Preliminary Water Quality Management Plan

For:

Tract 20481

ID: PROJ-2022-00037

APN 1011-351-02

WQMP-2022-00034

Prepared for:

All-Era Properties, LLC

PO Box 11503

Carson, CA 90749

310-768-3338

Byron Walker

Prepared by:

Encompass Associates, Inc.

5699 Cousins Place

Rancho Cucamonga, CA 91737

909-684-0093

Aaron Skeers, P.E.

Date: August 30, 2022

Approval Date:_____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for All-Era Properties, LLC by Encompass Associates, Inc. The WQMP is intended to comply with the requirements of the County of San Bernardino 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):	WQMP-2022-00034 PROJ-2022-00037	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	Tract 20481	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0257-021-28, 0257-031-35

Owner's Signature		
Owner Name:	Byron Walker	
Title	Owner	
Company	All-Era Properties, LLC	
Address	PO Box 11503	
Email	bwalker@alleraproperties.com	
Telephone #	310-768-3338	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	WQMP-2022-00034 PROJ-2022-00037	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	Tract 20481	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			Lot 1 (with 180 Condominium Units)

"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."

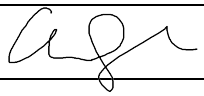
Engineer:	Aaron T. Skeers, P.E.	PE Stamp Below
Title	President	
Company	Encompass Associates, Inc.	
Address	5699 Cousins Place, Rancho Cucamonga, CA, 91737	
Email	askeers@encompasscivil.com	
Telephone #	909-684-0093	
Signature		
Date	9/1/2022	

Table of Contents

Forms

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Tract 20481				
Project Owner Contact Name:	Byron Walker				
Mailing Address:	PO Box 11503 Carson, CA 90749	E-mail Address:	bwalker@allerapproperties.com	Telephone:	310-768-3338
Permit/Application Number(s):	WQMP-2022-00034 PROJ-2022-00037	Tract/Parcel Map Number(s):	Lot 1 (with 180 Condominium Units)		
Additional Information/ Comments:	**Notice to homeowners:** removal or revision of BMPs described in this document and as constructed is prohibited. Maintenance is required and shall be conducted as described in this document.				
Description of Project:	Subdivision of 154 detached condominium units on three parcels, all on an existing vacant property south of Orchard Street and Slover Avenue, West of Linden Avenue, and north of Santa Ana Avenue. Single-family residences exist to the north, west and south. An unimproved SBCFCD easement comprises the easterly boundary of the site. In addition to the residential buildings, the condo site will be comprised of drives, parking, a private park with tot lot, and paseos throughout. DA 1 comprises the entire site and is 494,560 sf, with 146,046 sf pervious and 348,514 sf impervious (buildings, pavement, sidewalks and driveways). All runoff drains as sheet flow across the properties to the south and onto Santa Ana Avenue. All proposed runoff will be collected via area drains inlets and pipes and conveyed to an underground perforated pipe infiltration system. Discharge in excess of the water quality volume will surface drain out to the existing properties to the south. A CDS clarifier is proposed for pre-treatment purposes.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.					

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

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

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

2 Project Area (ft2):	623610	**3** Number of Dwelling Units:	180	**4** SIC Code:	6513,6514

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:

The site will be maintained by the Homeowner's Association.

Until the HOA is established, the following will be the contact information:

All-Era Properties, LLC

PO Box 11503

Carson, CA 90749

310-768-3338

Byron Walker

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 ☐	Bacterial indicators are routinely detected in pavement runoff. Can be caused by the transport of human or fecal wastes in runoff. Santa Ana River Reaches 2-4
Phosphorous	E ☒	N ☐	Primary sources are from fertilizers and eroded soils. Eroded soils can be deposited by air to the site.
Nitrogen	E ☒	N ☐	Expected pollutant due to on-site landscaping
Sediment	E ☒	N ☐	Expected pollutant due to on-site landscaping
Metals	E ☒	N ☐	The primary source is emissions from brake pad and tire tread wear associated with driving. Santa Ana River Reach 3
Oil and Grease	E ☒	N ☐	Expected pollutant due to uncovered parking areas. Petroleum hydrocarbon products for motor vehicles and equipment are the primary source.
Trash/Debris	E ☒	N ☐	Even with good housekeeping practices, random trash and debris can still exist on site after being blown in from adjacent properties, roadways, etc.
Pesticides / Herbicides	E ☒	N ☐	These products can be washed off urban landscapes and hardscapes during storm events.
Organic Compounds	E ☒	N ☐	Expected due to on-site landscaping. Includes solvents.
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] **50%**	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % **0%** *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)	N/A		

Section 3 Site and Watershed Description

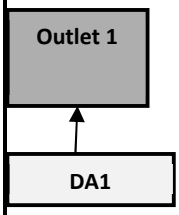
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.0595°N	Longitude 117.3993°W	Thomas Bros Map page 601

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

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



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA 1 to Outlet 1	*There is proposed to be one WQ BMP, therefore one DA / DMA. Overflow from DA1 discharges to Santa Ana Avenue to the south*

Form 3-2 Existing Hydrologic Characteristics for Drainage Areas 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DA 1 / DMA A			
1 DMA drainage area (ft^2)	623610			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	A			
5 Longest flowpath length (ft)	2580			
6 Longest flowpath slope (ft/ft)	0.01			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Grass			
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*	Fair (60%)			

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool -* *http://sbcounty.permitrack.com/WAP* *See 'Drainage Facilities" link at this website*	Santa Ana River Reach 4 Santa Ana River Reach 3 Prado Flood Control Basin Santa Ana River Reach 2 Santa Ana River Reach 1 Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River, Reach 3: Pathogens
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Santa Ana River, Reach 4: Indicator Bacteria Santa Ana River, Reach 3: Copper, Lead, Indicator Bacteria Prado Flood Control Basin - pH
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	No
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	Santa Ana River
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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

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

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	☒	☐	Property owner shall be provided educational material including but not limited to: litter/trash collection program, water conservation, and guidelines on stormwater quality consistent with and County guidelines. Training will be required within 6 months of hire dates for new employees, and then annually thereafter
N2	Activity Restrictions	☒	☐	Use restrictions shall include the following: no rubbish, trash, garbage, or other waste material shall be kept or permitted on or adjacent to the site, the common area, or on any public street abutting or visible from the property, except in proper refuse enclosures or DOT 55 gallon drum sanitary containers. No odor shall be permitted to arise therefrom so as to render the property, or any portion thereof, unsanitary, or detrimental to any other property in the vicinity therof or its occupants. Pesticide application shall be by permitted operators only in accordance with manufacturer's specifications.
N3	Landscape Management BMPs	☒	☐	Plants with similar water requirements shall be grouped in order to reduce excess irrigation runoff, promote surface filtration, and adhere to County landscape design standards. Landscaping shall be maintained monthly or as required by maintenance personnel, and waste disposed and/or recycled in appropriate bins per County requirements. Fertilizers and amendments shall be applied only per manufacturers specifications.
N4	BMP Maintenance	☒	☐	The owner is responsible to ensure BMPs are properly maintained. Maintenance for BMPs are shown in Appendix A
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No medical waste to be stored onsite.
N6	Local Water Quality Ordinances	☒	☐	The project shall comply with any local water quality ordinances as determined by the County of San Bernardino.
N7	Spill Contingency Plan	☒	☐	The owner or agent will prepare and maintain spill contingency plans as required by local, state, and federal requirements. A spill plan for chlorine for the pool is provided in Appendix A. Spill absorbent materials shall be kept on-site. All employees will be trained in spill contingency planning, spill prevention, notification, and cleanup.
N8	Underground Storage Tank Compliance	☐	☒	No proposed USTs
N9	Hazardous Materials Disclosure Compliance	☒	☐	Pool chemicals (chlorine) require careful handing by qualified, trained personnel only. Limit storage to 5 separate 1 gallon sealed containers. Storage and usage shall be limited to the immediate pool area.

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	☒	☐	Pool chemicals (chlorine) require careful handing by qualified, trained personnel only. Limit storage to 5 separate 1 gallon sealed containers. Storage and usage shall be limited to the immediate pool area.
N11	Litter/Debris Control Program	☒	☐	The owner shall implement trash management and litter control procedures to prevent off-site migration of trash. Specifically, the owner/operator will inspect the site on a daily basis and will ensure that all litter is removed for proper disposal on a regular basis.
N12	Employee Training	☒	☐	Owner/operator shall provide a training program for all employees, within 3 months of initial hiring, and annually thereafter. Include a litter/trash collection program, water conservation, and guidelines on stormwater quality consistent with County guidelines.
N13	Housekeeping of Loading Docks	☐	☒	No loading docks on this project
N14	Catch Basin Inspection Program	☒	☐	Catch basins to be maintained as part of routine landscape maintenance, including inspection, removal of debris and trash (with proper disposal). Owner will have at least 80% of drainage facilities inspected, cleaned and maintained on an annual basis and 100% of the facilities included in a two-year period.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking lots shall be vacuum swept at least twice annually, prior to the storm season in the late summer or early fall, to reduce the amount of sediment, garden waste, and trash entering the storm drain systems
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Project is not a public agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	Project will comply with NPDES requirements during and after construction, including compliance with a site-specific SWPPP which meets State General Construction Permit requirements

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)	☒	☐	Management company to regularly inspect catch basin stencil (see exhibit, "NO DUMPING/DRAINS TO RIVER") to ensure it is legible and to have it inspected quarterly and reapplied as needed.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage proposed
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash and waste storage areas shall be designed to reduce pollution introduction and will comply with local ordinances and requirements. The proposed trash enclosure will have a roof, paved underneath and the paved grades surrounding the enclosure will be such to prevent stormwater from entering the trash enclosure area.
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 be electronically controlled and set for optimum water timing. Irrigation duration times shall be short to minimize the potential for overwatering and runoff. Irrigation shall be tested monthly as part of landscape maintenance and repairs made as part of inspection. Malfunctions reported at other times shall be repaired within 24 hours.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaping will be designed to be 1-2 inches below top of curb, sidewalk or pavement.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No slopes with significant runoff are proposed.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No docks are proposed for this project.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered maintenance bays
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Vehicle washing is not part of this project. Vehicle washing is prohibited.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing is proposed.

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)	☐	☒	There is no equipment washing proposed for this project. Washing of equipment is prohibited on-site.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	There is no fueling proposed for this project.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillsides on site.
S14	Wash water control for food preparation areas	☐	☒	There is no food preparation proposed for this project.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	There is no car washing proposed for this project.

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: Street widths are at the minimum allowed. There will be 348,514 sf of impervious area and 146,046 sf of landscaping
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Building runoff will be discharged to adjacent landscaping. There is 146,046 sf of landscaping proposed.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Street flow length is longer than original, natural flow path, and is directed to WQ retention facilities, which helps increase time of concentration. Proposed drainage is to the south, consistent with existing drainage.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Lot runoff drains to infiltration BMP prior to discharge into Santa Ana Avenue. Street runoff will be directed to on-lot BMPs.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: Optimized site layout and grading does not provide for protection of existing vegetation, however there is proposed landscaping throughout the site.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Landscaping will be installed on lots and in parkways
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Infiltration BMPs will be per manufacturer's specifications, are outside of the building pad, therefore compaction will be less
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Swales are not utilized. All runoff is directed to retention facilities.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Common area landscaping and infiltration BMP areas will be staked off to limit compaction during construction.

4.2 Project Performance Criteria

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

Methods applied in the following forms include:

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

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

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

1 Project area DA 1 (ft^2): 623610	**2** Imperviousness after applying preventative site design practices (Imp%): 70%	**3** Runoff Coefficient (Rc): 0.49 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): **0.53** *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.78 *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): 38989 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

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

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

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

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

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

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

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

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

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

11 Precipitation for 2 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

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

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

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

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

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

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o = *Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) V_{fps} = *(1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*								
11 Travel time to outlet (min) T_t = *Item 6 / (Item 10 * 60)*								
12 Total time of concentration (min) T_c = *Item 5 + Item 11*								
13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*								
14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*								
15 Additional time of concentration needed to meet HCOC requirement (min): $T_{C\text{-}HCOC}$ = *(Item 14 * 0.95) – Item 13*								

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1-3)

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (ft^2) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B		*n/a*			*n/a*	
	DMA C			*n/a*			*n/a*

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

4.3 Project Conformance Analysis

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

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

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

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

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

1 Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒

Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒

(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis:

7 Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒

If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 9 below.

8 Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒

If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.
If no, then proceed to Item 9, below.

9 All answers to Item 1 through Item 6 are "No": Yes ☒ 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 1 DMA A BMP Type	DA DMA BMP Type	DA DMA BMP Type
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): 0 *$V_{retention}$ =Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA 1 DMA A BMP Type	DA 1 DMA BMP Type	DA 1 DMA BMP Type
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (for paver voids: 10% of 4" depth)			
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 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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): 0 $V_{retention}$ *=Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 20-2. If no, proceed to Item 24*	DA 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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): 0 $V_{retention}$ *= Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrels/cisterns: Yes☐ No ☒ *If yes, complete Items 27-28; If no, proceed to Item 29*	DA 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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): 0 $V_{retention}$ *=Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 Infiltration BMPs

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

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

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

.

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

1 Remaining LID DCV not met by site design HSC BMP (ft³): 38989 *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 BMP Type Infiltration System		
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*	11.57		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.44		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.36		
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*	13.45		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	9		
8 Infiltrating surface area, SA_{BMP} (ft²) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	6168 (from manufacturer sheet, just for infiltration area)		
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*			
10 Amended soil porosity			
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*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft³) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Underground Retention Volume (ft³) *Volume determined using manufacturer's specifications and calculations*	49191		

16 Total Retention Volume from LID Infiltration BMPs: 49191 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 126 % (over) *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.3 Harvest and Use BMP

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

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

Form 4.3-4 Harvest and Use BMPs (DA 1&2)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0 sf

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 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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 n/a *Sum of Item 8 for all harvest and use BMP included in plan*

10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest and use BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.

4.3.4 Biotreatment BMP

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

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

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

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1&2)

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.* Pathogens, Nitrogen, Sediment, Oil & Grease, Trash/Debris, Pesticides/Herbicides	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): 0 *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): 0 *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): n/a *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-6 Volume Based Biotreatment (DA 1 & 2) – Bioretention and Planter Boxes with Underdrains

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

Form 4.3-7 Volume Based Biotreatment (DA 1 & 2) – Constructed Wetlands and Extended Detention

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

Form 4.3-8 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

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

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 38989 *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): 49191 *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): 0.0 *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

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

Form 4.3-10 Hydromodification Control BMPs (DA 1 - 3)

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): n/a *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): - n/a *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): n/a *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 ☐ n/a

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 ☐ n/a

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).

Alternative Compliance Plan is not applicable to the Project.

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	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N11- Litter/Debris Control	Owner/Manager	Inspect site on a daily basis. Remove trash and debris and dispose into proper trash receptacles	Daily
N15- Vacuum Sweeping of Parking Lots	Owner/Manager	Vacuum sweep parking lots at least twice annually to reduce the amount of sediment, garden waste, and trash entering into BMPs.	In the month of September and in the month of January at minimum.
N3,S5- Landscape Maintenance	Owner/Manager	Remove trash and debris and rake soils to maintain 1 to 2 inch depression next to hardscape	Monthly
N3-Landscape Maintenance	Owner/Manager	Limit pesticide and herbicide use. If pesticides/herbicides are used they shall be used in conformance with manufacturers recommendations regarding application rate and applied by a certified applicator.	N/A
N3-Landscape Maintenance	Owner/Manager	Eradicate weeds and prune back excess plant growth. Remove invasive vegetation. Limit overspray of landscaping from draining into the storm drain inlets. Excess periodic drainage will result in a shorter useful life for the infiltration system. Fix broken sprinkler system components immediately. Ensure proper watering levels are maintained to ensure overspray and runoff is limited.	Monthly
Infiltration Pipe	Owner/Manager	Inspection of hydraulic and structural facilities. Examine inlets for blockage, as well as damage to any structural element	Once per year between September 1 and September 30
Infiltration Pipe	Owner/Manager	Check pipe depth for sediment build-up and reduced total capacity. Vacuum bottom as needed and remove sediment. Restore to original cross-section and infiltration rate.	Once per year between September 1 and September 30
Infiltration Pipe	Owner/Manager	No water should be present 72 hours after an event. No long-term standing water should be present at all. No algae formation should be visible. Correct problem as required.	Within three days of storm end.

Infiltration Pipe	Owner/Manager	Remove debris and litter from the system to minimize clogging.	Monthly, and before and after rainfall events.
Infiltration Pipe	Owner/Manager	Check for obvious problems and repair as needed. Address odor, insects, and overgrowth issues (weeds) associated with stagnant or standing water in the bottom. There should be no long-term ponding water.	Monthly, and before and after rainfall events.
CDS Clarifier (Pre-treatment)	Property Owners	Inspect for debris/sediment accumulation after rain event. If debris is accumulating, a vactor truck shall be hired to remove dirt/debris	Monthly, and before and after rainfall events.
S1—Storm Drain Stenciling and Signage	Property Owners	Maintain stenciling and/or signage so that the messages are highly visible. Stenciling and signage shall be repaired immediately if vandalized or removed.	Quarterly at minimum.
Spill Contingency Plan (N7)	Property Owners	Ensure the spill cleanup kit is adequately supplied and located near the pool chemical storage. Ensure only properly qualified and trained personnel are handling these chemicals and are trained in what to do if a spill should occur.	Monthly
N1-Eductaion for Property Owners, Tenants, and Occupants	Owner	As part of employee orientation, all employees will be educated on the information shown. Information about hazardous materials and uniform fire code will be posted per OSHA and local ordinances.	With 6 months of hiring and annually thereafter

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

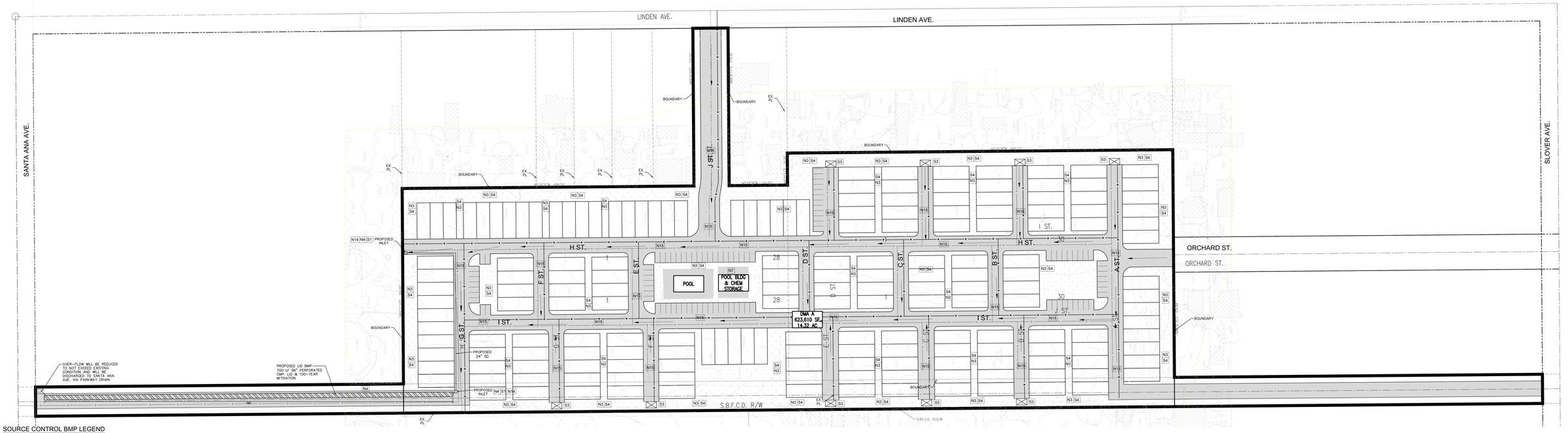
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

Appendix A: Operation and Maintenance Plan
Appendix B: Supporting Documentation
Appendix C: BMP Educational Materials
Appendix D: Soils Report
Appendix E: Factor of Safety Calculation
Appendix F: Agreement

WQMP Plan (In Back Pocket)

WATER QUALITY MANAGEMENT PLAN
TRACT 20481



SITE INFORMATION

APN: 0257-031-08 & 0257-031-35
AREA: 623610 SF / 14.32 AC

IMPERVIOUS AREA 439021 SF (70%)

VICINITY MAP
1"=2000'

SOURCE CONTROL BMP LEGEND

N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs
N2	Activity Restrictions
N3	Landscape Management BMPs
N4	BMP Maintenance
N6	Local Water Quality Ordinances
N7	Spill Contingency Plan (Supplies to be stored near Pool Chemical Storage, in Pool Building)
N11	Litter/Debris Control Program
N12	Employee Training
N14	Catch Basin Inspection Program
N15	Vacuum Sweeping of Private Streets and Parking Lots
N17	Comply with all other applicable NPDES permits
S1	Provide storm drain system stenciling and signage
S3	Design and Construct Trash and Waste Storage areas
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

CATCH BASIN STENCIL

BMP SUMMARY TABLE			
DA/BMP	AREA (SF)	DCV (CF)	V-PROVIDED (CF)
DA 1/BMP 1	623,610	38989	49191

LEGEND

TB	–	TRACT BOUNDARY	PROPOSED STORM DRAIN
PL	–	PROPERTY LINE	EXISTING STORM DRAIN
R/W	–	RIGHT-OF-WAY	PROPOSED WATER LINE
CL	–	CENTERLINE	EXISTING WATER LINE
EP	–	EDGE OF PAVEMENT	PROPOSED FIRE LINE
TC	–	TOP OF CURB	EXISTING FIRE LINE
FL	–	FLOWLINE	PROPOSED SEWER LINE
FS	–	FINISHED SURFACE	EXISTING SEWER LINE
GB	–	GRADE BREAK	PROPERTY LINE
INV	–	PIPE INVERT	RIGHT-OF-WAY
FG	–	FINISH GRADE	CENTERLINE
ES	–	EXISTING SURFACE	RETAINING WALL
EG	–	EXISTING GROUND	INDICATES EXTRA DEPTH FOOTING
PAD	–	PAD ELEVATION	STREETLIGHT
FF	–	FINISH FLOOR ELEVATION	DRIVEWAY APPROACH
GF	–	GARAGE FLOOR ELEVATION	DRAIN INLET
DF	–	DRAIN FLOW	AREA DRAIN SYSTEM
TRW	–	TOP OF RETAINING WALL	DA BOUNDARY
TF	–	TOP OF FOOTING	DMA BOUNDARY
97.61	–	INDICATES PROPOSED ELEVATION	PCC PAVEMENT
(97.61)	–	INDICATES EXISTING ELEVATION	

DEVELOPER
BYRON WALKER
ALL-ERA PROPERTIES, LLC
PO BOX 11503
CASTRO VALLEY, CA 94549
bwalker@allerapropertes.com
310-768-3338

TRACT NO. 20481

WATER QUALITY MANAGEMENT PLAN

VERSION HISTORY

6/22	EXPAND INTO SBCFCD R/W
10/21	INITIAL SUBMITTAL

SHEET

1 1

Appendix A: Operation and Maintenance Plan

Appendix B: Supporting Documentation

WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Friday, November 12, 2021

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):	025702128, 025703135
Project Site Acreage:	11.288
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** - **Facility Name** - Mulberry Channel **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	EHM
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	No
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	A
Environmentally Sensitive Areas within 200':	None
Groundwater Depth (FT):	-247
Parcels with potential septic tanks within 1000':	Yes
Known Groundwater Contamination Plumes within 1000':	No
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 SBCounty CSDP Project No.2 Volume 1 SBCounty CSDP Project No.2 Volume 2 Volume 2 Map SBCounty CSDP Project No.3 Volume I SBCounty CSDP Project No.3 Volume II SBVMWD High Groundwater / Pressure Zone Area

NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, USA*
Latitude: 34.0595°, Longitude: -117.3993°
Elevation: 1054.32 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	**0.108** (0.090-0.131)	**0.140** (0.117-0.170)	**0.183** (0.152-0.223)	**0.219** (0.180-0.269)	**0.269** (0.214-0.342)	**0.308** (0.240-0.400)	**0.349** (0.265-0.465)	**0.392** (0.289-0.538)	**0.453** (0.320-0.649)	**0.503** (0.343-0.746)
10-min	**0.155** (0.129-0.188)	**0.201** (0.167-0.244)	**0.263** (0.218-0.320)	**0.314** (0.258-0.385)	**0.385** (0.306-0.490)	**0.442** (0.344-0.573)	**0.500** (0.379-0.666)	**0.562** (0.414-0.771)	**0.650** (0.459-0.930)	**0.721** (0.491-1.07)
15-min	**0.188** (0.156-0.228)	**0.243** (0.203-0.295)	**0.318** (0.264-0.387)	**0.380** (0.313-0.466)	**0.466** (0.370-0.592)	**0.534** (0.415-0.693)	**0.605** (0.459-0.806)	**0.680** (0.501-0.933)	**0.786** (0.555-1.13)	**0.872** (0.594-1.29)
30-min	**0.280** (0.233-0.340)	**0.363** (0.302-0.441)	**0.474** (0.393-0.577)	**0.566** (0.466-0.695)	**0.695** (0.553-0.883)	**0.797** (0.620-1.03)	**0.902** (0.684-1.20)	**1.01** (0.748-1.39)	**1.17** (0.828-1.68)	**1.30** (0.886-1.93)
60-min	**0.409** (0.341-0.496)	**0.530** (0.441-0.643)	**0.692** (0.574-0.842)	**0.827** (0.680-1.01)	**1.01** (0.806-1.29)	**1.16** (0.904-1.51)	**1.32** (0.999-1.75)	**1.48** (1.09-2.03)	**1.71** (1.21-2.45)	**1.90** (1.29-2.81)
2-hr	**0.599** (0.499-0.726)	**0.769** (0.640-0.934)	**0.994** (0.825-1.21)	**1.18** (0.970-1.45)	**1.43** (1.14-1.82)	**1.63** (1.27-2.12)	**1.84** (1.39-2.44)	**2.05** (1.51-2.81)	**2.34** (1.66-3.35)	**2.58** (1.76-3.83)
3-hr	**0.747** (0.623-0.906)	**0.957** (0.797-1.16)	**1.23** (1.02-1.50)	**1.46** (1.20-1.79)	**1.77** (1.40-2.24)	**2.00** (1.56-2.60)	**2.25** (1.70-2.99)	**2.50** (1.84-3.43)	**2.85** (2.01-4.08)	**3.13** (2.13-4.64)
6-hr	**1.06** (0.879-1.28)	**1.35** (1.13-1.64)	**1.74** (1.44-2.12)	**2.05** (1.69-2.52)	**2.48** (1.97-3.15)	**2.80** (2.18-3.64)	**3.13** (2.37-4.17)	**3.47** (2.56-4.76)	**3.93** (2.78-5.63)	**4.30** (2.93-6.37)
12-hr	**1.40** (1.17-1.70)	**1.81** (1.51-2.19)	**2.33** (1.94-2.84)	**2.75** (2.27-3.38)	**3.32** (2.64-4.21)	**3.75** (2.91-4.86)	**4.18** (3.17-5.56)	**4.62** (3.41-6.34)	**5.22** (3.69-7.47)	**5.69** (3.87-8.43)
24-hr	**1.88** (1.66-2.16)	**2.44** (2.16-2.82)	**3.17** (2.80-3.67)	**3.76** (3.29-4.39)	**4.55** (3.85-5.48)	**5.14** (4.26-6.32)	**5.74** (4.65-7.23)	**6.35** (5.00-8.22)	**7.17** (5.42-9.67)	**7.80** (5.71-10.9)
2-day	**2.28** (2.02-2.63)	**3.02** (2.67-3.49)	**3.99** (3.52-4.62)	**4.77** (4.17-5.56)	**5.83** (4.93-7.02)	**6.63** (5.50-8.16)	**7.45** (6.03-9.38)	**8.29** (6.53-10.7)	**9.43** (7.13-12.7)	**10.3** (7.54-14.4)
3-day	**2.44** (2.16-2.82)	**3.29** (2.91-3.80)	**4.40** (3.88-5.10)	**5.31** (4.65-6.19)	**6.55** (5.55-7.89)	**7.51** (6.23-9.23)	**8.48** (6.87-10.7)	**9.50** (7.48-12.3)	**10.9** (8.23-14.7)	**12.0** (8.75-16.7)
4-day	**2.63** (2.33-3.03)	**3.58** (3.16-4.13)	**4.82** (4.25-5.58)	**5.84** (5.11-6.82)	**7.25** (6.14-8.73)	**8.34** (6.92-10.3)	**9.46** (7.66-11.9)	**10.6** (8.37-13.8)	**12.2** (9.25-16.5)	**13.5** (9.86-18.8)
7-day	**3.00** (2.66-3.46)	**4.14** (3.66-4.77)	**5.63** (4.96-6.51)	**6.86** (6.00-8.00)	**8.55** (7.24-10.3)	**9.88** (8.19-12.1)	**11.2** (9.11-14.2)	**12.7** (9.99-16.4)	**14.6** (11.1-19.7)	**16.2** (11.9-22.6)
10-day	**3.26** (2.89-3.76)	**4.52** (4.00-5.21)	**6.18** (5.45-7.15)	**7.56** (6.61-8.81)	**9.46** (8.01-11.4)	**10.9** (9.08-13.5)	**12.5** (10.1-15.7)	**14.1** (11.1-18.3)	**16.4** (12.4-22.1)	**18.2** (13.3-25.3)
20-day	**3.95** (3.50-4.55)	**5.51** (4.87-6.36)	**7.60** (6.70-8.79)	**9.34** (8.17-10.9)	**11.8** (9.97-14.2)	**13.7** (11.4-16.8)	**15.7** (12.7-19.8)	**17.8** (14.1-23.1)	**20.8** (15.8-28.1)	**23.3** (17.0-32.4)
30-day	**4.67** (4.14-5.39)	**6.53** (5.77-7.53)	**9.01** (7.95-10.4)	**11.1** (9.71-13.0)	**14.0** (11.9-16.9)	**16.4** (13.6-20.1)	**18.8** (15.3-23.7)	**21.5** (16.9-27.8)	**25.2** (19.1-34.0)	**28.2** (20.6-39.4)
45-day	**5.58** (4.94-6.44)	**7.73** (6.84-8.93)	**10.6** (9.39-12.3)	**13.1** (11.5-15.3)	**16.6** (14.0-20.0)	**19.4** (16.1-23.8)	**22.3** (18.1-28.1)	**25.5** (20.1-33.0)	**30.1** (22.8-40.6)	**33.8** (24.7-47.2)
60-day	**6.53** (5.78-7.53)	**8.95** (7.92-10.3)	**12.2** (10.8-14.2)	**15.0** (13.2-17.5)	**19.0** (16.1-22.9)	**22.2** (18.4-27.3)	**25.6** (20.8-32.3)	**29.3** (23.1-38.0)	**34.6** (26.2-46.7)	**39.1** (28.6-54.5)

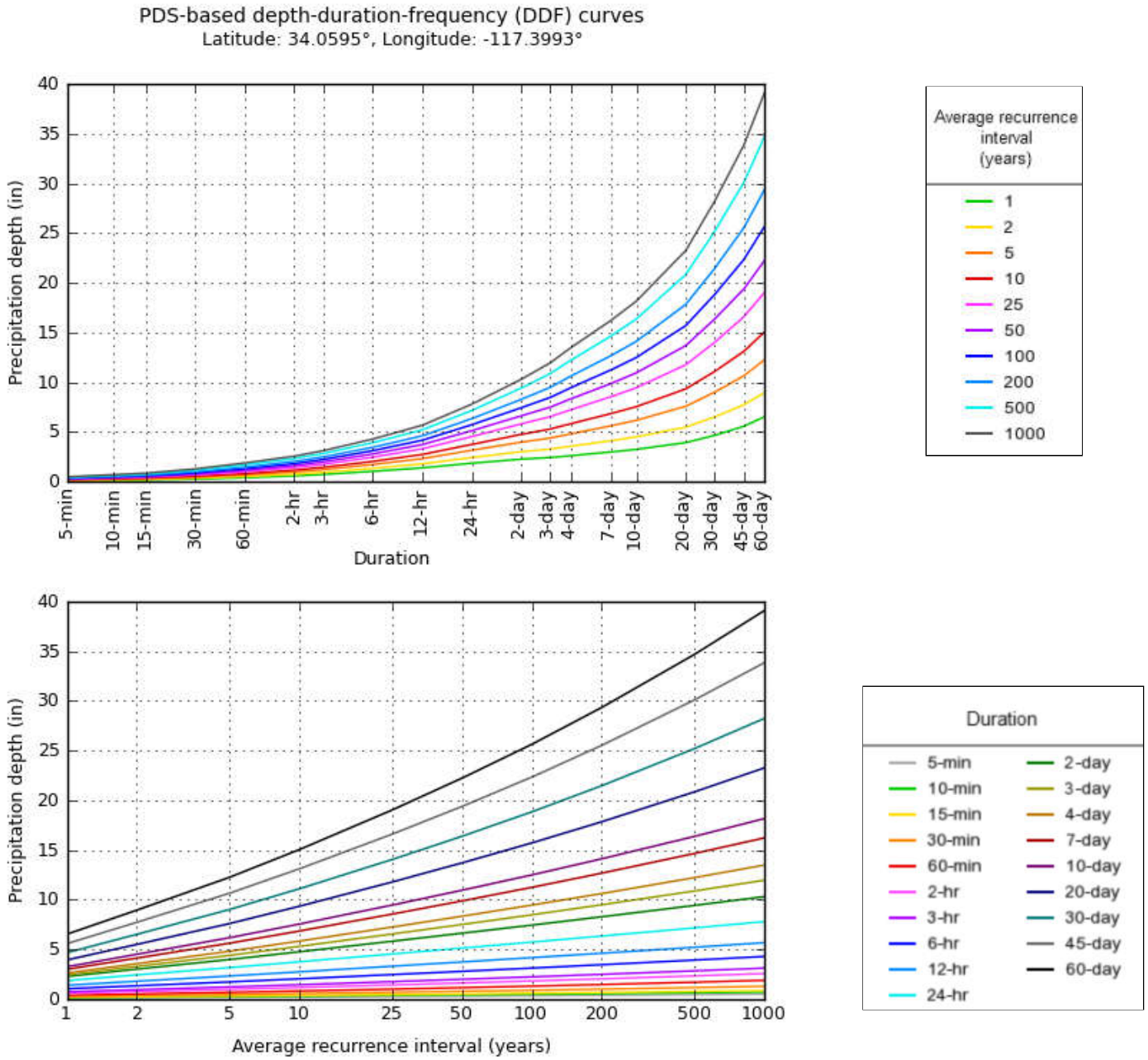
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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



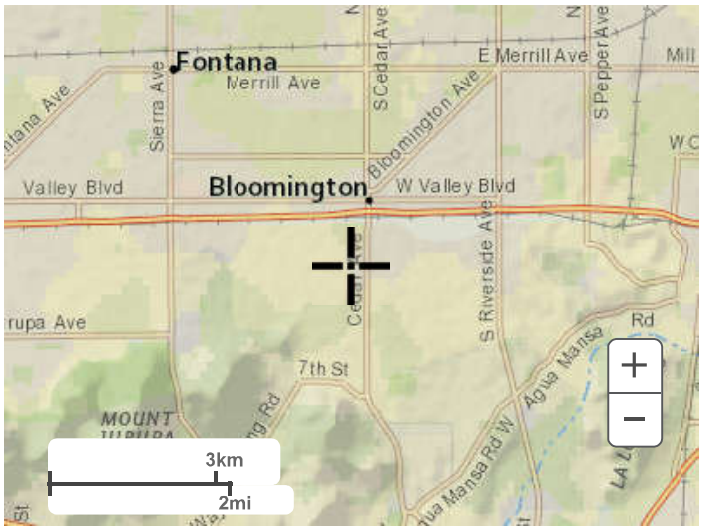
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Nov 12 23:14:27 2021

Back to Top

Maps & aerials

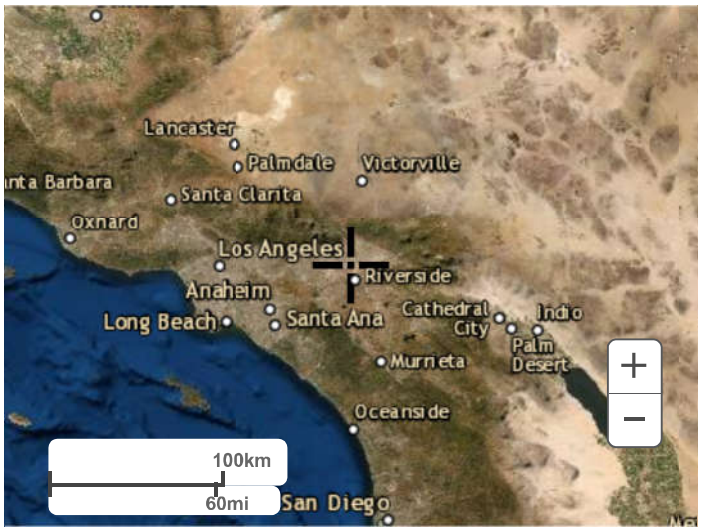
Small scale terrain



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

CONTECH ENGINEERED SOLUTIONS

Date: 8/30/2022
Project Name: Tr 20481

City / County: SB Co
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):	700.0	Backfill Porosity (%):	40%	System Diameter (in):	96
Out-to-out width (ft):	8.0	Depth Above Pipe (in):	12.0	Pipe Spacing (in):	18
Number of Manifolds (ea):	0.0	Depth Below Pipe (in):	12.0	Incremental Analysis (in):	12
Number of Barrels (ea):	1.0	Width At Ends (ft):	1.0	System Invert (Elevation):	0
Perforated		Width At Sides (ft):	1.0		

Storage Volume Estimation

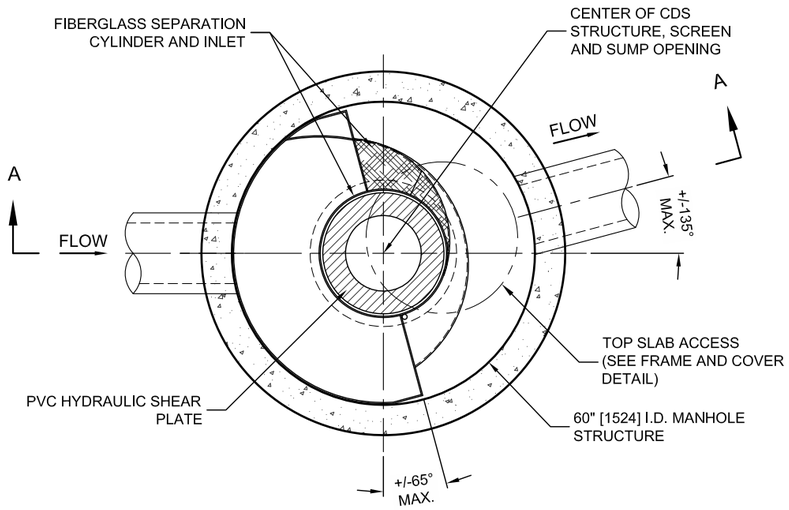
System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	2,808.0
1.00	1.00	0.0	0.0	2,808.0	2,808.0	2,808.0	2,808.0	0.0%	2,808.0
2.00	2.00	2,538.5	2,538.5	1,792.6	4,600.6	4,331.1	7,139.1	35.6%	5,030.4
3.00	3.00	4,340.3	6,878.9	1,071.9	5,672.5	5,412.2	12,551.3	54.8%	5,717.8
4.00	4.00	5,172.9	12,051.8	738.8	6,411.3	5,911.8	18,463.1	65.3%	6,061.3
5.00	5.00	5,541.1	17,592.9	591.6	7,002.8	6,132.7	24,595.8	71.5%	6,168.0
6.00	6.00	5,541.1	23,134.0	591.6	7,594.4	6,132.7	30,728.4	75.3%	6,061.3
7.00	7.00	5,172.9	28,307.0	738.8	8,333.2	5,911.8	36,640.2	77.3%	5,717.8
8.00	8.00	4,340.3	32,647.3	1,071.9	9,405.1	5,412.2	42,052.4	77.6%	5,030.4
9.00	9.00	2,538.5	35,185.8	1,792.6	11,197.7	4,331.1	46,383.5	75.9%	2,808.0
10.00	10.00	0.0	35,185.8	2,808.0	14,005.7	2,808.0	49,191.5	71.5%	2,808.0

CDS® Models and Capacities

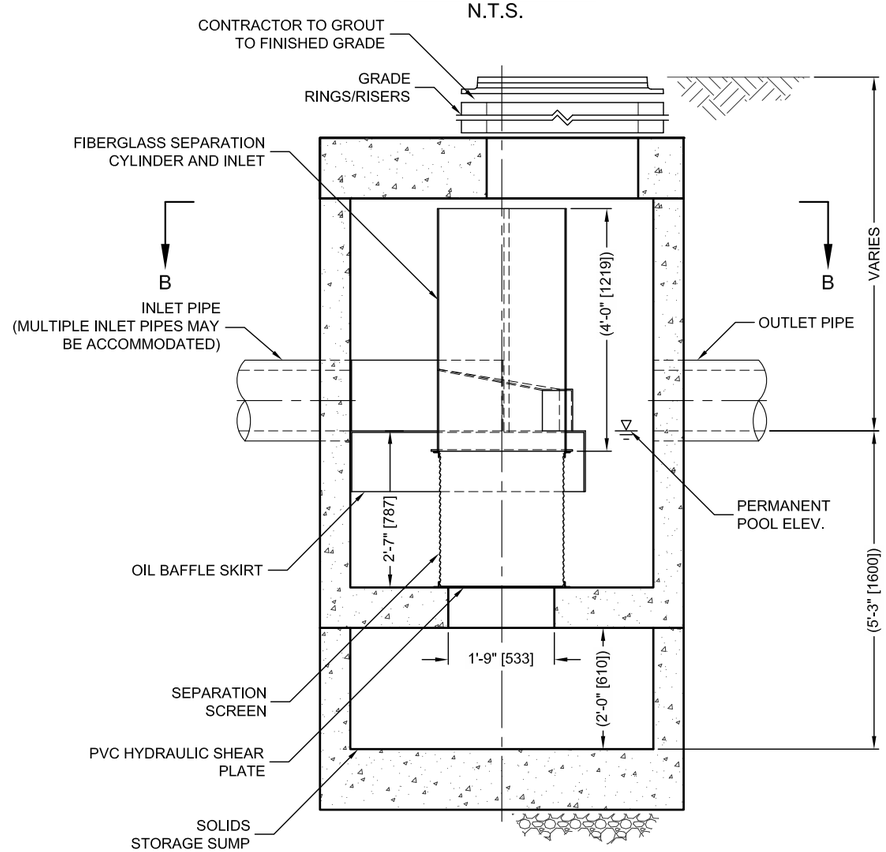
	CDS MODEL	Treatment Flow Rates			Estimated Maximum Peak Conveyance Flow** (cfs)/(L/s)	Minimum Sump Storage Capacity* (yd^3)/(m^3)	Minimum Oil Storage Capacity (gal)/(L)
		75 microns (cfs)/(L/s)	125 microns (cfs)/(L/s)	Trash & Debris (cfs)/(L/s)			
PRECAST	CDS2015-4	0.5 (14.2)	0.7 (19.8)	1.0 (28.3)	10 (283)	0.9 (0.7)	61 (232)
	CDS2015-5	0.5 (14.2)	0.7(19.8)	1.0 (28.3)	10 (283)	1.5 (1.1)	83 (313)
	CDS2020-5	0.7 (19.8)	1.1 (31.2)	1.5 (42.5)	14 (396)	1.5 (1.1)	99 (376)
	CDS2025-5	1.1 (31.2)	1.6 (45.3)	2.2 (62.3)	14 (396)	1.5 (1.1)	116 (439)
	CDS3020-6	1.4 (39.6)	2.0 (56.6)	2.8 (79.3)	20 (566)	2.1 (1.6)	184 (696)
	CDS3025-6	1.7 (48.1)	2.5 (70.8)	3.5 (99.2)	20 (566)	2.1 (1.6)	210 (795)
	CDS3030-6	2.0 (56.6)	3.0 (85.0)	4.2 (118.9)	20 (566)	2.1 (1.6)	236 (895)
	CDS3035-6	2.6 (73.6)	3.8 (106.2)	5.3 (150.0)	20 (566)	2.1 (1.6)	263 (994)
	CDS4030-8	3.1 (87.7)	4.5 (127.4)	6.3 (178.3)	30 (850)	5.6 (4.3)	426 (1612)
	CDS4040-8	4.1 (116.1)	6.0 (169.9)	8.4 (237.8)	30 (850)	5.6 (4.3)	520 (1970)
	CDS4045-8	5.1 (144.4)	7.5 (212.4)	10.5 (297.2)	30 (850)	5.6 (4.3)	568 (2149)
	CDS5640-10	6.1 (172.7)	9.0 (254.9)	12.6 (356.7)	50 (1416)	8.7 (6.7)	758 (2869)
	CDS5653-10	9.5 (268.9)	14.0 (396.5)	19.6 (554.8)	50 (1416)	8.7 (6.7)	965 (3652)
	CDS5668-10	12.9 (365.1)	19.0 (538.1)	26.6 (752.9)	50 (1416)	8.7 (6.7)	1172 (4435)
	CDS5678-10	17.0 (481.2)	25.0 (708.0)	35.0 (990.7)	50 (1416)	8.7 (6.7)	1309 (4956)
	CDS9280-12	27.2 (770.2)	40.0 (1132.7)	56.0 (1585.7)	Offline	16.8 (12.8)	N/A
	CDS9290-12	35.4 (1002.4)	52.0 (1472.5)	72 (2038.8)		16.8 (12.8)	
	CDS92100-12	42.8 (1212.0)	63.0 (1783.9)	88 (2491.9)		16.8 (12.8)	
CAST-IN-PLACE	CDS150134-22	100.7 (2851.5)	148.0 (4190.9)	270 (7645.6)		56.3 (43.0)	
	CDS200164-26	183.6 (5199.0)	270.0 (7645.6)	378.0 (10703.8)		78.7 (60.2)	
	CDS240160-32	204 (5776.6)	300.0 (8495.1)	420.0 (8495.1)		119.1 (91.1)	
	Additional Cast-in-Place models available upon request.						

- 125 micron flows are based on the CDS Washington State Department of Ecology approval for 80% removal of a particle size distribution (PSD) having a mean particle size (D_{50}) of 125 microns.
- Alternative PSD/D_{50} sizing is available upon request.
- Estimated maximum peak conveyance flow is calculated using conservative values and may be exceeded on sites with lower inflow velocities and sufficient head over the weir.
- Sump and oil capacities can be customized to meet site needs

Appendix C: BMP Educational Materials



PLAN VIEW B-B
N.T.S.

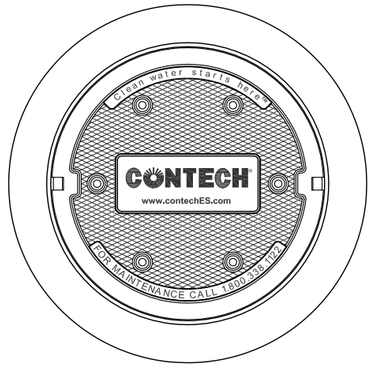


ELEVATION A-A
N.T.S.

CDS2020-5-C DESIGN NOTES

THE STANDARD CDS2020-5-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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

CDS2020-5-C
INLINE CDS
STANDARD DETAIL

CONTECH®
ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

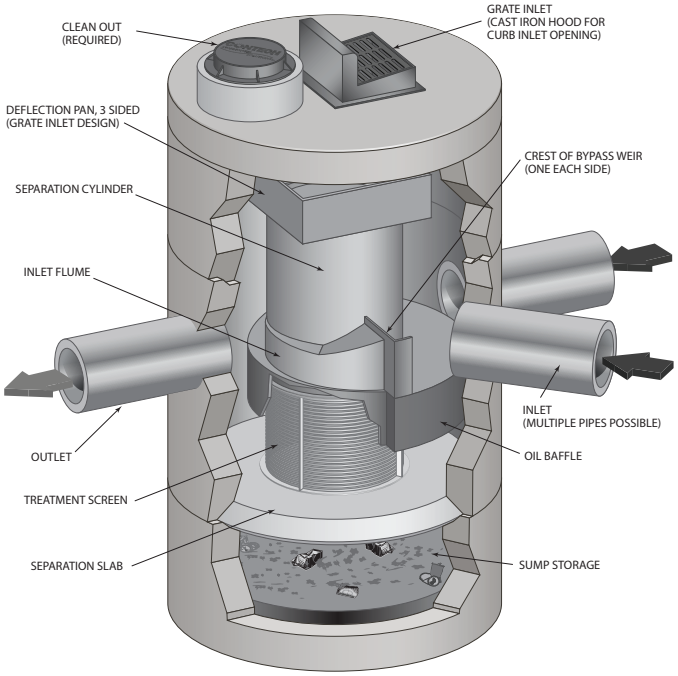
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

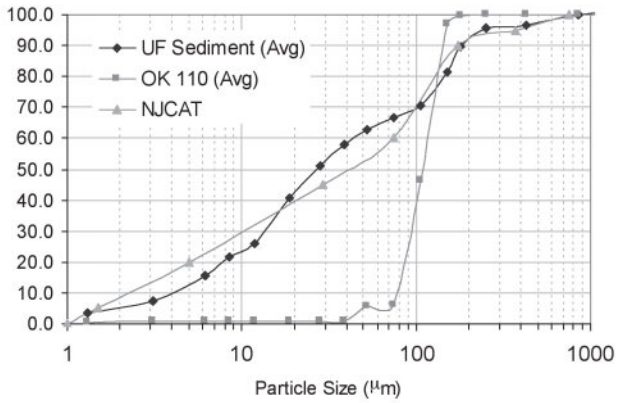


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

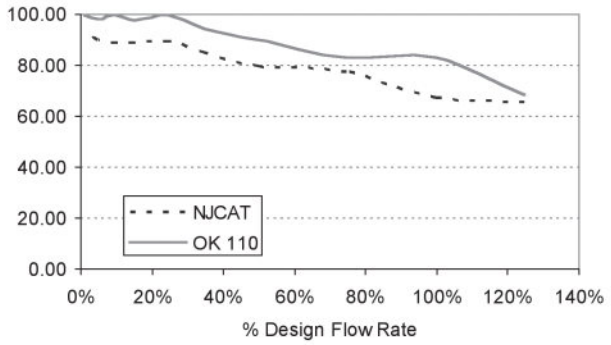


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

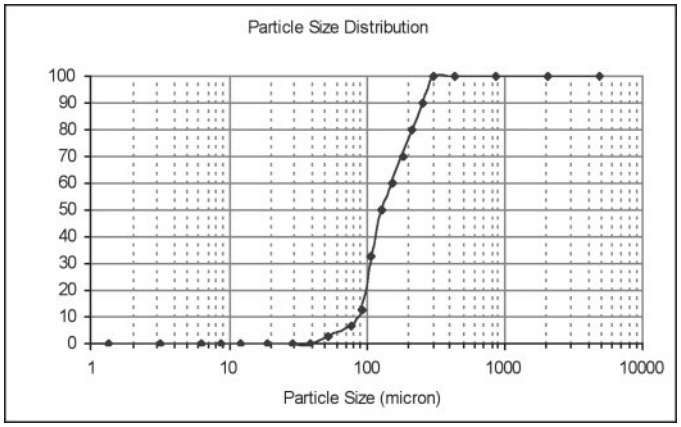


Figure 3. WASDOE PSD

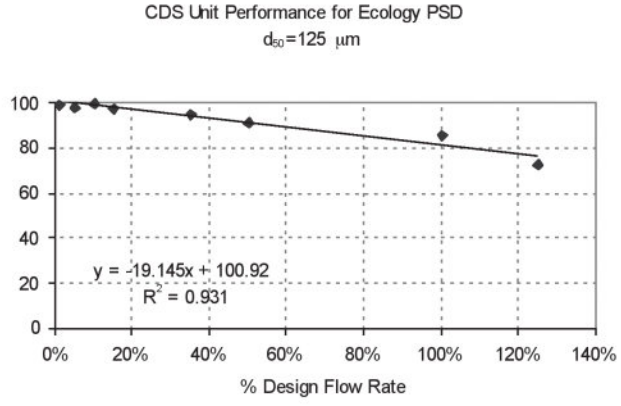


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

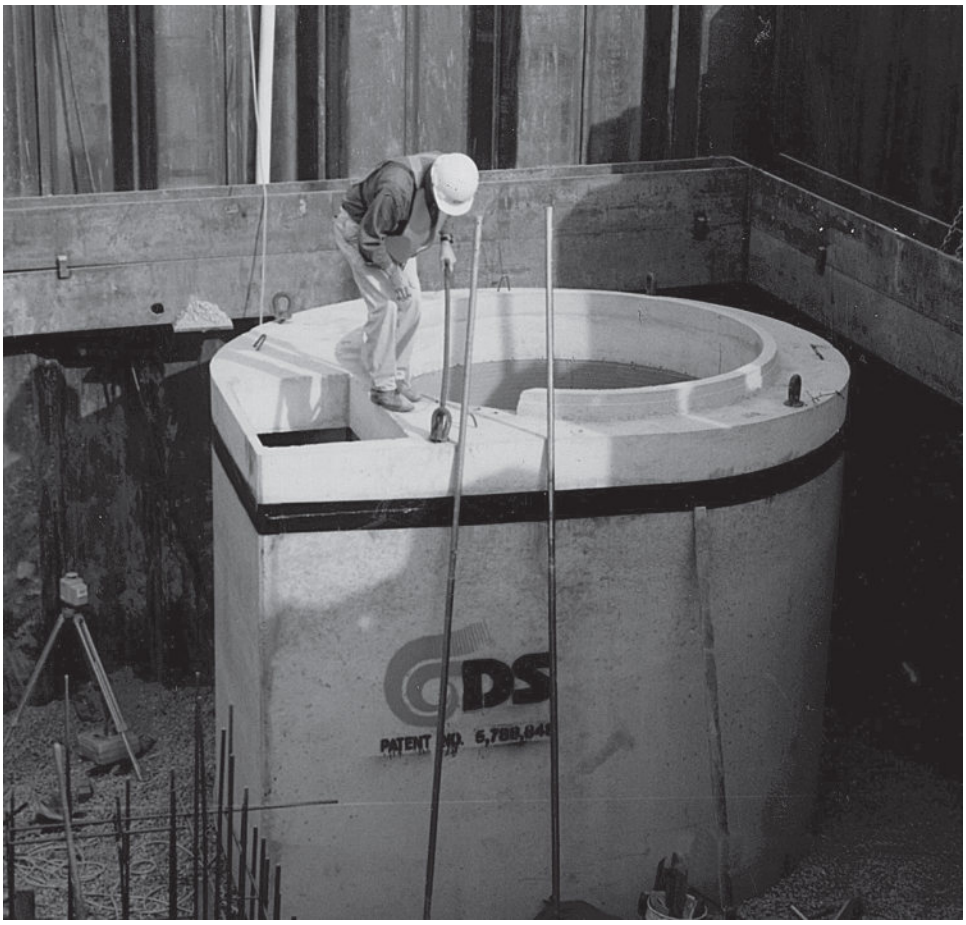
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	yd3	m3
CDS2015-4	4	1.2	3.0	0.9	0.5	0.4
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

CONTECH®
ENGINEERED SOLUTIONS
800-338-1122
www.ContechES.com

Contech Engineered Solutions provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, earth stabilization and stormwater treatment products. For information on other Contech division offerings, visit www.ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; related foreign patents or other patents pending.

cds_manual 3/17 PDF

STORMWATER Pollution Prevention

PAINTING

Paints, solvents, adhesives and other toxic chemicals used in painting 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 simple tips to prevent pollution and protect our health.

Water-Based Paints
Use water-based paints whenever possible. They are less toxic than oil-based paints and easier to clean up. Look for products labeled "latex" or "cleans with water."

Paint Removal
Sweep up paint stripping residue, chips and dust instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.

Painting Cleanup
Never clean brushes or rinse paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which can be reused by putting it in a jar to settle out the paint particles and then pouring off the clear liquid for future use. Wrap dried paint residue in newspaper and dispose of it in the trash.

Exterior Paint Removal
When stripping or cleaning building exteriors with high-pressure water, block nearby storm drains and divert washwater onto a designated dirt area. Ask your local wastewater treatment authority if you can collect building cleaning water and discharge it to the sewer.

Recycling Paint
Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

HOME REPAIR & REMODELING

Paints, solvents, adhesives and other toxic substances used in home repair and remodeling 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 simple tips to prevent pollution and protect your health.

Construction Projects

Keep construction debris away from the street, gutter and storm drains. Schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of soil, sand or gravel, protected from rain, wind and runoff. Prevent erosion by planting fast-growing annual and perennial grass, which can shield and bind soil.

Recycle Household Hazardous Waste

Household cleaners, paint and other home improvement products like wallpaper and tile adhesives are too toxic to trash. Recycle them instead, at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.

Landscaping & Gardening

Avoid applying fertilizers or pesticide near curbs and driveways, and store covered, protected from rain, wind and runoff. Try using organic or non-toxic alternatives. Reduce runoff and lower your water bill by using drip irrigation, soaker hoses or micro-spray systems. Recycle leaves instead of blowing, sweeping or raking them into the street, gutter or storm drain.

Paint Removal

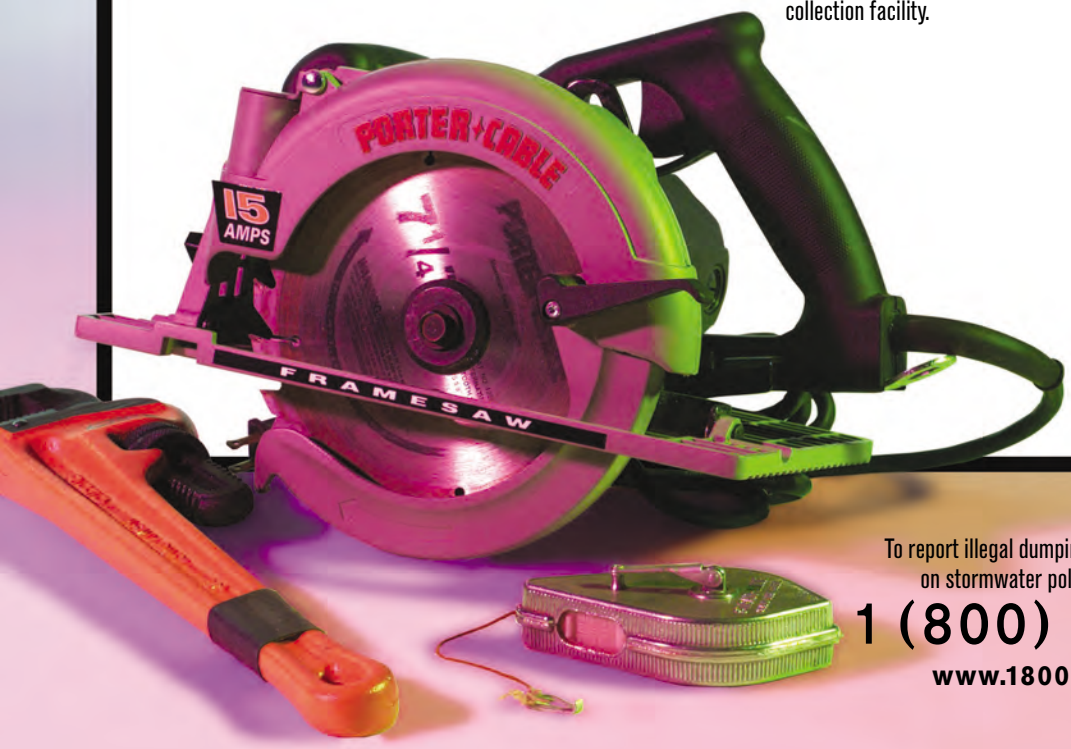
Paint stripping residue, chips and dust from marine paints and paints containing lead or tributyl tin are hazardous wastes. Sweep them up instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility.

Painting Cleanup

Avoid cleaning brushes or rinsing paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which you can filter and reuse. Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.

Concrete and Masonry

Store bags of cement and plaster away from gutters and storm drains, and cover them to protect against rain, wind and runoff. Sweep or scoop up cement washout or concrete dust instead of hosing into driveways, streets, gutters or storm drains.



To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

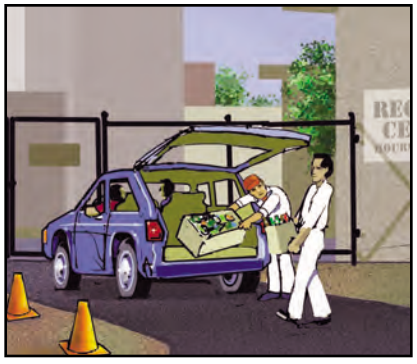
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

HOME & GARDEN

Yard waste and household toxics like paints and pesticides 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 simple tips to prevent pollution and protect your health.

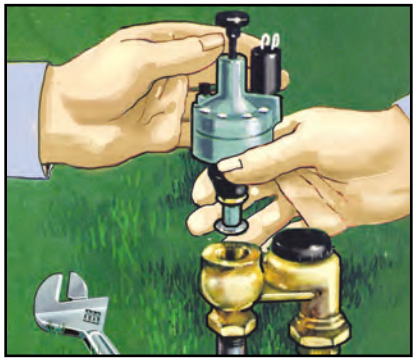


Recycle Household Hazardous Waste
Household products like paint, pesticides, solvents and cleaners are too dangerous to dump and too toxic to trash. Take them to be recycled at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.

Disposing of Yard Waste
Recycle leaves, grass clippings and other yard waste, instead of blowing, sweeping or hosing into the street. Try grasscycling, leaving grass clippings on your lawn instead of using a grass catcher. The clippings act as a natural fertilizer, and because grass is mostly water, it also irrigates your lawn, conserving water.

Use Fertilizers & Pesticides Safely
Fertilizers and pesticides are often carried into the storm drain system by sprinkler runoff. Try using organic or non-toxic alternatives. If you use chemical fertilizers or pesticides, avoid applying near curbs and driveways and never apply before a rain.

Planting in the Yard
Produce less yard waste and save water by planting low maintenance, drought-tolerant trees and shrubs. Using drip irrigation, soaker hoses or micro-spray systems for flower beds and vegetation can also help reduce your water bill and prevent runoff.



Use Water Wisely
Cut your water costs and prevent runoff by controlling the amount of water and direction of sprinklers. The average lawn needs about an inch of water a week, including rainfall, or 10 to 20 minutes of watering. A half-inch per week is enough for fall and spring. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

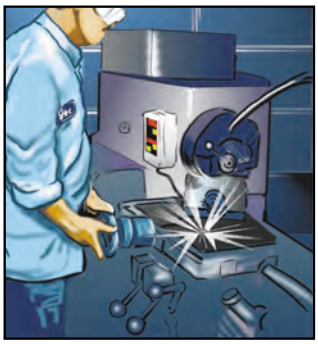
STORMWATER Pollution Prevention

AUTO MAINTENANCE

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 and protect public health.

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 parts washer or the fluid holding tank. Do not wash parts or equipment in a shop sink, parking lot, driveway or street.

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 under cover with spill containment or inside to prevent contamination of rainwater runoff.



Metal Grinding and 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.

Preventing Leaks and Spills
Place drip pans underneath to capture fluids. Use absorbent cleaning agents instead of water to clean work areas.

Cleaning Spills
Use dry methods for spill cleanup (sweeping, absorbent materials). 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. To report serious toxic spills, call 911.

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 or polishing auto parts. Contact a licensed hazardous waste hauler. For more recycling information, call (909) 386-8401.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

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.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- 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.

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Appendix D: Soils Report

Converse Consultants
Geotechnical Engineering
Environmental & Groundwater Science
Inspection & Testing Services

PRELIMINARY GEOTECHNICAL INVESTIGATION & WATER INFILTRATION TEST REPORT

LINDEN BLOOMINGTON CONDOS, TENTATIVE TRACT 20481

10598 ORCHARD STREET
BLOOMINGTON AREA, SAN BERNARDINO COUNTY, CALIFORNIA

CONVERSE PROJECT NO. 21-81-176-01

Prepared For:

ALL-ERA PROPERTIES, LLC
P.O. Box 11503
Carson, CA 90749

Presented By:

CONVERSE CONSULTANTS
2021 Rancho Drive, Suite 1
Redlands, CA 92373
909-796-0544

December 20, 2021

Converse Consultants

75 Years of Dedication in Geotechnical Engineering & Consulting, Environmental & Groundwater Science, Materials Testing & Inspection Services

December 20, 2021

Mr. Byron Walker
Owner
All-ERA Properties, LLC
P.O. Box 11503
Carson, CA 90749

Subject: **PRELIMINARY GEOTECHNICAL INVESTIGATION AND WATER INFILTRATION TEST REPORT**
Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
Converse Project No. 21-81-176-01

Dear Mr. Walker:

Converse Consultants (Converse) has prepared this geotechnical investigation and water infiltration test report to present the findings, conclusions and recommendations, for the proposed Linden Bloomington Condos residential development project**,** Tentative Tract 20481, located at 10598 Orchard Street in the Bloomington Area, San Bernardino County, California. This report is prepared in accordance with our proposal dated June 26, 2021, and your e-mail acceptance of the Agreement and Authorization to Proceed, dated July 27, 2021.

Based upon our field investigation, laboratory data, and analyses, as well as review of the referenced conceptual grading plan, the proposed project is considered feasible from a geotechnical standpoint, provided the recommendations presented in this report are incorporated into the design and construction of the project.

We appreciate the opportunity to be of continued service to All-ERA Properties, LLC. If you should have any questions, please contact the undersigned at 909-796-0544.

CONVERSE CONSULTANTS

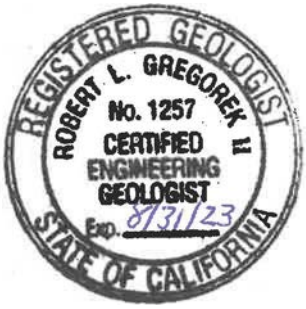
Hashmi S. E. Quazi, PhD, PE, GE
Regional Manager/Principal Engineer

Dist.:1/Addressee (electronic)
HSQ/RLG/ZA/CN

PROFESSIONAL CERTIFICATION

This report has been prepared by the individuals whose seals and signatures appear herein.

The findings, recommendations, specifications, or professional opinions contained in this report were prepared in accordance with generally accepted professional engineering, engineering geologic principles, and practice in this area of Southern California. There is no warranty, either expressed or implied.



Zahangir Alam, PhD, PE (TX)
Sr. Staff Engineer

Robert L Gregorek II, PG, CEG
Senior Geologist

Hashmi S. E. Quazi, PhD, PE, GE
Principal Engineer

TABLE OF CONTENTS

FIGURES

Following Page No.

TABLES

Page No.

APPENDICES

1.0 INTRODUCTION

This report contains the findings of the preliminary geotechnical investigation and percolation tests performed by Converse for the proposed Linden Bloomington Condos residential development project**,** Tentative Tract 20481, located at 10598 Orchard Street in the Bloomington Area, San Bernardino County, California. The project location is shown in Figure No. 1, *Approximate Site Location Map.*

The purpose of this investigation was to evaluate the current nature and engineering properties of the subsurface soils and groundwater conditions and to provide geotechnical recommendations for the proposed residential development.

This updated report is written for the project described herein and is intended for use solely by All-ERA Properties, LLC and their design team. It should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.

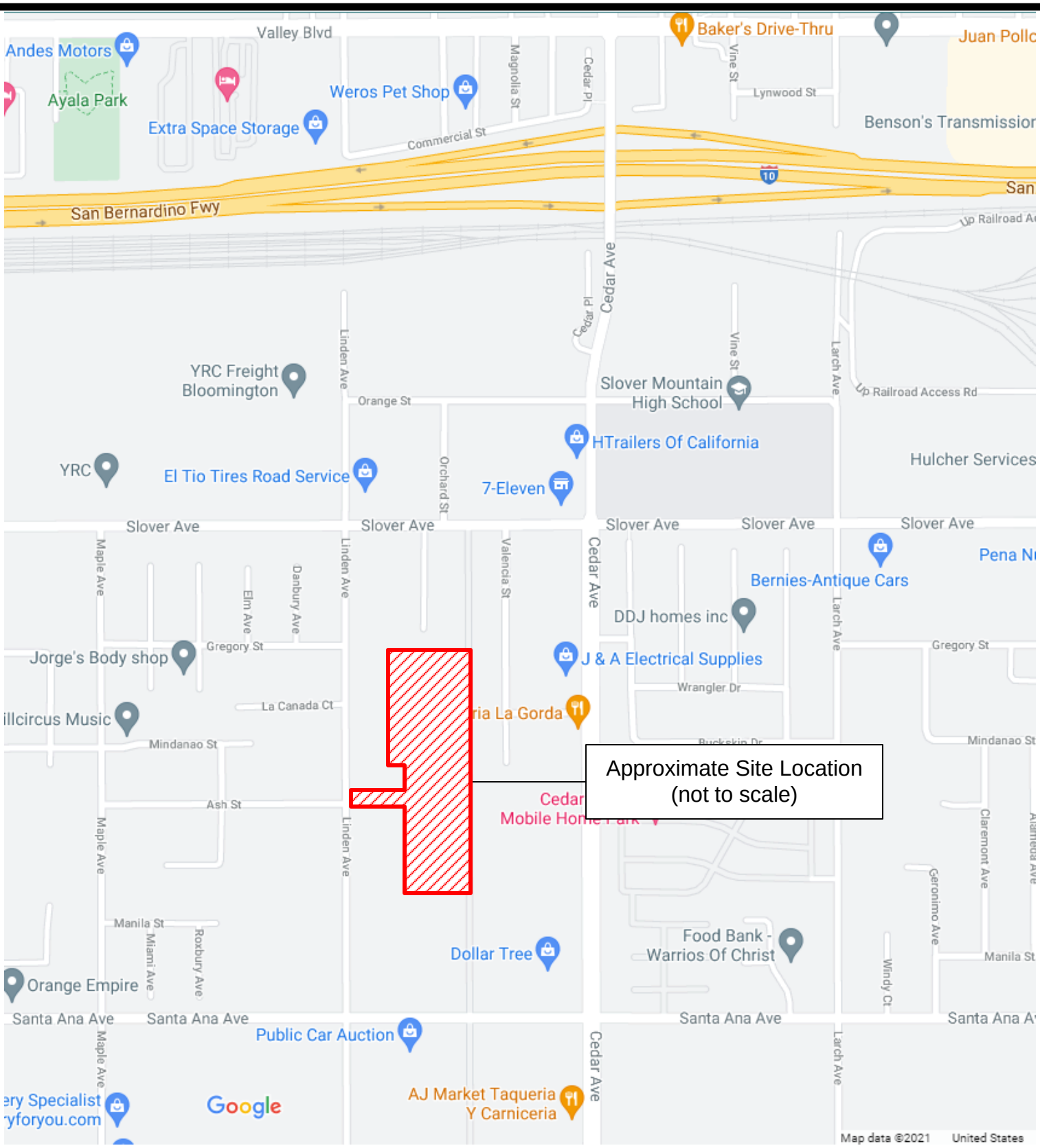
2.0 PROJECT DESCRIPTION

Based on the review of the referenced conceptual site plan, as well conversations with Mr. Kevin Kent of TK Management and Mr. Aaron Skeers of Encompass Associates, Inc., the proposed development will consist of 154 one to two-story single-family residential buildings and are anticipated to be wood framed structures founded on shallow footings with slab-on-grade construction. There will also be one water infiltration device, approximately 10 feet to 15 feet deep, at the southern portion of the site. Associated with the development will be roadways, parking areas, concrete walkways, paseos, open space areas, block walls, above and underground utilities as well as landscaping. Even though final plans are not developed at this time, grading, based on the shallow relief on the site, is anticipated to consist of cuts and fills of up to about 5 feet or less.

The original plans used for exploration was for 147 units, however due to density changes to the project by the city the report was delayed at the TK Management's request until the current 154-unit plan was approved.

3.0 SITE DESCRIPTION

The approximately 11.5-acre site is currently vacant undeveloped land. The site is located at the south end of Orchard Street and is bounded on the north and west by residential developments, on the east by San Bernardino County Flood Control District right of way and on the south by vacant land and some residential structures. Some scattered trash and debris were observed on the site. Vegetation consists of a light to moderate growth of grass and weeds with some scattered bushes and trees at the



Approximate Site Location Map

Project: Linden Bloomington Condos, Tentative Tract 20481
Location: 10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No
21-81-176-01

Converse Consultants

FIGURE NO.
1

northeast portion of the site. The site is roughly flat and appears to drain towards the south and southeast. Elevations range from approximately 1,059 feet above mean sea level (msl) in the northwest portion of the site to approximately 1,039 feet above msl in the southeast portion of the site.

Present site conditions are shown below in the Photograph Nos. 1 and 2.

Photograph No. 1: Present site conditions, facing northwest.

Photograph No. 2: Present site conditions, facing southwest.

4.0 SCOPE OF WORK

The scope of Converse's investigation is described in the following sections.

4.1 Project Set-up

The project set-up consisted of the following tasks.

- Conducted a site reconnaissance to mark the boring and percolation test locations such that drill rig access to all the locations was available.
- Notified Underground Service Alert (USA) at least 48 hours prior to drilling to clear the boring locations of any conflict with existing underground utilities.
- Engaged a California-licensed driller to drill exploratory borings.

4.2 Subsurface Exploration

Six exploratory borings (BH-01 through BH-06) were drilled on August 02, 2021, to investigate the subsurface conditions at the project site. The drilling was performed with a CME-75 truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers and a drive sampler for soil sampling. The borings were drilled to depths ranging from approximately 13.5 to 51.0 feet below existing ground surface (bgs).

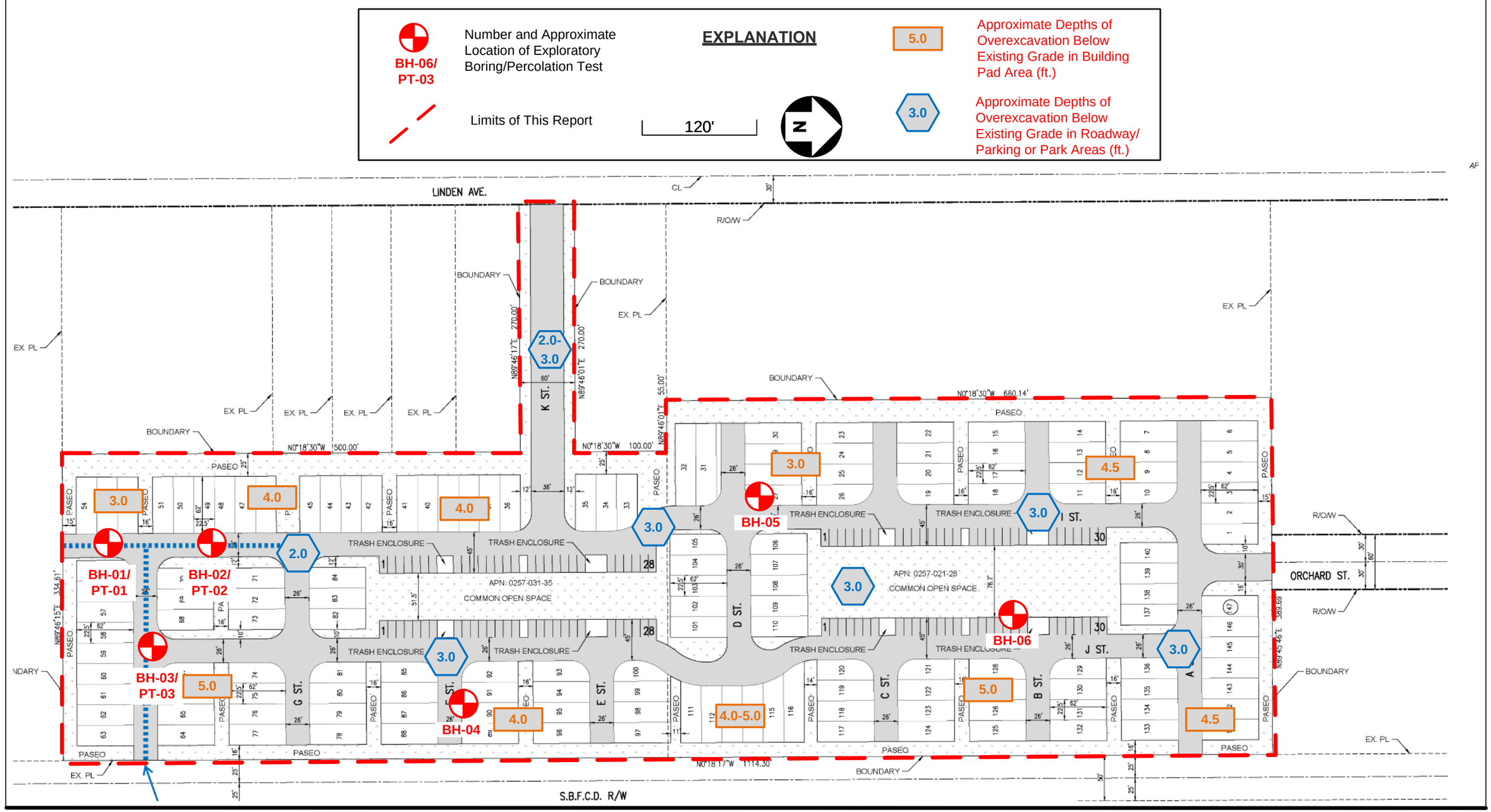
Three exploratory borings (BH-01/PT-01 through BH-03/PT-03) were prepared for percolation testing. Percolation test borings were drilled to depths ranging from approximately 13.5 to 16.5 feet below the existing ground surface (bgs).

Approximate boring and percolation testing locations are indicated in Figure No. 2, *Approximate Boring, Percolation Test, and Overexcavation Locations Map*. For a description of the exploration and sampling program, see Appendix A, *Field Exploration*.

4.3 Laboratory Testing

Representative samples of the site soils were tested in the laboratory to aid in classification and to evaluate relevant engineering properties. These tests included the following.

- *In-situ* moisture contents and dry densities (ASTM D2216 and D2937)
- Expansion index (ASTM D4829)
- R-value (California Test 301)
- Soil corrosivity (California Test Methods 643, 422, and 417)
- Grain size Analysis (ASTM 6913)
- Maximum dry density and optimum-moisture content (ASTM D1557)
- Direct shear (ASTM D3080)



Project: Linden Bloomington Condos, Tentative Tract 20481
Location: 10598 Orchard Street
Bloomington Area, San Bernardino County, California

For: All-ERA Properties, LLC

Approximate Boring, Percolation Test and Overexcavation Locations Map

Project No.
21-81-176-01

Converse Consultants

Figure No.
2

For *in-situ* moisture and dry density data, see the logs of borings in Appendix A, *Field Exploration*. For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program*.

4.4 Analysis and Report Preparation

Data obtained from the field exploration and laboratory testing program was assembled and evaluated. Geotechnical analyses of the compiled data were performed, followed by the preparation of this report to present our findings, conclusions, and recommendations for the proposed project.

5.0 SUBSURFACE CONDITIONS

A general description of the subsurface conditions, various materials and groundwater conditions encountered at the site during our field exploration is discussed below.

5.1 Subsurface Profile

Based on the exploratory borings and laboratory test results, the subsurface at the project site generally consisted primarily of young and old alluvial fan deposits.

The various subsurface profiles and description of the earth material soils encountered are discussed below.

Young Alluvial Fan Deposits: Holocene-aged young alluvial fan deposits were encountered in all of the exploratory borings below the surface. These materials were comprised of sand, silty sand and sandy silt which are fine to coarse-grained, has little to some gravel up to 3 inches in maximum dimension, locally slightly to moderately desiccated, some oxidation staining, medium dense to very dense/stiff to very stiff, dry to moist and are various shades of gray, brown, red and yellow. Where observed, in boring BH-04, these materials were approximately 36.5 feet thick.

Old Alluvial Fan Deposits: Late to Middle Pleistocene-aged older alluvial deposits were encountered in exploratory boring BH-04 below the young alluvial fan deposits at a depth of approximately 36.5 feet bgs. These materials were comprised of sand and silty sand which are fine to coarse-grained, has little gravel up to 3 inches in maximum dimension, some cobbles, locally moderately desiccated, very dense, dry and are various shades of gray, brown and red.

For a detailed description of the subsurface materials encountered in the exploratory borings, see the logs, Drawings No. A-2 through A-7, in Appendix A, *Field Exploration.*

5.2 Groundwater

Groundwater was not encountered during our field investigation in any borings, to the maximum depths explored of 51.0 feet bgs. The GeoTracker database (SWRCB, 2021) was reviewed for groundwater data from sites within an approximately 1.0-mile radius of the proposed development, but no results were found.

The National Water Information System (USGS, 2021) were reviewed for groundwater data from sites within an approximately 1.0-mile radius of the proposed development and the results of that search are included below.

Table No. 1, Summary of USGS Groundwater Depth Data

Alignment No.	Location	Groundwater Depth Range (ft. bgs)	Date Range
340402117234501	W end of Cedar Place; approximately 2194 feet north of project site	250.94-260.81	2001-2008
340402117234601	W end of Cedar Place; approximately 2185 feet north of project site	240-288	1956-2001

The California Department of Water Resources database (DWR, 2021) was reviewed for historical groundwater data from sites within a 1.0-mile radius of the project site. One site was identified within a 1.0-mile radius of the project site that contained groundwater elevation data. Details of that record are listed below.

- Well No. Santa Fe Gas 2A (Station 340470N1174020W0011), located approximately 4,164 feet south of the project site, reported groundwater at depths ranging from 176.33-187.16 feet bgs between 2011-2021.

Based on available data, the historical high groundwater level near the site is estimated to be approximately 176 feet bgs, and the current groundwater level is estimated to be deeper than 51.0 feet bgs. Groundwater is not expected to be encountered during construction of the proposed project, however perched water layers may be present at shallower depths, particularly following high precipitation or irrigation events.

5.3 Excavatability

The subsurface materials of the project site are expected to be excavatable by conventional heavy-duty earth moving and trenching equipment. However, difficult excavation may occur, approximately 8 feet to 10 feet bgs, due to high concentrations of gravel and the very nature of the alluvial fan deposits.

The phrase “conventional heavy-duty excavation equipment” is intended to include commonly used equipment such as excavators, scrapers, and trenching machines. It

does not include hydraulic hammers (“breakers”), jackhammers, blasting, or other specialized equipment and techniques used to excavate hard earth materials. Selection of an appropriate excavation equipment model should be done by an experienced earthwork contractor.

5.4 Subsurface Variations

Based on results of the subsurface exploration and our experience, some variations in the continuity and nature of subsurface soil conditions within the project site should be anticipated. Because of the uncertainties involved in the nature and depositional characteristics of the earth material, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond the boring locations.

5.5 Caving

Caving was not encountered in any of the exploratory borings. However, localized caving could occur within excavations made into granular soils of the on-site soils.

5.6 Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from precipitation, landscape irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of structures or concrete slabs supported on grade. Depending on the extent and location below finish subgrade, expansive soils can have a detrimental effect on structures.

Based on the laboratory test results, the expansion index of the upper 6 feet of the site soils was 0, corresponding to a very low expansion potential.

6.0 ENGINEERING GEOLOGY

The regional and local geology within the proposed project area are discussed below.

6.1 Regional Geology

The project site is located within the northern Peninsular Ranges Geomorphic Province of Southern California. The Peninsular Ranges Geomorphic Province consists of a series of northwest-trending mountain ranges and valleys bounded on the north by the San Bernardino and San Gabriel Mountains, on the west by the Los Angeles Basin, and on the southwest by the Pacific Ocean.

The province is a seismically active region characterized by a series of northwest-trending strike-slip faults. The most prominent of the nearby fault zones include the San Jacinto, Elsinore, and San Andreas fault zones (CGS, 2007), all of which have been known to be active during Quaternary time.

Topography within the province is generally characterized by broad alluvial valleys separated by linear mountain ranges. This northwest-trending linear fabric is created by the regional faulting within the granitic basement rock of the Southern California Batholith. Broad, linear, alluvial valleys have been formed by erosion of these principally granitic mountain ranges.

The site is located within the southeastern portion of the Chino Basin of the Peninsular Ranges province. The Chino Basin is a broad alluvial valley bounded by the San Gabriel Mountains on the north, the San Bernardino Mountains on the east and northeast, the Santa Ana Mountains on the southwest, and the Puente Hills on the west.

6.2 Local Geology

Based on our review of the available geological and geotechnical literature (Dibblee and Minch, 2004; Morton and Miller, 2006) as well as the results of our exploration and laboratory testing, it is our understanding that the site is primarily underlain by young and old alluvial fan deposits, comprised of sand, silt and gravel with some cobbles.

6.3 Flooding

Review of National Flood Insurance Rate Maps indicates that the project site is within a Flood Hazard Zone "X". The Zone “X” is designated as an area with an area of minimal hazard (FEMA, 2008).

7.0 FAULTING AND SEISMICITY

The approximate distance and seismic characteristics of nearby faults as well as seismic design coefficients are presented in the following subsections.

7.1 Faulting

The proposed site is situated in a seismically active region. As is the case for most areas of Southern California, ground-shaking resulting from earthquakes associated with nearby and more distant faults may occur at the project site. During the life of the project, seismic activity associated with active faults can be expected to generate moderate to strong ground shaking at the site. Review of recent seismological and geophysical publications indicates that the seismic hazard for the project is high.

The project site is not located within a currently mapped State of California Earthquake Fault Zone for surface fault rupture (CGS, 2007). Table No. 2, *Summary of Regional Faults,* summarizes selected data of known faults capable of seismic activity within 50 kilometers of the site. The data presented below was calculated using the National Seismic Hazard Maps Database (USGS, 2008) and other published geologic data.

Table No. 2, Summary of Regional Faults

Fault Name and Section	Closest Distance (km)	Slip Sense	Length (km)	Slip Rate (mm/year)	Maximum Magnitude
San Jacinto	8.15	strike slip	241	n/a	7.80
Cucamonga	13.53	thrust	28	5	6.70
S. San Andreas	16.68	strike slip	548	n/a	8.18
Cleghorn	25.01	strike slip	25	3	6.80
San Jose	27.55	strike slip	20	0.5	6.70
Chino, alt 1	28.65	strike slip	24	1	6.70
Chino, alt 2	28.71	strike slip	29	1	6.80
Elsinore	30.75	strike slip	241	n/a	7.85
North Frontal (West)	30.85	reverse	50	1	7.20
Sierra Madre	32.27	reverse	57	2	7.20
Sierra Madre Connected	32.27	reverse	76	2	7.30
Clamshell-Sawpit	45.81	reverse	16	0.5	6.70
Puente Hills (Coyote Hills)	46.94	thrust	17	0.7	6.90

(Source: https://earthquake.usgs.gov/cfusion/hazfaults_2008_search/)

7.2 CBC Seismic Design Parameters

Seismic parameters based on the 2019 California Building Code (CBSC, 2019) and ASCE 7-16 are provided in the following table. These parameters were determined using the generalized coordinates (34.0606N, 117.3993W) and the Seismic Design Maps ATC online tool.

Table No. 3, CBC Seismic Design Parameters

Seismic Parameters	
Site Coordinates	34.0606 N, 117.3993 W
Site Class	D*
Risk Category	II
Mapped Short period (0.2-sec) Spectral Response Acceleration, S_s	1.550g
Mapped 1-second Spectral Response Acceleration, S_1	0.601g
Site Coefficient (from Table 1613.5.3(1)), F_a	1.00

Seismic Parameters	
Site Coefficient (from Table 1613.5.3(2)), F_v	1.70
MCE 0.2-sec period Spectral Response Acceleration, S_{MS}	1.550g
MCE 1-second period Spectral Response Acceleration, SM_1	1.022g
Design Spectral Response Acceleration for short period S_{DS}	1.033 g
Design Spectral Response Acceleration for 1-second period, S_{D1}	0.681g
Site Modified Peak Ground Acceleration, PGA_M	0.724g

** Stiff Soil Classification*

7.3 Secondary Effects of Seismic Activity

In addition to ground shaking, effects of seismic activity on a project site may include surface fault rupture, soil liquefaction, landslides, lateral spreading, seismic settlement, tsunamis, seiches and earthquake-induced flooding. Results of a site-specific evaluation of each of the above secondary effects are explained below.

Surface Fault Rupture: The project site is not located within a currently designated State of California or San Bernardino County Earthquake Fault Zone (CGS, 2007; SBC, 2021b). Based on review of existing geologic information, no major surface fault crosses through or extends toward the site. The potential for surface rupture resulting from the movement of a presently unrecognized fault beneath the site is not known with certainty but is considered very low.

Liquefaction: Liquefaction is defined as the phenomenon in a soil mass, because of the development of excess pore pressures, soil mass suffers a substantial reduction in its shear strength. During earthquakes, excess pore pressures in saturated soil deposits may develop as a result of induced cyclic shear stresses, resulting in liquefaction. Soil liquefaction occurs in submerged granular soils during or after strong ground shaking. There are several requirements for liquefaction to occur. They are as follows.

- Soils must be submerged.
- Soils must be primarily granular.
- Soils must be contractive, that is, loose to medium-dense.
- Ground motion must be intense.
- Duration of shaking must be sufficient for the soils to lose shear resistance.

This site is not located in a State of California or San Bernardino County designated liquefaction zone (CGS, 2007; SBC 2021b). Based on the lack of shallow groundwater (within 50.5 feet bgs), dense soil conditions and high blow counts, liquefaction potential at the site is expected to be negligible.

***Seismic Settlement**:* Dynamic dry settlement may occur in loose, granular, unsaturated soils during a large seismic event. Based on the relatively dense nature of the soils, high blow counts and recommended remedial grading, the potential for dry seismic settlement of the site is expected to be negligible.

Landslides: Seismically induced landslides and other slope failures are common occurrences during or after earthquakes in areas of significant relief. The project site is not in a State of California or San Bernardino County designated landslide susceptibility area. The site is not adjacent to any steep slopes. In the absence of significant ground slopes, the potential for seismically induced landslides to affect the proposed site is considered low.

Lateral Spreading: Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from the slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. Due to the relatively flat nature of the project site, the relatively dense nature of the soils, recommended remedial grading and the negligible amount of potential liquefaction, the risk of lateral spreading is considered very low.

Tsunamis: Tsunamis are tidal waves generated in large bodies of water by fault displacement or major ground movement. Based on the location of the site, tsunamis do not pose a hazard to this site.

Seiches: Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Review of the area adjacent to the site indicates that there are no significant up-gradient lakes or reservoirs with the potential of flooding the site.

Earthquake-Induced Flooding: This is flooding caused by failure of dams or other water-retaining structures as a result of earthquakes. The project site is not located in a State of California or County of San Bernardino designated dam inundation zone (DSOD, 2021; SBC 2021a). Review of the area adjacent to the site indicates the site is not located in any potential inundation path of any reservoir. The potential for flooding of the site due to dam failure is considered very low.

8.0 LABORATORY TEST RESULTS

Laboratory testing was performed to determine the physical and chemical characteristics and engineering properties of the subsurface soils. Tests results are included in Appendix A, *Field Exploration* and Appendix B, *Laboratory Testing Program*. Discussions of the various test results are presented below:

8.1 Physical Testing

- In-situ Moisture and Dry Density: *In-situ* dry density and moisture content of the soils were determined in accordance with ASTM Standard D2216 and D2937. Results are presented in the log of borings in Appendix A, *Field Exploration.*
  - Dry densities of the upper 10 feet ranged from 105 to 129 per cubic feet (pcf) with moisture contents ranging from 1 to 9 percent.
  - Dry densities of the below the upper 10 feet of soils at the site ranged from 99 to 125 pcf with moisture contents ranging from 1 to 11 percent.
- Expansion Index: Two representative bulk soil samples from the upper 6 feet of the site materials were tested to evaluate the expansion potential in accordance with ASTM Standard D4829. The test results both indicated expansion indices of 0, corresponding to very low expansion potential.
- R-Value: Two representative bulk samples were tested in accordance with Caltrans Test Method 301. The results of the R-value tests were 67 and 77.
- Grain Size Analysis – Three representative samples were tested to determine the relative grain size distribution in accordance with the ASTM Standard D6913. The test results are graphically presented in Drawing No. B-1, *Grain Size Distribution Results.*
- Maximum Dry Density and Optimum Moisture Content: Typical moisture-density relationships of two representative soil samples were performed in accordance with ASTM Standard D1557. The test results are presented in Drawing No. B-2, *Moisture-Density Relationship Result*, in Appendix B, *Laboratory Testing Program.* The laboratory maximum dry densities were 127.0 and 132.0 pounds per cubic feet (pcf), with optimum moisture contents of 7.0 and 5.5 percent, respectively.
- Direct Shear: One direct shear test was performed on a sample remolded to 90% of the maximum dry density under soaked moisture condition in accordance with ASTM Standard D3080. The result of the direct shear test is presented in Drawing No. B-3, *Direct Shear Test Results* in Appendix B, *Laboratory Testing Program*.

8.2 Chemical Testing - Corrosivity Evaluation

One representative soil sample was tested to determine minimum electrical resistivity, pH, and chemical content, including soluble sulfate and chloride concentrations. The purpose of this test was to determine the corrosion potential of site soils when placed in contact with common pipe materials. The test was performed by AP Engineering and Testing, Inc. (Pomona, CA) in accordance with California Test Methods 643, 422, and 417. The test results are presented in Appendix B, *Laboratory Testing Program and* are summarized in below*.*

- The pH measurement of the sample tested was 7.5.

- The sulfate content of the sample tested was 21 ppm (0.0021 percent by weight ppm).
- The chloride concentration of the sample tested was 19 ppm.
- The minimum electrical resistivity when saturated was 12,753 ohm-cm.

9.0 PERCOLATION TESTING

Three percolation tests (PT-01 through PT-03) were performed on August 03, 2021, to estimate the water infiltration rate, within the area of the proposed water infiltration device, located in the southwest corner of the site. The measured percolation test data and calculations are represented in Appendix C, *Percolation Testing*. The estimated infiltration rates at each test hole are presented in the following table.

Table No. 4, Estimated Infiltration Rates

Percolation Test	Test Depth (feet)	Soil Type	Infiltration Rate (inches/hr) (FOS 2)
PT-01	15.1	Sand/Silty Sand, with Gravel (SP/SM)	11.62
PT-02	13.1	Sand/Silty Sand, with Gravel (SP/SM)	11.53
PT-03	13.9	Sand/Silty Sand, with Gravel (SP/SM)	11.57

Based on the calculated infiltration rate during the final respective intervals in each test, an average infiltration rate of 11.57 inches per hour can be utilized for design.

10.0 EARTHWORK AND SITE GRADING RECOMMENDATIONS

Earthwork for the project will include grading, trench excavation, pipe subgrade preparation, pipeline bedding placement and trench backfill, as well as roadway pavement construction. Recommendations for earthwork are presented in the following subsections. General Earthwork Specifications are presented in Appendix D*, Earthwork Specifications.*

10.1 General

This section contains our general recommendations regarding earthwork for the proposed Linden Bloomington Condos residential development project.

These recommendations are based on the results of our field exploration and laboratory testing, our experience with similar projects, and data evaluation as presented in the preceding sections. These recommendations may require modification by the geotechnical consultant based on observation of the actual field conditions during remedial grading.

Prior to the start of construction, all underground existing utilities and appurtenances should be located at the project site. Such utilities should either be protected in-place or

removed and replaced during construction as required by the project specifications. All excavations should be conducted in such a manner as not to cause loss of bearing and/or lateral support of existing structures or utilities.

All debris, deleterious material and surficial soils containing roots and perishable materials should be stripped and removed from the project site. Deleterious material, including organics, concrete, and debris generated during excavation, should not be placed as fill.

The final bottom surfaces of all excavations should be observed and approved by the project geotechnical consultant prior to placing any fill. Based on these observations, localized areas may require remedial grading deeper than indicated herein. Therefore, some variations in the depth and lateral extent of excavation recommended in this report should be anticipated.

10.2 Private Sewage System Abandonment

Any seepage pits, other private sewage systems, and/or other subsurface structures that may be encountered should be located, mapped on the grading plans, removed and/or properly abandoned. Abandonment and/or removal of septic systems that may exist should be in accordance with local codes and recommendations by Converse. Seepage pits, if abandoned in-place, should be pumped clean, backfilled with gravel or clean sand jetted into place, and then capped with a minimum of 2 feet of a 2-sack or greater slurry or concrete for a minimum distance of 2 feet outside the edge of the seepage pit. The top of the slurry or concrete cap should be at a minimum 10 feet below proposed grade.

10.3 Overexcavation

The site is generally underlain by approximately 2.0 feet to 5.0 feet of potentially compressible soils (upper low-density portions of the young alluvial fan deposits), which may be prone to future adverse settlement under the surcharge of foundation, improvements and/or fill loads. Therefore, these materials should be over-excavated to competent alluvial fan deposits, within all areas of proposed structures, walls and other improvements, and replaced with compacted fill soils.

Building Pad Areas: Within the entire level portions of the building pad areas overexcavations should be approximately 4.0 feet to 5.0 feet below existing grade or and least 4.0 feet below proposed grade, as well as 2.0 feet below the bottom of the proposed building footings, whichever is deeper. All over-excavations should extend laterally at least 5.0 feet or equal to the depth of over-excavation, whichever is greater, outside the entire level portions of the building pad area.

Improvements Outside of the Building Pad Areas: For areas of proposed roadways, parking, flatwork, walls and other improvements, overexcavations should be at least 2.0 to 3.0 feet below existing grade. Within wall areas overexcavations should also be a minimum of 2.0 feet below the proposed wall footings, all over-excavations should extend laterally at least 3.0 feet or equal to the depth of over-excavation, whichever is greater.

The final bottom surfaces of all excavations should be observed and approved by the project geotechnical consultant prior to placing any fill or structures. However, localized deeper over-excavation could be encountered, based on observations and density testing by the geotechnical consultant during grading of the final bottom surfaces of all excavations.

The estimated locations and approximate depths of overexcavation of unsuitable, compressible soil materials are indicated on Figure No. 2, *Approximate Boring, Percolation Testing and Overexcavation Locations Map*.

If isolated pockets of very soft, loose, eroded, or pumping soil are encountered, the unstable soil should be excavated as needed to expose undisturbed, firm, and unyielding soils.

The contractor should determine the best manner to conduct the excavations, such that there are no losses of bearing and/or lateral support to the existing structures or utilities (if any).

Following overexcavation areas to receive fill and/or other surface improvements should be scarified to a minimum depth of 6 inches, brought to a near-optimum moisture condition, and recompacted to at least 90 percent relative compaction (based on ASTM Test Method D1557).

10.4 Cut/Fill Transition and Fill Differentials

To mitigate distress to structures related to the potential adverse effects of excessive differential settlement, cut/fill transitions should be eliminated from all level portions of the building pad areas. This should be accomplished by overexcavating the entire “cut” portion of the entire building pad area by at least 4.0 feet below proposed grade and replacing the excavated materials as properly compacted fill, so that all footings for structures and walls are founded into engineered fill with a minimum of 2.0 feet of fill below footings for proposed structures and 2.0 feet below footings for proposed walls. Recommended depths of over-excavation are provided in the following table.

Table No. 5, Overexcavation Depth for Cut/Fill Transitions

Depth of Fill ("Fill" Portion)	Depth of Overexcavation ("Cut" Portion)
Up to 12.0 feet	4.0 feet
Greater than 12.0 feet	One-third the maximum thickness of fill placed on the "fill" portion (15 feet maximum)

10.5 Engineered Fill

No fill should be placed until excavations and/or natural ground preparation have been observed by the geotechnical consultant. The existing soils encountered within the project site are generally considered suitable for re-use as compacted fill. Excavated soils should be processed, including removal of roots and debris, removal of oversized particles, mixing, and moisture conditioning, before placing as compacted fill. On-site soils used as fill should meet the following criteria.

- No particles larger than 3 inches in largest dimension.
- Rocks larger than one inch should not be placed within the upper 12 inches of subgrade soils.
- Free of all organic matter, debris, or other deleterious material.
- Expansion index of 20 or less.
- Sand equivalent greater than 15 (greater than 30 for pipe bedding).
- Contain less than 30 percent by weight retained in 3/4-inch sieve.
- Contain less than 40 percent fines (passing #200 sieve).

Based on field investigation and laboratory testing results, on-sites soils may be suitable as fill materials.

Imported materials, if required, should meet the above criteria prior to being used as compacted fill. Any imported fills should be tested and approved by the geotechnical consultant prior to delivery to the site.

10.6 Compacted Fill Placement

All surfaces to receive structural fills should be scarified to a depth of 6 inches. The soil should be moisture conditioned to within ±3 percent of optimum moisture content for coarse soils and 0 to 2 percent above optimum moisture content for fine soils. The scarified soils should be recompacted to at least 90 percent of the laboratory maximum dry density.

Fill soils should be thoroughly mixed, and moisture conditioned to within ±3 percent of optimum moisture content for coarse soils and 0 to 2 percent above optimum moisture content for fine soils. Fill soils should be evenly spread in horizontal lifts not exceeding 8 inches in uncompacted thickness.

All fill placed at the site should be compacted to at least 90 percent of the laboratory maximum dry densities as determined by ASTM Standard D1557 test method unless a higher compaction is specified herein. Prior to placement of pavement sections at least the upper 1 foot of subgrade soils underneath pavements intended to support vehicle loads should be scarified, moisture conditioned, and compacted to at least 95 percent of the laboratory maximum dry density.

To reduce differential settlement, variations in the soil type, degree of compaction and thickness of the engineered fill placed underneath the foundations should be minimized.

Fill materials should not be placed, spread, or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations should not resume until the geotechnical consultant approves the moisture and density conditions of the previously placed fill.

10.7 Backfill Recommendations Behind Walls

Compaction of backfill adjacent to perimeter wall or any retaining walls, which may be proposed in the future, can produce excessive lateral pressures. Improper types and locations of compaction equipment and/or compaction techniques may damage the walls. The use of heavy compaction equipment should not be permitted within a horizontal distance of 5 feet from the wall. Backfill behind any structural walls within the recommended 5-foot zone should be compacted using lightweight construction equipment such as handheld compactors to avoid overstressing the walls.

10.8 Shrinkage and Subsidence

The volume of excavated and recompacted soils will decrease as a result of grading. The shrinkage would depend on, among other factors, the depth of cut and/or fill, and the grading method and equipment utilized. Based on our exploration, laboratory test results, as well as previous experience in the other projects in close vicinity of this site, for the preliminary estimation, shrinkage factors for various units of earth material at the site may be taken as presented below.

- The shrinkage factor (defined as a percentage of soil volume reduction when moisture conditioned and compacted to the average of 92 percent relative compaction) for the upper 10 feet of soils is estimated to range from approximately 0 to 13 percent. An average value of 6 percent may be used for preliminary earthwork planning.
- Subsidence (defined as the settlement of native materials from the equipment load applied during grading) would depend on the construction methods including type of equipment utilized. Ground subsidence is estimated to be approximately 0.15 foot to 0.20 foot.

Although these values are only approximate, they represent our best estimates of the factors to be used to calculate lost volume that may occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field-testing using the actual equipment and grading techniques be conducted.

10.9 Site Drainage

Adequate positive drainage should be provided away from the structures and excavation areas to prevent ponding and to reduce percolation of water into the foundation soils. A desirable drainage gradient is 1 percent for paved areas and 2 percent in landscaped areas. Surface drainage should be directed to suitable non-erosive devices.

10.10 Utility Trench Backfill

The following sections present earthwork recommendations for utility trench backfill, including subgrade preparation and trench zone backfill.

Open cuts adjacent to existing roadways or structures are not recommended within a 1:1 (horizontal: vertical) plane extending down and away from the roadway or structure perimeter (if any).

Soils from the trench excavation should not be stockpiled more than 6 feet in height or within a horizontal distance from the trench edge equal to the depth of the trench. Soils should not be stockpiled behind the shoring, if any, within a horizontal distance equal to the depth of the trench, unless the shoring has been designed for such loads.

10.10.1 Pipeline Subgrade Preparation

The final subgrade surface should be level, firm, uniform, and free of loose materials and properly graded to provide uniform bearing and support to the entire section of the pipe placed on bedding material. Protruding oversize particles larger than 2 inches in dimension, if any, should be removed from the trench bottom and replaced with compacted on-site materials.

Any loose, soft, and/or unsuitable materials encountered at the pipe subgrade should be removed and replaced with an adequate bedding material. During the digging of depressions for proper sealing of the pipe joints, the pipe should rest on a prepared bottom for as near its full length as is practicable.

10.10.2 Pipe Bedding

Bedding is defined as the material supporting and surrounding the pipe to 1 foot above the pipe. Recommendations for pipe bedding are provided below.

To provide uniform and firm support for the pipe, compacted granular materials such as clean sand, gravel or ¾-inch crushed aggregate, or crushed rock may be used as pipe bedding material. Typically, soils with sand equivalent value of 30 or more are used as pipe bedding material. The pipe designer should determine if the soils are suitable as pipe bedding material.

The type and thickness of the granular bedding placed underneath and around the pipe, if any, should be selected by the pipe designer. The load on the rigid pipes and deflection of flexible pipes and, hence, the pipe design, depends on the type and the amount of bedding placed underneath and around the pipe.

Bedding materials should be vibrated in-place to achieve compaction. Care should be taken to densify the bedding material below the spring line of the pipe. Prior to placing the pipe bedding material, the pipe subgrade should be uniform and properly graded to provide uniform bearing and support to the entire section of the pipe placed on bedding material. During the digging of depressions for proper sealing of the pipe joints, the pipe should rest on a prepared bottom for as near its full length as is practicable.

10.10.3 Trench Zone Backfill

The trench zone is defined as the portion of the trench above the pipe bedding extending up to the final grade level of the trench surface. Excavated site soils free of oversize particles and deleterious matter may be used to backfill the trench zone. Detailed trench backfill recommendations are provided below.

- Trench excavations to receive backfill should be free of trash, debris or other unsatisfactory materials at the time of backfill placement.
- Trench zone backfill should be compacted to at least 90 percent of the laboratory maximum dry density as per ASTM D1557 test method. At least the upper 1 foot of trench backfill underlying pavement should be compacted to at least 95 percent of the laboratory maximum dry density as per ASTM D1557 test method.
- Particles larger than 1 inch should not be placed within 12 inches of the pavement subgrade. No more than 30 percent of the backfill volume should be larger than ¾-inch in the largest dimension. Gravel should be well mixed with finer soil. Rocks larger than 3 inches in the largest dimension should not be placed as trench backfill.
- Trench backfill should be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers or mechanical tampers to achieve the density specified herein. The backfill materials should be brought to within ± 3 percent of optimum moisture content for coarse-grained soil, and between optimum and 2 percent above optimum for fine-grained soil, then placed in horizontal layers. The thickness of uncompacted layers should not exceed 8 inches. Each layer should be evenly spread, moistened, or dried as necessary, and then tamped or rolled until the specified density has been achieved.

- The contractor should select the equipment and processes to be used to achieve the specified density without damage to adjacent ground, structures, utilities and completed work.
- The field density of the compacted soil should be measured by the ASTM D1556 (Sand Cone) or ASTM D6938 (Nuclear Gauge) or equivalent.
- It should be the responsibility of the contractor to maintain safe working conditions during all phases of construction.
- Trench backfill should not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations should not resume until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are in compliance with project specifications.

11.0 DESIGN RECOMMENDATIONS

The various design recommendations provided in this section are based on the assumption that the above earthwork and grading recommendations will be implemented in the project design and construction.

11.1 Shallow Foundation Design Parameters

The proposed one- and two-story buildings as well as possible retaining walls and block walls may be supported on continuous or isolated spread footings founded completely within competent compacted fill. The design of the shallow foundations should be based on the recommended parameters presented in the table below.

Table No. 6, Recommended Foundation Parameters

Parameter	1-Story Value	2-Story Value
Minimum continuous footing width (interior and exterior)	12 inches	15 inches
Minimum continuous or isolated footing depth of embedment below lowest adjacent grade (interior and exterior)	15 inches	18 inches
Allowable net bearing capacity	2,500 psf	3,000 psf

Isolated interior footings should be at least 24 inches wide. The footing dimensions and reinforcement should be based on structural design. The allowable bearing capacity can be increased by 500 pounds per square foot (psf) with each foot of additional embedment and 100 psf with each foot of additional width up to a maximum of 3,500 psf.

The net allowable bearing values indicated above are for the dead loads and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity. If normal code requirements are applied for design, the above

vertical bearing value may be increased by 33 percent for short duration loadings, which will include loadings induced by wind or seismic forces.

11.2 Lateral Earth Pressures and Resistance to Lateral Loads

In the following subsections, the lateral earth pressures and resistance to lateral loads are estimated by using on-site native soils strength parameters obtained from laboratory testing.

11.2.1 Active Earth Pressures

The active earth pressure behind any buried wall or foundation depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall or foundation inclination, surcharges, and any hydrostatic pressures. The lateral earth pressures for the project site are presented in the following tables.

Table No. 7, Active and At-Rest Earth Pressures

Loading Conditions	Lateral Earth Pressure[1] (psf)	Lateral Earth Pressure[2] (psf)
	Level backfill	2:1 backfill
Active earth conditions (wall is free to deflect at least 0.001 radian)	40	60
At-rest (wall is restrained)	60	109

These pressures assume no surcharge, and no hydrostatic pressure. If water pressure is allowed to build up behind the structure, the active pressures should be reduced by 50 percent and added to a full hydrostatic pressure to compute the design pressures against the structure.

11.2.2 Passive Earth Pressure

Resistance to lateral loads can be assumed to be provided by a combination of friction acting at the base of foundations and by passive earth pressure. A coefficient of friction of 0.35 between formed concrete and soil may be used with the dead load forces. An allowable passive earth pressure of 270 psf per foot of depth may be used for the sides of footings poured against recompacted soils. A factor of safety of 1.5 was applied in calculating passive earth pressure. The maximum value of the passive earth pressure should be limited to 2,500 psf for compacted fill.

Vertical and lateral bearing values indicated above are for the total dead loads and frequently applied live loads. If normal code requirements are applied for design, the above vertical bearing and lateral resistance values may be increased by 33 percent for short duration loading, which will include the effect of wind or seismic forces.

Due to the low overburden stress of the soil at shallow depth, the upper 1 foot of passive resistance should be neglected unless the soil is confined by pavement or slab.

11.3 Retaining Walls Drainage

The recommended lateral earth pressure values, for any future retaining walls, do not include lateral pressures due to hydrostatic forces. Therefore, wall backfill should be free draining and provisions should be made to collect and dispose of excess water that may accumulate behind earth retaining structures. Behind wall drainage may be provided by free-draining gravel surrounded by synthetic filter fabric or by prefabricated, synthetic drain panels or weep holes. In either case, drainage should be collected by perforated pipes and directed to a sump, storm drain, or other suitable location for disposal. We recommend drain rock should consist of durable stone having 100 percent passing the 1-inch sieve and less than 5 percent passing the No. 4 sieve. Synthetic filter fabric should have an equivalent opening size (EOS), U.S. Standard Sieve, of between 40 and 70, a minimum flow rate of 110 gallons per minute per square foot of fabric, and a minimum puncture strength of 110 pounds.

11.4 Slabs-on-Grade

Slabs-on-grade should be supported on properly compacted fill. Compacted fill used to support slabs-on-grade should be placed and compacted in accordance with Section 10.6 *Compacted Fill Placement*.

Structural design elements of slabs-on-grade, including but not limited to thickness, reinforcement, joint spacing of more heavily loaded slabs will be dependent upon the anticipated loading conditions and the modulus of subgrade reaction (200 kcf) of the supporting materials and should be designed by a structural engineer.

Slabs should be designed and constructed as promulgated by the American Concrete Institute (ACI) and the Portland Cement Association (PCA). Care should be taken during concrete placement to avoid slab curling. Prior to the slab pour, all utility trenches should be properly backfilled and compacted.

Subgrade for slabs-on-grade should be firm and uniform. All loose or disturbed soils including under-slab utility trench backfill should be recompacted.

If moisture-sensitive flooring or environments are planned, slabs-on-grade should be protected by 10-mil-thick polyethylene vapor barriers. The sub-grade surface should be free of all exposed rocks or other sharp objects prior to placement of the barrier. The barrier should be overlain by 2 inches of sand, to minimize punctures and to aid in the concrete curing. At discretion of the structure engineer, the sand layer may be eliminated.

In hot weather, the contractor should take appropriate curing precautions after placement of concrete to minimize cracking or curling of the slabs. The potential for slab cracking may be lessened by the addition of fiber mesh to the concrete and/or control of the water/cement ratio (maximum 0.40).

Concrete should be cured by protecting it against loss of moisture and rapid temperature change for at least 7 days after placement. Moist curing, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used after finishing operations have been completed. The edges of concrete slabs exposed after removal of forms should be immediately protected to provide continuous curing.

11.5 Settlement

The total settlement of shallow footings, designed as recommended above, from static structural loads and short-term settlement of properly compacted fill is anticipated to be 1/2 inch or less. The static differential settlement can be taken as equal to one-half of the static total settlement over a lateral distance of 40 feet.

Based on the absence of shallow groundwater, within 50 feet bgs, dense nature of the soils and high blow counts, the potential dynamic settlement for the project site from liquefaction and dynamic differential settlement is considered negligible.

11.6 Expansion Potential

Based on the results of the expansion testing of representative site soils, on-site soils have expansion index of 0.

The expansion indices of the final finish-grade soils will vary from the results obtained during our investigation. The expansion potential of the finish-grade soils should be confirmed by additional testing at the completion of grading and revise the foundation design parameters if necessary. During construction, the contractor should determine effective methods to minimize moisture variations.

11.7 Pipe Design for Underground Utilities

Structural design of pipes requires proper evaluation of all possible loads acting on pipes. The stresses and strains induced on buried pipes depend on many factors, including the type of soil, density, bearing pressure, angle of internal friction, coefficient of passive earth pressure, and coefficient of friction at the interface between the backfill and native soils. The recommended values of the various soil parameters for the pipe design are provided in Table No. 8, *Soil Parameters for Pipe Design*.

Where pipes are connecting to rigid structures near, or at its lower levels, and then are subjected to significant loads as the backfill is placed to finish grade, we recommend that provisions be incorporated in the design to provide support of these pipes where they exit the structure. Consideration can be given to flexible connections, concrete slurry support beneath the pipes where they exit the structures, overlaying and supporting the pipes with a few inches of compressible material, (i.e., Styrofoam, or other materials), or other techniques. Automatic shutoffs should be installed to limit the potential leakage from seismic event related damage.

Table No. 8, Soil Parameters for Pipe Design

Soil Parameters	Parameters
Total unit weight of compacted backfill (assuming 92% average relative compaction), γ	128 pcf
Angle of internal friction of soils, ϕ	32º
Soil cohesion, c	0 psf
Coefficient of friction between concrete and native soils, fs	0.35
Coefficient of friction between pipe and compacted fill or native soils, fs	0.25 for metal or HDPE pipe 0.30 for CML&C pipe
Bearing pressure against compacted fill or natural soils	2,500 psf
Coefficient of passive earth pressure, Kp	3.25
Coefficient of active earth pressure, Ka	0.31
Modulus of Soil Reaction, E’	1,500 psi

11.8 Soil Corrosivity

The results of chemical testing of a representative sample of site soils with respect to common construction materials such as concrete and steel are presented in Appendix B, *Laboratory Testing Program*, and a general discussion are presented below.

The sulfate content of the sampled soils corresponds to American Concrete Institute (ACI) exposure category S0 for these sulfate concentrations (ACI 318-14, Table 19.3.1.1). No concrete type restrictions are specified for exposure category S0 (ACI 318-14, Table 19.3.2.1). A minimum compressive strength of 2,500 psi is recommended.

We anticipate that concrete structures such as footings, slab, and flatwork will be exposed to moisture from precipitation and irrigation. Based on the project location and the results of chloride testing of the site soils, we do not anticipate that concrete structures will be exposed to external sources of chlorides, such as deicing chemicals, salt, brackish water, or seawater. ACI specifies exposure category C1 where concrete is exposed to moisture, but not to external sources of chlorides (ACI 318-14, Table

19.3.1.1). ACI provides concrete design recommendations in ACI 318-14, Table 19.3.2.1, including a minimum compressive strength of 2,500 psi, and a maximum chloride content of 0.3 percent.

According to Romanoff, 1957, the following table provides general guideline of soil corrosion based on electrical resistivity.

Table No. 9, Correlation Between Resistivity and Corrosion

Soil Resistivity (ohm-cm) per Caltrans CT 643	Corrosivity Category
Over 10,000	Mildly corrosive
2,000 – 10,000	Moderately corrosive
1,000 – 2,000	corrosive
Less than 1,000	Severe corrosive

The measured value of the minimum electrical resistivity when saturated was 12,753 ohm-cm. This indicates that the soils tested are mildly corrosive for ferrous metals in contact with the soil (Romanoff, 1957). Converse does not practice in the area of corrosion consulting. If needed, a qualified corrosion consultant should provide appropriate corrosion mitigation measures for ferrous metals in contact with the site soils.

11.9 Pavement Recommendations

Two soil samples were tested to determine the R-value of the subgrade soils. Based on laboratory testing, the R-values were 67 and 77. For pavement design, we have utilized a maximum design R-value of 50 for design Traffic Indices (TIs) ranging from 5 to 8.

Based on the above information, asphalt concrete and aggregate base thickness results are presented using the Caltrans Highway Design Manual (Caltrans, 2020), Chapter 630 with a safety factor of 0.2 for asphalt concrete/aggregate base section and 0.1 for full depth asphalt concrete section. Preliminary asphalt concrete pavement sections are presented in the following table below. City of Bloomington minimum asphalt pavement and aggregate base thickness requirements should also be considered in the pavement design.

Table No. 10, Recommended Preliminary Pavement Sections

Design R-value	Traffic Index (TI)	Pavement Section		
		Option 1		Option 2
		Asphalt Concrete (inches)	Aggregate Base (inches)	Full AC Section (inches)
50	5	3.0	4.0	4.5
	6	3.5	4.0	5.5
	7	4.0	4.5	7.0
	8	4.5	6.0	8.0

At or near the completion of grading, subsurface samples should be tested to evaluate the actual subgrade R-value for final pavement design.

Prior to placement of aggregate base and AC, at least the upper 1 foot of subgrade soils should be scarified, moisture-conditioned if necessary, and recompacted to at least 95 percent of the laboratory maximum dry density as defined by ASTM Standard D1557 test method.

Base materials should conform with Section 200-2.2,"*Crushed Aggregate Base*," of the current Standard Specifications for Public Works Construction (SSPWC; Public Works Standards, 2018) and should be placed in accordance with Section 301.2 of the SSPWC.

Asphaltic concrete materials should conform to Section 203 of the SSPWC and should be placed in accordance with Section 302.5 of the SSPWC.

11.10 Concrete Flatwork

Except as modified herein, concrete walks, driveways, access ramps, curb and gutters should be constructed in accordance with Section 303-5, *Concrete Curbs, Walks, Gutters, Cross-Gutters, Alley Intersections, Access Ramps, and Driveways*, of the Standard Specifications for Public Works Construction (Public Works Standards, 2018).

The subgrade soils under the above structures should consist of compacted fill placed as described in this report. Prior to placement of concrete, the upper 1 foot of subgrade soils should be moisture conditioned to between within 3 percent of optimum moisture content for coarse-grained soils and 0 and 2 percent above optimum for fine-grained soils.

The thickness of driveways for passenger vehicles should be at least 4 inches, or as required by the civil or structural engineer. Transverse control joints for driveways should be spaced not more than 10 feet apart. Driveways wider than 12 feet should be provided with a longitudinal control joint.

Concrete walks subjected to pedestrian and bicycle loading should be at least 4 inches thick, or as required by the civil or structural engineer. Transverse joints should be spaced 15 feet or less and should be cut to a depth of one-fourth the slab thickness.

Positive drainage should be provided away from all driveways and sidewalks to prevent seepage of surface and/or subsurface water into the concrete base and/or subgrade.

12.0 CONSTRUCTION RECOMMENDATIONS

Temporary sloped excavation recommendations are presented in the following sections.

12.1 General

Prior to the start of construction, all existing underground utilities should be located at the project site. Such utilities should either be protected in-place or removed and replaced during construction as required by the project specifications.

Sloped excavations may not be feasible in locations adjacent to existing utilities, pavement, or structure (if any). Recommendations pertaining to temporary excavations are presented in this section.

Excavations near existing utilities or structures (if any) may require vertical sidewall excavation. Where the side of the excavation is a vertical cut, it should be adequately supported by temporary shoring to protect workers and any adjacent structures.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by the geotechnical consultant and the competent person designated by the contractor. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

12.2 Temporary Sloped Excavations

Temporary open-cut trenches may be constructed with side slopes as recommended in the following table. Temporary cuts encountering soft and wet fine-grained soils; dry loose, cohesionless soils or loose fill from trench backfill may have to be constructed at a flatter gradient than presented below.

Table No. 11, Slope Ratios for Temporary Excavations

Soil Type	OSHA Soil Type	Depth of Cut (feet)	Recommended Maximum Slope (Horizontal: Vertical)[1]
Silty Sand (SM) and Sandy Silt (ML)	C	0-10	1.5:1

[1] Slope ratio assumed to be uniform from top to toe of slope.

For shallow excavations up to 4 feet bgs, a slope ratio of 1:1 can be used for steeper temporary construction slopes or deeper excavations, or unstable soil encountered during the excavation, shoring or trench shields should be provided by the contractor to protect the workers in the excavation. Design recommendations for temporary shoring can be provided if requested.

Surfaces exposed in slope excavations should be kept moist but not saturated to retard raveling and sloughing during construction. Adequate provisions should be made to protect the slopes from erosion during periods of rainfall. Surcharge loads, including construction materials, should not be placed within 5 feet of the unsupported slope edge. Stockpiled soils with a height higher than 6 feet will require greater distance from trench edges.

13.0 GEOTECHNICAL SERVICES DURING CONSTRUCTION

The project geotechnical consultant should review plans and specifications as the project design progresses. Such review is necessary to identify design elements, assumptions, or new conditions which require revisions or additions to our geotechnical recommendations.

The project geotechnical consultant should be present to observe conditions during construction. Geotechnical observation and testing should be performed as needed to verify compliance with project specifications. Additional geotechnical recommendations may be required based on subsurface conditions encountered during construction.

14.0 CLOSURE

This report is prepared for the project described herein and is intended for use solely by All-ERA Properties, LLC and their authorized agents, to assist in the development of the proposed project. Our findings and recommendations were obtained in accordance with generally accepted professional principles practiced in geotechnical engineering. We make no other warranty, either expressed or implied.

Converse Consultants is not responsible or liable for any claims or damages associated with interpretation of available information provided to others. Site exploration identifies actual soil conditions only at those points where samples are taken, when they are taken. Data derived through sampling and laboratory testing is extrapolated by

Converse employees who render an opinion about the overall soil conditions. Actual conditions in areas not sampled may differ. In the event that changes to the project occur, or additional, relevant information about the project is brought to our attention, the recommendations contained in this report may not be valid unless these changes and additional relevant information are reviewed, and the recommendations of this report are modified or verified in writing. In addition, the recommendations can only be finalized by observing actual subsurface conditions revealed during construction. Converse cannot be held responsible for misinterpretation or changes to our recommendations made by others during construction.

As the project evolves, a continued consultation and construction monitoring by a qualified geotechnical consultant should be considered an extension of geotechnical investigation services performed to date. The geotechnical consultant should review plans and specifications to verify that the recommendations presented herein have been appropriately interpreted, and that the design assumptions used in this report are valid. Where significant design changes occur, Converse may be required to augment or modify the recommendations presented herein. Subsurface conditions may differ in some locations from those encountered in the explorations, and may require additional analyses and, possibly, modified recommendations.

Design recommendations given in this report are based on the assumption that the recommendations contained in this report are implemented. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.

15.0 REFERENCES

AMERICAN CONCRETE INSTITUTE (ACI), 2014, Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary, dated October 2014.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE), 2017, Minimum Design Loads for Buildings and Other Structures, SEI/ASCE Standard No. 7-16, dated 2017.

CALIFORNIA BUILDING STANDARDS COMMISSION (CBSC), 2019, California Building Code (CBC).

CALIFORNIA DEPARTMENT OF TRANSPORTATION (Caltrans), 2020, Highway Design Manual, dated March 2020.

CALIFORNIA DEPARTMENT OF WATER RESOURCES (CDWR), 2021 Water Data Library, Groundwater Levels, accessed November 2021.

CALIFORNIA GEOLOGICAL SURVEY (CGS), 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Faulting Zoning Act with Index to Earthquake Fault Zone Maps, Special Publication 42, revised 2007.

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD (SWRCB), 2021, GeoTracker database (http://geotracker.waterboards.ca.gov/), accessed November 2021.

DAS, B.M., 2011, Principles of Foundation Engineering, Seventh Edition, published by Global Engineering, 2011.

DEPARTMENT OF WATER RESOURCES - DIVISION OF SAFETY OF DAMS (DSOD), 2021, California Dam Breach Inundation Maps, (https://fmds.water.ca.gov/webgis/?appid=dam_prototype_v2), accessed March 2021.

ENCOMPASS ASSOCIATES, INC., Preliminary Site Plan, Linden Bloomington Condos, 10598 Orchard St., Sheet 1 of 1, Scale: 1’= 60’, No Date.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), 2008, Flood Insurance Rate Map, San Bernardino County, California and Incorporated Areas, Map No. 06071C8667H, effective date August 28, 2008.

MORTON, D.M. and MILLER, F.K., 2006, Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, California, U.S. Geological Survey Open-File Report 2006-1217, scale 1:100,000.

MOSER A. P. Buried Pipe Design, Second Edition, published by McGraw-Hill, 2001.

PUBLIC WORKS STANDARDS, INC., 2018, Standard Specifications for Public Works Construction (“Greenbook”), 2018.

ROMANOFF, MELVIN, 1957, Underground Corrosion, National Bureau of Standards Circular 579, dated April 1957.

SAN BERNARDINO COUNTY (SBC), 2021a, San Bernardino County General Plan Hazard Overlays, Map Sheets FH2 C, scale 1:14,400, dated May 30, 2007.

U.S. GEOLOGICAL SURVEY (USGS), 2021, National Water Information System: Web Interface (https://maps.waterdata.usgs.gov/mapper/index.html), accessed November 2021.

Appendix A

Field Exploration

APPENDIX A

FIELD EXPLORATION

Our field investigation included a site reconnaissance and a subsurface exploration program consisting of drilling soil borings. During the site reconnaissance, the surface conditions were noted, and the borings were marked in the field using approximate distances from local streets as a guide and should be considered accurate only to the degree implied by the method used to locate them. Description of the field investigation method is presented below.

Six borings (BH-01 through BH-06) were drilled on August 02, 2021, within the project site to investigate the subsurface conditions. The borings were drilled to depths ranging from approximately 13.5 to 51.0 feet below ground surface (bgs).

Three exploratory borings (BH-01 through BH-03) were utilized as percolation test holes (PT-01 through PT-03) to perform percolation testing. Percolation test borings were drilled to depths ranging from approximately 13.5 to 16.5 feet below the existing ground surface (bgs).

The borings were advanced using a CME 75 truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers for soils sampling. Encountered materials were continuously logged by a Converse geologist and classified in the field by visual classification in accordance with the Unified Soil Classification System. Where appropriate, the field descriptions and classifications have been modified to reflect laboratory test results.

Relatively undisturbed samples were obtained using California Modified Samplers (2.4 inches inside diameter and 3.0 inches outside diameter) lined with thin sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches. Blow counts at each sample interval are presented on the boring logs for each blow. The recorded blow counts for every 6 inches for a total of 1.5 feet of sampler penetration are shown on the Logs of Borings. Samples were retained in brass rings (2.4 inches inside diameter and 1.0 inch in height) and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Bulk samples of typical soil types were also obtained. Some ring samples collected from each borehole were disturbed or contained no soil recovery because of the poor consolidation and large grain sizes.

Standard Penetration Testing (SPT) was also performed in borings BH-04 and BH-05 in accordance with the ASTM Standard D1586 test method at 10-foot intervals beginning at 20 feet in both boreholes using a standard (1.4 inches inside diameter and 2.0 inches outside diameter) split-barrel sampler. The mechanically driven hammer for the SPT sampler was 140 pounds, falling 30 inches for each blow. The recorded blow counts for

every 6 inches for a total of 1.5 feet of sampler penetration are shown on the Logs of Borings.

Representative bulk samples were collected from selected depths and placed in large plastic bags for delivery to our laboratory.

The exact depths at which material changes occur cannot always be established accurately. Unless a more precise depth can be established by other means, changes in material conditions that occur between drive samples are indicated on the logs at the top of the next drive sample.

Following the completion of logging and sampling, borings BH-04 through BH-06 were backfilled with soil cuttings and compacted by pushing down with the augers using the drill rig weight. Following the completion of logging, sampling and percolation testing in borings BH-01/PT-01 through BH-03/PT-03, the perforated pipes were removed and then the holes were backfilled with soil cuttings and were tamped from the surface. If construction is delayed, the surface of the borings may settle over time. We recommend the owner monitor the boring locations and backfill any depressions that might occur or provide protection around the boring locations to prevent trip and fall injuries from occurring.

For a key to soil symbols and terminology used in the boring logs, refer to Drawing Nos. A-1a andA-1b, *Unified Soil Classification and Key to Boring Log Symbols*. For logs of borings, see Drawings No. A-2 through A-7, *Logs of Borings*.

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435)
CL	Collapse Potential (ASTM D 4546)
CP	Compaction Curve (ASTM D 1557)
CR	Corrosion, Sulfates, Chlorides (CTM 643-99; 417; 422)
CU	Consolidated Undrained Triaxial (ASTM D 4767)
DS	Direct Shear (ASTM D 3080)
EI	Expansion Index (ASTM D 4829)
M	Moisture Content (ASTM D 2216)
OC	Organic Content (ASTM D 2974)
P	Permeablility (ASTM D 2434)
PA	Particle Size Analysis (ASTM D 6913 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (ASTM D 4318)
PL	Point Load Index (ASTM D 5731)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301)
SE	Sand Equivalent (ASTM D 2419)
SG	Specific Gravity (ASTM D 854)
SW	Swell Potential (ASTM D 4546)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166)
	Unconfined Compression - Rock (ASTM D 7012)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850)
UW	Unit Weight (ASTM D 2937)

BORING LOG SYMBOLS

SAMPLE TYPE

- STANDARD PENETRATION TEST — Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method
- DRIVE SAMPLE 2.42" I.D. sampler (CMS).
- DRIVE SAMPLE No recovery
- BULK SAMPLE
- GROUNDWATER WHILE DRILLING
- GROUNDWATER AFTER DRILLING

DRILLING METHOD SYMBOLS

Auger Drilling | Mud Rotary Drilling | Dynamic Cone or Hand Driven | Diamond Core

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG AND TEST PIT SYMBOLS

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County,
California For: All-ERA Properties, LLC

Project No. **21-81-176-01**

Drawing No. **A-1a**

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	SPT Blow Counts	Pocket Penetrometer (tsf)	CA Sampler	Torvane (tsf)	Field Approximation
Very Soft	<0.25	< 2	<0.25	<3	<0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	2 - 4	0.25 - 0.50	3 - 6	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	5 - 8	0.50 - 1.0	7 - 12	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	9 - 15	1.0 - 2.0	13 - 25	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	16 - 30	2.0 - 4.0	26 - 50	1.0 - 2.0	Readily indented by thumbnail
Hard	>4.0	>30	>4.0	>50	>2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60}- Value (blows / foot)	CA Sampler
Very Loose	<4	<5
Loose	4- 10	5 - 12
Medium Dense	11 - 30	13 - 35
Dense	31 - 50	36 - 60
Very Dense	>50	>60

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OF PROPORTION OF SOILS

Descriptor	Criteria
Trace (fine)/ Scattered (coarse)	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION/ Induration

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

NOTE: This legend sheet provides descriptions and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010), Section 2, for tables of additional soil description components and discussion of soil description and identification.

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG AND TEST PIT SYMBOLS

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County,
California For: All-ERA Properties, LLC

Project No. **21-81-176-01**

Drawing No. **A-1b**

Log of Boring No. BH-01/PT-01

Dates Drilled: 8/2/2021 Logged by: Catherine Nelson Checked By: Robert Gregorek II

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 1047 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the 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 actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		YOUNG ALLUVIAL FAN DEPOSITS **SAND/SILTY SAND WITH GRAVEL (SP/SM):** fine to coarse-grained, little gravel up to 3" maximum dimension, roots and rootlets, medium dense, dry, brown to grayish brown.	■		5/7/12	1	122	EI, R
5		- @6.0': dense	■		14/21/25	1	111	
10		- @9.0': very dense	■		7/32/50-6"	1	119	
		- @12.0': dense	■		17/21/23	2	116	
15		- @15.0': very dense	■		36/36/41	1	125	
		End of boring at 16.5 feet bgs. No groundwater encountered. Borehole was utilized for percolation testing. Perforated tube was installed and hole was presoaked on 08/02/2021. After completion of percolation testing, pipe was removed and borehole was backfilled with soil cuttings and hand-tamped on 08/03/2021.						

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. 21-81-176-01

Drawing No. A-2

Log of Boring No. BH-02/PT-02

Dates Drilled: 8/2/2021 Logged by: Catherine Nelson Checked By: Robert Gregorek II

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 1048 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the 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 actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		YOUNG ALLUVIAL FAN DEPOSITS **SAND/SILTY SAND WITH GRAVEL (SP/SM):** fine to coarse-grained, little gravel up to 3" maximum dimension, roots and rootlets, medium dense, dry, brown to grayish brown.	■	▨	9/11/13	1	112	
5		- @4.0': dense	■		12/16/20	1	114	
			■		14/25/25	1	127	
10		- @10.0': very dense	■		22/36/40	2	117	
					50-6"			*no recovery*
		End of boring at 14.5 feet bgs. No groundwater encountered. Borehole was utilized for percolation testing. Perforated tube was installed and hole was presoaked on 08/02/2021. After completion of percolation testing, pipe was removed and borehole was backfilled with soil cuttings and hand-tamped on 08/03/2021.						

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. 21-81-176-01

Drawing No. A-3

Log of Boring No. BH-03/PT-03

Dates Drilled: 8/2/2021 Logged by: Catherine Nelson Checked By: Robert Gregorek II

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 1046 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the 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 actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		YOUNG ALLUVIAL FAN DEPOSITS **SAND/SILTY SAND WITH GRAVEL (SP/SM):** fine to coarse-grained, little gravel up to 3" maximum dimension, roots and rootlets, medium dense, dry, brown to grayish brown.	■		11/12/12	1	117	
5		**SILTY SAND (SM):** fine to coarse-grained, little gravel up to 3" maximum dimension, dense, moist, reddish brown.	■	▨	19/20/16	3	109	
		SAND/SILTY SAND (SP/SM): fine to coarse-grained, little gravel up to 3" maximum dimension, roots and rootlets, very dense, dry, brown to grayish brown.	■	▨	18/33/50	1	116	
10			■		26/27/36	2	117	
					50-6"			*no recovery*
		End of boring at 13.5 feet bgs. No groundwater encountered. Borehole was utilized for percolation testing. Perforated tube was installed and hole was presoaked on 08/02/2021. After completion of percolation testing, pipe was removed and borehole was backfilled with soil cuttings and hand-tamped on 08/03/2021.						

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. 21-81-176-01

Drawing No. A-4

Log of Boring No. BH-04

Dates Drilled: 8/2/2021 Logged by: Catherine Nelson Checked By: Robert Gregorek II

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 1050 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the 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 actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		YOUNG ALLUVIAL FAN DEPOSITS **SILTY SAND WITH GRAVEL (SM):** fine to coarse-grained, some gravel up to 3" maximum dimension, roots and rootlets, medium dense, dry, light brown to brown.	■	▨	5/8/9	1	129	R, PA
5			■	▨	9/11/16	1	128	
		- @7.5': 6" thick layer of fine sand, gravel up to 1" maximum dimension, very dense, dark brown	■		15/26/44	2	128	
10								
			■		19/40/46	2	120	
15								
		SAND (SP): fine to medium-grained, trace silt, dense, moist, grayish brown.	■		13/20/27			PA
20		- @20.0': very dense	⊠		8/13/50	2		
25		**SILTY SAND (SM):** fine to medium-grained, dense, moist, grayish brown.	■		10/18/38	11	105	
30			⊠		9/11/13	2		

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. **21-81-176-01**

Drawing No. **A-5a**

Log of Boring No. BH-04

Dates Drilled: 8/2/2021 Logged by: Catherine Nelson Checked By: Robert Gregorek II

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 1050 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the 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 actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		YOUNG ALLUVIAL FAN DEPOSITS	■		10/16/30			PA
		SILTY SAND/SANDY SILT (SM/ML): fine to coarse-grained, dense/very stiff, moist, grayish brown.						
		OLD ALLUVIAL FAN DEPOSITS						
40		**SAND/SILTY SAND (SP/SM):** fine to coarse-grained, little gravel up to 3" maximum dimension, moderately desiccated, very dense, moist, dark reddish brown to grayish brown.	⊠		26/39/45	2		
45		- @45.0': increased gravel and some cobbles	■		50-6"	2	99	
50			⊠		25/50-6"	2		
		End of boring at 51.0 feet bgs. No groundwater encountered. Borehole backfilled with soil cuttings and compacted by pushing down with the auger using the weight of the drill rig on 08/02/2021.						

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. 21-81-176-01

Drawing No. A-5b

Log of Boring No. BH-05

Dates Drilled: 8/2/2021 Logged by: Catherine Nelson Checked By: Robert Gregorek II

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 1058 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the 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 actual conditions encountered.						
		YOUNG ALLUVIAL FAN DEPOSITS **SILTY SAND WITH GRAVEL (SM):** fine to coarse-grained, little gravel up to 2" maximum dimension, trace oxidation staining, dense, moist, light reddish brown.	■	▨	11/17/26	3	115	EI, CR, CP, DS
5		- @5.0': medium dense	■		10/10/14	8	109	
		SILTY SAND/SANDY SILT (SM/ML): fine-grained, moderately desiccated, trace oxidation staining, medium dense/very stiff, moist, yellowish brown.	■		8/14/15	9	122	
10			■		11/14/16	9	123	
15		**SAND/SILTY SAND (SP/SM):** fine to coarse-grained, little gravel up to 3" maximum dimension, dry, brown to grayish brown.	■		15/25/38	1	108	
20		**SANDY SILT (ML):** fine-grained sand, trace oxidation, stiff, moist, greenish brown.	☒		6/9/13	11		
25		**SAND (SP):** fine to medium-grained, very dense, dry, light brown to grayish brown.	■		18/34/41	2	121	
30			☒		13/20/26	2		
		End of boring at 31.5 feet bgs. No groundwater encountered. Borehole backfilled with soil cuttings and compacted by pushing down with the auger using the weight of the drill rig on 08/02/2021.						

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. 21-81-176-01

Drawing No. A-6

Log of Boring No. BH-06

Dates Drilled: 8/2/2021 Logged by: Catherine Nelson Checked By: Robert Gregorek II

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 1059 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the 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 actual conditions encountered.						
		YOUNG ALLUVIAL FAN DEPOSITS **SILTY SAND WITH GRAVEL (SM):** fine to coarse-grained, little gravel up to 3" maximum dimension, trace oxidation, medium dense, dry, light grayish brown to brown.	■		9/14/15	1	105	
5			■	▨	12/19/16	1	121	CP
10		**SANDY SILT (ML):** fine-grained sand, oxidation staining, slightly to moderately desiccated, stiff, moist, reddish brown.	■		5/9/13	9	113	
15		**SILTY SAND (SM):** fine-grained, slightly desiccated, oxidation staining, medium dense, dry, yellowish gray.	■		6/11/12	2	103	
		End of boring at 16.5 feet bgs. No groundwater encountered. Borehole backfilled with soil cuttings and compacted by pushing down with the auger using the weight of the drill rig on 08/02/2021.						

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. **21-81-176-01**

Drawing No. **A-7**

Appendix B

Laboratory Testing Program

APPENDIX B

LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their physical properties and engineering characteristics. The amount and selection of tests were based on the geotechnical parameters required for this project. Test results are presented herein and on the Logs of Borings, in Appendix A, *Field Exploration*. The following is a summary of the various laboratory tests conducted for this project.

***In-Situ* Moisture Content and Dry Density**

In-situ dry density and moisture content tests were performed on relatively undisturbed ring samples, in accordance with ASTM Standard D2216 and D2937 to aid soils classification and to provide qualitative information on strength and compressibility characteristics of the site soils. For test results, see the Logs of Borings in Appendix A, Field Exploration.

Expansion Index

Two representative bulk samples were tested to evaluate the expansion potential of materials encountered at the site in accordance with ASTM D4829 Standard. The test results are presented in the following table.

Table No. B-1, Expansion Index Test Results

Boring No.	Depth (feet)	Soil Description	Expansion Index	Expansion Potential
BH-01	0-6	Sand/Silty Sand with Gravel (SP/SM)	0	Very Low
BH-05	0-5	Silty Sand with Gravel (SM)	0	Very Low

R-value

Two representative bulk soil samples were tested for resistance value (R-value) in accordance with California Test Method CT301. This test provides a relative measure of soil strength for use in pavement design. The test results are presented in the following table.

Table No. B-2, R-Value Test Results

Boring No.	Depth (feet)	Soil Classification	Measured R-value
BH-01	0-6	Sand/Silty Sand with Gravel (SP/SM)	77
BH-04	1-4	Silty Sand with Gravel (SM)	67

Soil Corrosivity

One representative soil sample was tested to determine minimum electrical resistivity, pH, and chemical content, including soluble sulfate and chloride concentrations. The purpose of the test was to determine the corrosion potential of sites soils when placed in contact with common construction materials. The test was performed by AP Engineering and Testing, Inc. (Pomona, CA) in accordance with Caltrans Test Methods 643, 422 and 417. Test results are presented in the following table.

Table No. B-3, Summary of Soil Corrosivity Test Results

Boring No.	Depth (feet)	pH	Soluble Sulfates (CA 417) (ppm)	Soluble Chlorides (CA 422) (ppm)	Min. Resistivity (CA 643) (Ohm-cm)
BH-05	0-5	7.5	21	19	12,753

Grain-Size Analyses

To assist in classification of soils, mechanical grain-size analyses were performed on three select samples in accordance with the ASTM Standard D6913 test method. Grain-size curves are shown in Drawing No. B-1, *Grain Size Distribution Results*.

Table No. B-4, Grain Size Distribution Test Results

Boring No.	Depth (ft)	Soil Classification	% Gravel	% Sand	%Silt	%Clay
BH-04	1.0-4.0	Silty Sand with Gravel (SM)	29.0	53.9	17.1	
BH-04	16.0-17.5	Sand (SP)	0.0	96.1	3.9	
BH-04	35.0-36.5	Silty Sand/Sandy Silt (SM/ML)	0.0	48.9	51.1	

Maximum Dry Density and Optimum Moisture Content

Laboratory maximum dry density-optimum moisture content relationship tests were performed on two representative bulk samples. These tests were conducted in accordance with the ASTM Standard D1557 test method. The test results are presented in Drawing No. B-2, *Moisture-Density Relationship Results,* and is summarized in the following table.

Table No B-5, Summary of Moisture-Density Relationship Results

Boring No.	Depth (feet)	Soil Description	Optimum Moisture (%)	Maximum Density (lb/cft)
BH-05	0-5	Silty Sand, with Gravel (SM), Light Reddish Brown	7.0	127.0
BH-06	5-9	Silty Sand with Gravel (SM), Light Grayish Brown	5.5	132.0

Direct Shear

One direct shear test was performed on samples remolded to 90% of the maximum dry density under soaked moisture conditions in accordance with ASTM D3080. For the test, three samples contained in brass sampler rings were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The samples were then sheared at a constant strain rate of 0.02 inch/minute. Shear deformation was recorded until a maximum of about 0.25-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear strength parameters. For test data, including sample density and moisture content, see Drawings No. B-3*, Direct Shear Test Results,* and the following table.

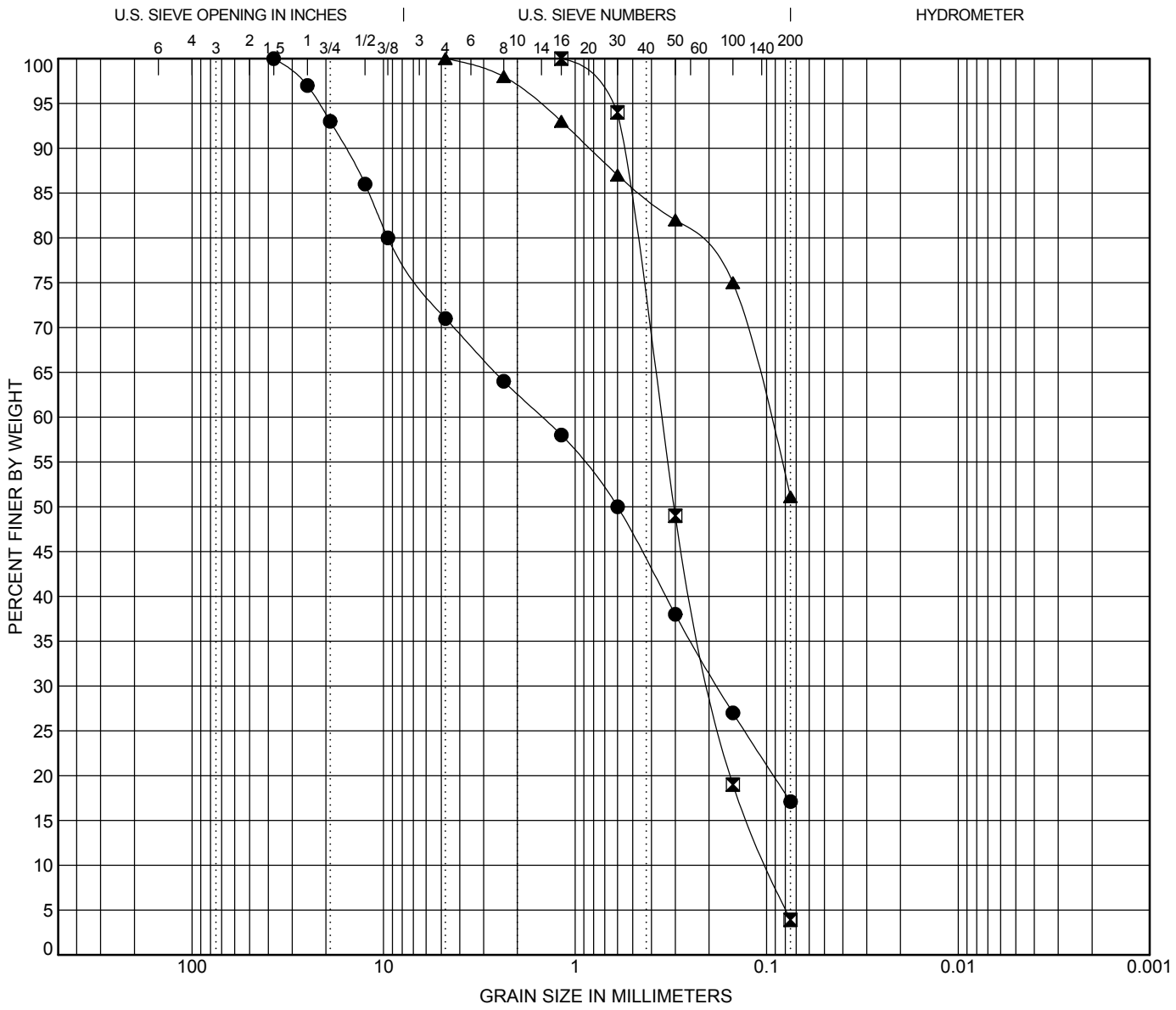
Table No. B-6, Summary of Direct Shear Test Results

Boring No.	Depth (feet)	Soil Description	Peak Strength Parameters	
			Friction Angle (degrees)	Cohesion (psf)
BH-05*	0-5	Silty Sand, with Gravel (SM)	32	70

*(*Sample remolded to 90% of the maximum dry density)*

Sample Storage

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	**BH-04**	**1-4**	**SILTY SAND WITH GRAVEL (SM)**					
⊠	**BH-04**	**16.0-17.5**	**SAND (SP)**				**1.06**	**3.58**
▲	**BH-04**	**35.0-36.5**	**SILTY SAND/SANDY SILT (SM/ML)**					

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-04**	**1-4**	**37.5**	**1.487**	**0.181**		**29.0**	**53.9**	**17.1**	
⊠	**BH-04**	**16.0-17.5**	**1.18**	**0.355**	**0.193**	**0.099**	**0.0**	**96.1**	**3.9**	
▲	**BH-04**	**35.0-36.5**	**4.75**	**0.097**			**0.0**	**48.9**	**51.1**	

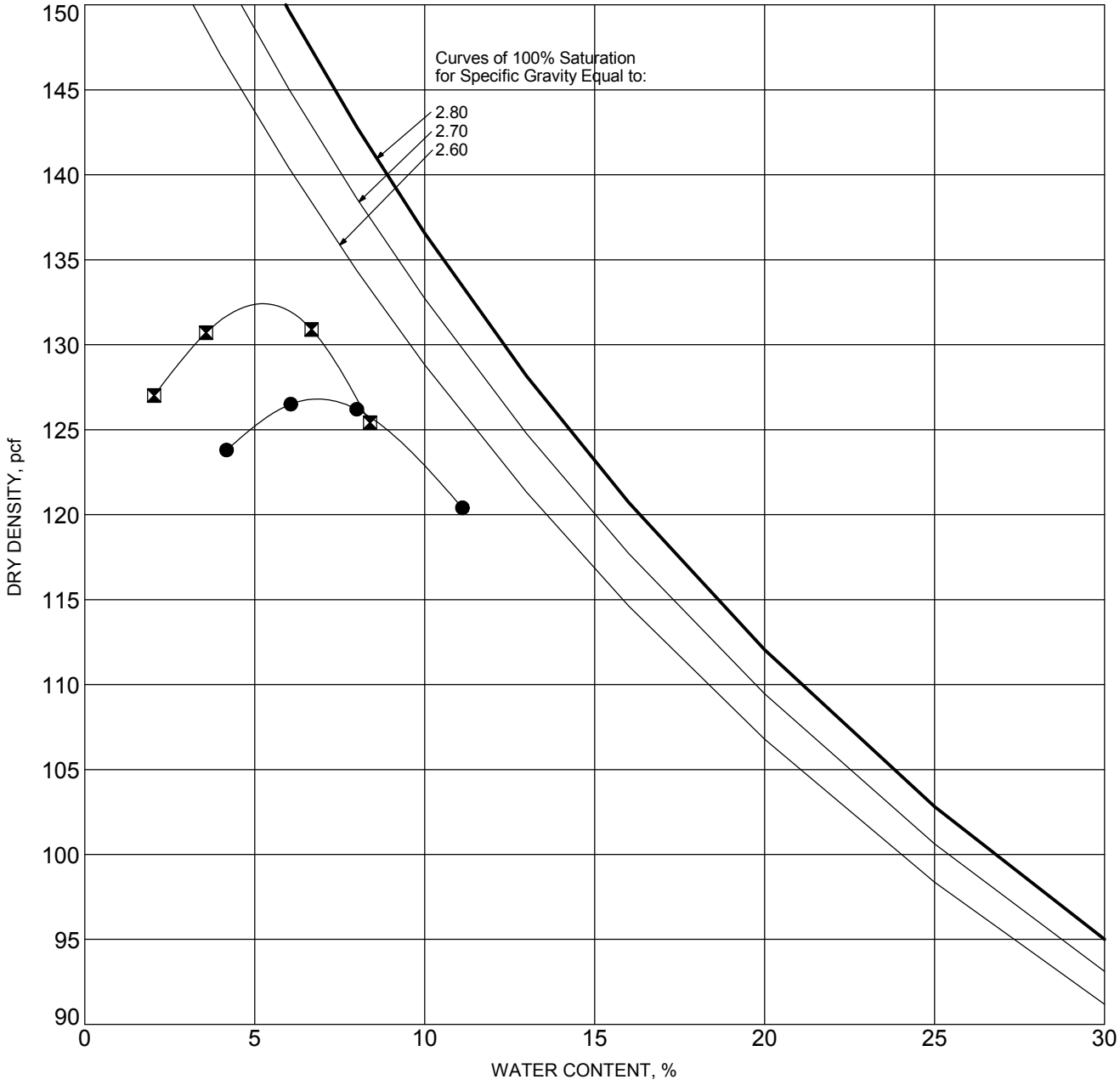
GRAIN SIZE DISTRIBUTION RESULTS

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. **21-81-176-01**

Drawing No. **B-1**



SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	**BH-05**	**0-5**	**SILTY SAND WITH GRAVEL (SM), Light Reddish Brown**	**D1557 - B**	**7.0**	**127.0**
⊠	**BH-06**	**5-9**	**SILTY SAND (SM), Light Grayish Brown**	**D1557 - B**	**5.5**	**132.0**

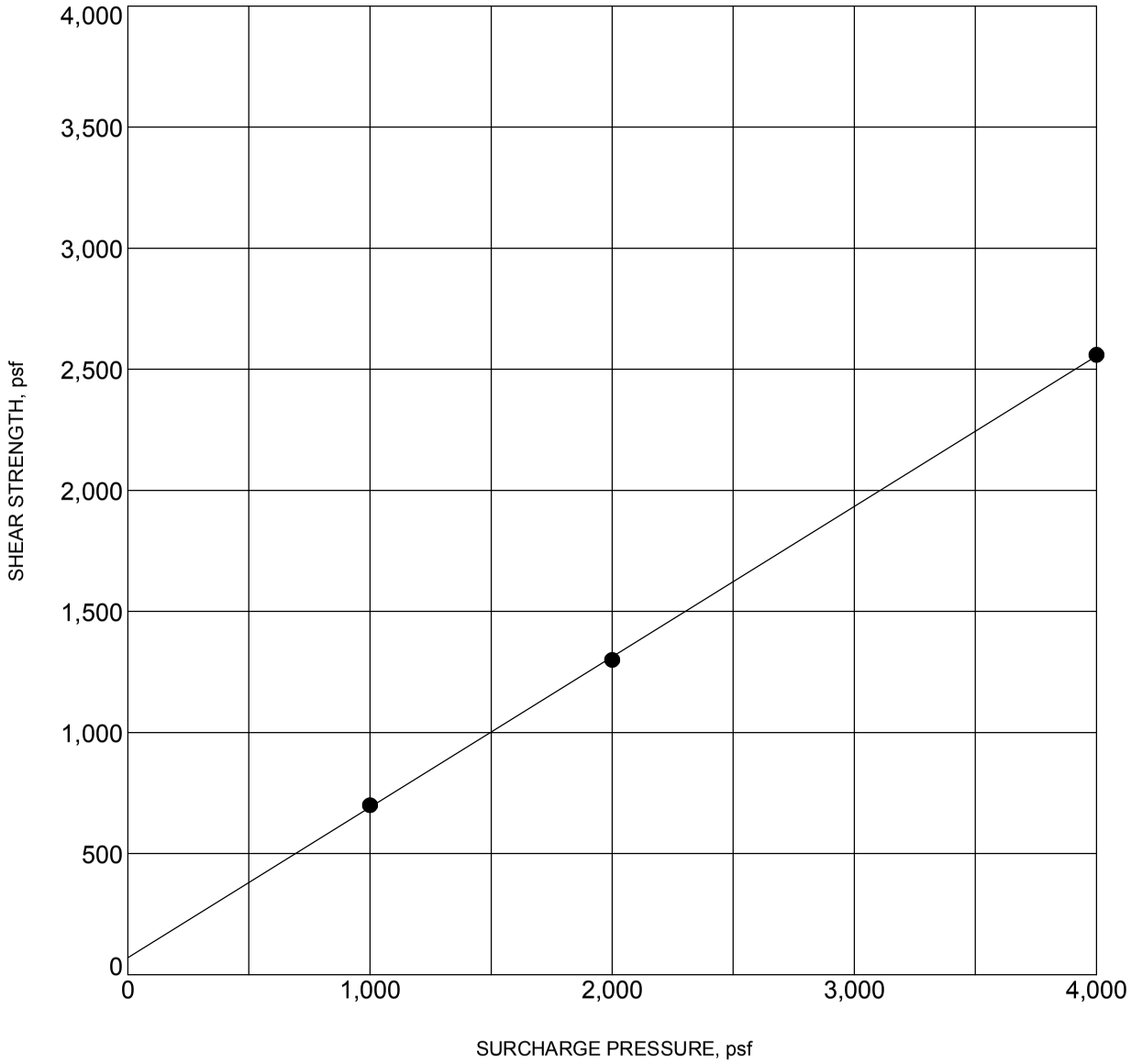
MOISTURE-DENSITY RELATIONSHIP RESULTS

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. **21-81-176-01**

Drawing No. **B-2**



BORING NO.	:	**BH-05**	DEPTH (ft)	:	**0-5**
DESCRIPTION	:	**SILTY SAND WITH GRAVEL (SM)**			
COHESION (psf)	:	**70**	FRICTION ANGLE (degrees):		**32**
MOISTURE CONTENT (%)	:	**7.0**	DRY DENSITY (pcf)	:	**114.5**

NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Linden Bloomington Condos, Tentative Tract 20481
10598 Orchard Street
Bloomington Area, San Bernardino County, California
For: All-ERA Properties, LLC

Project No. **21-81-176-01**

Drawing No. **B-3**

Appendix C

Percolation Testing

APPENDIX C

PERCOLATION TESTING

Percolation testing was performed at three locations (PT-01 through PT-03) on August 03, 2021. The testing was in general accordance with the San Bernardino County Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations (San Bernardino County, 2013). The percolation testing method was used to estimate infiltration rates.

Upon completion of drilling the test holes, approximately 2-inch-thick gravel layer was placed at the bottom of each hole and a 2.0-inch diameter perforated pipe was installed above the gravel to the ground surface. The boring annulus around the pipe was filled with gravel. The purpose of the pipe and gravel was to reduce the potential for erosion and caving due to the addition of water to the hole.

Each test hole was presoaked by filling with water to at least 5 times the radius of the test hole. More than 6 inches of water seeped into the test holes in less than 25 minutes for 2 consecutive measurements in all three borings, meeting the criteria for testing as “sandy soil”. Percolation testing was conducted within 26 hours of presoaking. During testing, the water level and total depth of the test hole were measured from the top of the pipe to a pre-determined height. During testing, the water level and total depth of the test holes were measured from the top of the pipe every *10* minutes for at least 1 hour. Following the completion of percolation testing, the pipe was removed, and the percolation test holes were backfilled with excavated soil and tamped.

Percolation rates describe the movement of water horizontally and downward into the soil from a boring. Infiltration rates describe the downward movement of water through a horizontal surface, such as the floor of a retention basin. Percolation rates are related to infiltration rates but are generally higher and require conversion before use in design. The percolation test data was used to estimate infiltration rates using the Porchet Inverse Borehole Method, in accordance with the San Bernardino County guidelines. A factor of safety of 2 was applied to the measured infiltration rates to account for subsurface variations, uncertainty in the test method, and future siltation. The infiltration structure designer should determine whether additional design-related safety factors are appropriate.

The measured percolation test data, calculations and estimated infiltration rates are shown on Plate Nos. 1 through 6. The estimated infiltration rates at the test holes are presented in the following table.

Table C-1, Estimated Infiltration Rates

Percolation Test	Test Depth (feet)	Soil Type	Infiltration Rate (inches/hr) (FOS 2)
PT-01	15.1	Sand/Silty Sand, with Gravel (SP/SM)	11.62
PT-02	13.1	Sand/Silty Sand, with Gravel (SP/SM)	11.53
PT-03	13.9	Sand/Silty Sand, with Gravel (SP/SM)	11.57

Based on the calculated infiltration rate during the final respective intervals in each test, an average infiltration rate of 11.57 inches per hour can be utilized for design.

Estimated Infiltration Rate from Percolation Test Data, PT-01

Project Name	Linden Bloomington Condos, Tentative Tract 20481
Project Number	21-81-176-01
Test Number	PT-01
Test Location	Roadway, Adj. Lot 53
Personnel	Joseph Hyunh
Presoak Date	8/2/2021
Test Date	8/3/2021

Shaded cells contain calculated values.

Test Hole Radius, r (inches)	4
Total Depth of Test hole, D_T (inches)	181.2
Inside Diameter of Pipe, I (inches)	2.93
Outside Diameter of Pipe, O (inches)	3.13
Factor of Safety (FOS), F	2

Interval No.	Time Interval, Δt (min)	Initial Depth to Water, D_0 (inches)	Final Depth to Water, D_f (inches)	Elapsed Time (min)	Initial Height of Water, H_0 (inches)	Final Height of Water, H_f (inches)	Change in Height of Water, ΔH (inches)	Average Head Height, H_{avg} (inches)	Infiltration Rate, I_t (inches/hr)		Infiltration Rate with FOS, I_f (inches/hr)
				0							0
1	25.00	60	181.20	25.00	121.20	0.00	121.20	60.60	9.29		4.65
2	25.00	60	181.20	50.00	121.20	0.00	121.20	60.60	9.29		4.65
3	10.00	60	181.20	60.00	121.20	0.00	121.20	60.60	23.23		11.62
4	10.00	60	181.20	70.00	121.20	0.00	121.20	60.60	23.23		11.62
5	10.00	60	181.20	80.00	121.20	0.00	121.20	60.60	23.23		11.62
6	10.00	60	181.20	90.00	121.20	0.00	121.20	60.60	23.23		11.62
7	10.00	60	181.20	100.00	121.20	0.00	121.20	60.60	23.23		11.62
8	10.00	60	181.20	110.00	121.20	0.00	121.20	60.60	23.23		11.62
9	10.00	60	181.20	120.00	121.20	0.00	121.20	60.60	23.23		11.62
10	10.00	60	181.20	130.00	121.20	0.00	121.20	60.60	23.23		11.62

Recommended Design Infiltration Rate (inches/hr)	**11.62**

San Bernardino County Technical Guidance Document for Water Quality Management Plans, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations (San Bernardino County, 2013)

$H_0 = D_T - D_0$

$H_f = D_T - D_f$

$\Delta H = H_0 - H_f$

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

$I_t = (\Delta H * (60 * r)) / (\Delta t * (r + (2 * H_{avg}))$

Plate No.
1

Infiltration Rate versus Time, PT-01

Project Name	Linden Bloomington Condos, Tentative Tract 20481
Project Number	21-81-176-01
Test Number	PT-01
Test Location	Roadway, Adj. Lot 53
Personnel	Joseph Hyunh
Presoak Date	8/2/2021
Test Date	8/3/2021

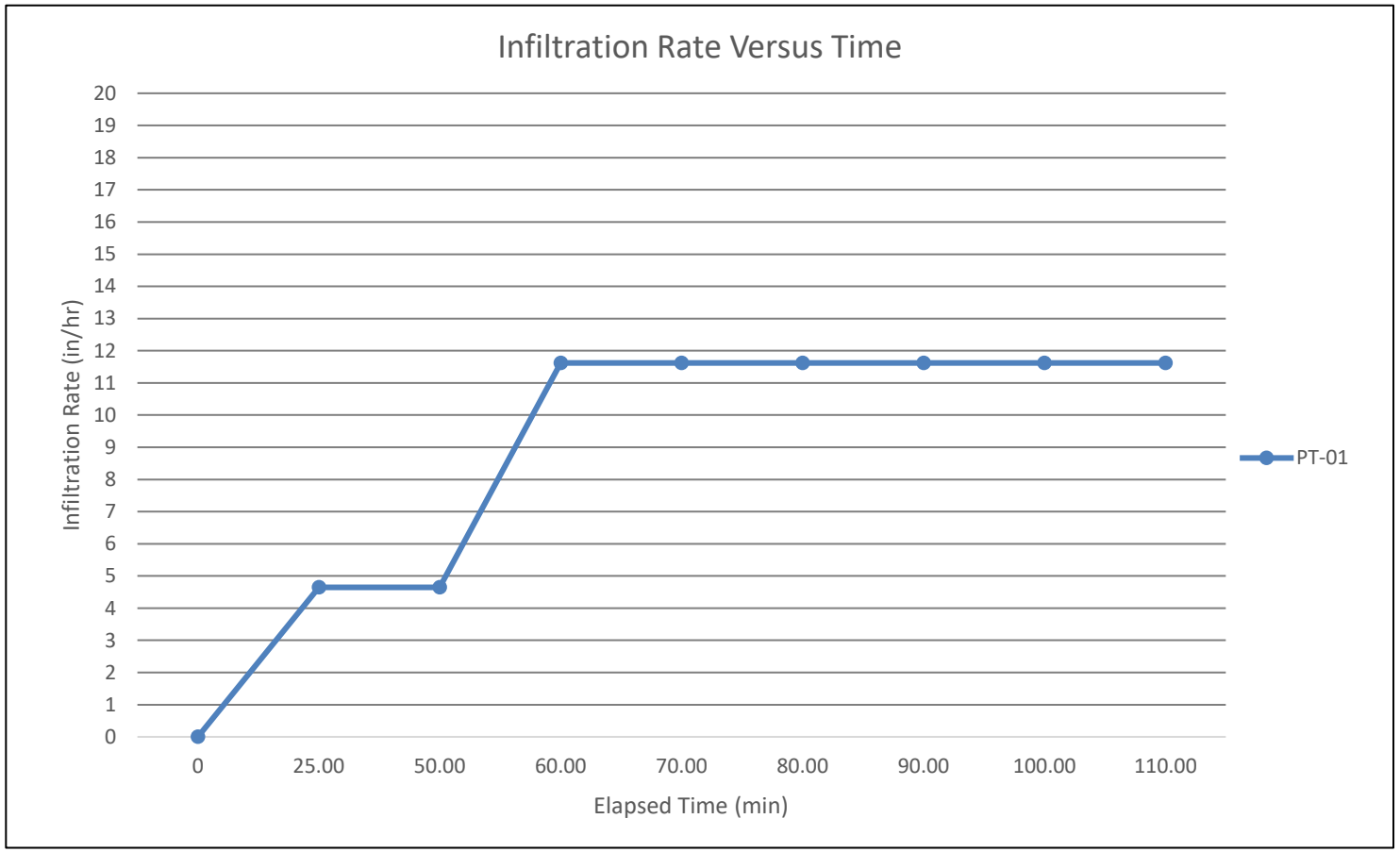


Plate No.
2

Estimated Infiltration Rate from Percolation Test Data, PT-02

Project Name	Linden Bloomington Condos, Tentative Tract 20481
Project Number	21-81-176-01
Test Number	PT-02
Test Location	Roadway, Adj. Lot 49
Personnel	Joseph Hyunh
Presoak Date	8/2/2021
Test Date	8/3/2021

Shaded cells contain calculated values.

Test Hole Radius, r (inches)	4
Total Depth of Test hole, D_T (inches)	157.2
Inside Diameter of Pipe, I (inches)	2.93
Outside Diameter of Pipe, O (inches)	3.13
Factor of Safety (FOS), F	2

Interval No.	Time Interval, Δt (min)	Initial Depth to Water, D_0 (inches)	Final Depth to Water, D_f (inches)	Elapsed Time (min)	Initial Height of Water, H_0 (inches)	Final Height of Water, H_f (inches)	Change in Height of Water, ΔH (inches)	Average Head Height, H_{avg} (inches)	Infiltration Rate, I_t (inches/hr)		Infiltration Rate with FOS, I_f (inches/hr)
				0							0
1	25.00	60	157.20	25.00	97.20	0.00	97.20	48.60	9.22		4.61
2	25.00	60	157.20	50.00	97.20	0.00	97.20	48.60	9.22		4.61
3	10.00	60	157.20	60.00	97.20	0.00	97.20	48.60	23.05		11.53
4	10.00	60	157.20	70.00	97.20	0.00	97.20	48.60	23.05		11.53
5	10.00	60	157.20	80.00	97.20	0.00	97.20	48.60	23.05		11.53
6	10.00	60	157.20	90.00	97.20	0.00	97.20	48.60	23.05		11.53
7	10.00	60	157.20	100.00	97.20	0.00	97.20	48.60	23.05		11.53
8	10.00	60	157.20	110.00	97.20	0.00	97.20	48.60	23.05		11.53
9	10.00	60	157.20	120.00	97.20	0.00	97.20	48.60	23.05		11.53
10	10.00	60	157.20	130.00	97.20	0.00	97.20	48.60	23.05		11.53

Recommended Design Infiltration Rate (inches/hr)	**11.53**

San Bernardino County Technical Guidance Document for Water Quality Management Plans, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations (San Bernardino County, 2013)

$H_0 = D_T - D_0$

$H_f = D_T - D_f$

$\Delta H = H_0 - H_f$

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

$I_t = (\Delta H * (60 * r)) / (\Delta t * (r + (2 * H_{avg}))$

Plate No.
1

Infiltration Rate versus Time, PT-02

Project Name	Linden Bloomington Condos, Tentative Tract 20481
Project Number	21-81-176-01
Test Number	PT-02
Test Location	Roadway, Adj. Lot 49
Personnel	Joseph Hyunh
Presoak Date	8/2/2021
Test Date	8/3/2021

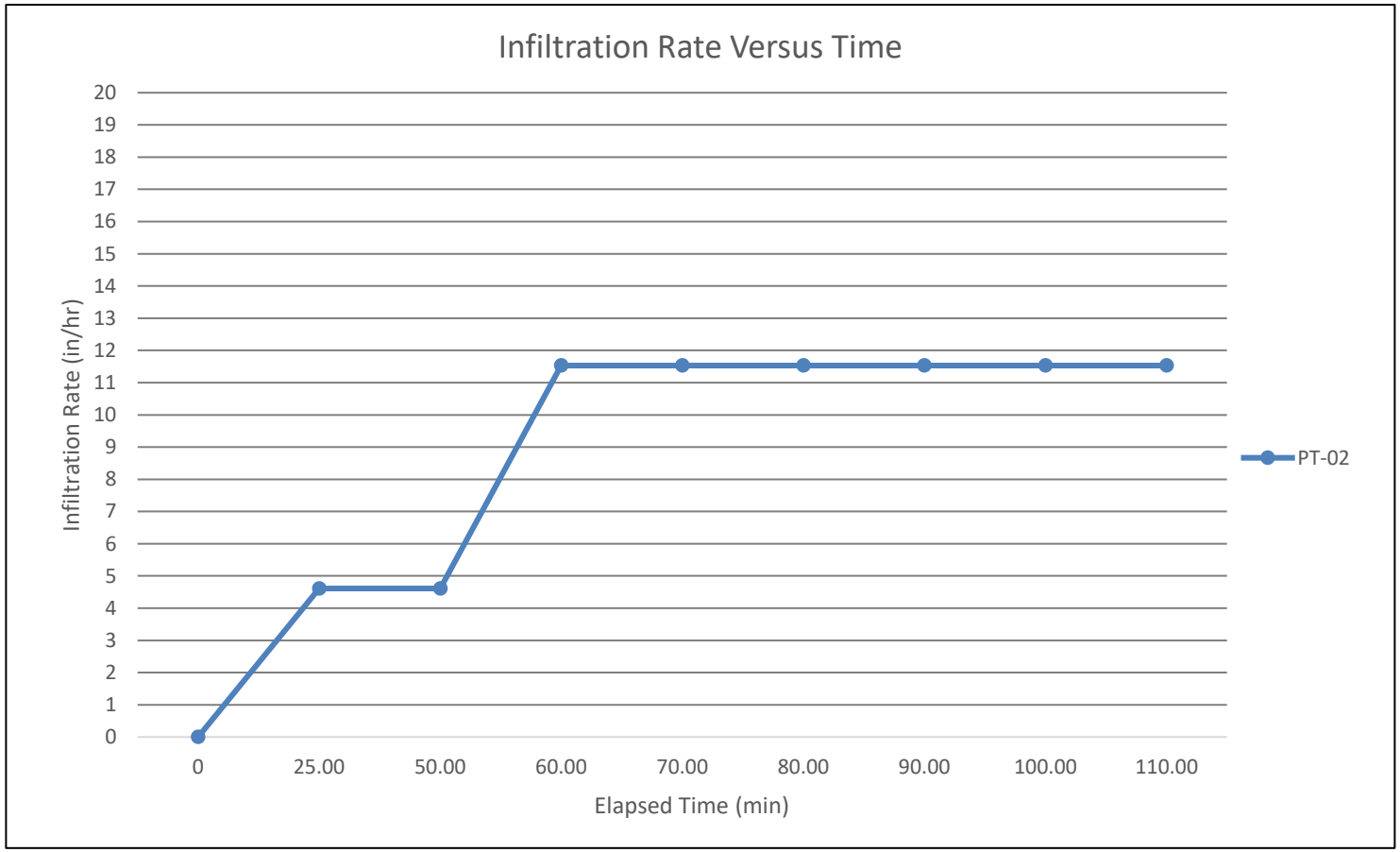


Plate No.
2

Estimated Infiltration Rate from Percolation Test Data, PT-03

Project Name	Linden Bloomington Condos, Tentative Tract 20481
Project Number	21-81-176-01
Test Number	PT-02
Test Location	Roadway, Adj. Lot 59
Personnel	Joseph Hyunh
Presoak Date	8/2/2021
Test Date	8/3/2021

Shaded cells contain calculated values.

Test Hole Radius, r (inches)	4
Total Depth of Test hole, D_T (inches)	166.8
Inside Diameter of Pipe, I (inches)	2.93
Outside Diameter of Pipe, O (inches)	3.13
Factor of Safety (FOS), F	2

Interval No.	Time Interval, Δt (min)	Initial Depth to Water, D_0 (inches)	Final Depth to Water, D_f (inches)	Elapsed Time (min)	Initial Height of Water, H_0 (inches)	Final Height of Water, H_f (inches)	Change in Height of Water, ΔH (inches)	Average Head Height, H_{avg} (inches)	Infiltration Rate, I_t (inches/hr)		Infiltration Rate with FOS, I_f (inches/hr)
				0							0
1	25.00	60	166.80	25.00	106.80	0.00	106.80	53.40	9.25		4.63
2	25.00	60	166.80	50.00	106.80	0.00	106.80	53.40	9.25		4.63
3	10.00	60	166.80	60.00	106.80	0.00	106.80	53.40	23.13		11.57
4	10.00	60	166.80	70.00	106.80	0.00	106.80	53.40	23.13		11.57
5	10.00	60	166.80	80.00	106.80	0.00	106.80	53.40	23.13		11.57
6	10.00	60	166.80	90.00	106.80	0.00	106.80	53.40	23.13		11.57
7	10.00	60	166.80	100.00	106.80	0.00	106.80	53.40	23.13		11.57
8	10.00	60	166.80	110.00	106.80	0.00	106.80	53.40	23.13		11.57
9	10.00	60	166.80	120.00	106.80	0.00	106.80	53.40	23.13		11.57
10	10.00	60	166.80	130.00	106.80	0.00	106.80	53.40	23.13		11.57

Recommended Design Infiltration Rate (inches/hr)	**11.57**

San Bernardino County Technical Guidance Document for Water Quality Management Plans, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations (San Bernardino County, 2013)

$H_0 = D_T - D_0$

$H_f = D_T - D_f$

$\Delta H = H_0 - H_f$

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

$I_t = (\Delta H * (60 * r)) / (\Delta t * (r + (2 * H_{avg}))$

Plate No.
1

Infiltration Rate versus Time, PT-03

Project Name	Linden Bloomington Condos, Tentative Tract 20481
Project Number	21-81-176-01
Test Number	PT-02
Test Location	Roadway, Adj. Lot 59
Personnel	Joseph Hyunh
Presoak Date	8/2/2021
Test Date	8/3/2021

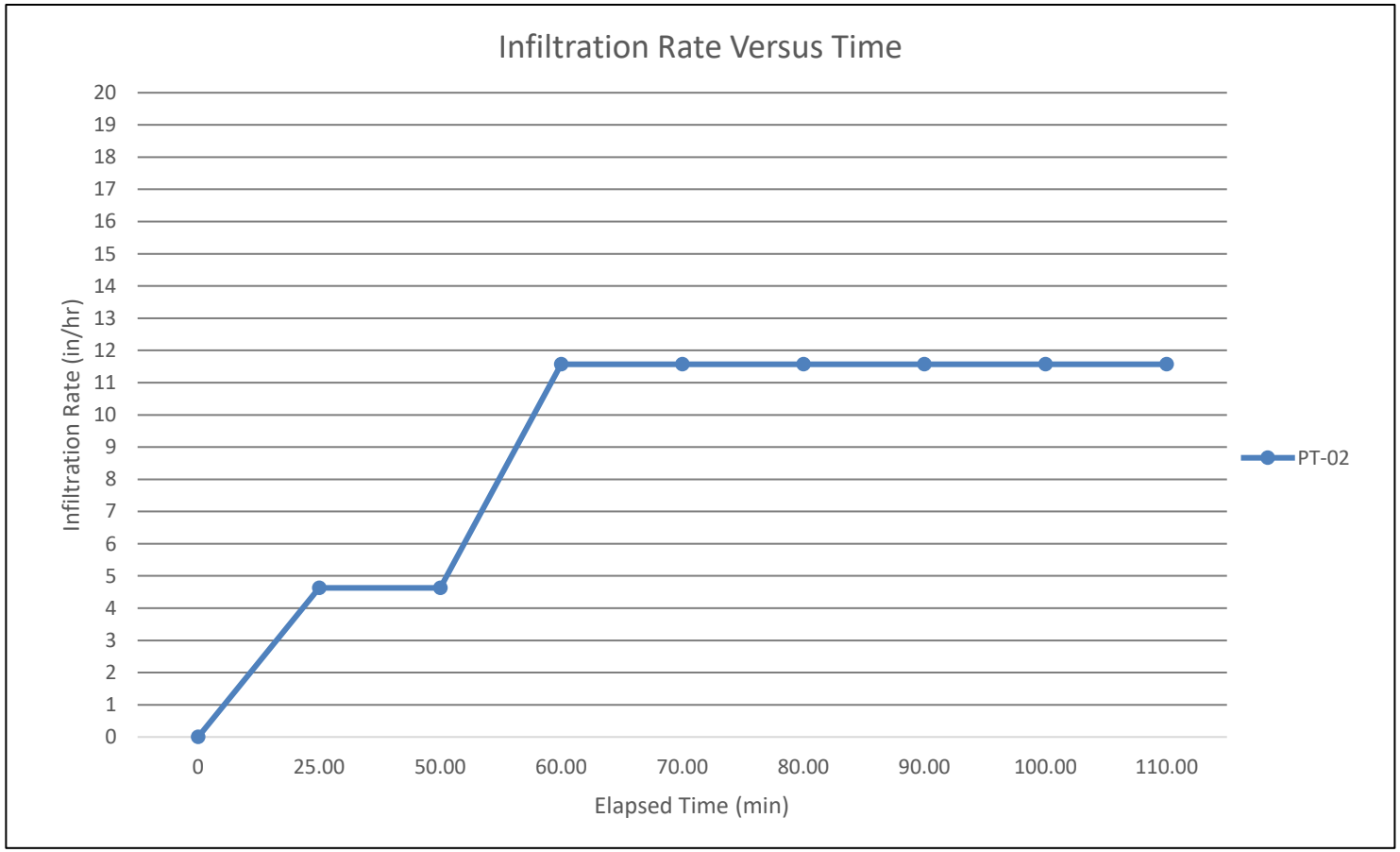


Plate No.
2

Appendix D

Earthwork Specifications

APPENDIX D

EARTHWORK SPECIFICATIONS

D1.1 Scope of Work

The work includes all labor, supplies and construction equipment required to construct the project in a good manner, as shown on the conceptual grading plans and herein specified. The major items of work covered in this section include the following:

- Site Inspection
- Authority of Geotechnical Engineer
- Site Clearing
- Excavations
- Preparation of Fill Areas
- Placement and Compaction of Fill
- Observation and Testing

D1.2 Site Inspection

1. The Contractor should carefully examine the site and make all inspections necessary in order to determine the full extent of the work required to make the completed work conform to the project conceptual grading plans and specifications. The Contractor should satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor should satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.

2. This Preliminary Geotechnical Investigation and Water Infiltration Testing Report by Converse Consultants, dated December 20, 2021, may be used as a reference to the surface and subsurface conditions on this project. The information presented in this report is intended for use in design and is subject to confirmation of the conditions encountered during construction. The exploration logs and related information depict subsurface conditions only at the particular time and location designated on the boring logs. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations. In addition, the passage of time may result in a change in subsurface conditions at the exploration locations. Any review of this information should not relieve the Contractor from performing such independent investigation and evaluation to satisfy himself as to the nature

of the surface and subsurface conditions to be encountered and the procedures to be used in performing his work.

D1.3 Authority of the Geotechnical Engineer

1. The Geotechnical Engineer will observe the placement of compacted fill and will take sufficient tests to evaluate the uniformity and degree of compaction of filled ground.
2. As the Owner's representative, the Geotechnical Engineer will (a) have the authority to cause the removal and replacement of loose, soft, disturbed and other unsatisfactory soils and uncontrolled fill; (b) have the authority to approve the preparation of native ground to receive fill material; and (c) have the authority to approve or reject soils proposed for use in building areas.
3. The Civil Engineer and/or Owner will decide all questions regarding (a) the interpretation of the drawings and specifications, (b) the acceptable fulfillment of the contract on the part of the Contractor and (c) the matters of compensation.

D1.4 Site Clearing

1. Clearing and grubbing should consist of the removal from areas to be graded: all existing pavement, utilities, and vegetation.
2. Organic and inorganic materials resulting from the clearing and grubbing operations should be hauled away from the areas to be graded.

D1.5 Excavations

1. Based on observations made during our field explorations, the surficial soils can be excavated with conventional earthwork equipment.

D1.6 Preparation of Fill Areas

1. All organic material, organic soils and debris should be removed from the proposed development areas.
2. After the required removals have been made, the exposed earth materials should be excavated to provide a zone of structural fill for the support of footings, slabs-on-grade, and exterior flatwork or other proposed improvements. All loose, soft or disturbed earth materials should be removed from the bottom of excavations before placing structural fill. All structures will require a minimum of 2.0 feet of compacted fill beneath building footings and 2.0 feet below any proposed wall footings .
3. The subgrade in all areas to receive fill should be scarified to a minimum depth of 6 inches. Scarification may be terminated on moderately hard to hard, cemented

earth materials with the approval of the Geotechnical Engineer. The soil moisture should be adjusted to at least 0 to 2 percent above optimum for fine-grained soils and within 3 percent of optimum moisture content for granular soils, and then compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method.

4. Compacted fill may be placed on native soils that have been properly scarified and recompacted as discussed above.
5. All areas to receive compacted fill will be observed and approved by the Geotechnical Engineer before the placement of fill.

D1.7 Placement and Compaction of Fill

1. Compacted fill placed for the construction of the embankment or for any planned structures will be considered structural fill. Structural fill may consist of approved on-site soils or imported fill that meets the criteria indicated below.
2. Fill consisting of selected on-site earth materials or imported soils approved by the Geotechnical Engineer should be placed in layers on approved earth materials. Soils used as compacted structural fill should have the following characteristics:
    a. All fill soil particles should not exceed 8 inches in nominal size and should be free of organic matter and miscellaneous inorganic debris and inert rubble.
    b. Imported fill materials should have an Expansion Index (EI) less than 20. All imported fill should be compacted to at least 90 percent of the laboratory maximum dry density (ASTM Standard D1557) at about 0 to 2 percent above optimum moisture for fine-grained soils, and within 3 percent of optimum for granular soils.
3. Fill exceeding 5 feet in height should not be placed on native slopes that are steeper than 5:1 horizontal:vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than 5 feet, the fill should be benched into competent materials. The height and width of the benches should be at least 2 feet.
4. Representative samples of materials being used, as compacted fill will be analyzed in the laboratory by the Geotechnical Engineer to obtain information on their physical properties. Maximum laboratory density of each soil type used in the compacted fill will be determined by the ASTM Standard D1557 compaction method.
5. Fill materials should not be placed, spread or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations should not resume until the Geotechnical Engineer approves the moisture and density conditions of the previously placed fill.

6. It should be the Grading Contractor's obligation to take all measures deemed necessary during grading to provide erosion control devices in order to protect slope areas and adjacent properties from storm damage and flood hazard originating on this project. It should be the Contractor's responsibility to maintain slopes in their as-graded form until all slopes are in satisfactory compliance with job specifications, all berms have been properly constructed, and all associated drainage devices meet the requirements of the Civil Engineer.

D1.8 Fill Slope Construction

1. Fill slopes placed above existing surfaces or cut slopes should be constructed with keyways.
2. Where fill is placed against existing slopes steeper than 5:1 H:V, the new fill slopes should be keyed and benched to provide increased lateral support after removal of the unsuitable surficial soils, when present.

Keyways and benches should be constructed as indicated in Section 10.3 of this report.

D1.9 Observation and Testing

1. During the progress of grading and trench backfill, the Geotechnical Engineer will provide observation of the fill placement operations.
2. Field density tests of all compacted fill will be made during grading and trench backfill to provide an opinion on the degree of compaction being obtained by the Contractor. Where compaction of less than specified herein is indicated, additional compactive effort with adjustment of the moisture content should be made as necessary, until the required degree of compaction is obtained.
3. A sufficient number of field density tests will be performed to provide an opinion to the degree of compaction achieved. In general, density tests will be performed on each one-foot lift of fill, but not less than one for each 500 cubic yards of fill placed.

Appendix E: Factor of Safety Calculation

Infiltration BMP - Infiltration Rate Factor of Safety
From Appendix D, TGD, Worksheet H

		Weight	Factor	Weighted Factor
A Suitability Assessment	Soil assessment methods	0.25	2	0.5
	Predominant soil texture	0.25	1	0.25
	Site soil variability	0.25	1	0.25
	Depth to groundwater / impervious layer	0.25	1	0.25
	Suitability Assessment Safety Factor, SA = Σp			1.25
B Design	Tributary area size	0.25	3	0.75
	Level of pretreatment/ expected sediment loads	0.25	3	0.75
	Redundancy	0.25	3	0.75
	Compaction during construction	0.25	2	0.5
	Design Safety Factor, SB = Σp			2.75

Combined Safety Factor, STOT= SA x SB		3.44	
	(Shall be between 2 and 9), SF=	3.44	
Measured Infiltration Rate, inch/hr, KM	=30 min/in - >	11.57	in/hr
(corrected for test-specific bias)			
Design Infiltration Rate, in/hr, KDESIGN = KM/STOT		**3.37**	in/hr
		(use 3.33)	

Ultimate FS between 2 and 9

Appendix F: Agreement

RECORDING REQUESTED BY:
County of San Bernardino
Department of Public Works

AND WHEN RECORDED MAIL TO:
County of San Bernardino
Department of Public Works
825 E. Third Street, Room 117
San Bernardino, CA 92415-0835

SPACE ABOVE THIS LINE FOR RECORDER'S USE

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT PRACTICES TRANSFER, ACCESS AND MAINTENANCE

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

OWNER NAME: All-Era Properties, LLC

PROPERTY ADDRESS:

Bloomington, CA 92316

APN: **0257-021-28, 257-031-35**

THIS AGREEMENT is made and entered into in

_____ ,California, this _____ day of

_____ , by and between

All-Era Properties, LLC , hereinafter

referred to as Owner, and the COUNTY OF SAN BERNARDINO, a political subdivision of the State of California, hereinafter referred to as "the County";

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

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

Tract 20481 within the Property described herein, the County required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

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

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

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

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

1. Owner shall comply with the WQMP.

2. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.

3. Owner hereby provides the County's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the County Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the County may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay County for all costs incurred by County in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of County invoice.

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

5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the County , the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the County Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay County within thirty (30) calendar days of County invoice.

6. The County may require the owner to post security in form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the County may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety(ies) to perform the obligations of this Agreement.

7. The County agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the County in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a County invoice and prior to the County's issuance of such certificate. Where the County cannot issue an estoppel certificate, Owner shall pay the County within thirty (30) calendar days of receipt of a County invoice.

8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the County and the Owner.

9. County and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.

10. In addition to any remedy available to County under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the County if said cure reasonably requires more than the subject time, the County may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the County may recover any damages to which the County may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

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

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

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

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

interest in all or part of the Property. Owner shall provide a copy of such notice to the County at the same time such notice is provided to the successor.

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

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

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the County) and hold harmless the County and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the County on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the County's "active" as well as "passive" negligence but does not apply to the County's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the County under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO COUNTY :

Director of Public Works

825 E. Third Street, Room 117

San Bernardino, CA 92415-0835

IF TO OWNER:

Byron Walker

PO Box 11503

Carson, CA 90749

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

OWNER:

Company/Trust: All-Era Properties, LLC

Signature: _____

Name: Byron Walker

Title: Owner

Date: _____

FOR: Maintenance Agreement, dated _____, for the project known as Tract 20481 _____ (APN) 0257-021-28, 257-031-35, As described in the WQMP dated _____.

OWNER:

Company/Trust: _____

Signature: _____

Name: _____

Title: _____

Date: _____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

BRENDON BIGGS, M.S., P.E., Director of Public Works

Date: _____

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A
(Legal Description)

EXHIBIT B
(Map/illustration)