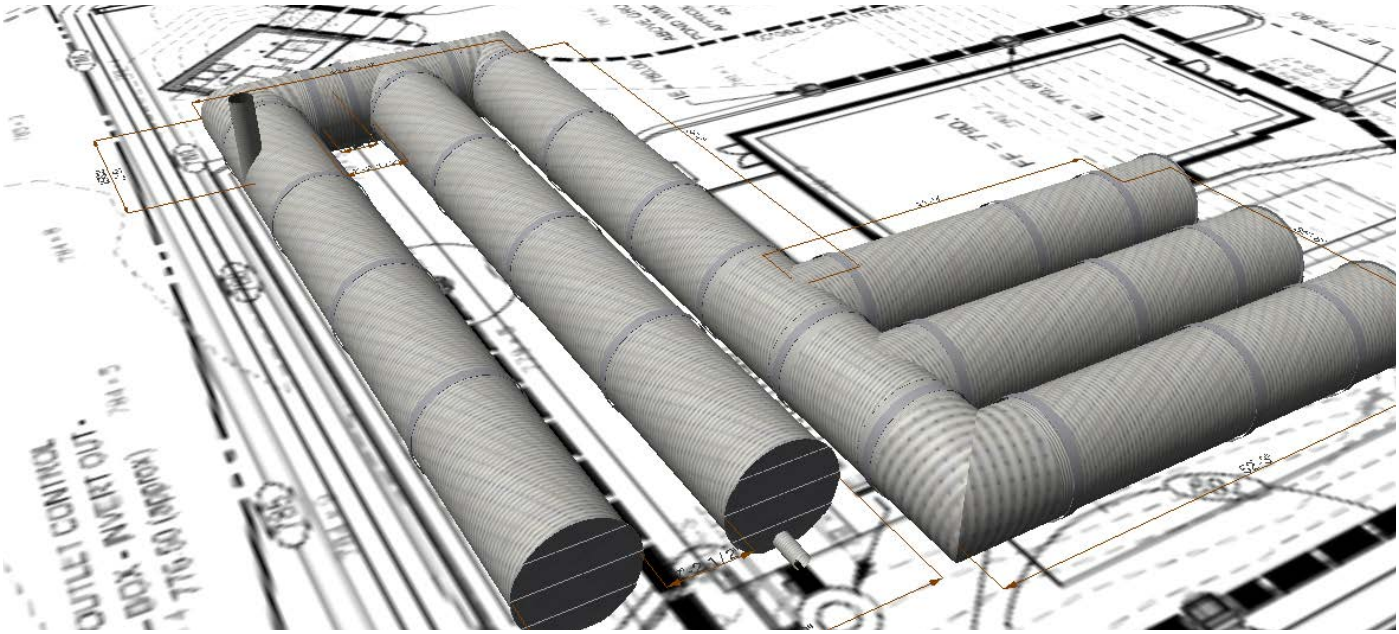
- Chambers may be beneficial for sites with limited vertical storage.
- Lightweight and installed by hand.
- Heavy equipment is not required to set units into place.
- Centralized stocking locations for short lead times.

Concrete Structures/Vaults

Some concrete structures and vaults are best suited for high loading applications such as railroads or airports. Concrete units are also ideal in corrosive environments or areas with high salinity. Some benefits of concrete structures are:

- Wide range of spans and heights.
- Greater underground infiltration storage in a smaller footprint.
- Ample and easy maintenance access.
- Fast installation.

Design Your Own Detention System (DYODS®)



Learn More:
www.ContechES.com/designcenter

Quickly prepare designs for estimates and project meetings ...

Engineers are always looking for new ways to quickly prepare designs for estimates and project meetings. We have a tool that does just that… the Design Your Own Detention System (DYODS®) tool.

Part of the Contech Design Center, this free, online tool fully automates the layout process for stormwater detention and infiltration systems. The tool allows you to design systems using corrugated metal pipe (CMP), ChamberMaxx® plastic chambers, or DuroMaxx® steel reinforced polyethylene (SRPE). You can also create multiple systems for each project while saving all project information for future use.

- "Drag and drop" feature allows users to customize layout
- A 2D/3D design environment with high-resolution graphics including BIM model output
- Optimize designs for the storage requirement or maximize storage for a given footprint
- Import a PDF site plan, scale and design a system over the plan and view the overlay in 2D
- Instant access to customized, project specific drawings, and CAD files
- Ability to co-workers or Contech design engineers to your project with the new Collaborator feature

CONTECH® DESIGNCENTER
DESIGN MADE EASY

A free, online tool that fully automates the layout process for stormwater detention systems.

A partner you can rely on



STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

TAKE THE NEXT STEP

For more information: www.ContechES.com

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CONTECH® ENGINEERED SOLUTIONS

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AquaShield™

INNOVATING GOOD CLEAN WATER



AQUA-SWIRL® TRASH CAPTURE

HYDRODYNAMIC SEPARATOR

FEATURES

1. The Aqua-Swirl® Trash Capture is constructed of durable, lightweight, high performance materials to withstand up to HS-25 loads.
2. Floatable trash, debris and coarse sediments enter tangentially into the unit.
3. Vortex separation removes coarse particles of TSS, floatable debris, and free oil.
4. Stainless steel screen removes trash larger than 5 mm.
5. Independent testing & validation for 100% trash removal larger than 5 mm before discharging into sensitive receiving waters.







Water Boards

Aqua-Swirl® TRASH CAPTURE System

AQUA-SWIRL® TRASH CAPTURE

- Provides customized solutions for project specific requirements.
- Systems designed for specific water quality treatment flow rates.
- Modular sizes from 2.5 – 13 ft diameters with attached riser(s) to finish grade.
- Online project and system design tool at http://pda.aquashieldinc.com.

Vortex Separation Technology

- Utilizes hydrodynamic and gravitational forces incorporating a stainless steel screen to remove trash/debris greater than 5mm, coarse sediment (TSS), and free oil.
- Extensive full-scale laboratory testing with independent 3rd parties.
- Certified Full Trash Capture device by CA State Water Resources Control Board.

Bypass Designs

- Systems are designed to treat water quality flow rates and bypass peak storm events.
- Internal and external bypass configurations are available and tailored to site-specific needs.

Pipe Connections

- Systems are designed with custom inlet/outlet diameters at various configuration angles.
- Inlet/outlet stub outs are provided for easy coupling to storm drain lines.
- Easily plumbed to RCP, CMP, PVC, and HDPE piping with dissimilar pipe diameters.

Installation Benefits

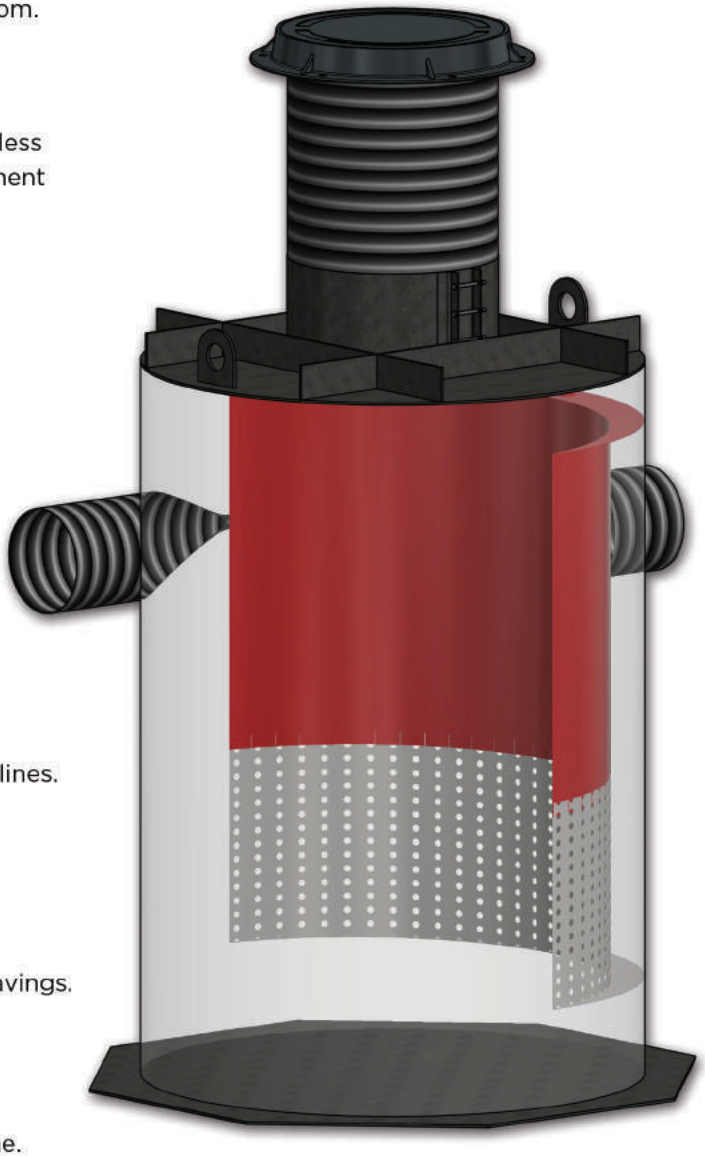
- Quick and simple installation, resulting in measurable project cost savings.
- Designed to withstand HS-25 loadings with capabilities of heavier loads available.
- Small footprint design reduces excavation costs.
- Lightweight and durable construction eliminating the need of a crane.
- Lifting lugs attached for easy maneuverability on site.

Storage Capacities

- Large storage capacities for sediment, debris and free oil to extend maintenance frequency.
- Screened trash capture storage capacities up to 122 ft3.
- Sediment storage capacities up to 310 ft3.

Inspection & Maintenance

- AquaShield™ offers an extensive network of local service providers across the country to ensure system performance efficiency.
- I&M manuals are available to download at www.aquashieldinc.com.



AquaShield™
WATER TREATMENT SOLUTIONS

www.aquashieldinc.com

2733 Kanasita Dr., Ste 111
Chattanooga, TN 37343

888.344.9044
423.870.8888
423.826.2112 (fax)

STORMWATER Pollution Prevention

ROADWORK AND PAVING

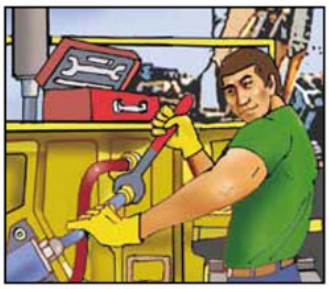
Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Preventing Erosion
Schedule excavation and grading work during dry weather. Develop and implement erosion and sediment control plans for excavated embankments. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



During Construction
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.



Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

Asphalt & Concrete Removal
Barricade storm drain openings during saw-cutting, and recycle broken up pavement at a crushing company. For recycling information, call (909) 386-8401.



Cleaning & Preventing Spills
Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Sweep up dry spills, instead of hosing. Prevent spills from paver machines by using drip pans, or by placing absorbent materials like cloths or rags under the machines when not in use. To report serious spills, call 911.



To report illegal dumping call

(877) WASTE18

sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

SAN BERNARDINO COUNTY STORMWATER PROGRAM

WHERE WATER MEETS COMMUNITY

Automotive Services

Oil, grease, anti-freeze and other toxic automotive fluids often make their way into the San Bernardino County storm drain system, and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.

- **Storing Hazardous Waste:** Keep your liquid waste segregated. Many fluids can be recycled via hazardous waste disposal companies if they are not mixed. Store all materials undercover with spill containment or inside to prevent contamination of rainwater runoff.
- **Proper Disposal of Hazardous Waste:** Recycle used motor oil and oil filters, anti-freeze and other hazardous automotive fluids, batteries, tires and metal filings collected from grinding polishing auto parts. Contact a licensed hazardous waste hauler. For more recycling information, call (909) 382-5401.
- **Cleaning Auto Parts:** Scrape parts with a wire brush or use a bake oven rather than liquid cleaners. Arrange drip pans, drying racks and drain boards so that fluids are directed back into the sink or the fluid holding tank. Do not wash parts or equipment in a parking lot, driveway or street.
- **Preventing Leaks and Spills:** Place chip pans underneath to capture fluids. Use absorbent cleaning agents instead of water to clean work areas.
- **Metal Grinding & Polishing:** Keep a bin under your lathe or grinder to capture metal filings. Send uncontaminated filings to a scrap metal recycler for reclamation. Store metal filings in a covered container or indoors.
- **Cleaning Spills:** Follow your hazardous materials response plan, as filed with your local fire department or other hazardous materials authority. Be sure that all employees are aware of the plan and are capable of implementing each phase of the plan. Use dry methods for spill cleanup (sweeping, absorbent materials, etc.). To report serious spills, call 911.
- **Washing Vehicles:** Wash vehicles where the wash water can soak into grass, gravel or be diverted to nearby landscaping, away from the street and storm drains. Wash vehicles at a designated wash rack that is connected to the sanitary sewer or take vehicles to a professional car wash. Use soaps, cleaners and detergents that are labeled phosphate free or biodegradable. The safest products for the environment are vegetable-based or citrus-based soaps.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Commercial landscape maintenance:

Yard waste, sediments and toxic lawn and garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.

- **Recycle Yard Waste:** Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Let your customers know about grass cycling --the natural recycling of grass by leaving clippings on the lawn when mowing instead of using a grass catcher. Grass clippings will quickly decompose, returning valuable nutrients to the soil. You can get more information at www.ciwmb.ca.gov/Organics.
- **Use Fertilizers, Herbicides & Pesticides Safely:** Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural, non-toxic alternatives to traditional garden chemicals. If you must use chemical fertilizers, herbicides, or pesticides spot apply rather than blanketing entire areas, avoid applying near curbs and driveways and never apply before a rain.
- **Recycle Hazardous Waste:** Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility. For information on proper disposal, call (909) 386-8401.
- **Use Water Wisely:** Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads.



- **Planting:** Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.
- **Prevent Erosion:** Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways. Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff. Avoid excavation or grading during wet weather.



- **Store Materials Safely:** Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials should be covered with plastic sheeting to protect from rain, wind and runoff.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

STORMWATER Pollution Prevention

FRESH CONCRETE & MORTAR APPLICATION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Storing Materials
Keep construction materials and debris away from the street, gutter and storm drains. Secure open bags of cement and cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



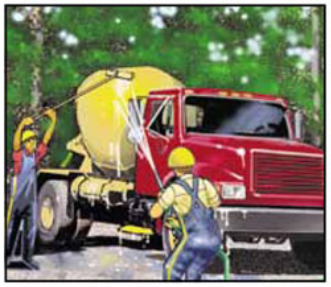
Ordering Materials & Recycling Waste
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. When breaking up paving, recycle the pieces at a crushing company. You can also recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. Call (909) 386-8401 for recycling and disposal information.



During Construction
Schedule excavation and grading during dry weather. Prevent mortar and cement from entering the street and storm drains by placing erosion controls. Setup small mixers on tarps or drop cloths, for easy cleanup of debris. Never bury waste material. Recycle or dispose of it as hazardous waste.



Cleaning Up
Wash concrete dust onto designated dirt areas, not down driveways or into the street or storm drains. Wash out concrete mixers and equipment in specified washout areas, where water can flow into a containment pond. Cement washwater can be recycled by pumping it back into cement mixers for reuse. Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.



To report illegal dumping call
(877) WASTE18
sbcountystormwater.org

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Construction & development:

Soil, cement wash, asphalt, oil and other hazardous debris from construction sites often make their way into the San Bernardino County storm drain system, and flow untreated into local waterways. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.



- **Store Materials Safely:** Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.
- **Preventing Erosion:** Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydro mulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Use gravel approaches where truck traffic is frequent to reduce soil compaction and limit the tracking of sediment into the streets. For more information on erosion control, call (909) 799-7407.



- **Cleaning & Preventing Spills:** Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.
- **Maintaining Vehicles & Equipment:** Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, and brake and radiator fluids.
- **Ordering Materials & Recycling Waste:** Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Dispose of hazardous materials through a hazardous waste hauler or other means in accordance with the construction permit. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.
- **Concrete and mortar application:** Never dispose of cement washout into driveways, streets, gutters or drainage ditches. Wash concrete mixers and equipment only in specified washout areas, where the water flows into lined containment ponds. Cement wash water can be recycled by pumping it back into cement mixers for reuse.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

STORMWATER Pollution Prevention

CONSTRUCTION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Store Materials Safely
Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



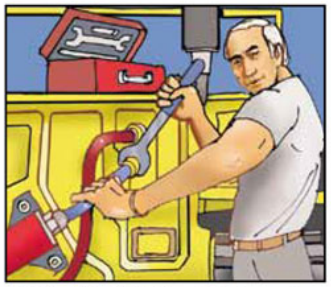
Ordering Materials & Recycling Waste
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.



Cleaning & Preventing Spills
Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.



Preventing Erosion
Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.



Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.



To report illegal dumping call
(877) WASTE18
sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

LANDSCAPE MAINTENANCE

DISCHARGE TO THE STORM DRAIN, ACCIDENTAL OR NOT, COULD LEAD TO ENFORCEMENT ACTIONS, WHICH COULD INCLUDE FINES.

Follow the best practices below to **prevent water pollution from landscaping activities.**

RECYCLE YARD WASTE



- Recycle leaves, grass clippings and other yard waste.
- Do not blow, sweep, rake or hose yard waste into the street or catch basin.
- **Try grasscycling:** the natural recycling of grass by leaving clippings on the lawn when mowing.

  For more information, please visit: **www.calrecycle.ca.gov/organics/grasscycling**

USE FERTILIZERS, HERBICIDES AND PESTICIDES SAFELY



- Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural and non-toxic alternatives as often as possible.
- If you must use chemical fertilizers, herbicides or pesticides:
  - Spot apply, rather than blanketing entire areas.
  - Avoid applying near curbs and driveways, and **never** before a rain.
  - Apply fertilizers as needed: when plants could best use it and when the potential runoff would be low.
  - Follow the manufacturer's instructions carefully—this will not only give the best results, but will save money.

USE WATER WISELY



- Control the amount of water and direction of sprinklers. Sprinklers should only be on long enough to allow water to soak into the ground, but not so long as to cause runoff.
- Periodically inspect, fix leaks and realign sprinkler heads.
- Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.

HOMEOWNERS

KEEP THESE TIPS IN MIND WHEN HIRING PROFESSIONAL LANDSCAPERS AND REMIND AS NECESSARY.

Leftover pesticides, fertilizers, and herbicides contaminate landfills and should be disposed of through a Hazardous Waste Facility.

For more information on proper disposal call,

(909) 382-5401 or 1-800-OILY CAT.

*FREE for San Bernardino County residents only. Businesses can call for cost inquiries and to schedule an appointment.

To report illegal dumping, call (877) WASTE18 or visit sbcountystormwater.org
To report toxic spills, call 1(800) 33 TOXIC
To dispose of hazardous waste, call 1(800) OILY CAT

sbcountystormwater.org

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Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

COMMERCIAL TRASH ENCLOSURES

FOLLOW THESE **REQUIREMENTS** TO **KEEP OUR WATERWAYS CLEAN**

Trash enclosures, such as those found in commercial and apartment complexes, typically contain materials that are intended to find their way to a landfill or a recycling facility. **These materials are NOT meant to go into our local lakes and rivers.**

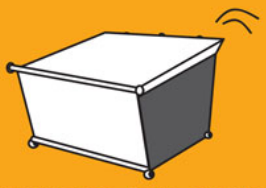
PROTECT WATER QUALITY BY FOLLOWING THESE SIMPLE STEPS

PUT TRASH INSIDE



Place trash inside the bin (preferably in sealed bags)

CLOSE THE LID



Prevent rain from entering the bin in order to avoid leakage of polluted water runoff

KEEP TOXICS OUT



- Paint
- Grease, fats and used oils
- Batteries, electronics and fluorescent lights

SOME ADDITIONAL GUIDELINES, INCLUDE

✓ SWEEP FREQUENTLY
Sweep trash enclosure areas frequently, instead of hosing them down, to prevent polluted water from flowing into the streets and storm drains.

✓ FIX LEAKS
Address trash bin leaks immediately by using dry clean up methods and report to your waste hauler to receive a replacement.

✓ CONSTRUCT ROOF
Construct a solid cover roof over the existing trash enclosure structure to prevent rainwater from coming into contact with trash and garbage. Check with your local City/County for Building Codes.

In San Bernardino County, stormwater pollution is caused by food waste, landscape waste, chemicals and other debris that are washed into storm drains and end up in our waterways - untreated! You can be part of the solution by maintaining a water-friendly trash enclosure.

THANK YOU FOR HELPING TO KEEP SAN BERNARDINO COUNTY CLEAN AND HEALTHY!

To report illegal dumping **(877-WASTE18)** or
to find a household hazardous waste facility (800-OILY CAT): **sbcountystormwater.org**
To dispose of hazardous waste call the San Bernardino County Fire Dept. - CUPA Program **(909) 386-8401**

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Spill Prevention, Control & Cleanup SC-11



Photo Credit: Geoff Brosseau

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- If consistent illegal dumping is observed at the facility:
  - Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - Landscaping and beautification efforts may also discourage illegal dumping.
  - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

- Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

- Routine maintenance:
  - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
  - Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
  - Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain*.

  - Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- Establish a system for tracking incidents. The system should be designed to identify the following:

  - Types and quantities (in some cases) of wastes

  - Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

Training

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from

tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off' of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)

- Keep accurate maintenance logs to evaluate BMP implementation.

CASQA California Stormwater Quality Association

SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Landscape Maintenance



Photo Credit: Geoff Brosseau

Description

This category includes businesses that provide landscaping and landscape maintenance/gardening services.

Pollutant Sources

The following are sources of pollutants:

- Selecting plants or landscape design
- Installing new landscaping
- Maintaining landscapes
- Using pesticides and fertilizers
- Using gas-powered equipment
- Working near waterbodies

Pollutants can include:

- Nutrients (fertilizers, yard wastes)
- Pesticides
- Heavy metals (copper, lead, and zinc)
- Hydrocarbons (fuels, oils and grease)
- Sediments

Approach

Minimize the potential for stormwater pollution and the need for resources/controls (water, pesticides, fertilizers) by creating and maintaining landscapes in a way that is compatible with the local soils, climate, and amount of rain and sun. Make stormwater

pollution prevention BMPs a part of standard operating procedures and the employee training program. Provide employee education materials in the first language of employees, as necessary.

Source Control BMPs

The best management practices are listed by activity or area.

Landscape Design

- Specify native, low maintenance, and insectary (attract beneficial insects) plants and landscape designs.
- Design zoned, water-efficient irrigation systems using technologies such drip irrigation, soaker hoses, or microspray systems.
- Do not landscape riparian areas, except to remove non-native plants and replace them with native riparian landscaping.
- Replant with native species where possible when landscaping or building an ornamental pond. Do not assume something is native because you have seen it in your area. Contact the local nursery for information or visit the California Exotic Pest Plant Council website (www.caleppc.org).

Landscape Installation

- Protect stockpiles and landscaping materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Schedule grading and excavation projects during dry weather.
- Divert runoff from exposed soils or lower its velocity by leveling and terracing.
- Use temporary check dams or ditches to divert runoff away from storm drains.
- Protect storm drains with sandbags or other sediment controls.
- Revegetation is an excellent form of erosion control for any site. Keep soils covered with vegetation or temporary cover material (mulch) to control erosion.
- Check plant roots before buying a plant. Do not buy plants with roots are that kinked or circling around the container. Do not buy plants with soft, rotten, or deformed root crowns.
- Do not pile soil around the plant any higher than the root crown.

Landscape Maintenance

Yard Waste

- Allow leaf drop to become part of the mulch layer in tree, shrub, and groundcover areas.
- Keep lawn mower blades sharp and grasscycle.
- Grasscycle – leave grass clippings on the lawn when mowing. Once cut, grass clippings first dehydrate, then decompose, quickly disappearing from view. Proper mowing is required for successful grasscycling. Cut grass when the surface is dry, and keep mower blades sharp. Follow the "1/3 Rule": mow the lawn often enough so that no more than 1/3 of the length of the grass blade is cut in any one mowing. Frequent mowing will produce short clippings that will not cover up the grass surface. The lawn may have to be cut every seven days when the lawn is growing fast but only every 7 to 14 days when the lawn is growing slowly.

- Do not leave clippings on pavement or sidewalks where they can wash off into the street, gutter, or storm drain.
- Collect lawn and garden clippings, pruning waste, and tree trimmings. Chip if necessary, and compost or take to the local municipal yard waste recycling/composting facility.
- In communities with curbside pick-up of yard waste, place clippings and pruning waste at the curb in approved bags or containers. No curbside pickup of yard waste is available for commercial properties.
- Do not blow or rake leaves or other yard waste into the street, or place yard waste in gutters or on dirt shoulders, unless it is being piled up for recycling (allowed by some municipalities). After pick-up, sweep up any leaves, litter, or residue in gutters or on street.

Fertilizing and Pruning

- Perform soil analysis seasonally to determine actual fertilization need and application rates.
- Fertilize garden areas with a mulch of leaves, bark, or composted manure and/or garden waste.
- Apply chemical fertilizer only as needed, when plants can best use it, and when the potential for it being carried away by runoff is low. Make sure the fertilizer spreader is calibrated.
- Prune plants sparingly, if at all. A healthy plant – one that is native to the area and growing under the right conditions – should not need pruning, except when it is not in the right location (where safety or liability is a concern).

Watering

- Use soil probes to determine soil moisture depth, overall moisture levels, and the need to adjust irrigation schedules.

Pest and Weed Control

- Anyone who is in the business of landscape maintenance and performs pest control as part of providing that service must have a license from the state to apply pesticides. Contact the Department of Pesticide Regulation for more information.
- Become trained in and offer customers less-toxic pest control or Integrated Pest Management (IPM).
- The label on a pesticide container is a legal document. Use a pesticide only as instructed on the label.
- Store pesticides, fertilizers, and other chemicals indoors or in a shed or storage cabinet.
- Use pesticides sparingly, according to instructions on the label. Rinse empty containers, and use rinsewater as product.
- Dispose of rinsed, empty containers in the trash. Dispose of unused pesticides as hazardous waste.
- To control weeds, use drip irrigation and mulch. Hand-pull weeds including roots or cut down to ground. Repeat cutting before they flower, grow new leaves, or go to seed. Use herbicides containing pelargonic acid or herbicidal soap as a last resort.

Handling Gasoline

- Use only containers approved by a nationally recognized testing lab, such as Underwriters Laboratories (UL). Keep the container tightly sealed. Containers should be fitted with a spout to allow pouring without spilling and to minimize the generation of vapors.
- Fill cautiously. Always use a funnel and/or spout to prevent spilling or splashing when fueling power mowers, blowers, and all other gas-powered equipment.
- Avoid spilling gasoline on the ground, especially near wells. If a spill occurs use kitty litter, saw dust, or an absorbent towel to soak up the spill, then dispose of it properly.
- Store carefully. Gasoline moves quickly through soil and into groundwater, therefore, store and use gasoline and fuel equipment as far away from your drinking water well as possible. Be certain to keep a closed cap on the gasoline container. Store at ground level, not on a shelf to minimize the danger of falling and spilling.
- Do not dispose of gasoline down the drain, into surface water, onto the ground, or in the trash. Contact the local municipality for directions on proper disposal of excess or old gasoline. Transport old gas in an approved gasoline container.

Working Near Waterbodies

- Do not dump lawn clippings, other yard waste, or soil along creek banks or in creeks.
- Do not store stockpiles of materials (soil, mulch) along creek banks. These piles can erode over time into a creek.
- Do not spray pesticides or fertilizers by creeks.
- Do not over water near streams. The excess water may carry pesticides, fertilizers, sediments, and anything else in its path directly into the creek.
- Do not remove native vegetation along creek banks or remove large woody debris from creek banks or creeks. Instead, contact the local municipal planning department and Department of Fish & Game for guidance.

Treatment Control BMPs

Not applicable.

More Information

Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. (http://www.basmaa.org).

Bay Area Water Pollution Prevention Agencies, 1998 - 2002. Less-Toxic Pest Management Fact Sheets, Less-Toxic Product List, and In-store display and promotion materials. (http://www.basmaa.org)

California Exotic Pest Plant Council, 1999. Exotic Pest Plant List. (http://www.caleppc.org)

California Integrated Waste Management Board, 1999. Grasscycle! Make the Most of Your Lawn. Make the Most of Your Time. (http://www.ciwmb.ca.gov/organics/Pubs.htm).

California Integrated Waste Management Board, 2001. Resource-Efficient Turf Management and Resource-Efficient Landscaping. (http://www.ciwmb.ca.gov/organics/Pubs.htm).

Contra Costa County, no date. Grasscycle! Clip your waste! (http://grasscycle.abag.ca.gov).

Marin County Stormwater Pollution Prevention Program, no date. Creek Care: A Guide for Urban Marin Residents. (http://www.mcstoppp.org/).

Professional Lawn Care Association of America, 1997. Water Quality and Your Lawn. (http://www.pesp.org/1995/plcaa95-final.htm).

San Francisquito Watershed Council and San Mateo Countywide Stormwater Pollution Prevention Program, no date. Streamside Planting Guide for San Mateo and Santa Clara County Streams. (http://www.acterra.org/watershed/)

The Alliance for Proper Gasoline Handling, 1999. Consumer Tips for Proper Gasoline Handling. (http://www.gas-care.org/consumer_tips.htm).

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CCCSD, 2001. The Healthy Home & Garden - Less-Toxic Pest Control (for residents). (http://www.centralsan.org/education/ipm/hgonlineguide.html).

References

Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. (http://www.basmaa.org).

Bay Area Water Pollution Prevention Agencies, 1998 - 2002. Less-Toxic Pest Management Fact Sheets, Less-Toxic Product List, and In-store display and promotion materials. (http://www.basmaa.org)

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California Integrated Waste Management Board, 2001. Resource-Efficient Turf Management and Resource-Efficient Landscaping. (http://www.ciwmb.ca.gov/organics/Pubs.htm).

City of Bellevue, 1991. Water Quality Protection for Landscaping Businesses, Business Partners for Clean Water.

Contra Costa County, no date. Grasscycle! Clip your waste! (http://grasscycle.abag.ca.gov).

County of Los Angeles, no date. Landscaping and Nursery Facilities – Best Management Practices, Project Pollution Prevention.

Marin County Stormwater Pollution Prevention Program, no date. Creek Care: A Guide for Urban Marin Residents. (http://www.mcstoppp.org/).

Professional Lawn Care Association of America, 1997. Water Quality and Your Lawn. (http://www.pesp.org/1995/plcaa95-final.htm).

San Francisquito Watershed Council and San Mateo Countywide Stormwater Pollution Prevention Program, no date. Streamside Planting Guide for San Mateo and Santa Clara County Streams. (http://www.acterra.org/watershed/)

Santa Clara Valley Urban Runoff Pollution Prevention Program, 2001. Landscaping, Gardening, and Pool Maintenance – Best Management Practices for the Construction Industry.

The Alliance for Proper Gasoline Handling, 1999. Consumer Tips for Proper Gasoline Handling. (http://www.gas-care.org/consumer_tips.htm).

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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Designing New Installations

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Roof Runoff Controls SD-11



Rain Garden

Design Objectives

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

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

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

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Vortex Separator MP-51

Description

Vortex separators: (alternatively, swirl concentrators) are gravity separators, and in principle are essentially wet vaults. The difference from wet vaults, however, is that the vortex separator is round, rather than rectangular, and the water moves in a centrifugal fashion before exiting. By having the water move in a circular fashion, rather than a straight line as is the case with a standard wet vault, it is possible to obtain significant removal of suspended sediments and attached pollutants with less space. Vortex separators were originally developed for combined sewer overflows (CSOs), where it is used primarily to remove coarse inorganic solids. Vortex separation has been adapted to stormwater treatment by several manufacturers.

California Experience

There are currently about 100 installations in California.

Advantages

- May provide the desired performance in less space and therefore less cost.
- May be more cost-effective pre-treatment devices than traditional wet or dry basins.
- Mosquito control may be less of an issue than with traditional wet basins.

Limitations

- As some of the systems have standing water that remains between storms, there is concern about mosquito breeding.
- It is likely that vortex separators are not as effective as wet vaults at removing fine sediments, on the order 50 to 100 microns in diameter and less.
- The area served is limited by the capacity of the largest models.
- As the products come in standard sizes, the facilities will be oversized in many cases relative to the design treatment storm, increasing the cost.
- The non-steady flows of stormwater decreases the efficiency of vortex separators from what may be estimated or determined from testing under constant flow.
- Do not remove dissolved pollutants.
- A loss of dissolved pollutants may occur as accumulated organic

Design Considerations

- Service Area
- Settling Velocity
- Appropriate Sizing
- Inlet Pipe Diameter

Targeted Constituents

✓	Sediment	▲
✓	Nutrients	●
✓	Trash	
✓	Metals	●
	Bacteria	
✓	Oil and Grease	
✓	Organics	

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

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matter (e.g., leaves) decomposes in the units.

Design and Sizing Guidelines

The stormwater enters, typically below the effluent line, tangentially into the basin, thereby imparting a circular motion in the system. Due to centrifugal forces created by the circular motion, the suspended particles move to the center of the device where they settle to the bottom. There are two general types of vortex separation: free vortex and dampened (or impeded) vortex. Free vortex separation becomes dampened vortex separation by the placement of radial baffles on the weir-plate that impede the free vortex-flow pattern

It has been stated with respect to CSOs that the practical lower limit of vortex separation is a particle with a settling velocity of 12 to 16.5 feet per hour (0.10 to 0.14 cm/s). As such, the focus for vortex separation in CSOs has been with settleable solids generally 200 microns and larger, given the presence of the lighter organic solids. For inorganic sediment, the above settling velocity range represents a particle diameter of 50 to 100 microns. Head loss is a function of the size of the target particle. At 200 microns it is normally minor but increases significantly if the goal is to remove smaller particles.

The commercial separators applied to stormwater treatment vary considerably with respect to geometry, and the inclusion of radial baffles and internal circular chambers. At one extreme is the inclusion of a chamber within the round concentrator. Water flows initially around the perimeter between the inner and outer chambers, and then into the inner chamber, giving rise to a sudden change in velocity that purportedly enhances removal efficiency. The opposite extreme is to introduce the water tangentially into a round manhole with no internal parts of any kind except for an outlet hood. Whether the inclusion of chambers and baffles gives better performance is unknown. Some contend that free vortex, also identified as swirl concentration, creates less turbulence thereby increasing removal efficiency. One product is unique in that it includes a static separator screen.

- Sized is based on the peak flow of the design treatment event as specified by local government.
- If an in-line facility, the design peak flow is four times the peak of the design treatment event.
- If an off-line facility, the design peak flow is equal to the peak of the design treatment event.
- Headloss differs with the product and the model but is generally on the order of one foot or less in most cases.

Construction/Inspection Considerations

No special considerations.

Performance

Manufacturer's differ with respect to performance claims, but a general statement is that the manufacturer's design and rated capacity (cfs) for each model is based on and believed to achieve an aggregate reduction of 90% of all particles with a specific gravity of 2.65 (glacial sand) down to 150 microns, and to capture the floatables, and oil and grease. Laboratory tests of two products support this claim. The stated performance expectation therefore implies that a

lesser removal efficiency is obtained with particles less than 150 microns, and the lighter, organic settleables. Laboratory tests of one of the products found about 60% removal of 50 micron sand at the expected average operating flow rate

Experience with the use of vortex separators for treating combined sewer overflows (CSOs), the original application of this technology, suggests that the lower practical limit for particle removal are particles with a settling velocity of 12 feet per hour (Sullivan, 1982), which represents a particle diameter of 100 to 200 microns, depending on the specific gravity of the particle. The CSO experience therefore seems consistent with the limited experience with treating stormwater, summarized above

Traditional treatment technologies such as wet ponds and extended detention basins are generally believed to be more effective at removing very small particles, down to the range of 10 to 20 microns. Hence, it is intuitively expected that vortex separators do not perform as well as the traditional wet and dry basins, and filters. Whether this matters depends on the particle size distribution of the sediments in stormwater. If the distribution leans towards small material, there should be a marked difference between vortex separators and, say, traditional wet vaults. There are little data to support this conjecture

In comparison to other treatment technologies, such as wet ponds and grass swales, there are few studies of vortex separators. Only two of manufactured products currently available have been field tested. Two field studies have been conducted. Both achieved in excess of 80% removal of TSS. However, the test was conducted in the Northeast (New York state and Maine) where it is possible the stormwater contained significant quantities of deicing sand. Consequently, the influent TSS concentrations and particle size are both likely considerably higher than is found in California stormwater. These data suggest that if the stormwater particles are for the most part fine (i.e., less than 50 microns), vortex separators will not be as efficient as traditional treatment BMPs such as wet ponds and swales, if the latter are sized according to the recommendations of this handbook.

There are no equations that provide a straightforward determination of efficiency as a function of unit configuration and size. Design specifications of commercial separators are derived from empirical equations that are unique and proprietary to each manufacturer. However, some general relationships between performance and the geometry of a separator have been developed. CSO studies have found that the primary determinants of performance of vortex separators are the diameters of the inlet pipe and chamber with all other geometry proportional to these two.

Sullivan et al. (1982) found that performance is related to the ratios of chamber to inlet diameters, D2/D1, and height between the inlet and outlet and the inlet diameter, H1/D1, shown in Figure 3. The relationships are: as D2/D1 approaches one, the efficiency decreases; and, as the H1/D1 ratio decreases, the efficiency decreases. These relationships may allow qualitative comparisons of the alternative designs of manufacturers. Engineers who wish to apply these concepts should review relevant publications presented in the References.

Siting Criteria

There are no particularly unique siting criteria. The size of the drainage area that can be served by vortex separators is directly related to the capacities of the largest models.

Additional Design Guidelines

Vortex separators have two capacities if positioned as in-line facilities, a treatment capacity and a hydraulic capacity. Failure to recognize the difference between the two may lead to significant under sizing; i.e., too small a model is selected. This observation is relevant to three of the five products. These three technologies all are designed to experience a unit flow rate of about 24 gallons/square foot of separator footprint at the peak of the design treatment event. This is the horizontal area of the separator zone within the container, not the total footprint of the unit. At this unit flow rate, laboratory tests by these manufacturers have established that the performance will meet the general claims previously described. However, the units are sized to handle 100 gallons/square foot at the peak of the hydraulic event. Hence, in selecting a particular model the design engineer must be certain to match the peak flow of the design event to the stated treatment capacity, not the hydraulic capacity. The former is one-fourth the latter. If the unit is positioned as an off-line facility, the model selected is based on the capacity equal to the peak of the design treatment event.

Maintenance

Maintenance consists of the removal of accumulated material with an eductor truck. It may be necessary to remove and dispose the floatables separately due to the presence of petroleum product.

Maintenance Requirements

Remove all accumulated sediment, and litter and other floatables, annually, unless experience indicates the need for more or less frequent maintenance.

Cost

Manufacturers provide costs for the units including delivery. Installation costs are generally on the order of 50 to 100 % of the manufacturer's cost. For most sites the units are cleaned annually.

Cost Considerations

The different geometry of the several manufactured separators suggests that when comparing the costs of these systems to each other, that local conditions (e.g., groundwater levels) may affect the relative cost-effectiveness.

References and Sources of Additional Information

Field, R., 1972, The swirl concentrator as a combined sewer overflow regulator facility, EPA/R2-72-008, U.S. Environmental Protection Agency, Washington, D.C.

Field, R., D. Averill, T.P. O'Connor, and P. Steel, 1997, Vortex separation technology, Water Qual. Res. J. Canada, 32, 1, 185

Manufacturers technical materials

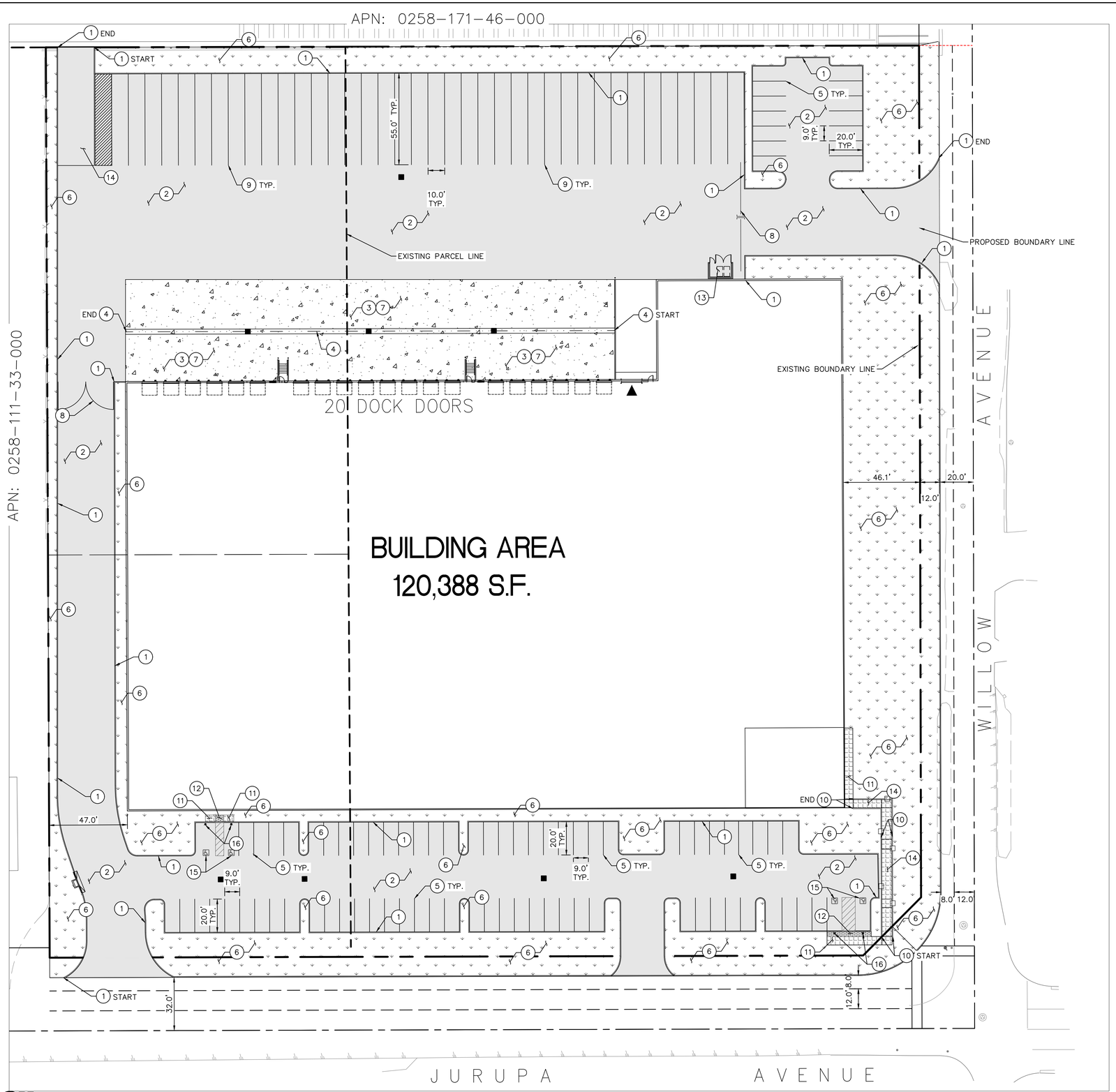
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Sullivan, R.H., M.M. Cohn, J.E. Ure, F.F. Parkinson, and G. Caliana, 1974, Relationship between diameter and height for the design of a swirl concentrator as a combined sewer overflow regulator, EPA 670/2-74-039, U.S. Environmental Protection Agency, Washington, D.C.

Sullivan, R.H., M.M. Cohn, J.E. Ure, F.F. Parkinson, and G. Caliana, 1974, The swirl concentrator as a grit separator device, EPA670/2-74-026, U.S. Environmental Protection Agency, Washington, D.C.

Sullivan, R.H., M.M. Cohn, J.E. Ure, F.F. Parkinson, and G. Caliana, 1978, Swirl primary separator device and pilot demonstration, EPA600/2-78-126, U.S. Environmental Protection Agency, Washington, D.C.

Section 6.4.7 Construction Plans



LEGEND

- PROPERTY LINE
- EXISTING EASEMENT
- PROPOSED HANDRAILS
- HEAVY DUTY ASPHALT PAVING
- LANDSCAPING
- CONCRETE PAVEMENT
- CONCRETE SIDEWALK

CONSTRUCTION NOTES

1. PROPOSED CONCRETE CURB
2. PROPOSED HEAVY DUTY ASPHALT PAVEMENT
3. PROPOSED CONCRETE PAVEMENT
4. PROPOSED VALLEY GUTTER
5. PROPOSED REGULAR STRIPING. DIMENSIONS PER PLAN.
6. PROPOSED LANDSCAPING.
7. PROPOSED TRUCK DOCK AREA.
8. PROPOSED GATE. REFER TO ARCHITECTURAL PLANS FOR MORE INFORMATION.
9. PROPOSED TRAILER PARKING. DIMENSIONS PER PLAN.
10. PROPOSED HANDRAILS
11. PROPOSED CONCRETE SIDEWALK
12. PROPOSED TRUNCATED DOMES
13. PROPOSED TRASH ENCLOSURE. REFER TO ARCHITECTURAL PLANS FOR MORE INFORMATION.
14. PROPOSED CONCRETE RAMP. REFER TO GRADING PLANS FOR MORE DETAILS.
15. PROPOSED ACCESSIBLE PARKING STALL
16. PROPOSED ACCESSIBLE PARKING SIGN ON POST AND BOLLARD

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

SCALE: 1" = 30'
WHEN PRINTED AT FULL SIZE 24"X36"

DEDEAUX PROPERTIES | DONLON BUILDERS

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PRELIMINARY SITE PLAN

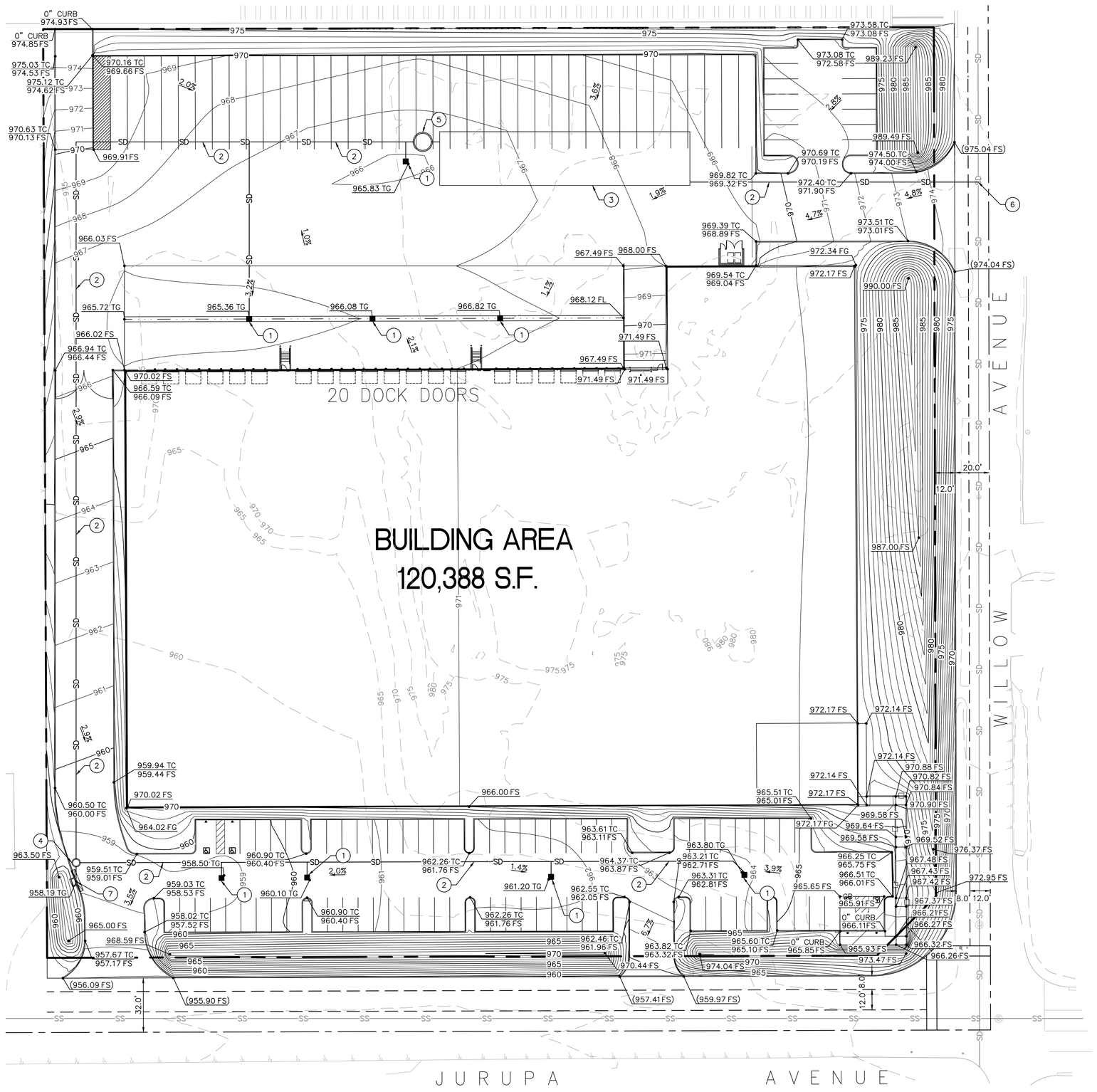
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CITY OF RIALTO CALIFORNIA

SHEET NUMBER
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GRADING LEGEND

———	PROPERTY LINE
- - - -	EASEMENT LINE
980	PROPOSED CONTOUR
980	EXISTING CONTOUR
FFE	FINISH FLOOR ELEVATION
TC	TOP OF CURB
FS	FINISH SURFACE
(974.50 TC) (975.00 FS)	EXISTING GRADE
974.50 TC 975.00 FS	PROPOSED GRADE

EARTHWORK*

CUT: 59,500 CY

FILL: 17,600 CY

NET: 41,900 CY (CUT)

*EARTHWORK QUANTITIES INCLUDE ROUGH PAVEMENT SECTION ESTIMATION

*FOR PERMITTING PURPOSES ONLY NOT FOR BID QUANTITY

CONSTRUCTION NOTES

1. PROPOSED GRATE INLET
2. PROPOSED STORM DRAIN LINE
3. PROPOSED UNDERGROUND DETENTION SYSTEM
4. PROPOSED STORM DRAIN MANHOLE
5. PROPOSED AQUA SWIRL PRE-TREATMENT
6. PROPOSED CONNECTION TO EXISTING STORM DRAIN LINE
7. PROPOSED CATCH BASIN

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

SCALE: 1" = 30'
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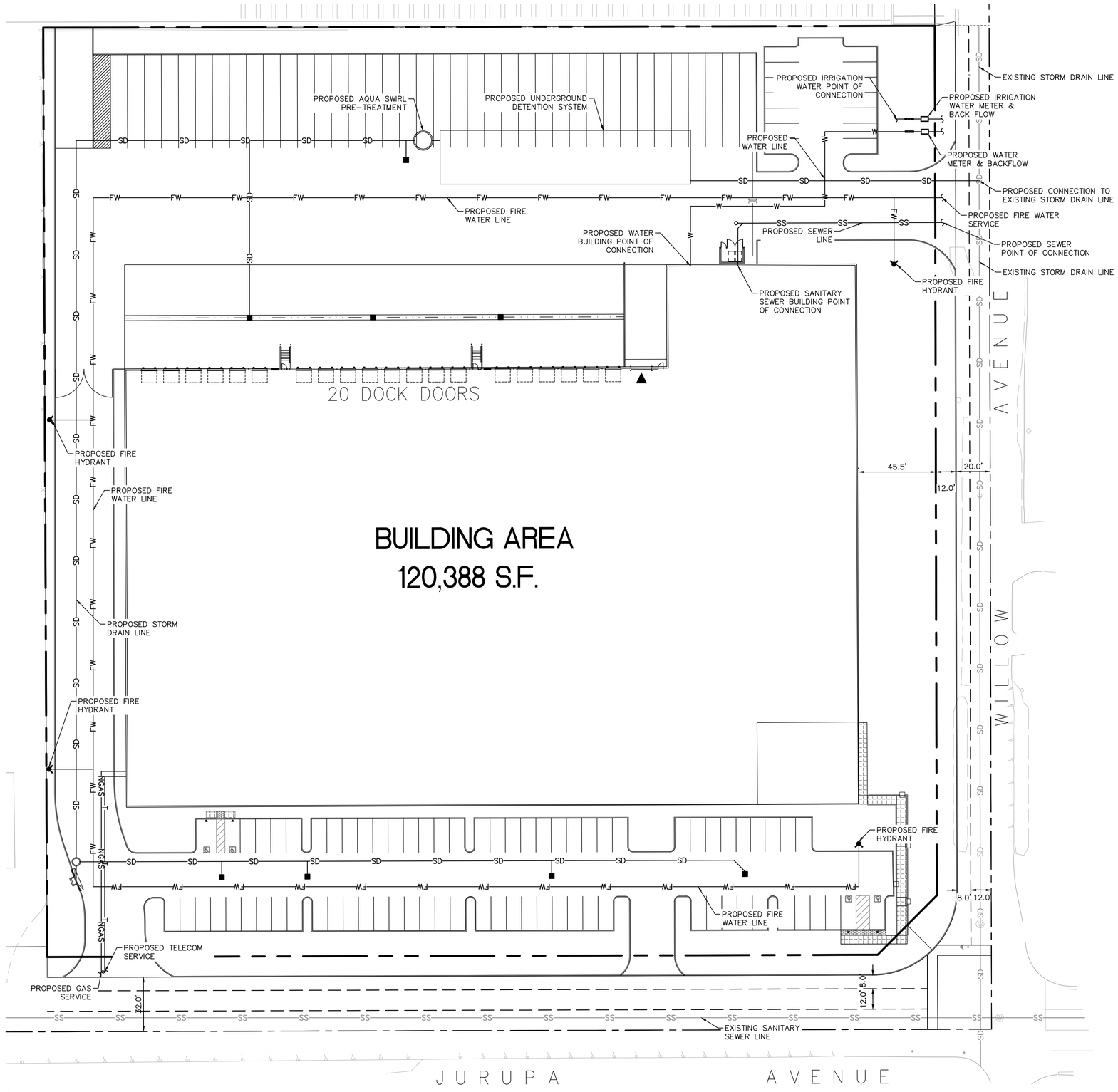
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UTILITY LEGEND

- PROPERTY LINE
- EXISTING EASEMENT
- W — PROPOSED WATER LINE
- SS — PROPOSED SANITARY LINE
- FW — PROPOSED FIRE WATER LINE
- NGAS — PROPOSED GAS LINE
- T — PROPOSED TELECOM LINE
- SD — PROPOSED STORM DRAIN LINE

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

SCALE: 1" = 30'
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GENERAL LANDSCAPE NOTES

1. THE WORK SHALL BE DONE IN ACCORDANCE WITH THE PLANS AND THE MOST CURRENT EDITION OF THE APPLICABLE CITY AND/OR REGIONAL STANDARDS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN COPIES OF THESE STANDARDS, SPECIFICATIONS AND DRAWINGS, AS WELL AS ALL OTHER STANDARDS AND SPECIFICATIONS WHICH MAY BE NECESSARY TO COMPLETE AND ACCURATELY INTERPRET THESE PLANS.
2. ALL QUANTITIES LISTED IN THE LANDSCAPE SCHEDULE ARE FOR THE CONVENIENCE OF THE CONTRACTOR. IN THE CASE OF ANY DISCREPANCIES, PLANS SHALL OVERRIDE THE LANDSCAPE AND BID SCHEDULE QUANTITIES. CONTRACTOR SHALL VERIFY QUANTITIES SHOWN ON THE PLANS AND BASE THEIR BID ACCORDINGLY.
3. RESPONSIBILITY FOR ESTABLISHING SUBGRADES IS NOT INCLUDED IN THIS WORK. INSPECT SUBGRADES PRIOR TO COMMENCING WORK TO CONFIRM SUBGRADE DEPTHS AND GRADES. ADVISE LANDSCAPE ARCHITECT OF DISCREPANCIES WITH DRAWINGS OR SPECIFICATIONS. ALL PLANTING AREAS SHALL BE LEFT FREE OF CONSTRUCTION DEBRIS AND/OR TOXIC MATERIAL AND GRADED TO A LEVEL TO PERMIT LANDSCAPE CONSTRUCTION. TRENCHES OR OTHER FILLED EXCAVATIONS SHALL BE COMPACTED PRIOR TO LANDSCAPE INSTALLATION.
4. SITE GRADING NECESSITATED BY THE WORK AS IT PROGRESSES AND NOT SPECIFICALLY CALLED OUT ON THE PLANS WILL BE CONSIDERED INCIDENTAL WORK.
5. ALL LANDSCAPE AREAS SHALL BE UNIFORMLY GRADED SO THAT FINISHED SURFACES CONFORM TO THE TYPICAL SECTIONS AND PROPOSED GRADES SHOWN. FINISHED SURFACES SHALL BE REASONABLY SMOOTH, COMPACTED, AND FREE FROM IRREGULAR SURFACE DRAINAGE. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING THE FINISH GRADE AND SHALL BEAR FINAL RESPONSIBILITY FOR PROPER SURFACE DRAINAGE OF PLANTED AREAS.
6. AFTER ROUGH GRADING HAS OCCURRED, CONTRACTOR SHALL OBTAIN AN AGRONOMIC SOILS REPORT AND SUBMIT TO LANDSCAPE ARCHITECT FOR APPROVAL PRIOR TO AMENDMENTS AND/OR PLANTING. CONTRACTOR SHALL APPLY RECOMMENDATIONS UNLESS OTHERWISE NOTED BY LANDSCAPE ARCHITECT.
7. BACKFILL MIX SHALL BE PLACED IN 6" LIFTS AND TAMPED INTO PLACE AROUND THE PLANT. NO TRANSPLANTING SHALL BE DONE WHEN SOIL IS EXCESSIVELY WET. DO NOT COUNTERSINK AROUND CACTI OR SUCCULENTS. PROVIDE POSITIVE DRAINAGE AWAY FROM PLANT.
8. ALL TREES SHALL BE PLANTED A MINIMUM OF 5 FEET, ALL SHRUBS AND ACCENTS A MINIMUM OF 24", AND ALL GROUNDCOVERS 18" FROM EDGE OF CURBS, WALKS, WALLS, PADS, ETC., UNLESS DIRECTED OTHERWISE BY THE LANDSCAPE ARCHITECT.
9. EXCAVATE PITS, AS SHOWN ON DRAWINGS AND DETAILS. LOOSEN HARD SUBSOIL IN BOTTOM OF PIT. TEST DRAINAGE OF TREE, SHRUB AND PLANT PITS BY FILLING WITH WATER TWICE IN SUCCESSION. THE RETENTION OF WATER IN PLANTING PITS FOR MORE THAN TWENTY-FOUR (24) HOURS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE. SUBMIT IN WRITING A PROPOSAL FOR THE CORRECTION TO THE OWNER'S REPRESENTATIVE FOR APPROVAL BEFORE PROCEEDING WITH WORK.
10. IF ROCK, UNDERGROUND CONSTRUCTION, ADVERSE DRAINAGE CONDITIONS, OR OTHER OBSTRUCTIONS ARE ENCOUNTERED IN EXCAVATION FOR PLANTING OF ANY PLANT MATERIAL, NOTIFY THE OWNER'S REPRESENTATIVE. NEW LOCATIONS MAY BE SELECTED BY THE OWNER'S REPRESENTATIVE, OR INSTRUCTIONS MAY BE ISSUED TO DIRECT REMOVAL OF OBSTRUCTION. PROCEED WITH WORK ONLY AFTER APPROVAL OF THE OWNER'S REPRESENTATIVE.
11. DO NOT MAKE SUBSTITUTIONS. IF SPECIFIED LANDSCAPE MATERIAL IS NOT OBTAINABLE, SUBMIT PROOF OF NON-AVAILABILITY FROM AT LEAST FIVE SOURCES TO THE OWNER'S REPRESENTATIVE, TOGETHER WITH PROPOSAL FOR USE OF EQUIVALENT MATERIAL FOR FINAL APPROVAL.
12. ALL PLANT MATERIAL AND SPECIFICATIONS TO CONFORM TO THE AMERICAN STANDARD FOR NURSERY STOCK STANDARDS UNLESS OTHERWISE NOTED.
13. LAY OUT INDIVIDUAL TREE AND PLANT LOCATIONS AND AREAS FOR MULTIPLE PLANTINGS, STAKE LOCATIONS AND OUTLINE AREAS AND SECURE THE OWNER'S REPRESENTATIVE'S ACCEPTANCE BEFORE START OF PLANTING WORK. MAKE MINOR ADJUSTMENTS AS DIRECTED.
14. ALL SHRUBS SHALL HAVE A FULL HEAD THAT COVERS THE CAN DIAMETER (CAN FULL) AND A MINIMUM OF THREE STEMS/BRANCHES.
15. FINISH GRADE FOR PLANTED AREAS SHALL BE 1" BELOW ALL CURBS, WALKS AND PAVING WITH SMOOTH EVEN LINES AT EDGES OF STRUCTURES.
16. FINISH LANDSCAPE GRADES SHALL SLOPE AT A 2% GRADE AWAY FROM CURBS, WALKS, AND WALLS.
17. ALL LANDSCAPE AREAS SHALL RECEIVE A 3" DEPTH OF MULCH, UNLESS OTHERWISE NOTED ON THESE PLANS. TREES TO HAVE A 6' DIAMETER RING AROUND TRUNK FREE OF MULCH. MULCH SHALL EXTEND UNDER ALL SHRUBS AND PLANTS. APPLY PRE-EMERGENT HERBICIDE PRIOR TO AND AFTER MULCH INSTALLATION.
18. PROVIDE SAMPLES OF PROPOSED MULCH SHOWING COLOR, GRADATION SIZE RANGE AND TEXTURE INCLUDING PROPOSED SOURCE. PROVIDE 1/2 CUBIC FOOT SAMPLE OF EACH.
19. ANY ROCK MULCH OR DECOMPOSED GRANITE SHALL NOT CONTAIN LUMPS OR BALLS OF CLAY, CALICHE, ORGANIC MATTER OR CALCAREOUS COATING. PROVIDE WEED BARRIER UNDER ALL DG AND/OR ROCK MULCH. THE CONTRACTOR SHALL ENSURE THAT SUFFICIENT QUANTITY IS AVAILABLE FROM A SINGLE SOURCE TO COMPLETE THE PROJECT. THE OWNER'S REPRESENTATIVE SHALL APPROVE SAMPLES PRIOR TO ORDERING.
20. NO JOB WILL BE CONSIDERED COMPLETE UNTIL ALL CURBS, PAVEMENT AND SIDEWALKS HAVE BEEN SWEPT CLEAN OF ALL DIRT AND DEBRIS ACCORDING TO PLANS.
21. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN ANY PERMITS REQUIRED. (SEE THE CITY GENERAL CONDITIONS)
22. ALL CONSTRUCTION ROADS AND COMPACTED AREAS DEVELOPED THROUGH CONSTRUCTION THAT ARE WITHIN THE LANDSCAPE AREAS SHALL BE SCARIFIED AND LOOSENED TO A DEPTH OF 12" PRIOR TO LANDSCAPE AND IRRIGATION WORK BEGINNING
23. PLANTINGS WITHIN THE SIGHT VISIBILITY TRIANGLE LINE SHALL BE MAINTAINED SO THAT NO LIMBS HANG LOWER THAN SEVEN (7) FEET AND SHRUBS OR OTHER PLANTS PLANTED WITHIN THE SIGHT VISIBILITY TRIANGLE LINE SHALL BE NO TALLER THAN TWO (2) FEET AT FULL GROWTH.

LANDSCAPE ARCHITECT NOTES

1. THE TERM "LANDSCAPE ARCHITECT" USED HEREIN SHALL MEAN THE LANDSCAPE ARCHITECT WHO HAS SIGNED AND SEALED THESE PLANS AND IS IN RESPONSIBLE CHARGE OF THE LANDSCAPE ARCHITECTURE DESIGN. THE TERM "CONTRACTOR" USED HEREIN SHALL MEAN ANY GENERAL CONTRACTOR OR SUBCONTRACTOR USING THESE PLANS. ANY AGENCY SIGNATURE OR APPROVAL ON THESE PLANS DOES NOT CONSTITUTE APPROVAL OF ANY OF THESE NOTES.
2. THE LANDSCAPE ARCHITECT WILL NOT PROVIDE, OBSERVE, COMMENT ON NOR ENFORCE ANY SAFETY MEASURES OR REGULATIONS. THE CONTRACTOR SHALL DESIGN, CONSTRUCT, AND MAINTAIN ALL SAFETY MEASURES AND SHALL BE SOLELY RESPONSIBLE FOR SAME AND COMPLYING WITH ALL LOCAL, STATE AND FEDERAL SAFETY AND HEALTH STANDARDS, LAWS, AND REGULATIONS. THE CONTRACTOR AGREES THAT SHE/HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOBSITE CONDITIONS AND SAFETY OF ALL PERSONS AND PROPERTY DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.
3. THE LANDSCAPE ARCHITECT SHALL HAVE NO RESPONSIBILITY FOR ANY OF THE CONTRACTOR'S MEANS AND METHODS OF CONSTRUCTION, TECHNIQUES, EQUIPMENT CHOICE AND USAGE, SEQUENCE, SCHEDULE, SAFETY PROGRAMS, OR SAFETY PRACTICES, NOR SHALL THE LANDSCAPE ARCHITECT HAVE ANY AUTHORITY OR RESPONSIBILITY TO STOP OR DIRECT THE WORK OF ANY CONTRACTOR.
4. THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE LANDSCAPE ARCHITECT AND OWNER, THEIR AGENTS AND EMPLOYEES, HARMLESS FROM ANY AND ALL CLAIMS, DEMANDS, JUDGMENTS, LOSS, DAMAGES, COSTS, EXPENSES, FEES OR LIABILITY WHATSOEVER, REAL OR ALLEGED, IN CONNECTION WITH, IN WHOLE OR IN PART, DIRECTLY OR INDIRECTLY, THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE LANDSCAPE ARCHITECT.
5. IF THERE ARE ANY QUESTIONS REGARDING THESE PLANS, THE CONTRACTOR SHALL REQUEST IN WRITING FROM THE LANDSCAPE ARCHITECT AND THE OWNER, AN INTERPRETATION BEFORE DOING ANY RELATED OR IMPACTED WORK.
6. THE CONTRACTOR SHALL TAKE THE NECESSARY STEPS TO PROTECT THE PROPERTY FROM ANY EROSION AND SILTATION THAT RESULT FROM CONTRACTOR OPERATIONS BY APPROPRIATE MEANS UNTIL SUCH TIME THAT THE PROJECT IS COMPLETED AND ACCEPTED FOR MAINTENANCE BY WHOMEVER IS TO BE ULTIMATELY RESPONSIBLE FOR MAINTENANCE.
7. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES PRIOR TO STARTING WORK NEAR THEIR FACILITIES AND SHALL COORDINATE WORK WITH UTILITY COMPANY REPRESENTATIVES.
8. THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED FROM A SEARCH OF READILY AVAILABLE RECORDS. NO REPRESENTATION IS MADE AS TO THE ACCURACY OR COMPLETENESS OF SAID UTILITY INFORMATION. THE CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN HEREON AND ANY OTHERS NOT OF RECORD OR NOT SHOWN ON THESE PLANS. ALL DAMAGES THERETO CAUSED BY THE CONTRACTOR SHALL BE REPAIRED TO THE APPROPRIATE SPECIFICATIONS AND STANDARDS AT THE SOLE EXPENSE OF THE CONTRACTOR.
9. THE LOCATION, ELEVATIONS, SIZE, TYPE AND CONDITION OF EXISTING IMPROVEMENTS ADJACENT TO THE PROPOSED WORK INDICATED ON THESE PLANS SHALL BE CONFIRMED BY THE CONTRACTOR BY FIELD MEASUREMENTS AND OBSERVATIONS PRIOR TO CONSTRUCTION OF NEW WORK. THE CONTRACTOR WILL IMMEDIATELY INFORM THE LANDSCAPE ARCHITECT IN WRITING IF ANY DISCREPANCIES OR CONFLICTING INFORMATION IS FOUND.
10. THE CONTRACTOR SHALL MAKE EXPLORATORY EXCAVATIONS AND LOCATE EXISTING UNDERGROUND FACILITIES AS NEEDED, SUFFICIENTLY AHEAD OF CONSTRUCTION TO PERMIT REVISIONS TO PLANS IF REVISIONS ARE NECESSARY DUE TO THE ACTUAL LOCATION, SIZE, TYPE, OR CONDITION OF EXISTING FACILITIES DIFFERING FROM WHAT IS SHOWN ON THESE PLANS.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL OF ANY DAMAGE TO THE EXISTING IMPROVEMENTS AND REPLACEMENT TO THE SATISFACTION OF THE OWNER.
12. SHOULD CONFLICTING INFORMATION BE FOUND ON THE PLANS THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT IN WRITING IMMEDIATELY BEFORE PROCEEDING WITH THE WORK IN QUESTION.
13. ANYTHING MENTIONED IN THE SPECIFICATIONS, IF ANY, AND NOT SHOWN ON THE DRAWINGS, OR SHOWN ON THE DRAWINGS AND NOT MENTIONED IN THE SPECIFICATIONS, SHALL BE OF LIKE EFFECT AS IF SHOWN OR MENTIONED IN BOTH.

PLANT SCHEDULE

TREES	CODE	QTY	BOTANICAL / COMMON NAME	CONT.	HEIGHT/SPREAD	CAL.	WUCOLS
	LC3	5	LAGERSTROEMIA INDICA `CHEROKEE` / CHEROKEE CRAPE MYRTLE	24" BOX	6`-7` HT. X 4`-5` SPR.	2" CAL.	MODERATE
	PR	15	PLATANUS RACEMOSA / CALIFORNIA SYCAMORE	24" BOX	10-12` HT. X 4-5` SPR.	2" CAL.	MODERATE
	TT	33	TIPUANA TIPU / TIPU TREE	24" BOX	9`-11` HT. X 4`-5` SPR.	2" CAL.	MODEATE

SHRUBS	CODE	QTY	BOTANICAL / COMMON NAME	CONT.	SPACING	WUCOLS
	AS	53	AGAVE ATTENUATA 'SUPER NOVA' / SUPER NOVA FOXTAIL AGAVE	5 GAL.	60" O.C.	LOW
	AP	86	ARTEMISIA X 'POWIS CASTLE' / POWIS CASTLE ARTEMISIA	5 GAL.	36" O.C.	LOW
	CL	509	CALLISTEMON VIMINALIS 'LITTLE JOHN' / LITTLE JOHN WEEPING BOTTLEBRUSH	5 GAL.	36" O.C.	LOW
	CD	74	CAREX DIVULSA / EUROPEAN GREY SEDGE	1 GAL.	24" O.C.	LOW
	HP	23	HESPERALOE PARVIFLORA / RED YUCCA	5 GAL.	48" O.C.	LOW
	LA	27	LAVANDULA ANGUSTIFOLIA / ENGLISH LAVENDER	5 GAL.	36" O.C.	LOW
	LF	22	LEUCOPHYLLUM FRUTESCENS / TEXAS SAGE	15 GAL.	48" O.C.	LOW
	MR	302	MUHLENBERGIA RIGENS / DEER GRASS	5 GAL.	36" O.C.	LOW
	RP	119	RHAPHIOLEPIS INDICA 'PINK LADY' / PINK LADY INDIAN HAWTHORN	5 GAL.	36" O.C.	LOW
	SB	117	SALVIA LEUCANTHA 'SANTA BARBARA' / MEXICAN BUSH SAGE	5 GAL.	36" O.C.	LOW
	WW	73	WESTRINGIA FRUTICOSA 'WYNABBIE GEM' / WYNABBIE GEM COAST ROSEMARY	5 GAL.	48" O.C.	LOW

GROUND COVERS	CODE	QTY	BOTANICAL / COMMON NAME	CONT.	SPACING	WUCOLS
	BP	429	BACCHARIS PILULARIS 'PIGEON POINT' / PIGEON POINT COYOTE BRUSH	1 GAL.	48" O.C.	LOW
	CH	160	CEANOTHUS HEARSTIORUM / HEARST CEANOTHUS	1 GAL.	36" O.C.	LOW

Know what's below. Call 811 before you dig.

Plotted By:Franco, Francisco Sheet Set:Kha Layout:L1.0 LANDSCAPE SCHEDULE AND NOTES October 28, 2022 09:39:06am K:\ORA_LDEV\Dedeaux\Jurupa and Willow — Industrial\CADD\Exhibits\Prelim Landscape Plan.dwg
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DEDEAUX PROPERTIES | DONLON BUILDERS

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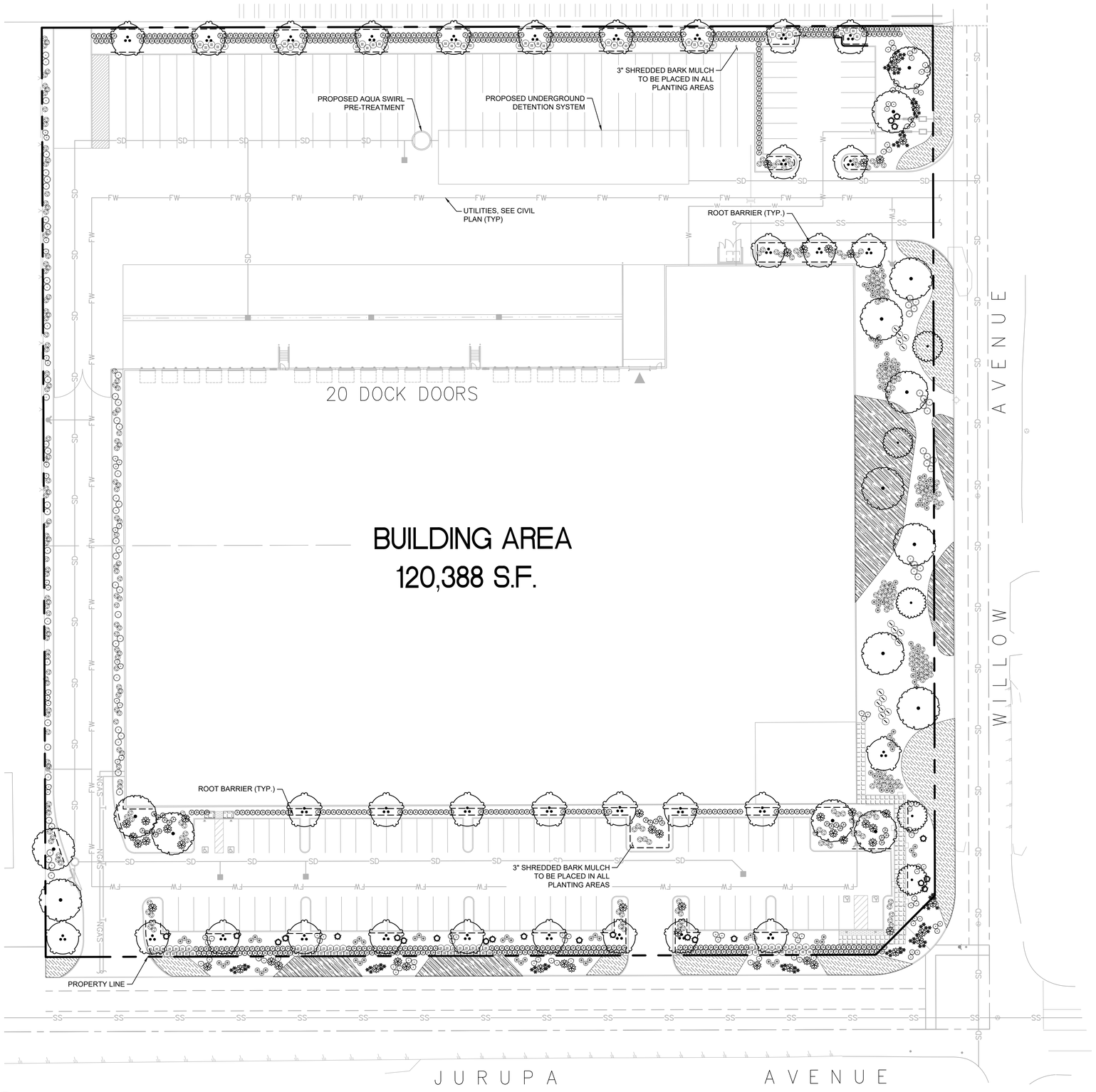
KHA PROJECT	194487001
DATE	2022/10/28
SCALE	AS SHOWN
DESIGNED BY	E.W
DRAWN BY	E.W
CHECKED BY	J.O

LANDSCAPE SCHEDULE AND NOTES

322-338 JURUPA AVE.
RIALTO, CA 92316

CITY OF RIALTO CALIFORNIA

SHEET NUMBER
L1.0



PLANT SCHEDULE (SEE SHEET L1.0 FOR FULL PLANT SCHEDULE)

TREES	CODE	QTY	BOTANICAL / COMMON NAME
	LC3	5	LAGERSTROEMIA INDICA `CHEROKEE` / CHEROKEE CRAPE MYRTLE
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	TT	33	TIPUANA TIPU / TIPU TREE

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GROUND COVERS	CODE	QTY	BOTANICAL / COMMON NAME
	BP	429	BACCHARIS PILULARIS 'PIGEON POINT' / PIGEON POINT COYOTE BRUSH
	CH	160	CEANOTHUS HEARSTIORUM / HEARST CEANOTHUS

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

SCALE: 1" = 30'
WHEN PRINTED AT FULL SIZE 24"X36"

DEDEAUX PROPERTIES
DONLON BUILDERS

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KHA PROJECT	194487001
DATE	2022/10/28
SCALE	AS SHOWN
DESIGNED BY	EW
DRAWN BY	EW
CHECKED BY	JO

LANDSCAPE PLAN

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SHEET NUMBER
L1.1

Plotted By:Franco, Francisco Sheet Set:Kha Layout:L1.1 LANDSCAPE PLAN October 28, 2022 09:39:11am K:\ORA_LDEV\Dedeaux\Jurupa and Willow — Industrial\CADD\Exhibits\Prelim Landscape Plan.dwg
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Section 6.4.8 Preliminary WQMP

To be prepared in Final Engineering