APPENDIX G

PRELIMINARY WATER QUALITY MANAGEMENT PLAN

Preliminary Water Quality Management Plan

For:

The Commons at California
913 California St. Redlands
Tentative Parcel Map 20854
M24-0054

Prepared for:

JD Fuel LLC
1031 Rosecrans Ave, Suite 207
Fullerton, CA. 92833
(909) 562-6388

Prepared by:

SP2 & Co.
A Land Development Services Company
451 W. LAMBERT RD, SUITE 216
BREA, CALIFORNIA 92821
714.490.1514 | 714.490.1515

Submittal Date: 5/20/2025

Revision Date: ____________________

Approval Date: ____________________

Project Owner's Certification

This Preliminary Water Quality Management Plan (PWQMP) has been prepared for JD Fuel LLC by SP2 & Co. The WQMP is intended to comply with the requirements of the San Bernardino County and the NPDES Areawide Stormwater Program requiring the preparation of a PWQMP. 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 PWQMP. 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 PWQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	TPM 20854	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0292-034-17-0-000

Owner's Signature			
Owner Name: Chandresh Ravaliya, JD Fuel LLC			
Title	Owner		
Company	JD Fuel LLC		
Address	1031 Rosecrans Ave, Suite 207 Fullerton, CA 92833		
Email	cravaliya@gmail.com		
Telephone #	(909) 562-6388		
Signature		Date	

Preparer's Certification

Project Data

Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0292-034-17-0-000

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

Engineer: Jimmy C. Chen		PE Stamp Below
Title	Principal Engineer	REGISTERED PROFESSIONAL ENGINEER JIMMY C. CHEN NO. C51394 6/30/2026 CIVIL STATE OF CALIFORNIA
Company	SP2 & Co.	
Address	451 W Lambert Rd. Ste 216 Brea, CA. 92821	
Email	jimmy@sp2inc.com	
Telephone #	(714) 490-1514, (714) 490-1515	
Signature		
Date	5/20/2025	

Table of Contents

Forms

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	The Commons at California				
Project Owner Contact Name:	John Heimann				
Mailing Address:	1031 Rosecrans Avenue, Suite 207 Fullerton, CA 92833	E-mail Address:	cravaliya@gmail.com, heimanndevgrp@outlook.com	Telephone:	(909) 562-6388 (909) 260-2100
Permit/Application Number(s):		Tract/Parcel Map Number(s):	TPM 20854		
Additional Information/ Comments:					
Description of Project:	Tentative Parcel Map 20854 (The Project) proposes the development of approximately 5.08 acres of vacant land located northwest of Redlands Blvd. and California St. in the City of Redlands, San Bernardino County into three (3) commercial parcels. The Project proposes a four-story hotel, a drive-thru carwash, a drive-thru coffee shop and dedicated parking for each. The project fronts a railroad right of way to the north, a drainage channel to the south, and commercial/retail to the east. The existing topography for the property gently slopes from the northeast to the southwest towards the drainage channel at approximately 0.5 to 2% over natural cover. The Project proposes an infiltration basin that will provide stormwater treatment and detention capacity for peak developed runoff mitigation. Where feasible, open space landscaped areas shall be used as BMP infiltration trenches for their respective tributaries. The increased runoff from the Project will be detained on site and released via a calibrated basin outlet structure (see outlet detail on the PWQMP Site Plan) connected to the adjacent drainage channel with the required DCV being retained and infiltration onsite.				
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 ft^2 or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft^2 or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☒ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft^2 or more
☐ Hillside developments of 5,000 ft^2 or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft^2 of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☒ Parking lots of 5,000 ft^2 or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft^2 or more, or have a projected average daily traffic of 100 or more vehicles per day
☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.			

[2] Project Area (ft2):	215,657	[3] Number of Dwelling Units:	0	[4] SIC Code:	1542, 5812, 7011

[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 maintenance responsibility for the drainage facilities shall fall under the current property owner until the Property Owner’s Association (POA) has been established. No infrastructure improvements will be transferred to the public for ownership or maintenance.

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 ☐	Santa Ana River Reach 4 is impaired by indicator bacteria. Santa Ana River Reach 3 is impaired by indicator bacteria. <u>Origin:</u> Waste storage area and pavement runoff. Decomposition of organic waste. <u>Mitigation:</u> Regular street/parking sweeping and maintaining trash enclosures. Removal of organic waste from
Nutrients - Phosphorous	E ☒	N ☐	Downstream receiving waters <u>not</u> impaired by phosphorus. <u>Origin:</u> Landscaping fertilizer and pesticide use. <u>Mitigation:</u> Restrict use of fertilizer and pesticides onsite.
Nutrients - Nitrogen	E ☒	N ☐	Downstream receiving waters <u>not</u> impaired by nitrogen. <u>Origin:</u> Landscaping fertilizer. <u>Mitigation:</u> Restrict use of fertilizer.
Noxious Aquatic Plants	E ☐	N ☒	Downstream receiving waters <u>not</u> impaired by noxious aquatic plants. <u>Origin:</u> Aquatic plants not native to the local ecology. <u>Mitigation:</u> Project does not propose aquatic plants onsite as part of the landscaping plan and design.
Sediment	E ☒	N ☐	Downstream receiving waters <u>not</u> impaired by sediment. <u>Origin:</u> Unprotected slopes and non-landscaped areas. <u>Mitigation:</u> Dampen unprotected slopes during grading operations. Minimize bare soil slopes with landscaping plan. Regularly perform street and parking lot sweeping. Stormwater inlets to be cleaned out periodically before wet season.
Metals	E ☒	N ☐	Santa Ana River Reach 3 is impaired by metals (copper & Lead). <u>Origin:</u> Runoff from parking lots and waste storage areas. <u>Mitigation:</u> Regularly sweep streets and parking lots. Restrict vehicle maintenance activities onsite.
Oil and Grease	E ☒	N ☐	Downstream receiving waters <u>not</u> impaired by oil and grease. <u>Origin:</u> Runoff from parking lots and paved areas. Vehicle washing. <u>Mitigation:</u> Perform regular street and parking sweeping. Vehicle washing to be performed in designated areas with inlets not connected to the stormwater system.
Trash/Debris	E ☒	N ☐	Downstream receiving waters <u>not</u> impaired by trash & debris. <u>Origin:</u> Waste storage areas and parking lots. Vehicle washing. <u>Mitigation:</u> Regularly perform street and parking sweeping. Clear property of trash and debris regularly.
Pesticides / Herbicides	E ☒	N ☐	Downstream receiving waters <u>not</u> impaired by pesticides or herbicides. <u>Origin:</u> Pesticide and/or herbicide use for weed abatement. <u>Mitigation:</u> Restrict use of pesticides and herbicides onsite.
Organic Compounds	E ☒	N ☐	Downstream receiving waters <u>not</u> impaired by organic compounds. <u>Origin:</u> Runoff from waste storage areas and landscape areas. Mitigation: Trash enclosures to be cleared and maintained regularly. Landscaping waste to be properly removed and disposed of.

Other: pH	E ☒	N ☐	Prado Dam is impaired by pH. Origin: Runoff from waste storage areas, landscaped areas, parking lots and street. Use of herbicides and/pesticides. Vehicle washing. Mitigation: Use of herbicides, pesticides, and fertilizer to be restricted. Runoff from car washing designated areas to be disconnected from the stormwater treatment system. Street and parking sweeping to be conducted regularly.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits

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

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°04’54” N	Longitude: 117°13’37” W	Thomas Bros Map page 607

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

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

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA.
DA1 DMA A to DA1	DMA A drains to a 5-ft. deep, 7,471 ft^2 infiltration basin “A” via the proposed onsite drainage inlets and storm drain pipes. Peak runoff from DMA A is detained within Basin “A”.
DA1 to Outlet 1	Emergency overflow and mitigated peak runoff from the project discharges from Basin “A”, via a calibrated outlet structure, into the adjacent drainage channel (Mission Channel).

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	215,657			
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://permitrack.sbcounty.gov/wap/*	B			
5 Longest flowpath length (ft)	1,002			
6 Longest flowpath slope (ft/ft)	0.0150			
7 Current land cover type(s). *Select from Fig C-3 of Hydrology Manual*	Fallow			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor			

Tentative Parcel Map 20854

Site Photos

Figure 1. Taken from northwest corner of adjacent gas station looking west along northern property line.

Figure 2. Taken from northwest corner of adjacent gas station looking southwest.

Figure 3. Taken from northwest corner of adjacent gas station looking south.

Figure 4. Taken from northwest corner of property looking southeast.

Figure 5. Taken from northwest corner of property looking east northern property line.

Figure 6. Taken from southeast corner of property looking northwest.

Figure 7. Taken from southeast corner of property looking north along California St.

Figure 8. Taken from southeast corner of adjacent gas station looking west.

Figure 9. Taken from southeast corner of adjacent gas station looking southwest.

Figure 10. Taken from southeast corner of adjacent gas station looking south along California St.

Form 3-3 Watershed Description for Drainage Area 1

Receiving waters *Refer to Watershed Mapping Tool -* *http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Mission Channel Santa Ana River Reach 4 Santa Ana River Reach 3 Prado Dam Santa Ana River thru Orange County Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	Pathogens, Metals (Lead & Copper), & pH
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Santa Ana Reach 3: Pathogens, Metals (Lead & Copper) Santa Ana Reach 4: Pathogens Prado Dam: pH
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Not Applicable
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Mission Channel 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	☒	☐	Provide Literature including, but not limited to, the materials attached in *Section 6.4.6* of this report to Property Owner(s) upon purchase of unit. Additional Resources can be found at County of San Bernardino NPDES Website. http://www.sbcounty.gov/dpw/land/npdes.asp
N2	Activity Restrictions	☒	☐	Pesticide Controls: Pesticides and Herbicides shall be applied in accordance with the California Department of Pesticides requirements. Must be done by a state certified applicator.
N3	Landscape Management BMPs	☒	☐	Landscape management including, but not limited to, mowing of lawns, pruning of vegetation, removal of invasive plant species, shall be provided into perpetuity as the responsibility of the Owner/POA.
N4	BMP Maintenance	☒	☐	BMP Maintenance shall be performed in accordance with Section 5 of this report, the Operations & Maintenance Plan in the Appendix of this report, or the currently accepted Maintenance Procedures at the time of maintenance.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Project will not produce, nor transport hazardous waste.
N6	Local Water Quality Ordinances	☐	☒	Project does not consist of fuel dispensing areas or other areas of concern to public properties.
N7	Spill Contingency Plan	☐	☒	Hazardous materials will not be stockpiled on-site.
N8	Underground Storage Tank Compliance	☐	☒	Project will not have underground storage tanks.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Hazardous materials will not be stored on-site.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☐	☒	Hazardous Materials will not be stored or used onsite. Article 80 does not apply.
N11	Litter/Debris Control Program	☐	☒	It shall be the Owner's/POS's responsibility to provide proper litter control per CASQA BMP SC 60. Litter controls shall be provided during regularly scheduled landscape maintenance, or as needed to prevent transportation of trash & debris from the site.
N12	Employee Training	☒	☐	Owner/POA to prepare and provide applicable educational materials and training to future employees of the businesses regarding the care and maintenance of the applicable BMP facilities, storage and use of fertilizers and pesticides.
N13	Housekeeping of Loading Docks	☐	☒	Project does not propose loading docks.
N14	Catch Basin Inspection Program	☒	☐	Owner/POA responsible for the maintenance and inspection of the catch basin and drainage facilities on an annual basis and after every storm event.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Owner/POA is responsible for keeping the parking and drive isles clean and clear of the accumulation of debris by performing sweeping/vacuuming at regular intervals and prior to the start of the rainy season (late summary to early fall).
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a public agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	Projects disturbing greater than one (1) acre are required to implement a Storm Water Pollution Prevention Plan during construction to control stormwater and non-stormwater discharges from the site, in conjunction with providing erosion control to prevent sediment from leaving the site.

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)	☒	☐	- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language (such as: "No Dumping Flows to Creek") and/or graphical icons to discourage illegal dumping. - Post signs and prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area. - Maintain legibility of stencils and signs.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	Hazardous materials with the potential to contaminate urban runoff shall either be: (a) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the MS4; or (b) protected by secondary containment structures (not double wall containers) such as berms, dikes, or curbs. - The storage area shall be paved and sufficiently impervious to contain leaks and spills. - The storage area shall have a roof or awning to minimize direct precipitation and exposure, and collection of stormwater within the secondary containment area. - Any stormwater retained within the containment structure must not be discharged to the street or storm drain system. - Location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	All trash container areas shall meet the following requirements (limited exclusion: detached residential homes): - Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and

				pavements diverted around the area, screened or walled to prevent off-site transport of trash; and Provide solid roof or awning to prevent exposure to direct precipitation. Connection of trash area drains to the MS4 is prohibited.
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)	☒	☐	In general, the following methods to reduce excessive irrigation runoff shall be considered, and incorporated for all landscaped areas: - Employing rain shutoff devices to prevent irrigation after precipitation. - Designing irrigation systems to each landscape area's specific water requirements. - Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines. - The timing and application methods of irrigation water shall be designed to minimize the runoff of excess irrigation water into the municipal storm drain system. - Employing other comparable, equally effective, methods to reduce irrigation water runoff. - 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 other design features, such as: - Use mulches (such as wood chips or shredded wood products) in planter areas without ground cover to minimize sediment in runoff. - Install appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant material where possible and/or as recommended by the landscape architect. - Leave a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible. - Choose plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth.

S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☐	☒	All landscape pockets, fingers, setback areas, parkway strips, street medians, etc., shall be finish-graded at a minimum of 1-2 inches below top of curb or sidewalk for increased retention/infiltration of stormwater and irrigation water.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Project plans should include Source Control BMPs to decrease the potential for erosion of slopes and/or channels. The following design principles should be considered and incorporated and implemented where determined applicable and feasible by the local jurisdiction: - Convey runoff safely from the tops of slopes. - Avoid disturbing steep or unstable slopes. - Avoid disturbing natural channels. - Install permanent stabilization BMPs on disturbed slopes as quickly as possible. - Vegetate slopes with native or drought tolerant vegetation. - Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems. - Install permanent stabilization BMPs in channel crossings as quickly as possible and ensure that increases in runoff velocity and frequency caused by the project do not erode the channel. - Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters should be installed in such a way as to minimize impacts to receiving waters. - On-site conveyance channels should be lined, where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. Irrigation demand of vegetated systems should be considered. If velocities in the channel are large enough to erode grass or other vegetative linings, rock, riprap, concrete soil cement or geo-grid stabilization may be substituted or used in combination with grass or other vegetation stabilization. - Other design principles which are comparable and equally effective.

				- These practices should be implemented, as feasible, consistent with local codes and ordinances. Projects involving an alteration to bed, bank, or channel of a Water of the US may require approval of additional regulatory agencies with jurisdiction over water bodies, (e.g., the U.S. Army Corps of Engineers, the California Regional Water Quality Control Boards and the California Department of Fish and Game).
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Loading /unloading dock areas shall include the following: - Cover loading dock areas, or design drainage to preclude run-on and runoff, unless the material loaded and unloaded at the docks does not have potential to contribute to stormwater pollution, and this use is ensured for the life of the facility. - Direct connections to the municipal storm drain system from below grade loading docks (truck wells) or similar structures are prohibited. Stormwater can be discharged through a permitted connection to the storm drain system with a treatment control BMP applicable to the use. - Other comparable and equally effective features that prevent unpermitted discharges to the MS4. - Housekeeping of loading docks shall be consistent with Housekeeping of Loading Dock Areas (SD-31).
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Maintenance bays shall include the following: - Repair/maintenance bays shall be indoors; or, designed to preclude urban run-on and runoff. - Design a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters from entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the MS4 is prohibited. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered only if allowed by the local sewerage agency through permitted connection. - Other features which are comparable and equally effective that prevent discharges to the MS4 without appropriate permits.

S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☒	☐	Projects that include areas for washing /steam cleaning of vehicles shall use the following: - Self-contained or covered with a roof or overhang. - Equipped with a wash rack, and with the prior approval of the sewerage agency (Note: Discharge monitoring may be required by the sewerage agency). - Equipped with a clarifier or other pretreatment facility. - If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered only allowed by the local sewerage agency through permitted connection. - Other features which are comparable and equally effective that prevent unpermitted discharge, to the MS4.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	Outdoor process equipment operations, such as rock grinding or crushing, painting or coating, grinding or sanding, degreasing or parts cleaning, landfills, waste piles, and wastewater and solid waste handling, treatment, and disposal, and other operations determined to be a potential threat to water quality by the local jurisdiction shall adhere to the following requirements. - Cover or enclose areas that would be the sources of pollutants; or slope the area toward a sump that will provide infiltration or evaporation with no discharge; or, if there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered only allowed by the local sewerage agency through permitted connection. - Grade or berm area to prevent run-on from surrounding areas. - Installation of storm drains in areas of equipment repair is prohibited. - Other features which are comparable or equally effective that prevent unpermitted discharges to the MS4. - Where wet material processing occurs (e.g. electroplating), secondary containment structures (not double wall containers) shall be provided to hold spills resulting from accidents, leaking tanks or equipment, or any other unplanned releases. - Some of these land uses (e.g. landfills, waste piles, wastewater and solid waste handling, treatment and disposal) may be subject to other permits including Phase I Industrial Permits that may require additional BMPs.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☒	☐	Outdoor equipment/accessory washing and steam cleaning activities shall use the following: - Be self-contained or covered with a roof or overhang. - Design an equipment wash area drainage system to capture all wash water. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around equipment wash areas to prevent wash -down waters from entering the storm drain system. Connect drains to a sump for collection and disposal. Discharge from equipment wash areas to the MS4 is prohibited. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered, but only when allowed by the local sewerage agency through a permitted connection. - Other comparable or equally effective features that prevent unpermitted discharges to the MS4.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	Fuel dispensing areas shall contain the following: - At a minimum, the fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less. - The fuel dispensing area shall be paved with Portland cement concrete (or equivalent smooth impervious surface). The use of asphalt concrete shall be prohibited. - The fuel dispensing area shall have an appropriate slope (2 percent - 4 percent) to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of stormwater. - An overhanging roof structure or canopy shall be provided. The cover's minimum dimensions must be equal to or greater than the area of the fuel dispensing area in the first item above. The cover must not drain onto the fuel dispensing area and the downspouts must be routed to prevent drainage across

				the fueling area. The fueling area shall drain to the project's Treatment Control BMP(s) prior to discharging to the MS4. - See CASQA Stormwater Handbook Section 3.2.11 and BMP Fact Sheet SD-30 for additional information.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	Hillside areas that are disturbed by project development shall be landscaped with deep-rooted, drought tolerant plant species selected for erosion control, satisfactory to the local jurisdiction.
S14	Wash water control for food preparation areas	☒	☐	Food establishments (per State Health & Safety Code 27520) shall have either contained areas or sinks, each with sanitary sewer connections for disposal of wash waters containing kitchen and food wastes. If located outside, the contained areas or sinks shall also be structurally covered to prevent entry of stormwater. Adequate signs shall be provided and appropriately placed stating the prohibition of discharging wash water to the storm drain system.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	In complexes larger than 100 dwelling units where car washing is allowed, a designated carwash area that does not drain to a storm drain system shall be provided for common usage. Wash water from this area may be directed to the sanitary sewer (with the prior approval of the sewerage agency); to an engineered infiltration system; or to an equally effective alternative. Ore-treatment may also be required.

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

Minimize impervious areas: Yes ☒ No ☐
Explanation: Driveway and drive isle widths have been minimized to the allowable minimum for fire access and turn-around requirements. Sidewalk and walkway widths have been reduced to the allowable minimum for ADA compliance. The parking lots have been reduced to the required stall counts.

Maximize natural infiltration capacity: Yes ☒ No ☐
Explanation: Minimize unnecessary compaction of soils in order to maximize infiltration. To the maximum extent practical, heavy machinery shall be prohibited from long term contact on surface where infiltration BMPs will be implemented.

Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐
Explanation: The use of LID infiltration BMPs effectively increases the concentration time of runoff due to routing through the proposed BMPs. An increase in concentration time does not adversely affect downstream water ways. The proposed basin will provide mitigation capacity for the increased runoff from the proposed development.

Disconnect impervious areas: Yes ☒ No ☐
Explanation: Roofs and hardscape walkways shall discharge to adjacent landscaped areas. This allows some incidental infiltration and aids in removing sediment from runoff prior to infiltration in the onsite infiltration BMPs.

Protect existing vegetation and sensitive areas: Yes ☐ No ☒
Explanation: Existing weeds shall be replaced by landscaping more appropriate for commercial development.

Re-vegetate disturbed areas: Yes ☒ No ☐
Explanation: Disturbed areas shall be replaced with landscaping more appropriate for commercial development.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐
Explanation: Heavy machinery shall be actively prohibited from long term contact with any surface within an infiltration BMP area.

Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☒ No ☐
Explanation: Where possible, landscaped areas shall be graded as swales and will direct runoff away from buildings and toward the infiltration BMPs.

Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☒ No ☐
Explanation: Proposed landscape area shall be delineated in construction drawings and staked during construction. Heavy machinery shall be prohibited from long term contact within proposed landscaped areas (i.e. no overnight storage).

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.

<table>
<tr><th colspan="4">Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)</th></tr>
<tr><td>[1] Project area DA 1 (ft^2):
215,657</td><td>[2] Imperviousness after applying preventative site design practices (Imp%): **0.64**</td><td colspan="2">[3] Runoff Coefficient (Rc): **0.44**
$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$</td></tr>
<tr><td colspan="4">[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): **0.47**
http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html</td></tr>
<tr><td colspan="4">[5] Compute P_6, Mean 6-hr Precipitation (inches): **0.70**
*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)*</td></tr>
<tr><td colspan="3">[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.</td><td>24-hrs ☐
48-hrs ☒</td></tr>
<tr><td colspan="4">[7] Compute design capture volume, DCV (ft^3): **10,795**
*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</td></tr>
</table>

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

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

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

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)*

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

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

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

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

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

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)*

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

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

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): $I_a = 0.2 * \text{Item } 7$
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): $I_a = 0.2 * \text{Item } 8$

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)*$^{\wedge 0.67}$ ** (Item 3)*$^{\wedge 0.5}$								
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 13 * 0.95) – Item 14*

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

Compute peak runoff for pre- and post-developed conditions

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

8 Pre-developed Q_p at T_c for DMA A:
*Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*

9 Pre-developed Q_p at T_c for DMA B:
*Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*

10 Pre-developed Q_p at T_c for DMA C:
*Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*

10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*

11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*

12 Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*

13 Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*

14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

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

4.3 Project Conformance Analysis

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

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

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

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

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

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

If Yes, provide basis: (attach)

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

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

If Yes, provide basis: (attach)

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

If Yes, provide basis: (attach)

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

If Yes, provide basis: (attach)

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

If Yes, provide basis: (attach)

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

If Yes, provide basis: (attach)

[7] Any answer from Item 1 through Item 3 is “Yes”: Yes ☐ No ☒
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

[8] Any answer from Item 4 through Item 6 is “Yes”: Yes ☐ No ☒
If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.

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

4.3.1 Site Design Hydrologic Source Control BMP

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

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

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

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

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

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

4.3.2 Infiltration BMPs

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

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

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

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

[1] Remaining LID DCV not met by site design HSC BMP (ft^3): **10,795** *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA A BMP Type Infiltration Basin		
[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*	1.3 in/hr		
[3] Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3		
[4] Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.43 in/hr		
[5] Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48 hrs		
[6] Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	4.0 ft		
[7] Ponding depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1.73 ft		
[8] Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	7,471 sf		
[9] Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A		
[10] Amended soil porosity	N/A		
[11] Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*			
[12] Gravel porosity			
[13] Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3 hrs		
[14] Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	13,220 cf		
[15] Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A		

[16] Total Retention Volume from LID Infiltration BMPs: **13,220 cu-ft**

[17] Fraction of DCV achieved with infiltration BMP: **122.5%** *Retention% = Item 16 / Form 4.2-1 Item 7*

[18] Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs?

Yes ☒ No ☐

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

4.3.3 Harvest and Use BMP

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

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

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

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

4.3.4 Biotreatment BMP

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

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

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

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

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*

2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment

3 Volume biotreated in volume based biotreatment BMP (ft³): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*

6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*

7 Metrics for MEP determination:

- Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*

4.3.4 Biotreatment BMP

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

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

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

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

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*

List pollutants of concern *Copy from Form 2.3-1.*

2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment

3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*

6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*

7 Metrics for MEP determination:

- Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*

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

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
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) – 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) $A_{bottom} = \text{Item } 2 * \text{Item } 3$				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface} = (\text{Item } 2 + (2 * \text{Item } 5 * \text{Item } 6)) * (\text{Item } 3 + (2 * \text{Item } 5 * \text{Item } 6))$				
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* $V = \text{Item } 6 / 3 * [\text{Item } 4 + \text{Item } 7 + (\text{Item } 4 * \text{Item } 7)\text{^}0.5]$				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) $Q_{BMP} = (\text{Item } 8_{forebay} + \text{Item } 8_{basin}) / (\text{Item } 9 * 3600)$				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated} = (\text{Item } 8_{forebay} + \text{Item } 8_{basin}) + (\text{Item } 10 * \text{Item } 11 * 3600)$				
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 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w = (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item $2^{\wedge 1.67}$ * Item $3^{\wedge 0.5}$)			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item* $2^{\wedge 2}$)			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow-based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) SA_{top} = (Item 5 + (2 * Item 2 * Item 6)) * Item 10			

4.3.5 Conformance Summary

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

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

1 Total LID DCV for the Project DA-1 (ft^3): 10,795 *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): 13,220 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

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

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs (DA 1)

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

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

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

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

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

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

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

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

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

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
TC-11 Infiltration Basin	Owner/Future POA	Inspection Activities: • Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained. • Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary. • Inspect for differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, and pretreatment device condition. Maintenance Activities: • Factors responsible for clogging should be repaired immediately. • Weed once monthly during the first growing seasons. • Stabilize eroded banks. • Repair undercut and eroded areas at inflow and outflow structures. • Maintain access to the basin for regular maintenance activities. • Mow as appropriate for vegetation and replace as necessary. • Control mosquitoes as necessary.	After construction. Semi-annual & after extreme events. Annual.

		• Remove litter and debris from infiltration basin area as required. • Mow and remove grass clippings, litter, and debris. • Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. • Replant eroded or barren spots to prevent erosion and accumulation of sediment. • Scape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment. • Seed or sod to restore ground cover. • Disc or otherwise aerate bottom. • Dethatch basin bottom.	
N1: Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Owner/Future POA	For developments with no Property Owners Association (POA)2 or with POA of less than fifty (50) dwelling units, practical information materials will be provided to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially developed and provided to first residents/occupants/tenants by the developer. Thereafter such materials will be available through the local jurisdiction's stormwater education program. Different materials for residential, office commercial, retail commercial, vehicle-related commercial and industrial uses have been developed. For developments with POA and residential projects of more than fifty (50) dwelling units, project conditions of approval will require that the POA periodically provide environmental awareness education materials, made available by the municipalities, to all members. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of wastes via hosing or other direct discharge to gutters, catch basins and storm drains. Educational materials available from the San Bernardino Stormwater Program and can be downloaded at: http://www.sbcountystormwater.org/gov_out.html	Once, upon purchase of unit.
N2: Activity Restrictions	Owner/Future POA	If a POA is formed, conditions, covenants, and restrictions (CCRs) must be prepared by the developer	As needed.

		for the purpose of surface water quality protection. An example would be not allowing car washing outside of established community car wash areas in multi-unit complexes. Alternatively, use restrictions may be developed by a building operator through lease terms, etc. These restrictions must be included in the Project WQMP.	
N3: Landscape Management BMPs	Owner/Future POA	Identify on-going landscape maintenance requirements consistent with applicable local ordinances that may include fertilizer and/or pesticide usage. See attached SC-73 protocol information obtained from the California Stormwater BMP Handbook.	As needed to achieve the goals outlined in the attached SC-73 protocol.
N12: Employee Training	Owner/Future POA	The developer prepares manual(s) for initial purchasers of a business site or for a development that is constructed for an unspecified use, the developer makes a commitment on behalf of POA or future business owner to prepare the training. An example would be a provision to provide training on the proper storage and use of fertilizers and pesticides, or training on the implementation of hazardous spill contingency plans.	Once, during employee training.
N14: Catch Basin Inspection	Owner/Future POA	For industrial/commercial developments and for developments with privately maintained drainage systems, the owner is required to have at least 80 percent of drainage facilities inspected, cleaned and maintained on an annual basis with 100 percent of the facilities included in a two-year period. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. Drainage facilities include catch basins (storm drain inlets) detention basins, retention basins, sediment basins, open drainage channels and lift stations.	Annually. Prior to the start of the rainy season. After extreme event.
N15: Vacuum Sweep Private Streets and Parking Lots	Owner/Future POA	Streets and parking lots are required to be swept on a regular frequency-based usage and field observations of waste accumulation, using a vacuum assisted sweeper. At a minimum all paved areas of a business shall be swept, in late summer or early fall, prior to the start of the rainy season or equivalent, as required by the governing jurisdiction.	Monthly or as needed. Prior to the start of the rainy season.

N17: Comply with Other Applicable NPDES Permits	Owner/Future POA	Projects disturbing greater than one (1) acre are required to implement a Storm Water Pollution Prevention Plan during construction to control stormwater and non-stormwater discharges from the site, in conjunction with providing erosion control to prevent sediment from leaving the site.	As needed during construction.

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

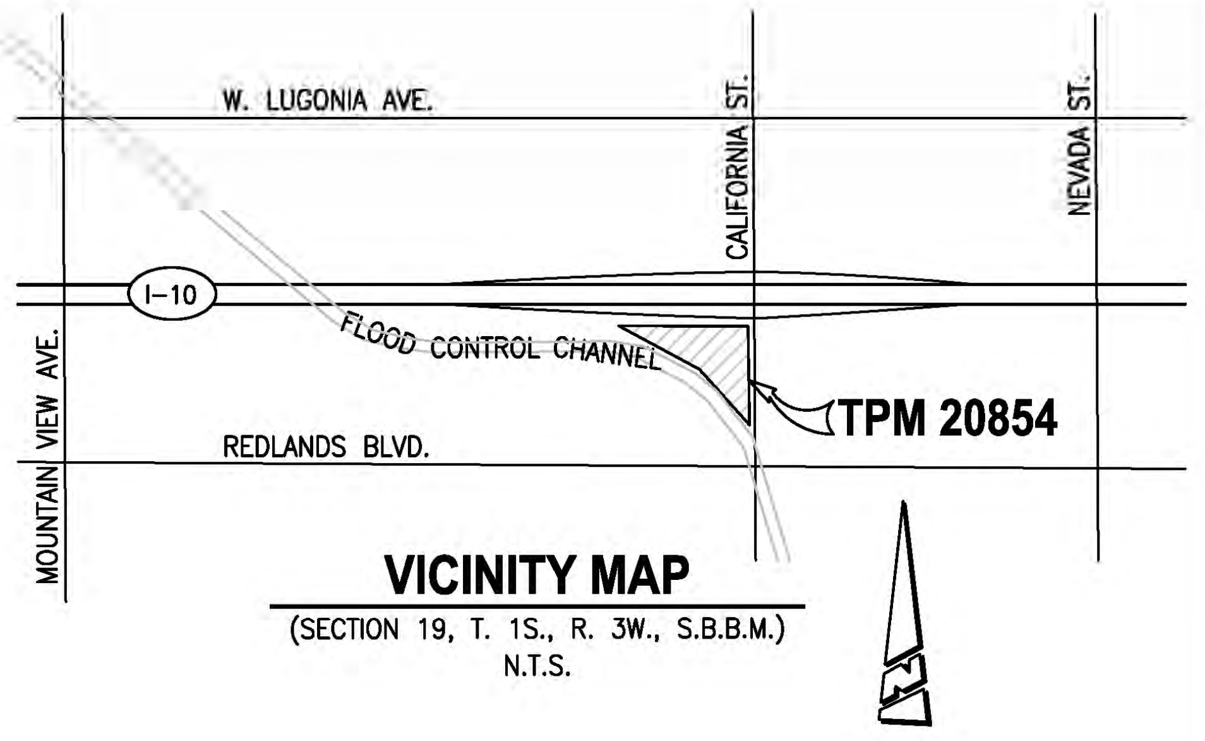
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

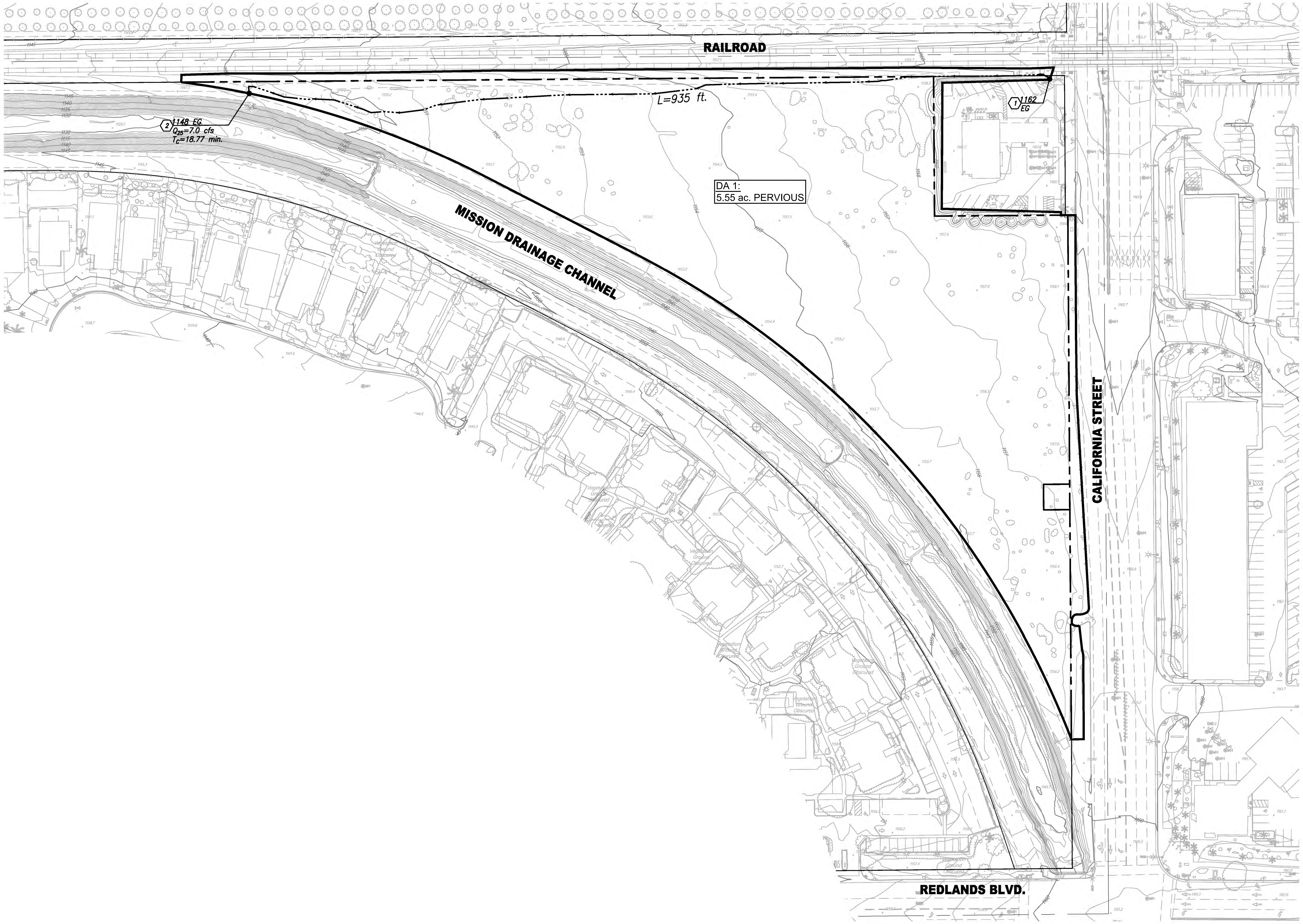
6.1 Site Plan and Drainage Plan

- Existing Drainage Exhibit
- Preliminary WQMP Site Plan
- Supporting Calculation Summary



VICINITY MAP

(SECTION 19, T. 1S., R. 3W., S.B.B.M.)
N.T.S.



LEGEND

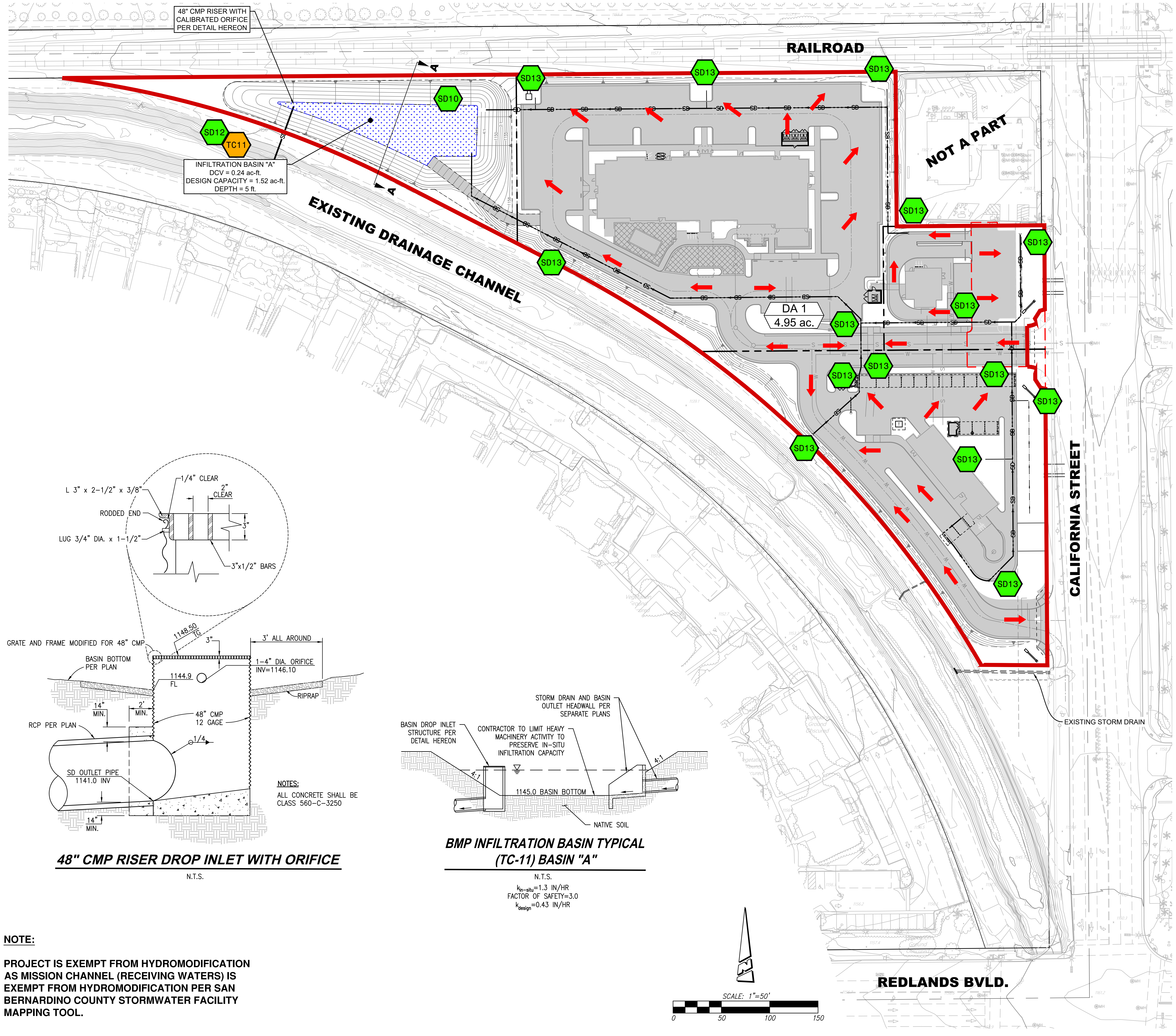
———	MAJOR DRAINAGE BOUNDARY
— — —	MINOR DRAINAGE SUB-BOUNDARY
—·—··	FLOW PATH
XX.XX	DRAINAGE TRIBUTARY ACREAGE
ELEVATION (ID)	HYDROLOGY NODE AND ELEVATION

SCALE: 1"=60'
0 60 120 180

SP2 & Co.
A LAND DEVELOPMENT SERVICES COMPANY
451 W LAMBERT RD. STE 216
BREA, CA 92821
PHONE: (714) 490-1500
"SERVING THE DEVELOPMENT COMMUNITY SINCE 1985"

TENTATIVE PARCEL MAP 20854
EXISTING DRAINAGE EXHIBIT

Plotted: Oct 10, 2024 - 6:26pm By: AlexanderJaramillo DWG: \\sp2-nas2\SP2-Data\SP2 Active\2023.08008 913 California St, Redlands - Chandresh Ravaliya\Stormwater\Preliminary WQMP\Calculations\PWQMP Existing Site Plan.dwg



48" CMP RISER DROP INLET WITH ORIFICE

N.T.S.

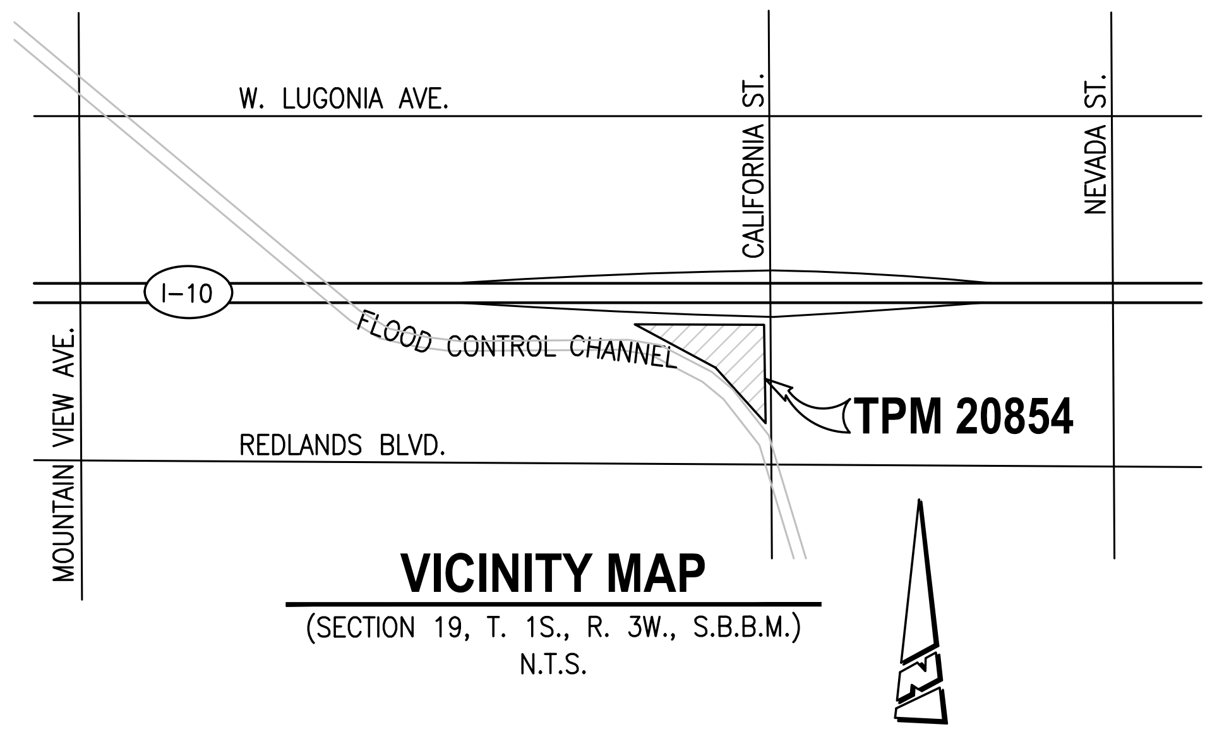
BMP INFILTRATION BASIN TYPICAL (TC-11) BASIN "A"

N.T.S.

$k_{in-situ}$=1.3 IN/HR
FACTOR OF SAFETY=3.0
k_{design}=0.43 IN/HR

NOTE:

PROJECT IS EXEMPT FROM HYDROMODIFICATION AS MISSION CHANNEL (RECEIVING WATERS) IS EXEMPT FROM HYDROMODIFICATION PER SAN BERNARDINO COUNTY STORMWATER FACILITY MAPPING TOOL.



VICINITY MAP
(SECTION 19, T. 1S., R. 3W., S.B.B.M.)
N.T.S.

LEGEND:

XX.XX	DMA LABEL (ID, ACREAGE, & IMPERVIOUS FRACTION)
🟥	DMA BOUNDARY
SD12 ☐	PERVIOUS AREA (LANDSCAPING)
▨	IMPERVIOUS AREA (PAVEMENT, CONCRETE, & ROOFS)
TC11 ▨	INFILTRATION BMP BASIN AREA (STRUCTURAL BMP)
—·—	PROPOSED STORM DRAIN & INLET
→	RUNOFF FLOW DIRECTION
—·—·—	STORM DRAIN FLOW PATH

STRUCTURAL SOURCE CONTROL BMPS:

- SD13 — CATCH BASIN MARKINGS "ONLY RAIN DOWN THE STORM DRAIN"
- SD12 — EFFICIENT IRRIGATION
- SD10 — PROTECT SLOPES AND CHANNELS AND PROVIDE ENERGY DISSIPATION

NON-STRUCTURAL SOURCE CONTROL BMPS:

- N1 — EDUCATION FOR PROPERTY OWNERS, TENANTS, AND OCCUPANTS (ENTIRE SITE)
- N2 — ACTIVITY RESTRICTIONS
- N3 — LANDSCAPE MANAGEMENT BMPs
- N4 — BMP MAINTENANCE
- N11 — LITTER/DEBRIS CONTROL PROGRAM
- N12 — EMPLOYEE TRAINING

TOTAL FORM 4.2-1 SUMMARY

Equations:

$R_C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$

$P_6 = (P_{2yr,1hr})(C_1)$

$P_{2yr,1hr}$ = 0.47 (FROM FIGURE D-1 NOAA Atlas 14 INSET MAP)

$DCV = 1/12 \times DA * R_C * P_6 * C_2$

Location	DA (ft^2)	i	R_C	P_6	C_2	DCV (ft^3)
DA1	215,657	0.64	0.44	0.70	1.963	10,795
Total	215,657					10,795

SP2 & Co.
A LAND DEVELOPMENT SERVICES COMPANY
451 W LAMBERT RD. STE 216
BREA, CA 92821
PHONE: (714) 490-1500
"SERVING THE DEVELOPMENT COMMUNITY SINCE 1985"

TENTATIVE PARCEL MAP 20854

PRELIMINARY WQMP SITE PLAN

WATER QUALITY CALCULATIONS

VOLUME-BASED BMP FOR SAN BERNARDINO COUNTY

Project number:	2023.08008
Project Name:	913 California St. Redlands
Project Region:	VALLEY

Equations: $R_C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$

$P_6 = (P_{2yr,1hr})(C_1)$

$P_{2yr,\ 1hr} =$ 0.47 (FROM FIGURE D-1 NOAA Atlas 14 INSET MAP)

$DCV = 1/12 \times DA * R_C * P_6 * C_2$

Location	DA (ft^2)	i	R_C	P_6	C_2	DCV (ft^3)
DA1	215,657	0.64	0.44	0.70	1.963	10,795
						0
						0
						0
						0
						0
						0
Total	215,657					10,795

Where: DA = Project Drainage Area, in square feet

i = watershed imperviousness ratio which is equal to the percent total impervious divided by 100

R_C = runoff coefficient

$P_{2yr,\ 1hr}$ = 1-hour rainfall depth for a 2-year return period, in inches

P_6 = mean annual runoff-producing rainfall depths. In watershed inches, Table #-1 in Appendix D

valley, C_1 = 1.4807
mountain, C_1 = 1.9090
desert, C_1 = 1.2371

C_2 = regression constant, 1.582 and 1.963 for 24 and 48 hour draw down, respectively

DCV = Design Capture Volume, in cubic feet

Urban Runoff Quality Management Approach
(WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87

Proposed Infiltration Basin "A"

Input	Basin Depth (ft)	Total Vol. (af)	Infiltration Outflow (cfs)	Orifice #1 (cfs)	Weir 1 Outflow (cfs)	Weir 2 - Emergancy Overflow (cfs)	Total Q outflow (cfs)	Contour Elevation	Contour Area (sf)	Inc. Volume (cf)	Inc. Volume (af)
1	**0.00**	**0.00**	0.07				**0.07**	1145.00	7,474		
2	**1.00**	**0.19**	0.10				**0.10**	1146.00	9,529	8,480	0.19
3	**2.00**	**0.44**	0.12	0.39			**0.51**	1147.00	11,794	10,641	0.24
4	**3.00**	**0.74**	0.14	0.60			**0.75**	1148.00	14,293	13,023	0.30
5	**4.00**	**1.10**	0.17	0.76	14.79		**15.72**	1149.00	16,915	15,585	0.36
6	**5.00**	**1.52**	0.20	0.89	76.88	23.55	**101.51**	1150.00	19,690	18,285	0.42

Infiltration				
In-Situ:	1.3	in/hr		
Factor of Safety:	3			
k_{design} =	0.43	in/hr	0.00001	cfs/sq-ft

Orifice Outflow [Q=CA(2g($h_{el.}$-h_{fl}		
	#1	#2
d (in)=	4	0
C=	0.66	0.66
A (ft^2)=	0.087	0.000
FL Elev.	1146.30	

Weir Flow [Q=(C_w)(L)(H)$^{3/2}$]		
	#1	#2
L (ft)	12.57	0
C_w	3.33	3.33
A (ft^2)=	12.56637	0
FL Elev.	1148.50	

Emergancy Overflow	
L (ft)	20
C_w	3.33
FL Elev.	1149.5

Target 100-yr outflow: 6.9 cfs

WQMP Project Report - San Bernardino Co. Stormwater Program

Area of Interest (AOI) Information

Area : 485,569.08 ft²

Apr 15 2024 11:45:08 Pacific Daylight Time

Esri Community Maps Contributors, Loma Linda University, City of Redlands, County of Riverside, County of San Bernardino, California State Parks, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS

Project Site Parcel Numbers

#	ParcelNumber	Acreage	Area(ft²)
1	029203417	5.08	220,299.74
2	029203411	0.00	265,269.63

Drainage Segment Details

#	System Number	Facility Name	Closest channel segment's susceptibility to Hydromodification	Highest downstream hydromodification susceptibility	Is this drainage segment subject to TMDLs?
1	3-501-1B	Mission Channel	EHM	High	No

#	Are there downstream drainage segments subject to TMDLs?	Is this drainage segment a 303d listed stream?	Are there 303d listed streams downstream?	Area(ft²)
1	No	No	Yes	485,569.04

Onsite Soil Groups

#	Onsite Soils Group	Soil Type	Soil Type Abbreviation	Area(ft²)
1	Soils - Hydro Group B	HbA HANFORD SANDY LOAM, 0 TO 2 PERCENT SLOPES B	HANFORD SANDY LOAM	485,569.08

Known Groundwater Contamination Plumes Within 1,000'

#	Name	Contaminant	Major Contaminant	Area(ft²)
1	Redlands-Lockhead	Perchlorate Plume (6ug/L; August 2006 Interpretation)	Perchlorate	485,569.08

Studies and Reports Related to Project Site

#	Report Link	Source	Date	Area(ft²)
1	SBVMWD_High_Groundwater_/_Pressure_Zone_Area	USGS & San Bern Valley Municipal Water District	2005	485,569.08
2	CSDP_No._7_Storm_Drain_Systems	CM Engineering Associates	December 1982	485,569.08
3	CSDP_No._7_Storm_Drain_Systems	CM Engineering Associates	December 1982	485,569.08
4	CSDP_No._7_Storm_Drain_Systems	CM Engineering Associates	December 1982	485,569.08
5	CSDP_No._7_Storm_Drain_Hydraulic_Design_Data	CM Engineering	December 1982	485,569.08
6	CSDP_4_CALC_SHEET_FOR_HYDRO	San Bernardino County Flood Control District	February 1975	485,569.08
7	CSDP_4_Hydrological_Design_Criteria	Omer H. Brodie & Associates	May 1975	485,569.08

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. without independent verification.

6.2 Electronic Data Submittal

PDF copies of the Final Approved WQMP, in addition to hard copies will be provided to the Developer/Owner and the City of Redlands, Public Works Department. The Developer shall deliver the hard copy of the WQMP to the POA, following the first year after POA establishment. If the City of Redlands requires specialized electronic document formats, we will provide them.

CD of digital copies to be provide with Final WQMP plan submittal.

6.3 Post Construction

To be completed with the Final WQMP report.

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: ____

PROPERTY ADDRESS: ____

____

APN: ____

THIS AGREEMENT is made and entered into in

______________________________________ ,California, this _________ day of

______________________________________ , by and between

____ , 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

____ 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:

____
____
____

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

OWNER:

Signature: ________________________

Name: ___________________________

Title: ___________________________

Date: ___________________________

FOR: Maintenance Agreement, dated ________________________, for the project known as

____

____

(APN)______________________________,
As described in the WQMP dated
_________________________________.

OWNER:

Signature: ________________________

Name: ___________________________

Title: ___________________________

Date: ___________________________

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

____

GERRY NEWCOMBE, Director of Public Works

Date: ________________________________

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A

(Legal Description)

EXHIBIT B
(Map/illustration)

6.4 Other Supporting Documentation

- 6.4.1 Geotechnical Report and Percolation Tests
- 6.4.2 Precipitation Data
- 6.4.3 Educational Materials

6.4.1 Geotechnical Report and Percolation Tests

REPORT OF

GEOTECHNICAL INVESTIGATION

AND PERCOLATION TESTING FOR SUSMP

PROPOSED COMMERCIAL DEVELOPMENT PROJECT

APN: 0292034170000

913 CALIFORNIA STREET

REDLANDS, CALIFORNIA 92374

FOR

J D FUEL, LLC

PROJECT NO. 23-536-02

NOVEMBER 30, 2023

AES
C. M. APPLIED EARTH SCIENCES
a division of Applied Soil Technology, Inc.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

November 30, 2023 23-536-02

J D Fuel LLC
1031 Rosecrans Avenue, Suite #207
Fullerton, California 92833

Attention: Chandresh Ravaliya

Subject: Geotechnical Investigation
And Percolation Testing For SUSMP
Proposed Commercial Development Project
APN: 0292034170000
913 California Street
Redlands, California 92374

Ladies & Gentlemen:

INTRODUCTION

This report presents the results of a geotechnical investigation for the subject project. During the course of this investigation, the engineering properties of the subsurface materials were evaluated in order to provide recommendations for design and construction of temporary excavation, foundations, grade slabs, and grading. Our investigation included subsurface exploration, soil sampling, laboratory testing, engineering evaluation and analysis, on-site percolation testing for SUSMP, consultation, and preparation of this report.

This office has previously issued a soils report dated April 15, 2005 (AES Report No. 05-533-02) for the subject lot. Based on the conversation with the client, it is our understanding that, since the issuance of the previous report, the owners and design team (including the architect) have changed. The new client has requested a new report for a an entirely different project at the subject site. For reference, we have enclosed a PDF version of the previous report to this new report.

During the course of this investigation, the provided architectural site plan provided by the client was used as reference.

The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries and the proposed development. This drawing also shows the location on the plan and profile of Cross Section A-A'.

Figure No. 1 shows the Site Vicinity Map. Figure No. 2 shows the Regional Topographic Map. Figure No. 3 shows the Regional Geologic Map.

The attached Appendix I, describes the method of field exploration. Figure Nos. I-1 through I-6 present summaries of the materials encountered at the location of our borings and test pits. The test pits were excavated for the purpose of percolation testing. Figure No. I-7 presents the Uniform Soil Classification System Chart; a guide to the Log of Exploratory Borings and test pits.

The attached Appendix II describes the laboratory testing procedures. Figure Nos. II-1 and II-2 present the results of direct shear and consolidation tests performed on selected undisturbed soil samples.

It should be noted that the presented recommendations for excavation and foundation are based on our understanding of the depth of cuts setback conditions and assumed structural loading. This office should be consulted to see if the actual structural loading and excavation depths are different from those used during this investigation.

PROJECT CONSIDERATION

It is our understanding that the proposed project will consist of construction of a commercial complex. The proposed project will consist of construction of a one-story carwash tube with vacuum station, one-story coffee shop, a 4-story hotel building, and site improvements including the addition of open paved parking spaces.

The proposed buildings are expected to be established near grade. No basement is proposed.

The flooring system will be in the form of concrete slab established at or close to the existing grade. The approximate location of the proposed buildings with respect to the site boundaries is shown on the enclosed Site Plan; Drawing No.1.

Structural loading data was not available at the time of this investigation. For the purpose of this report, it is assumed that maximum concentrated loads of the interior columns will be on the order of 40 kips for the coffee shop and car wash and 400 kips for the hotel, combined dead plus frequently applied live loads. Perimeter and interior wall footings of the structure are expected to exert loads of on the order of 2 kips per lineal foot for the coffee shop/car wash structures and 10 kips for the hotel building.

ANTICIPATED SITE GRADING WORK

The site grading is expected to involve removal and recompaction of any surficial fill and loose native soils (a maximum of 2 to 3 feet; to be determined by the Soil Engineer during site grading). The recompacted soils can then be used to receive new fill for support of foundations and grade slabs. The required grading in the areas of surface parking will be limited to removal and recompaction of the top 12 inches of the existing soils. As part of the site grading work, some utility trenches will be backfilled.

The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill.

In our previous report, it was noted that due to shrinkage considerations and raising the site grade above the potential flood zone, imported soils will be required to accomplish the site grading work. All imported soils should be non-expansive and granular in nature (similar to the site soils).

SITE CONDITIONS

SURFACE CONDITIONS

The site of the proposed development is an existing vacant located at 913 California Street in Redlands, California. At the time of our filed investigation, the site was vacant and covered with dirt/shrubs. The site was noted to be general level.

An existing service station occurs to the northeast of the subject site and is not part of the scope. A flood control channel occurs to the south of the site. See enclosed Site Plan; Drawing No.1.

SUBSURFACE CONDITIONS

Correlation of the subsoil between the test holes was considered to be good. Generally, the site, to the depth explored, was found to be covered by fill (silty sand) underlain by natural deposits of silty sand, sandy and/or clayey silt, and relatively clean sand soils with variable amounts of gravel. The thickness of the existing fill was found to be on the order of 1 foot at the location of our test holes. Deeper fill, however, may be present between and beyond our borings and closer to the storm drain channel.

The existing fill and top 2 feet of the site native soils were found to be generally porous and compressible. At their present state, such soils should not be used for support of new fill, structural foundations and grade slabs. The existing fill, however, may be excavated and reused in the areas of compacted fill.

The native soils found below a depth of about 3 feet were found to be medium dense in-place and free of visual porosity. The results of our laboratory testing indicated that the site native soils were of moderate strength and moderately compressible.

The site upper soils (including the existing fill) were found to be granular in nature. Such soils were found to be virtually non-expansive.

During the course of our field exploration, no groundwater was encountered in our test holes extended to maximum depth of 51 feet. No groundwater data could be found in the vicinity of the subject site.

Due to the method of drilling (use of continuous auger) caving was not detected during the course of our field exploration. Foundation construction will not require forming due to the silty nature of the upper site soils.

SEISMIC DESIGN CONSIDERATIONS

In accordance with the ASCE7-16, corresponding to CBC 2022, the project site can be classified as site "D". The mapped spectral accelerations of S_S= 2.002 (short period) and S_1 =0.792 (1-second period) can be used for this project. These parameters correspond to site Coefficients values of F_a =1.0 and F_V = null (see the Note below), respectively.

The seismic design parameters would be as follows:

S_{MS}= F_a (S_S) = 1.0 (2.002) = 2.002	**S_{M1}**=F_v (S_1) = 1.7 (0.792) = 1.346
S_{DS}=2/3 (S_{MS}) = 2/3 (2.002) = 1.335	**S_{D1}**=2/3 (S_{M1}) = 2/3 (1.346) = 0.898

Note: Since the seismic factor S1 is greater than 0.2 site-specific ground motion hazard analysis may be required. The project structural engineer shall determine if an exemption can be applied in accordance with ASCE7-16, Supplement 3, Section 11.4.8.

for structures on Site Class D sites with S1 greater than or equal to 0.2, the parameter SM1 determined by equation (11.4-2) shall be increased by 50%. Alternatively, a supplement report containing a site-specific ground motion hazard analysis in accordance with ASCE7-16 section 21.2 shall be submitted for review and approval. If an exemption applies, a long period coefficient (F_V) of 1.7 may be utilized for calculation of the seismic parameters $\mathbf{S_{M1}}$ and $\mathbf{S_{D1}}$ in the above table.

EVALUATION OF LIQUEFACTION POTENTIAL

As part of our field exploration, one boring was extended to a maximum depth of 51 feet. No water was encountered in our borings. There is no historic groundwater data available for this site and its vicinity. However, for evaluating liquefaction potential at the site, groundwater was assumed at a depth of about 4 feet below ground surface where a BMP will be used for infiltration of stormwater into the subsurface soils.

The results of our liquefaction analysis (using CivilTech program) with lower-level peak ground acceleration (PGA) corresponding to 2/3 of PGA_M (a value of 0.62g) and the predominant earthquake magnitude of 7.22 with 10% probability of exceedance in 50 years (475-year return period) a factor of safety of greater than 1.1 was obtained for all layers. The corresponding seismic related total and differential settlements were found to be negligible. See the enclosed engineering calculation sheets.

When using higher level peak ground acceleration value of 0.93g corresponding to PGA based on PGA_M (Maximum Considered Earthquake-Geometric Mean, MCEg, adjusted to site effects, ASCE 7-16 Eq. 11.8-1) and the predominant earthquake magnitude of 7.55 with 2% probability of exceedance in 50 years (2475-year return period) a factor of safety of greater than 1.0 was also obtained for all layers. The corresponding seismic related total and differential settlements were found to be less than 0.10 of an inch. It is our opinion that soil liquefaction will not occur at this site.

STATEMENT 111

For the purpose of the subject project, it is our opinion that when the proposed grading and construction is made as planned, following the recommendations of this report, the site will be safe against the hazards of landsliding, settlement or slippage. The proposed construction and grading will not have adverse effect on the geologic stability of the existing properties outside the boundaries of the subject site.

SOIL CHEMICAL IMPURITIES AND CORROSION CONSIDERATIONS

After the proposed finished grades are established, samples of the subgrade materials in contact with foundations and utility lines, should be tested for chemical impurity (soil corrosivity). For the purpose of this report, however, it should be assumed that the site soils are corrosive. Subject to the results of chemical testing during construction, the design may be changed.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived from this investigation, the site is considered to be suitable for the proposed development. The surficial fill and top zone of porous native soils (a total thickness of on the order of 2 to 3 feet) should be excavated until non-porous soils (to be determined by the Soil Engineer) are exposed. The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill.

After proper site grading, conventional spread footing foundation system can be used for support of the proposed buildings. The foundation bearing soils are expected to be properly compacted fill soils.

Grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with #4 bars placed at every 16 inches on center each way.

The following sections present our specific recommendations for temporary excavation, site grading, site drainage, foundations, lateral design, grade slabs, minor walls, and observations during construction.

TEMPORARY EXCAVATION

Where space limitations permit, unshored temporary excavation slopes can be used. Based upon the engineering characteristics of the site upper soils, it is our opinion that temporary excavation slopes in accordance with the following table should be used:

Maximum Depth of Cut (Ft)	Maximum Slope Ratio (Horizontal: Vertical)
0-3	Vertical
>3	1:1

Water should not be allowed to flow over the top of the excavation in an uncontrolled manner. No surcharge should be allowed within a 45-degree line drawn from the bottom of the excavation. Excavation surfaces should be kept moist but not saturated to retard raveling and sloughing during construction.

It would be advantageous, particularly during wet season construction, to place polyethylene plastic sheeting over the slopes. This will reduce the chances of moisture changes within the soil banks and material wash into the excavation.

GRADING RECOMMENDATIONS

Site grading for the proposed project will involve excavation of the existing fill and native soils until competent native soils are exposed which could be about 2 to 3 feet below the ground surface and properly recompact the excavated soils. The recompacted fill will be used for supporting structural foundations and grade slabs. Debris and rocks larger than 4 inches in diameter should be excluded from the areas of new compacted fill.

For utility trench backfill, place clean sand around and above the utility lines using jetting. The sand should be brought up to 12 inches above utility lines. Above the sand, normal soils from the site can be used. All utility backfills should be placed at a minimum relative compaction of 90% at optimum moisture content.

Prior to placement of any fill on the site, the Soil Engineer should observe the excavation bottoms. The areas to receive compacted fill should be scarified to a depth of about 8 inches, moistened as required to bring to optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM Designation D1557 Compaction Method.

General guidelines regarding site grading are presented below which may be included in the earthwork specification. It is recommended that all fill be placed under engineering observation and in accordance with the following guidelines:

1. All vegetation and debris should be collected and hauled off-site. In the areas of new fill, the existing fill should be excavated until native soils are exposed.

2. The excavated areas should be observed and approved by the Soil Engineer prior to placing any fill.

3. The excavated sandy soils from the site are considered to be satisfactory to be reused in the areas of compacted fill and wall backfill provided that rocks larger than 6 inches in diameter are removed.

5. Fill material, approved by the Soil Engineer, should be placed in controlled layers. Each layer should be compacted to at least 90 percent of the maximum unit weight as determined by ASTM designation D 1557-02 for the material used.

6. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer.

7. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the moisture content is near optimum. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading or other satisfactory methods until near optimum moisture condition is achieved.

8. Inspection and field density tests should be conducted by the Soil Engineer during grading work to assure that adequate compaction is attained. Where compaction of less than 90 percent is indicated, additional compactive effort should be made with adjustment of the moisture content or layer thickness, as necessary, until at least 90 percent compaction is obtained.

SITE DRAINAGE

Site drainage should be provided to divert roof and surface waters from the property through non-erodible drainage devices to the street. In no case should the surface waters be allowed to pond adjacent to the building or behind the walls. A minimum slope of two and five percent are recommended for paved and unpaved areas, respectively.

The site drainage recommendations should also include the following:

1. Having positive slope away from the buildings, as recommended above;
2. Installation of roof drains, area drains and catch basins with appropriate connecting lines;
3. Managing landscape watering;
4. Regular maintenance of the drainage devices;
5. Installing waterproofing or damp proofing, whichever appropriate, beneath concrete grade slabs and behind the walls;
6. The owners should be familiar with the general maintenance guidelines of the City requirements.

FOUNDATIONS

Conventional spread footing foundation systems could be used to support the proposed buildings. The foundation bearing materials are expected to be firm native and/or properly compacted fill soils.

Exterior and interior footings should be a minimum of 18 inches wide and should be placed at a minimum depth of 24 inches below the lowest adjacent final grades.

Properly designed and constructed spread footings may be based on an allowable maximum bearing pressure of 1,800 pounds per square foot. This value may be increased at a rate of 100 and 200 pounds per square foot for each additional foot of footing width and depth, to a maximum value of 2,400 pounds per square foot. The footings for this project should be connected in both directions using beams.

The above given values are for the total of dead and frequently applied live loads. For short duration transient loading, such as wind or seismic forces, the given values may be increased by one-third.

Under the allowable maximum soil pressure, footings carrying the assumed maximum concentrated loads of up to 400 kips are expected to settle on the order of 3/4 of one inch. Continuous footings, with loads of up to 10 kips per linear foot are expected to settle on the order of ½ of one inch. Maximum differential settlements are expected to be on the order of 1/4 of an inch. Due to granular nature of the materials, it is anticipated that the major portions of the settlements will occur during construction.

LATERAL DESIGN

Lateral resistance at the base of footings in contact with native soils and/or compacted fill soils may be assumed to be the product of the dead load forces and a coefficient of friction of 0.3. Passive pressure on the face of footings may also be used to resist lateral forces.

A passive pressure of zero at the finished grades and increasing at a rate of 250 pounds per square foot per foot of depth to a maximum value of 1,800 pounds per square foot may be used for footings poured against properly compacted fill soils.

GRADE SLABS

Grade slabs can be supported on finished grade which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with #4 bars placed at every 16 inches on center each way.

In the areas where moisture sensitive floor covering is used and slab dampness cannot be tolerated, a vapor-barrier should be used beneath the slabs. This normally consists of a 10-mil polyethylene film covered with 2 inches of clean sand.

RETAINING WALLS

Static design of minor retaining walls may be based on an equivalent fluid pressure of 40 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the walls. Hydrostatic pressures should be relieved from the back of the retaining walls through properly designed and constructed subdrain. This normally consisted of 4-inch diameter perforated pipes encased in free draining gravel (at least one cubic foot per lineal foot of the pipes). To reduce the chances of siltation, an approved fabric should be used around the gravel.

Uniform surcharge effects may be computed using a coefficient of 0.47 times the uniform loads. For allowable vertical and lateral pressure refer to the preceding sections.

It is noted that, based on the new Code requirement, if the walls higher than 6 feet should be designed not only for static, but also for seismic lateral earth pressures. For the purpose of this project, the magnitude of seismic lateral earth pressure should be assumed zero at the base of the excavation and increased upward at a rate of 48 pounds per square foot per decreasing depth to a maximum value at the ground surface. The point of application of the lateral thrust of the seismic pressure should be assumed 0.6 time the wall height, measured from the bottom of the wall. The seismic lateral earth pressure should be applied to the active pressure.

ON-SITE INFILTRATION CONSIDERATIONS

As part of the site development, it is required to provide an on-site storm water infiltration system. This normally consists of diversion of the stormwater into an underground system that will allow infiltration into the ground.

PERCOLATION TESTING

The procedure for percolation testing was based on the County of San Bernardino Technical Guidance Document, Appendix VII test procedures. The constant head method described in section 2 of the Design Handbook for Low Impact Development (LID) Best Management Practices (BMP) prepared by Riverside County Flood Control Water Conservation District (9/2011) was used to perform percolation tests. The percolation testing procedure was as follow:

1. Two test pits were excavated to a depth of 2 feet (passing the upper fill);
2. Using hand tools, excavated a 12-inch diameter test hole at the bottom of the test pit to a depth of 32 inches (5 times the radius of the hole);
3. Covered the bottom of the hole with 2 inches of gravel;
4. Due to silty sand native soils (USCS classification of SM), the tests were then run after 2 hours of presoaking instead of 24 hours;
5. As shown in the attached Table 5, our 2 consecutive measurements showed that more than 6 inches of water seeped away in less than 25 minutes. Therefore, the test was run for an additional hour with measurements taken every 10 minutes. The

drop that occurred during the final 10 minutes was used to calculate the percolation rate. File data showing the two 25-minute readings and the six 10-minute readings.

The percolation tests were performed in Test Pit No. 1 and 2 respectively at depth of 3.5 to 4.5 feet below the ground surface in native soils. The enclosed Site Plan; Drawing No. 1, shows the approximate location of excavated test pits and where the percolation test was conducted (Perc-1 and Perc-2).

PERCOLATION RATE CONVERSION

The Percolation Test Data Sheets (Table 5) were prepared as the test was performed in the field. The test was performed using 6 trials. The data collected from Test Pit No.1 at the final interval is as follows:

Time interval, $\Delta t = 10$ minutes

Initial Depth to Water, $D_0 = 12$ inches

Final Depth to Water, $D_f = 13.50$ inches

Total Depth of Test Hole, $D_T = 30$ inches

Test Hole Radius, $r = 6$ inches

The conversion equation used to calculate infiltration rate:

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

"H_0" is the initial height of water at the selected time interval:

$H_0 = D_T - D_0 = 30 - 12 = 18$ inches

"H_f" is the final height of water at the selected time interval:

$H_f = D_T - D_f = 30 - 13.50 = 16.5$ inches

"ΔH" is the change in height over the time interval:

$H_{avg} = \Delta D = H_0 - H_f = 18 - 16.5 = 1.5$ inches

"H_{avg}" is the average height over the time interval:

$H_{avg} = (H_0 + H_f)/2 = (18 + 16.5)/2 = 17.25$ inches

“$\mathrm{I_t}$” is the tested infiltration rate:

$$\mathrm{I_t} = \frac{\Delta\mathrm{H}\ 60\ \mathrm{r}}{\Delta\mathrm{t}(\mathrm{r} + 2\mathrm{H_{avg}})} = \frac{(1.5\ \mathrm{in})(60\ \mathrm{min/hr})(6\ \mathrm{in})}{(10\ \mathrm{min})((6\ \mathrm{in}) + 2(1.5))} = 1.3\ \mathrm{in/hr}$$

The Percolation Test Data Sheets (Table 5) were prepared as the test was performed in the field. The test was performed using 6 trials. The data collected from Test Pit No.2 at the final interval is as follows:

Time interval, $\Delta\mathrm{t} = 10$ minutes

Initial Depth to Water, $\mathrm{D_0} = 12$ inches

Final Depth to Water, $\mathrm{D_f} = 13.75$ inches

Total Depth of Test Hole, $\mathrm{D_T} = 30$ inches

Test Hole Radius, $\mathrm{r} = 6$ inches

The conversion equation used to calculate infiltration rate:

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

“$\mathrm{H_0}$” is the initial height of water at the selected time interval:

$\mathrm{H_0} = \mathrm{D_T} - \mathrm{D_0} = 30 - 12 = 18$ inches

“$\mathrm{H_f}$” is the final height of water at the selected time interval:

$\mathrm{H_f} = \mathrm{D_T} - \mathrm{D_f} = 30 - 13.75 = 16.25$ inches

“$\Delta\mathrm{H}$” is the change in height over the time interval:

$\mathrm{H_{avg}} = \Delta\mathrm{D} = \mathrm{H_0} - \mathrm{H_f} = 18 - 16.25 = 1.75$ inches

“$\mathrm{H_{avg}}$” is the average height over the time interval:

$\mathrm{H_{avg}} = (\mathrm{H_0} + \mathrm{H_f})/2 = (18 + 16.25)/2 = 17.125$ inches

“$\mathrm{I_t}$” is the tested infiltration rate:

$$\mathrm{I_t} = \frac{\Delta\mathrm{H}\ 60\ \mathrm{r}}{\Delta\mathrm{t}(\mathrm{r} + 2\mathrm{H_{avg}})} = \frac{(1.75\ \mathrm{in})(60\ \mathrm{min/hr})(6\ \mathrm{in})}{(10\ \mathrm{min})((6\ \mathrm{in}) + 2(1.75))} = 1.6\ \mathrm{in/hr}$$

The results of our in-situ testing with applied reduction factors indicated that the design infiltration rate was calculated to be about between 1.3 and 1.6 inches per hour. Using a factor of safety of 3, the infiltration rate of 0.43 inches per hour can be used in the design of LID system as the lowest available infiltration rate.

As shown in Drawing No.1, to minimize the potential for ground distress to adjacent buildings or adjacent properties, infiltration chambers set back laterally meet the minimum of 10 feet from the proposed footings and private property lines.

The system should be designed so that any excess water not infiltrated into the subsoil would be diverted into the planter boxes first and then to the street (after going through the required filtration process) or whichever method is acceptable by the City and local jurisdiction.

Assuming that the infiltration system will be maintained at least 10 feet from the building foundations and property lines, it is anticipated that hydroconsolidation, foundation settlement, liquefaction, groundwater, or hydrostatic pressure will not adversely affect the proposed building and off-site structures.

PERCOLATION CONCLUSIONS AND RECOMMENDATIONS

To minimize the potential for ground distress to adjacent buildings or adjacent properties, infiltration systems should be set back laterally a minimum of 10 feet from the proposed footings and private property lines.

Based on the data presented, it is anticipated that foundation settlement, liquefaction, groundwater, or hydrostatic pressure will not adversely affect the site improvements due to the proposed stormwater infiltration system if designed and implemented as recommended herein. It should be noted that the recommended infiltration rates are derived from field testing.

However, the tests are not full size, and the actual permeability or percolation rates obtained from the constructed seepage devices may vary from these test values. The infiltration system design, construction and operation should comply with the manufacturer’s specifications and applicable SUSMP requirements, environmental regulations and other applicable regulations. It should be understood that such infiltration devices are often susceptible to “fouling” or clogging due to silt, organics, or other foreign matter than enters the water during the life of the facility. Eventual replacement of the devices may be necessary eventually if clogging becomes too extensive over time. Periodic inspection and maintenance is recommended and will extend the life of the product.

Final plans for the development and the stormwater infiltration system should be made available to AES for review prior to final submittal to the City for approval. The infiltration gallery excavation should be observed by a representative of AES prior to placing geotextile fabric, gravel fill, or any other cover to confirm that the intended stratum has been encountered. All backfill should be properly compacted and tested by AES per current City guidelines.

The system should be designed so that any excess water not infiltrated into the subsoil would be diverted into the planter areas first and then to the street (after going through the required filtration process).

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all foundations will be established in properly compacted fill soils. All footing excavations should be observed and approved by a representative of this office before reinforcing is placed.

All site grading work should be observed and tested by a representative of this office. Please notify this office at least 24 hours before any observation work is required.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either express or implied.

It is noted that the conclusions and recommendations presented are based on exploration "window" borings and excavations which is in conformance with accepted engineering practice. Some variations of subsurface conditions are common between "windows" and major variations are possible.

-o0o-

The following Figures and Appendices are attached and complete this report:

Liquefaction Analysis, Wall Pressure Calculations, and Percolation Data Sheets
Drawing No. 1 - Site Plan
- Figure No. 1 - Site Vicinity Map
- Figure No. 2 - Regional Topographic Map
- Figure No. 3 - Regional Geologic Map
  - Appendix I- Method of Field Exploration
    - Log of Borings Figure Nos. I-1 through I-6
    - Unified Soil Classification System Figure No. I-7
  - Appendix II- Methods of Laboratory Testing
    - Figure Nos. II-1 and II-2
  - Appendix III - Soft Copy of AES Soil Report dated April 15, 2005 (PDF Only)

Respectfully Submitted,

APPLIED EARTH SCIENCES

Fereidoun “Fred” Jahani
Project Engineer
RE62875

REGISTERED PROFESSIONAL ENGINEER
FEREIDOUN JAHANI
C62875
CIVIL
STATE OF CALIFORNIA

Reviewed by:

Caro J. Minas, President
Geotechnical Engineer
GE 601

REGISTERED PROFESSIONAL ENGINEER
CARO J. MINAS
NO. 601
GEOTECHNICAL
STATE OF CALIFORNIA

FJ/CJM/la

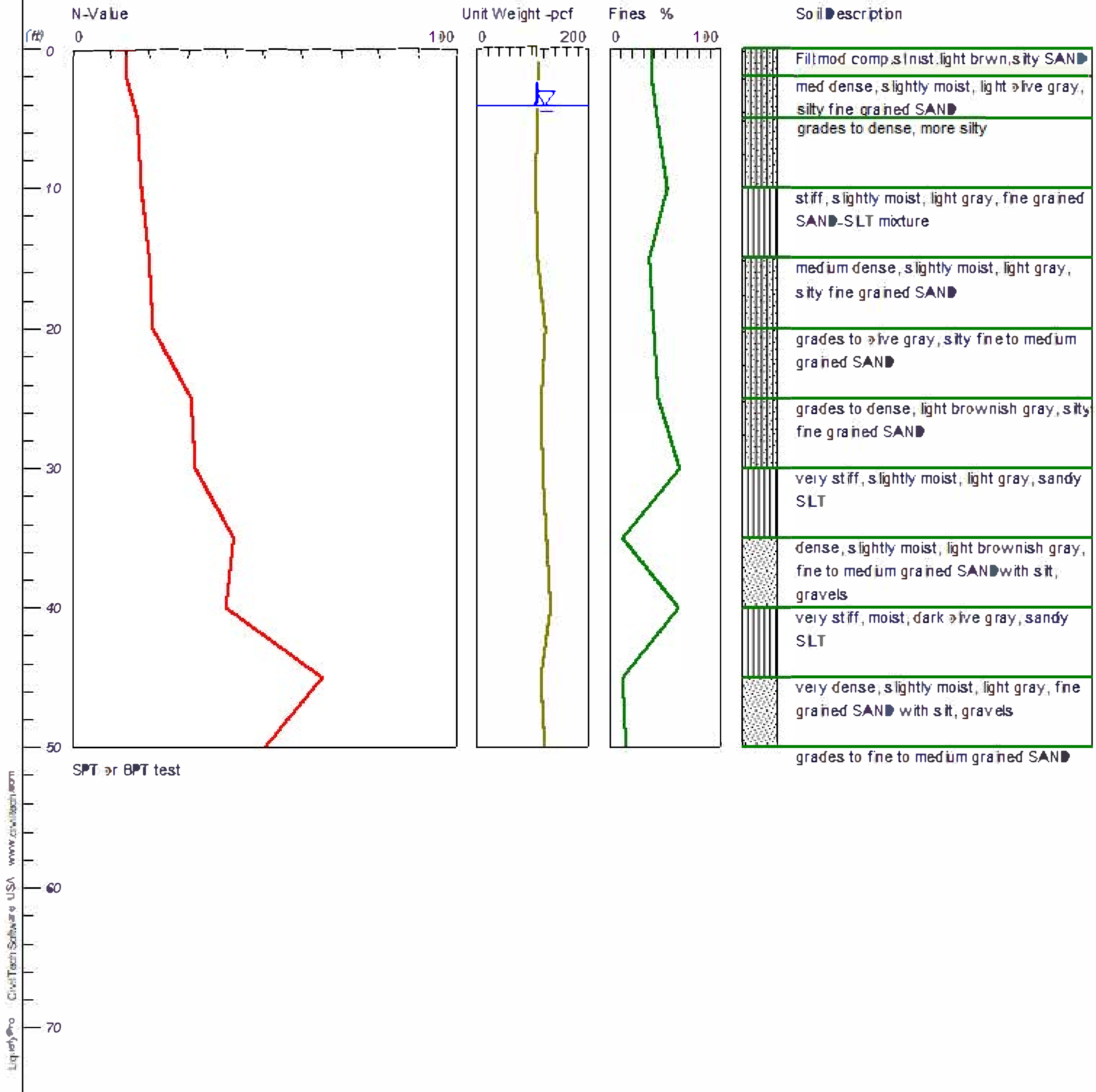
Distribution: (4) Addressee

LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1 Water Depth=4 ft

Magnitude=7.55
Acceleration=0.93g

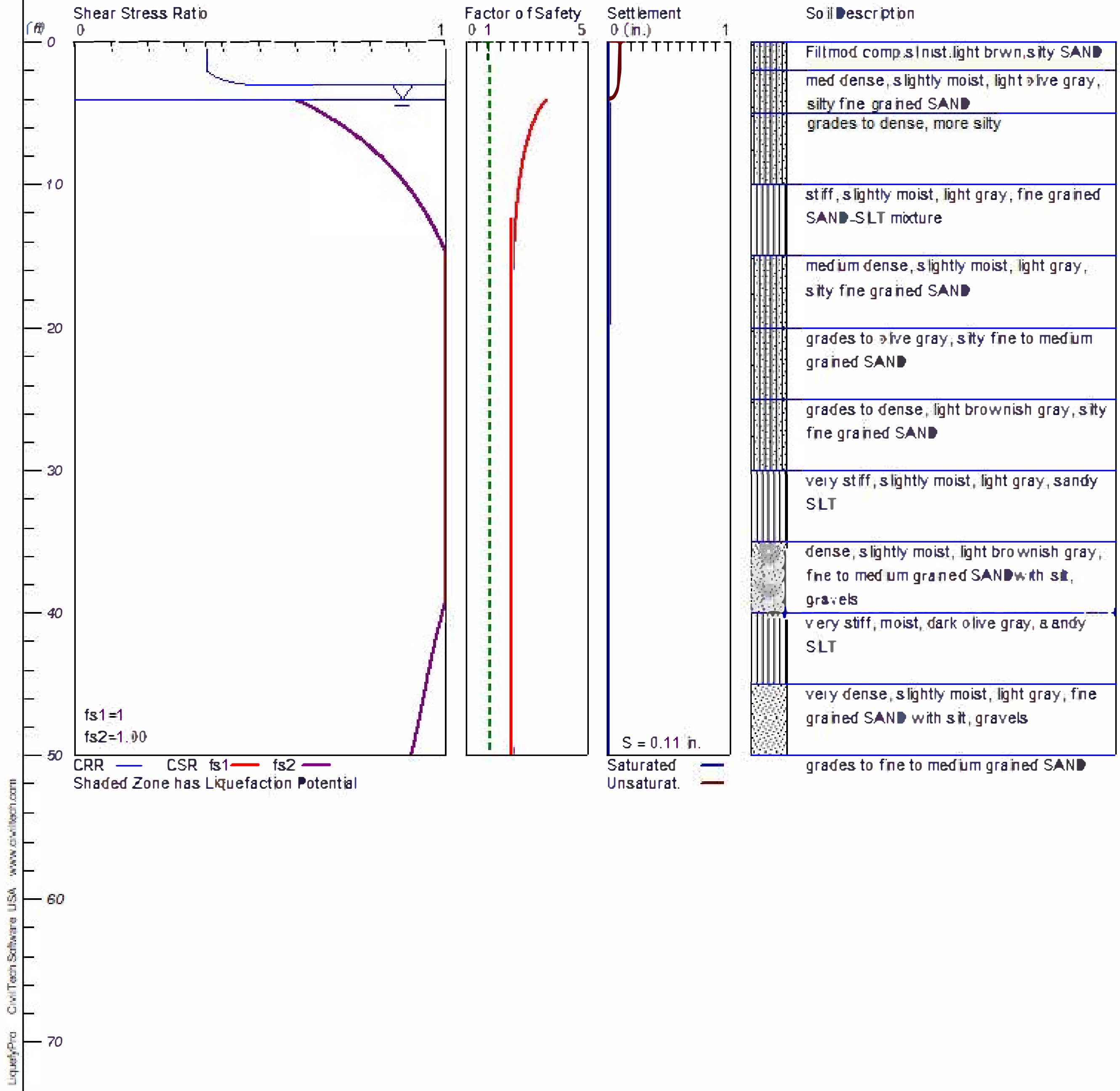


LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1   Water Depth=4 ft

Magnitude=7.55
Acceleration=0.93g



```
****************************************************************************************************
********************
                                          LIQUEFACTION ANALYSIS SUMMARY

                                         Copyright by CivilTech Software
                                               www.civiltech.com

****************************************************************************************************
********************
        Font: Courier New, Regular, Size 8 is recommended for this report.
        Licensed to ,   10/4/2023       2:36:57 PM

        Input File Name: P:\Projects-2023\23-536-02 & 24 xRef
05-333-02\Engineering-Calculation\Liquefaction\23-536-02_2%.liq
        Title:  913 California Street
        Subtitle:  23-536-02_2%

        Surface Elev.=
        Hole No.=1
        Depth of Hole= 50.00 ft
        Water Table during Earthquake= 4.00 ft
        Water Table during In-Situ Testing= 55.00 ft
        Max. Acceleration= 0.93 g
        Earthquake Magnitude= 7.55

 Input Data:
        Surface Elev.=
        Hole No.=1
        Depth of Hole=50.00 ft
        Water Table during Earthquake= 4.00 ft
        Water Table during In-Situ Testing= 55.00 ft
        Max. Acceleration=0.93 g
        Earthquake Magnitude=7.55
        No-Liquefiable Soils:   Based on Analysis

        1. SPT or BPT Calculation.
        2. Settlement Analysis Method: Ishihara / Yoshimine
        3. Fines Correction for Liquefaction: Stark/Olson et al.*
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                  Ce = 1.2
        7. Borehole Diameter,                                        Cb= 1
        8. Sampling Method,                                         Cs= 1
        9. User request factor of safety (apply to CSR) ,   User= 1
           Plot two CSR (fs1=1, fs2=User)
        10. Use Curve Smoothing: Yes*
        * Recommended Options

        In-Situ Test Data:
```

```
        Depth   SPT     gamma   Fines
        ft              pcf     %
        ____________________________________
        0.00    14.00   112.00  38.00
        2.00    14.00   112.00  38.00
        5.00    17.00   108.00  43.00
        10.00   18.00   106.00  52.00
        15.00   20.00   109.00  36.00
        20.00   21.00   123.00  40.00
        25.00   31.00   116.00  44.00
        30.00   32.00   118.00  63.00
        35.00   42.00   125.00  12.00
        40.00   40.00   132.00  62.00
        45.00   65.00   115.00  12.00
        50.00   50.00   122.00  15.00
        ____________________________________

Output Results:
        Settlement of Saturated Sands=0.02 in.
        Settlement of Unsaturated Sands=0.09 in.
        Total Settlement of Saturated and Unsaturated Sands=0.11 in.
        Differential Settlement=0.056 to 0.073 in.

        Depth   CRRm    CSRfs   F.S.    S_sat.  S_dry   S_all
        ft                              in.     in.     in.
        _______________________________________________________
        0.00    0.35    0.60    5.00    0.02    0.09    0.11
        2.00    0.35    0.60    5.00    0.02    0.09    0.10
        4.00    1.97    0.60    5.00    0.02    0.01    0.02
        6.00    1.97    0.73    2.69    0.02    0.00    0.02
        8.00    1.97    0.83    2.38    0.02    0.00    0.02
        10.00   1.97    0.90    2.19    0.02    0.00    0.02
        12.00   1.97    0.95    2.07    0.02    0.00    0.02
        14.00   1.97    0.99    1.99    0.02    0.00    0.02
        16.00   1.97    1.02    1.93    0.01    0.00    0.01
        18.00   1.97    1.04    1.89    0.01    0.00    0.01
        20.00   1.97    1.05    1.87    0.00    0.00    0.00
        22.00   1.97    1.06    1.86    0.00    0.00    0.00
        24.00   1.97    1.06    1.85    0.00    0.00    0.00
        26.00   1.97    1.07    1.84    0.00    0.00    0.00
        28.00   1.97    1.07    1.83    0.00    0.00    0.00
        30.00   1.97    1.08    1.83    0.00    0.00    0.00
        32.00   1.94    1.06    1.83    0.00    0.00    0.00
        34.00   1.92    1.05    1.83    0.00    0.00    0.00
        36.00   1.90    1.03    1.84    0.00    0.00    0.00
        38.00   1.88    1.01    1.85    0.00    0.00    0.00
        40.00   1.85    0.99    1.87    0.00    0.00    0.00
        42.00   1.83    0.97    1.88    0.00    0.00    0.00
        44.00   1.81    0.96    1.89    0.00    0.00    0.00
        46.00   1.80    0.94    1.90    0.00    0.00    0.00
```

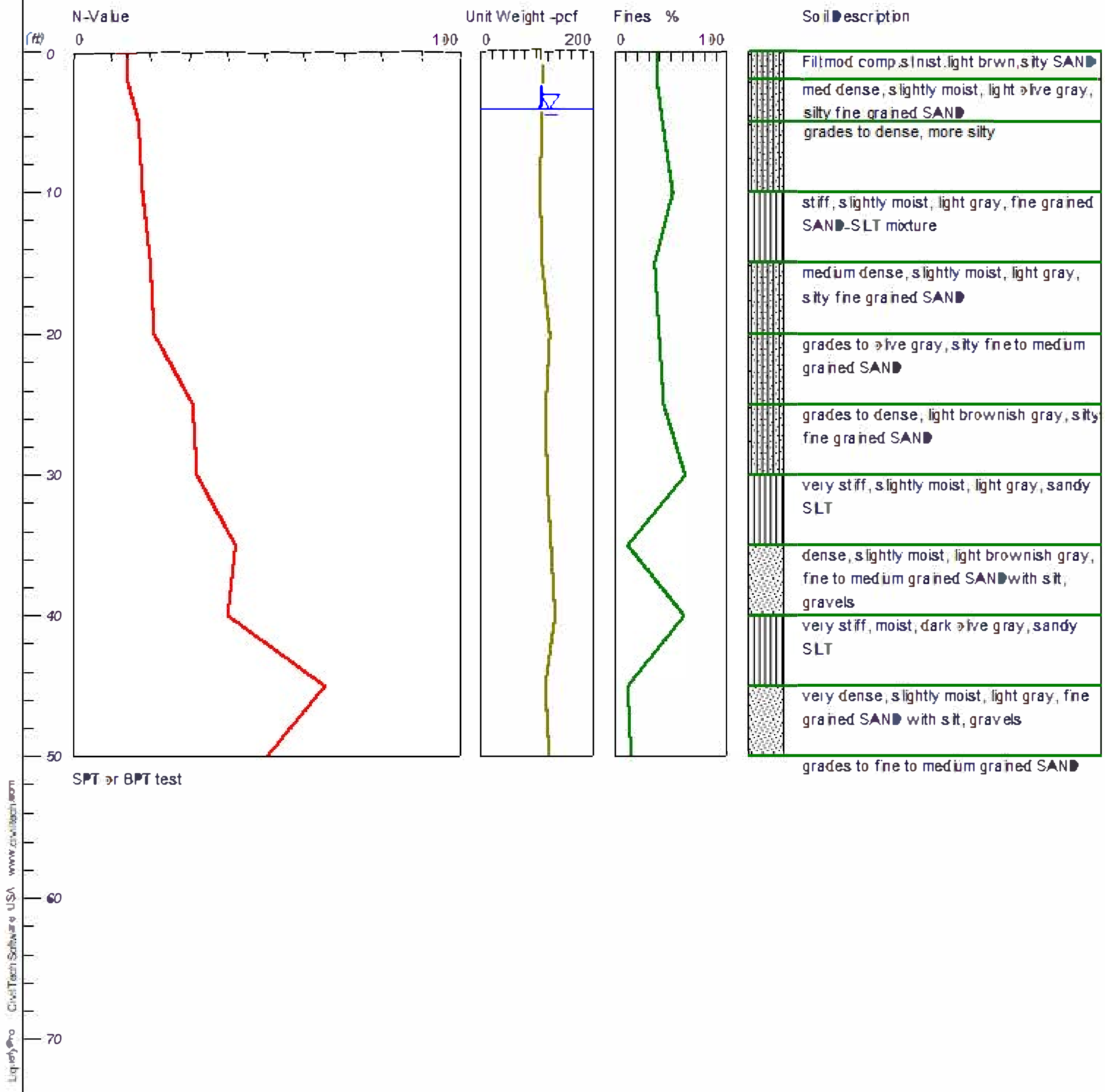
```
        48.00   1.78    0.93    1.92    0.00    0.00    0.00
        50.00   1.76    0.91    1.93    0.00    0.00    0.00
        _______________________________________________________
        * F.S.<1, Liquefaction Potential Zone
        (F.S. is limited to 5,  CRR is limited to 2,    CSR is limited to 2)

        Units:  Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight =
pcf; Depth = ft; Settlement = in.

___________________________________________________________________________________
_
        1 atm (atmosphere) = 1 tsf (ton/ft2)
        CRRm            Cyclic resistance ratio from soils
        CSRsf           Cyclic stress ratio induced by a given earthquake (with
user request factor of safety)
        F.S.            Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
        S_sat           Settlement from saturated sands
        S_dry           Settlement from Unsaturated Sands
        S_all           Total Settlement from Saturated and Unsaturated Sands
        NoLiq           No-Liquefy Soils
```

LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1   Water Depth=4 ft

Magnitude=7.22
Acceleration=0.62g

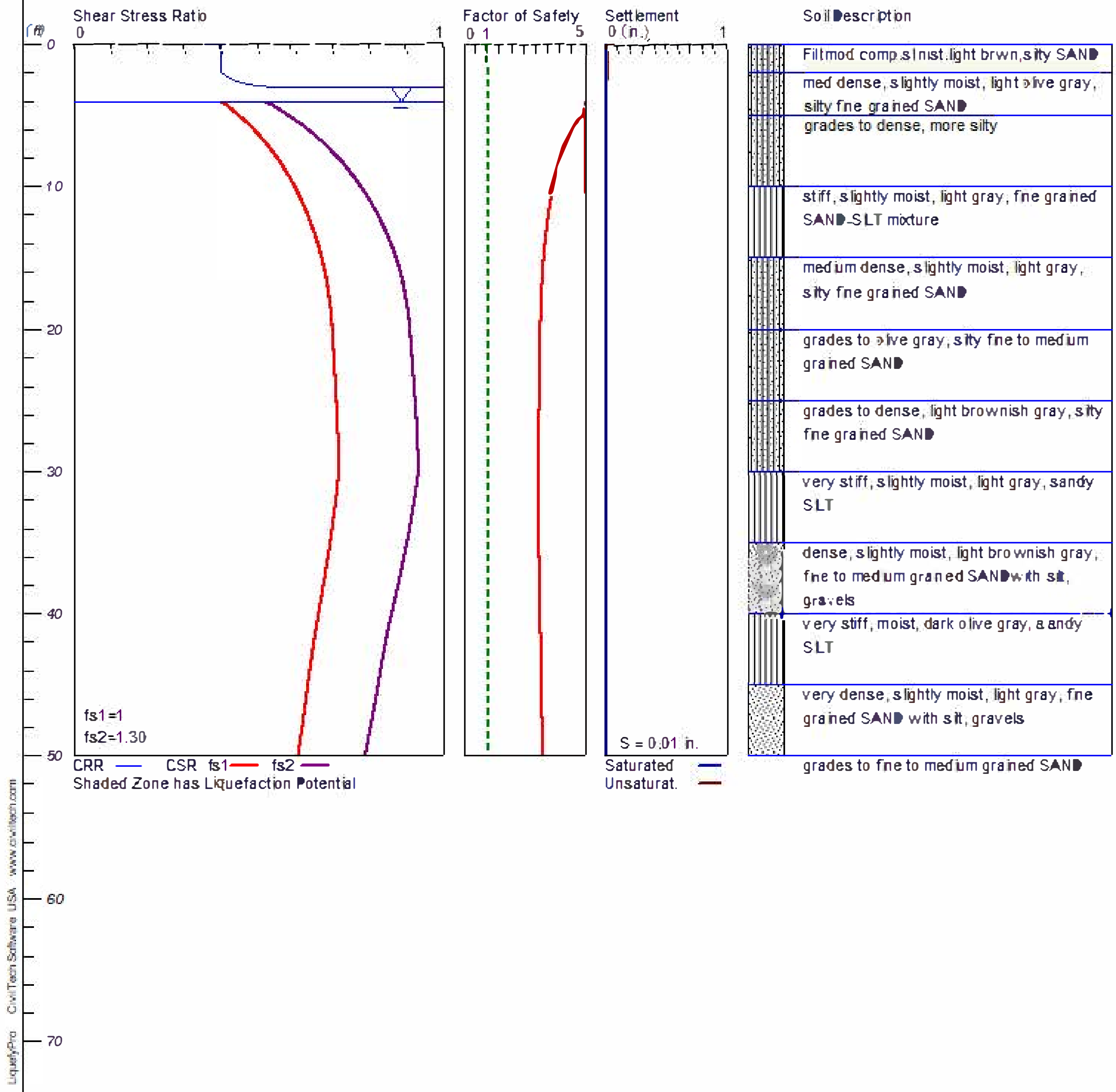


LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1   Water Depth=4 ft

Magnitude=7.22
Acceleration=0.62g



```
*************************************************************************************
********************
                                          LIQUEFACTION ANALYSIS SUMMARY

                                         Copyright by CivilTech Software
                                               www.civiltech.com

*************************************************************************************
********************
        Font: Courier New, Regular, Size 8 is recommended for this report.
        Licensed to ,   10/4/2023       2:42:32 PM

        Input File Name: P:\Projects-2023\23-536-02 & 24 xRef
05-333-02\Engineering-Calculation\Liquefaction\23-536-02_10%.liq
        Title:  913 California Street
        Subtitle:  23-536-02_10%

        Surface Elev.=
        Hole No.=1
        Depth of Hole= 50.00 ft
        Water Table during Earthquake= 4.00 ft
        Water Table during In-Situ Testing= 55.00 ft
        Max. Acceleration= 0.62 g
        Earthquake Magnitude= 7.22

 Input Data:
        Surface Elev.=
        Hole No.=1
        Depth of Hole=50.00 ft
        Water Table during Earthquake= 4.00 ft
        Water Table during In-Situ Testing= 55.00 ft
        Max. Acceleration=0.62 g
        Earthquake Magnitude=7.22
        No-Liquefiable Soils:   Based on Analysis

        1. SPT or BPT Calculation.
        2. Settlement Analysis Method: Ishihara / Yoshimine
        3. Fines Correction for Liquefaction: Stark/Olson et al.*
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                  Ce = 1.2
        7. Borehole Diameter,                                        Cb= 1
        8. Sampling Method,                                         Cs= 1
        9. User request factor of safety (apply to CSR) ,   User= 1.3
           Plot two CSR (fs1=1, fs2=User)
        10. Use Curve Smoothing: Yes*
        * Recommended Options

        In-Situ Test Data:
```

```
        Depth   SPT     gamma   Fines
        ft              pcf     %
        ____________________________________
        0.00    14.00   112.00  38.00
        2.00    14.00   112.00  38.00
        5.00    17.00   108.00  43.00
        10.00   18.00   106.00  52.00
        15.00   20.00   109.00  36.00
        20.00   21.00   123.00  40.00
        25.00   31.00   116.00  44.00
        30.00   32.00   118.00  63.00
        35.00   42.00   125.00  12.00
        40.00   40.00   132.00  62.00
        45.00   65.00   115.00  12.00
        50.00   50.00   122.00  15.00
        ____________________________________

Output Results:
        Settlement of Saturated Sands=0.00 in.
        Settlement of Unsaturated Sands=0.01 in.
        Total Settlement of Saturated and Unsaturated Sands=0.01 in.
        Differential Settlement=0.006 to 0.008 in.

        Depth   CRRm    CSRfs   F.S.    S_sat.  S_dry   S_all
        ft                              in.     in.     in.
        _______________________________________________________
        0.00    0.40    0.40    5.00    0.00    0.01    0.01
        2.00    0.40    0.40    5.00    0.00    0.01    0.01
        4.00    2.20    0.40    5.00    0.00    0.00    0.00
        6.00    2.20    0.49    4.53    0.00    0.00    0.00
        8.00    2.20    0.55    4.01    0.00    0.00    0.00
        10.00   2.20    0.60    3.69    0.00    0.00    0.00
        12.00   2.20    0.63    3.48    0.00    0.00    0.00
        14.00   2.20    0.66    3.34    0.00    0.00    0.00
        16.00   2.20    0.68    3.24    0.00    0.00    0.00
        18.00   2.20    0.69    3.18    0.00    0.00    0.00
        20.00   2.20    0.70    3.15    0.00    0.00    0.00
        22.00   2.20    0.70    3.13    0.00    0.00    0.00
        24.00   2.20    0.71    3.11    0.00    0.00    0.00
        26.00   2.20    0.71    3.09    0.00    0.00    0.00
        28.00   2.20    0.72    3.08    0.00    0.00    0.00
        30.00   2.20    0.72    3.07    0.00    0.00    0.00
        32.00   2.18    0.71    3.07    0.00    0.00    0.00
        34.00   2.15    0.70    3.08    0.00    0.00    0.00
        36.00   2.13    0.69    3.09    0.00    0.00    0.00
        38.00   2.10    0.68    3.11    0.00    0.00    0.00
        40.00   2.08    0.66    3.14    0.00    0.00    0.00
        42.00   2.05    0.65    3.16    0.00    0.00    0.00
        44.00   2.03    0.64    3.18    0.00    0.00    0.00
        46.00   2.01    0.63    3.20    0.00    0.00    0.00
```

```
        48.00   1.99    0.62    3.23    0.00    0.00    0.00
        50.00   1.97    0.61    3.25    0.00    0.00    0.00
        _______________________________________________________
        * F.S.<1, Liquefaction Potential Zone
        (F.S. is limited to 5,  CRR is limited to 2,    CSR is limited to 2)

        Units:  Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight =
pcf; Depth = ft; Settlement = in.

_____________________________________________________________________________________
_
        1 atm (atmosphere) = 1 tsf (ton/ft2)
        CRRm            Cyclic resistance ratio from soils
        CSRsf           Cyclic stress ratio induced by a given earthquake (with
user request factor of safety)
        F.S.            Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
        S_sat           Settlement from saturated sands
        S_dry           Settlement from Unsaturated Sands
        S_all           Total Settlement from Saturated and Unsaturated Sands
        NoLiq           No-Liquefy Soils
```

Assumed Granular Backfill Strength Parameters:
Saturated Unit Weight, γ = 131 pcf
Cohesion, C = 180 psf
Friction Angle, ϕ = 32 °

Height of Wall= 6 ft
Sds= 1.335
Weight of Surcharge Load on Wedge
W_q= 0.0 K

Seismic
PGA/g
Sds/2.5
0.534

					Driving Force	*Resisting Force*		*Factory of Safety*	
SECTION	**A (sf)**	**W (K)**	**L (feet)**	**α (degrees)**	**Wsinα (k)**	**Wcosαtanϕ (k)**	**CL (k)**	**∑ RF / ∑ DF**	
I	10.0	1.3	6.86	61	1.14	0.40	1.23	1.6	1.1
				∑	1.14	1.63		1.43	

TEMPORARY

FOR TEMPORARY CONDITION: FACTOR OF SAFETY = 1.25 [1.25 (DF) = (RF) + UBF]

1.25 * 1.14 = 1.63 + UBF

UBF = 1.43 - 1.63 = -0.20 k/lft.

Equivalent Fluid Density: $G_h = 2(UBF)/H^2$ G_h = -11.2 PCF

Therefore, for Cantilevered Temporary Condition, use recommended value of: 25 PCF

PERMANENT

FOR PERMANENT CONDITION: FACTOR OF SAFETY = 1.5 [1.5 (DF) = (RF) + UBF]

1.5 * 1.14 = 1.63 + UBF

UBF = 1.71 - 1.63 = 0.08 k/lft.

Equivalent Fluid Density: $G_h = 2(UBF)/H^2$ G_h = 4.7 PCF

Therefore, for Cantilevered Permanent Condition, use recommended value of: 30 PCF

AT-REST

FOR RESTRAINED CONDITION (AT-REST): Ko = 1-SIN(ϕ)

Ko = 1 - SIN 32

Ko = 1 - 0.53 = 0.47

Equivalent Fluid Density: $G_h = Ko * \gamma$ G_h = N/A PCF

Therefore, for Restrained (At-Rest) Condition, use recommended value of: N/A PCF

SEISMIC

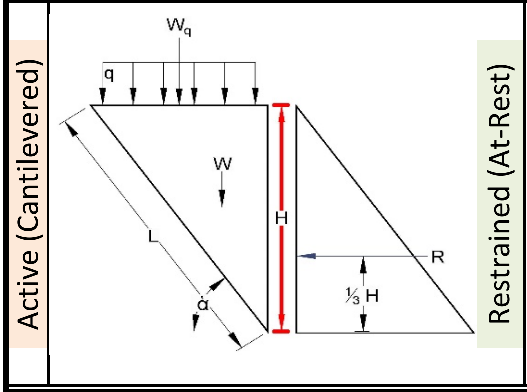
FOR SEISMIC CONDITION: $P_{AE} = {}^1/_2\,\gamma H^2 (K_h)$ $K_h = (0.68 * PGA)/g$

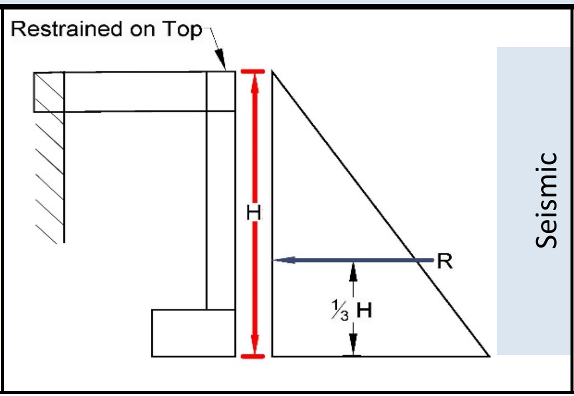
Kh= 0.68 * 0.53 = 0.36

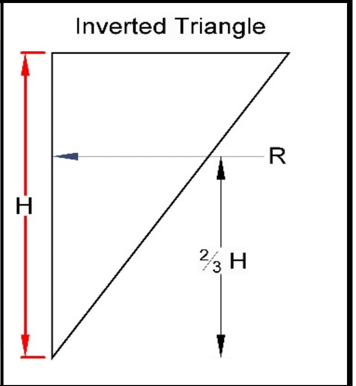
PAE = 1/2 * 131 * 36 * 0.36 = 856.2

$EFP = (\frac{2xP_{AE}}{H^2})$ 2 * 856.2 / 36 = 47.569

Therefore, for Seismic Condition, use recommended value of: 48 PCF







LATERAL EARTH PRESSURE CALCULATIONS

ACTIVE (Temporary/Permanent), & SEISMIC

Address: **913 California Street, Redlands, CA 91374**

Minor Retaining Walls

APPLIED EARTH SCIENCES
GEOTECHNICAL • GEOLOGY • ENVIRONMENTAL ENGINEERING CONSULTANTS

PROJECT #: 23-536-02
CALC SHEET No.: 1

Percolation Test Data Sheet

Project:	Comm. Develop.	Project No:	23.536-02	Date:	9/29/23
Test Hole No:	TP-2	Tested By:	Narek & Daniel		
Depth of Test Hole, D_T:	30''	USCS Soil Classification:	SM, silty fine grained SAND		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=		Sides (if rectangular)=	12"	12"	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	1:00	1:25	25	12.0	22.5	10.5	yes ✓
2	1:30	1:55	25	12.0	20	8.0	yes ✓

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

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	2:00	2:10	10	12.0	15.0"	3"	
2	2:10	2:20	10	12.0	14.5"	2.5"	
3	2:20	2:30	10	12.0	14.25"	2.25"	
4	2:30	2:40	10	12.0	14.0"	2"	
5	2:40	2:50	10	12.0	13.75"	1.75"	
6	2:50	3:00	10	12.0	13.75"	1.75"	
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS:

Table 5 – Sample Test Data Form for Percolation Test

Percolation Test Data Sheet

Project:	Comm. Deve.		Project No:	23-536-02		Date:	9/29/23
Test Hole No:		TP-1	Tested By:	Narek & Daniel			
Depth of Test Hole, D_T:		30"	USCS Soil Classification:	SM, silty fine grained SAND			
Test Hole Dimensions (inches)					Length	Width	
Diameter (if round)=			Sides (if rectangular)=		12"	12"	

Sandy Soil Criteria Test*

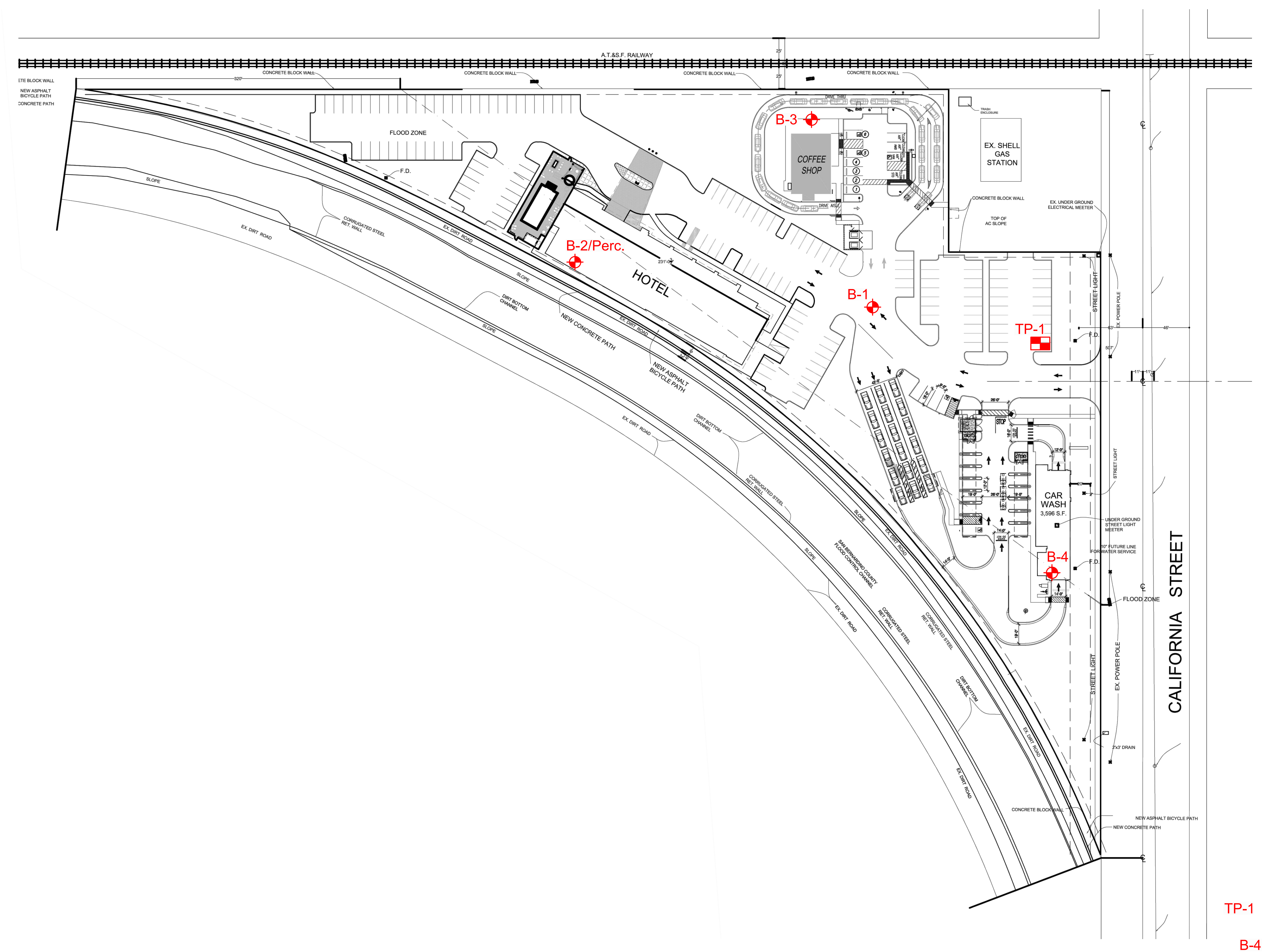
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	11:00	11:25	25	12.0	23.0	11.0	yes ✓
2	11:30	11:55	25	12.0	19.5	7.5	yes ✓

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

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	12:00	12:10	10	12.0	14.5	2.5"	
2	12:10	12:20	10	12.0	14.25	2.25"	
3	12:20	12:30	10	12.0	14.0	2"	
4	12:30	12:40	10	12.0	13.75	1.75"	
5	12:40	12:50	10	12.0	13.5	1.5"	
6	12:50	1:00	10	12.0	13.5	1.5"	
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS: Cloudy. Dry Ground, sl. soft.
First 2 measurements met sandy soils criterial.

Table 5 – Sample Test Data Form for Percolation Test



N

Scale: 1" = 100'

TP-1 🟥 = Location & Number of Test Pit

B-4 ⊕ = Location & Number of Boring

Note:

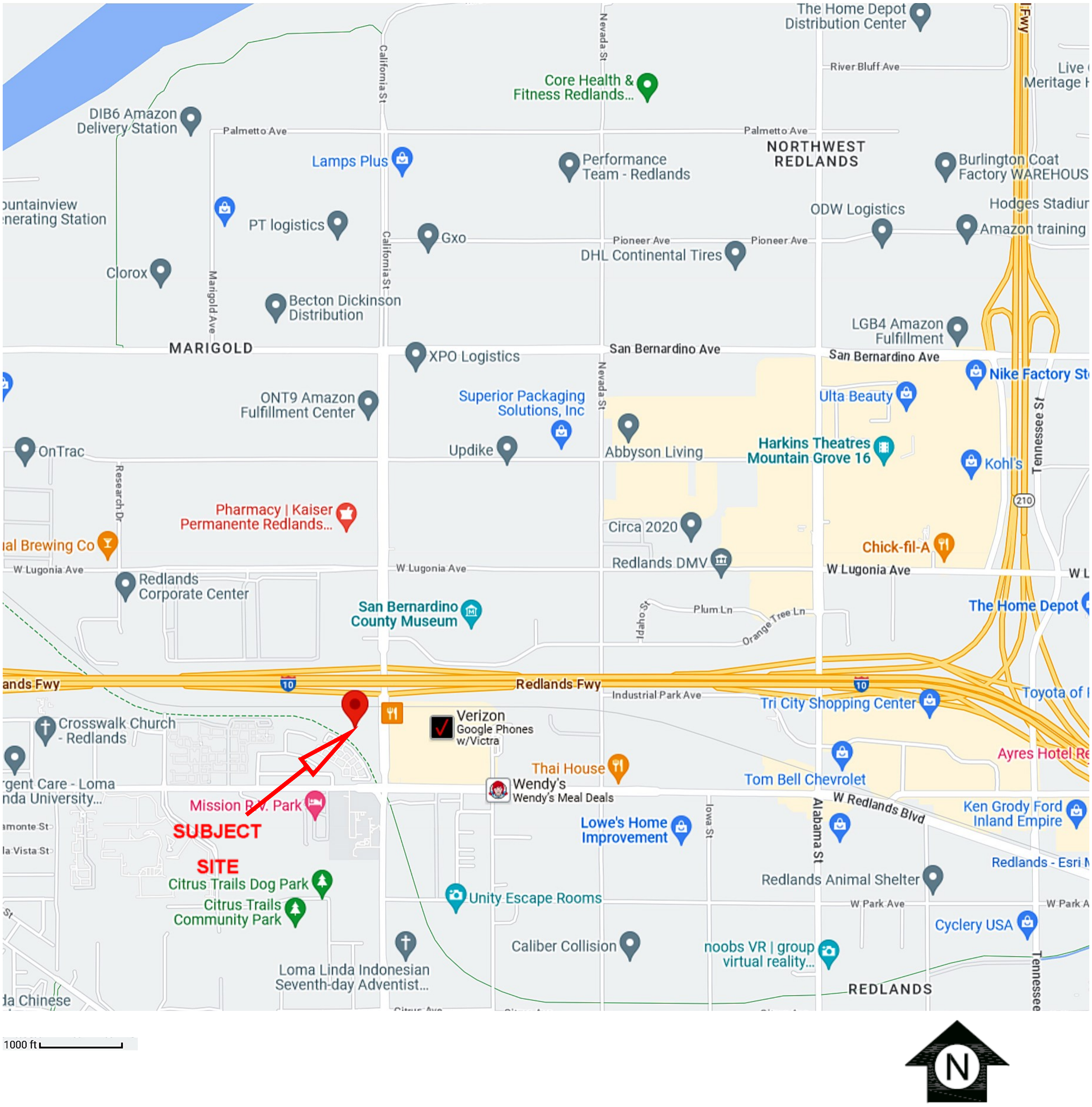
Site plan prepared by using a base plan provided by the client.

PROJECT No: 23-536-02
DATE: 11 / 30 / 2023
DRAWN BY: VM
DRAWING No: 1

SITE PLAN

Proposed Large Commercial Development
913 California Street, Redlands, CA 92374

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS
www.aessoil.com
(818) 552-6000



Reference: Portion of Google Map

SITE VICINITY MAP

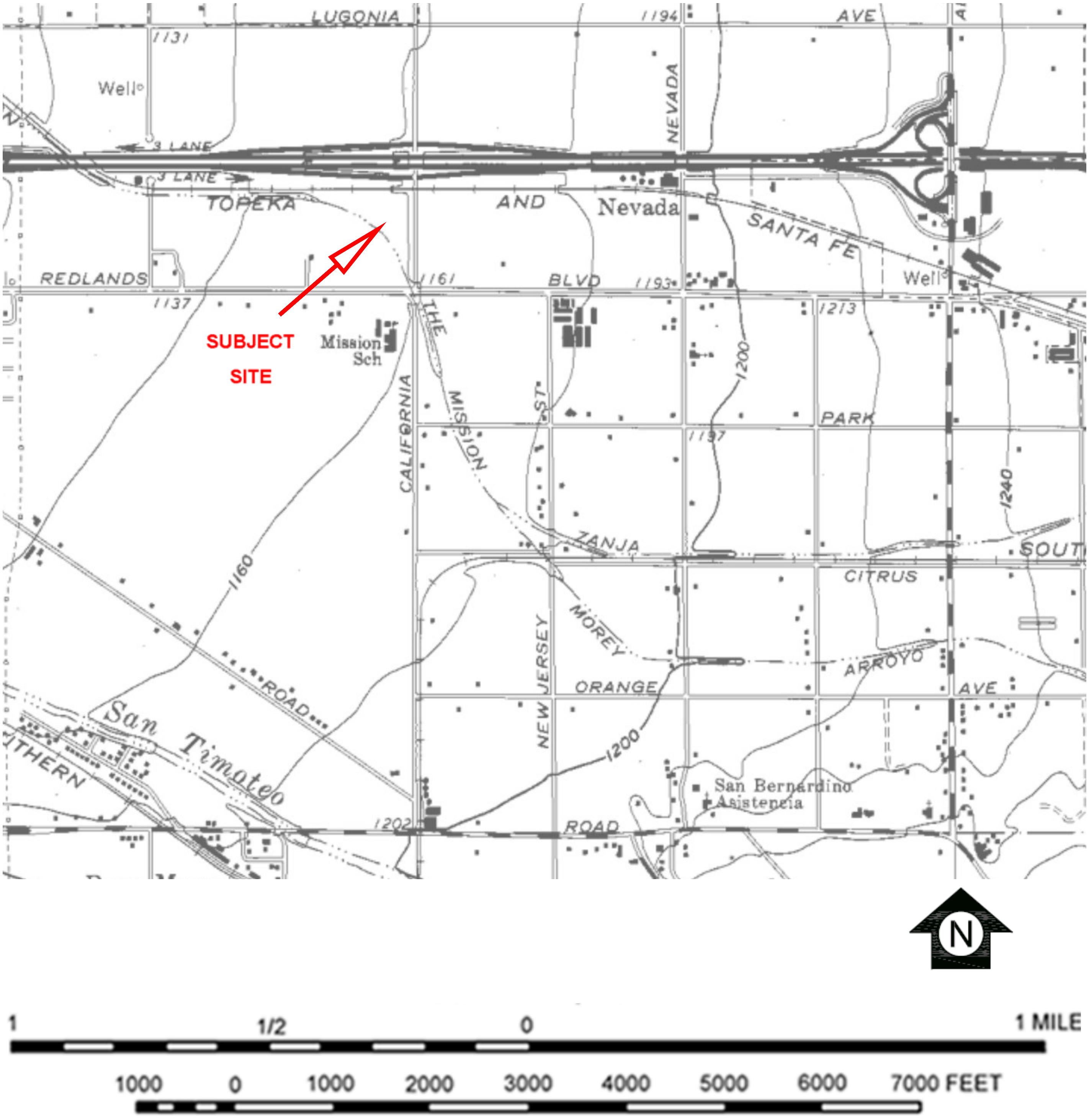
Proposed Large Commercial Development

913 California Street, Redlands, CA 92374

APPLIED EARTH SCIENCES

GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

PROJECT No.	23-536-24
FIGURE No.	1



Reference: Redlands Quadrangle 7.5 Minute Series

REGIONAL TOPOGRAPHIC MAP

Proposed Large Commercial Development

913 California Street, Redlands, CA 92374

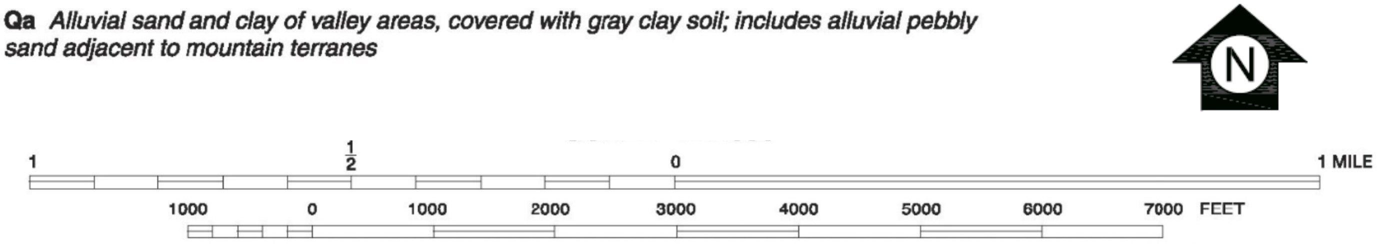
APPLIED EARTH SCIENCES

GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

PROJECT No.
23-536-24

FIGURE No.
2

Qa *Alluvial sand and clay of valley areas, covered with gray clay soil; includes alluvial pebbly sand adjacent to mountain terranes*



REGIONAL GEOLOGIC MAP

Proposed Large Commercial Development

913 California Street, Redlands, CA 92374

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

PROJECT No.
23-536-24

FIGURE No.
3

APPENDIX I

METHOD OF FIELD EXPLORATION

In order to define the subsurface conditions and for the purpose of percolation testing, two test pits and four borings were drilled at the site to a maximum depth of about 51 feet below the existing grades. Borings were drilled with a hollow stem drilling machine. The approximate locations of the drilled borings are shown on the enclosed Site Plan.

Continuous logs of the subsurface conditions, as encountered in the test borings, were recorded during the field work and are presented on Figure Nos. I-1 through I-6 within this Appendix. These figures also show the number and approximate depths of each of the recovered soil samples.

With hollow stem drilling, relatively undisturbed samples of the subsoils were obtained by driving a steel sampler with successive drops of a 140-pound standard sampling hammer free-falling a vertical distance of about 30 inches. The number of blows required for one foot of sampler penetration was recorded at the time of drilling and are shown on the log of exploratory borings. The relatively undisturbed soil samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

One boring (B-1) was drilled to a depth of 51 feet for liquefaction studies. The California Modified method samples are normally used for determination of strength and compression characteristics. In our Boring No. 1, California Modified method samples were obtained from depths of 2 to 15 feet. All samples from Boring No. 2 were taken using California Modified method. The remaining samples in Boring No. 1 below 15 feet were SPT samples taken in 1.5-inch diameter cylinders. Such samples are normally used for density, moisture content, and soil classification. See our liquefaction analysis write-up for correction factor of Cs=1 used when cylinders are used in SPT barrels.

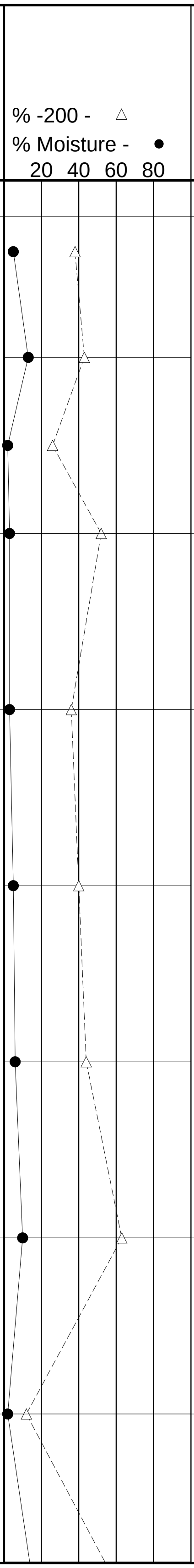
Field investigation for this project and prior work were performed on February 26, 2005, April 27, 2007, and September 29, 2023. The materials excavated from the test borings were placed back and compacted upon completion of the field work. Such materials may settle. The owner should periodically inspect these areas and notify this office if the settlements create a hazard to person or property in order to define subsurface conditions two borings were made at the site.

LOG OF BORING NO.1

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200
0	(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty sand.					
	(SM) SAND: Medium dense, slightly moist, light olive gray, silty fine grained sand.		19	5	107	38
5	(SM) Grades to dense, more silty.		23	13	95	43
	(SM) Grades to light gray, less silty.		22	2	107	26
10	(ML-SM) SILT: Stiff, slightly moist, light gray, fine grained sand-silt mixture.		24	3	103	52
15	(SM) SAND: Medium dense, slightly moist, light gray, silty fine grained sand.	20		3	106	36
20	(SM) Grades to olive gray, silty fine to medium grained sand.	21		5	117	40
25	(SM) Grades to dense, light brownish gray, silty fine grained sand.	31		6	109	44
30	(ML) SILT: Very stiff, slightly moist, light gray, sandy silt.	32		10	107	63
35	(SP) SAND: Dense, slightly moist, light brownish gray, fine to medium grained sand with silt, gravels.	42		2	122	12



COMPLETION DEPTH: 51
DATE: Septmeber 29, 2023

DEPTH TO WATER> INITIAL:
FINAL:

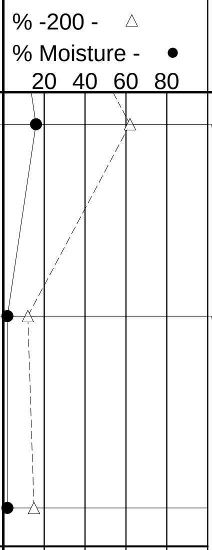
LOG OF BORING NO.1

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200
40		◤	(ML) SILT: Very stiff, moist, dark olive gray, sandy silt.	40		16	113	62
45		◤	(SP) SAND: Very dense, slightly moist, light gray, fine to medium grained sand with silt, gravels.	65		2	113	12
50		◤	(SP) Grades to fine to medium grained sand.	50/6"		2	119	15
55								
60								
65								
70								
75								

End of Boring @ 51'
No Groundwater Encountered
Hole Backfilled.



COMPLETION DEPTH: 51 DEPTH TO WATER> INITIAL:
DATE: Septmeber 29, 2023 FINAL:

LOG OF BORING NO.2

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0			(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty fine grained sand.						
		■			6	4	105	●	
			(SM) SAND: Medium dense, slightly moist, yellowish brown, silty fine grained sand.						
5		■	(SM) Grades to grayish brown, slightly more silty.		10	7	108	●	
		■	(SM) Grades to light gray, less silty.		15	2	112	●	
10		■	(ML-SM) SILT: Firm, slightly moist, light brownish gray, fine grained sand-silt mixture.		11	11	96	●	
		■	(ML) Grades to light gray to olive gray, sandy silt.		17	21	92	●	
15		■	(ML) Grades to grayish brown, slightly more sandy.		13	18	98	●	
20		■	(SM) SAND: Medium dense to dense, slightly moist, light gray, slightly silty, fine grained sand.		20	3	107	●	
25			End of Boring @ 21' No Groundwater Encountered Percolation Installed @ 10'-20'.						
30									
35									

COMPLETION DEPTH: 21 DEPTH TO WATER> INITIAL:
DATE: September 29, 2023 FINAL:

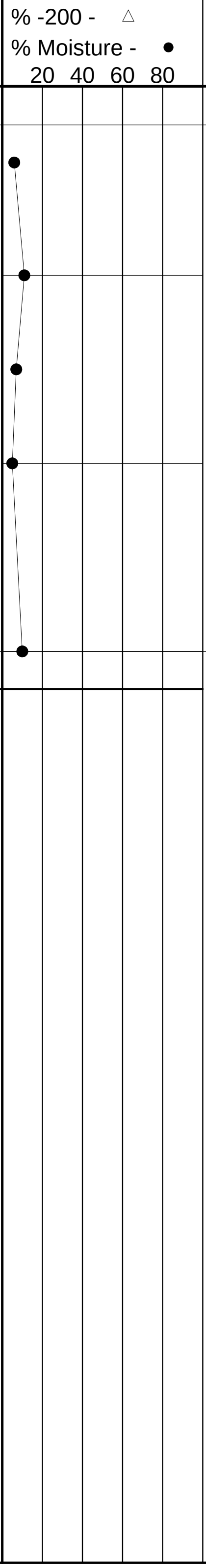
LOG OF BORING NO.3

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200
0		(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty fine grained sand.					
	■			6	6	107	
		(SM) SAND: Medium dense, slightly moist, yellowish brown, silty fine grained sand.					
5	■	(SM) Grades to grayish brown, more silty.		9	11	107	
	■	(SM) Grades to light brownish gray, less silty.		13	7	101	
10	■	(SM) Grades to light gray, more silty.		14	5	108	
15	■	(ML) SILT: Firm to stiff, slightly moist, gray, sandy silt.		20	10	99	
20							
25							
30							
35							

End of Boring @ 16'
No Groundwater Encountered
Hole Backfilled.



COMPLETION DEPTH: 16
DATE: September 29, 2023

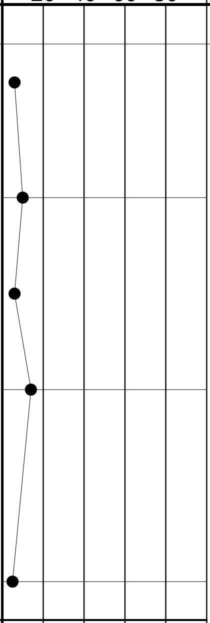
DEPTH TO WATER> INITIAL:
FINAL:

LOG OF BORING NO.4

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stew Auger, With 140 Lb Hammer   Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0		■	(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty fine grained sand, cobble trace (4" in size, sub-angular).		10	6	113		
5		■	(SM) SAND: Medium dense, slightly moist, yellowish brown, silty fine grained sand. (SM) Grades to grayish brown, more silty.		15	10	105		
		■	(SM) Grades to light gray, less silty.		16	6	102		
10		■	(SM) Grades to light olive gray, more silty.		12	14	104		
15		■	(SM) Grades to light brownish gray, less silty.		16	5	109		
20			End of Boring @ 16' No Groundwater Encountered Hole Backfilled.						
25									
30									
35									



COMPLETION DEPTH: 16   DEPTH TO WATER> INITIAL:
DATE: September 29, 2023   FINAL:

Date: October 3, 2023
Project No: 23-536-02

Figure No. I-5

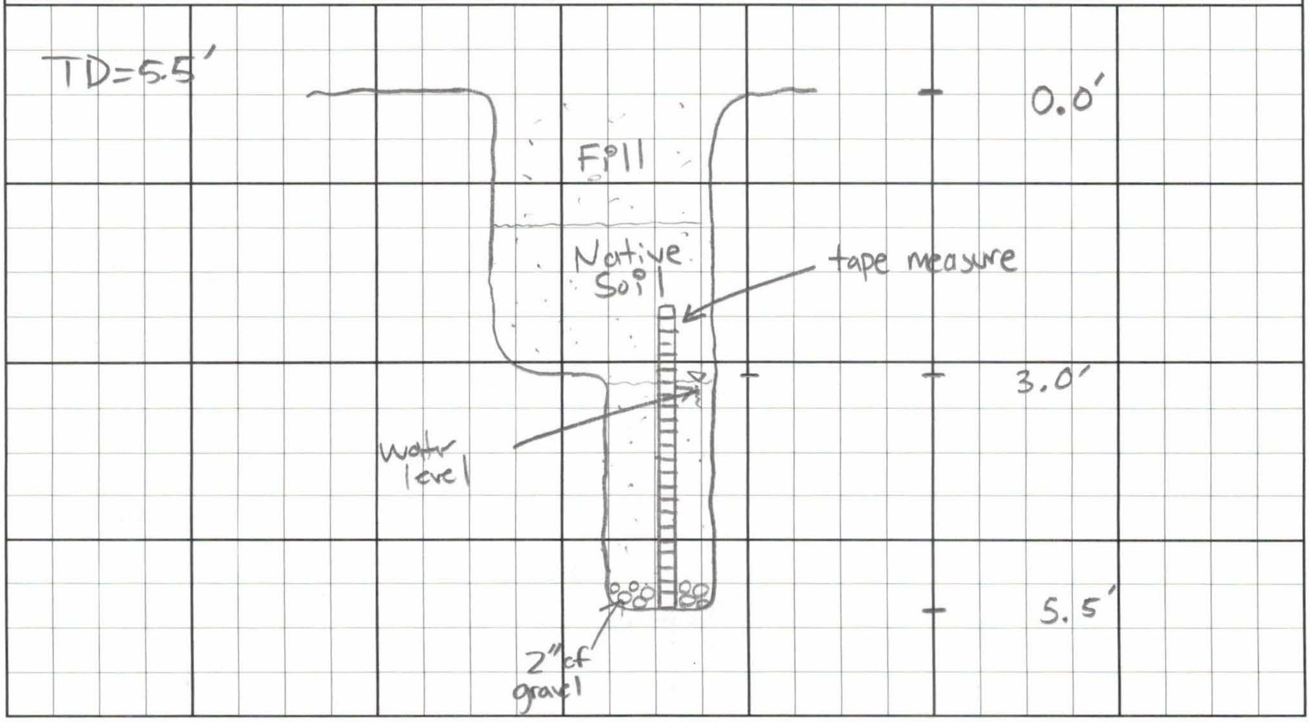
EXPLORATORY TEST PIT NO.1

PROJECT LOCATION: 913 California St., Redlands, CA
DATE LOGGED: September 29, 2023

PROJECT TYPE: Large Commercial Devel.
LOGGED BY: Daniel

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
				Artificial Fill (Af)	0' - 1.5': Fill: moderately compact, light brown, silty SAND (SM), gravel trace (0.5" in size), rootlets, slightly moist
				Native Soil (Qa)	1.5' - 5.5': Native Soil: medium dense, light brown to light olive gray, silty fine grained SAND (SM), slightly moist
					End of Test Pit at 5.5'. No groundwater encountered, no caving. Test Pit nominally backfilled with excavated materials to surface elevation.

Scale 1"=2'

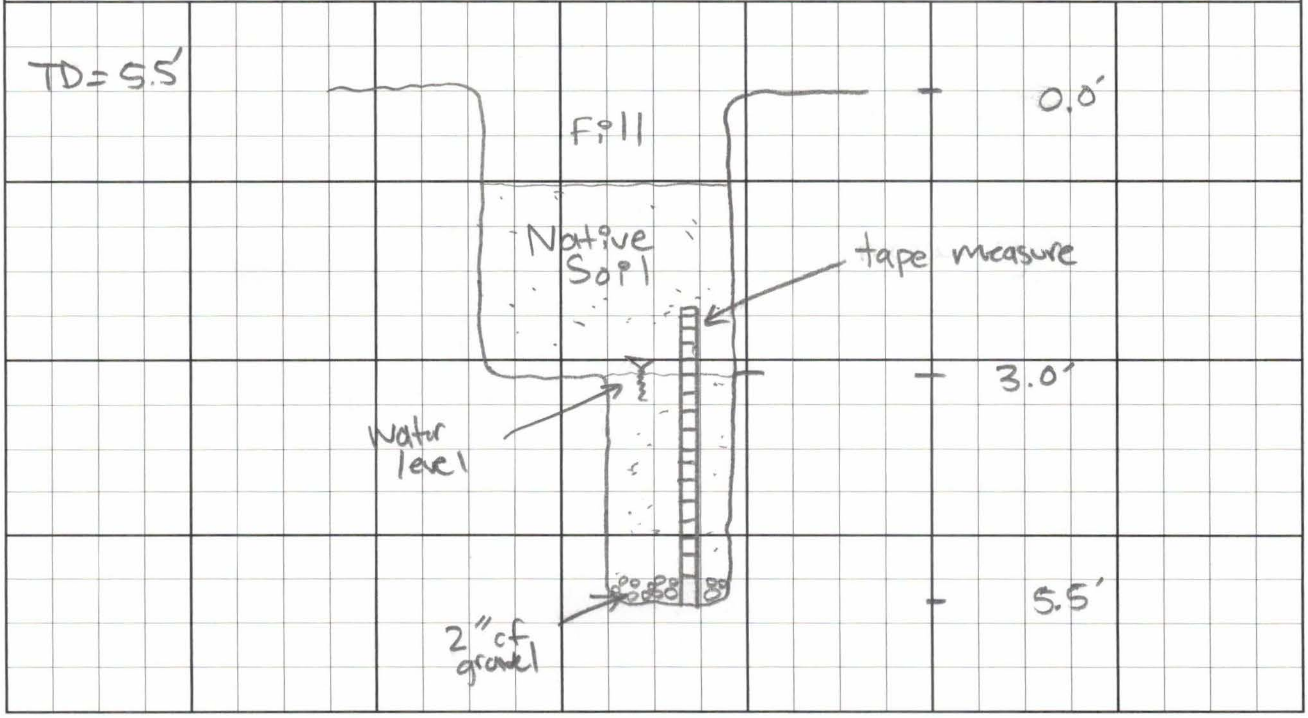


EXPLORATORY TEST PIT NO.2

PROJECT LOCATION: 913 California St., Redlands, CA
DATE LOGGED: September 29, 2023
PROJECT TYPE: Large Commercial Devel.
LOGGED BY: Daniel

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
				Artificial Fill (Af)	0' - 1.0': Fill: moderately compact, light brown, silty SAND (SM), gravel trace, rootlets, slightly moist
				Native Soil (Qa)	1.0' - 5.5': Native Soil: medium dense, light brown to light olive gray, silty fine grained SAND (SM), slightly moist
					End of Test Pit at 5.5'. No groundwater encountered, no caving. Test Pit nominally backfilled with excavated materials to surface elevation.

Scale 1"=2'



MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Organic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Organic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 ¾ in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

PROJECT ADDRESS : 913 California Street, CA 92374

JOB No. 23-536-02

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

www.aessoil.com
(818) 552-6000

FIGURE No. I-7

APPENDIX II

LABORATORY TESTING PROCEDURES

Moisture Density

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The tests were performed using ASTM D 2216 Laboratory Determination of water content Test Method. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on log of exploratory borings.

Shear Tests

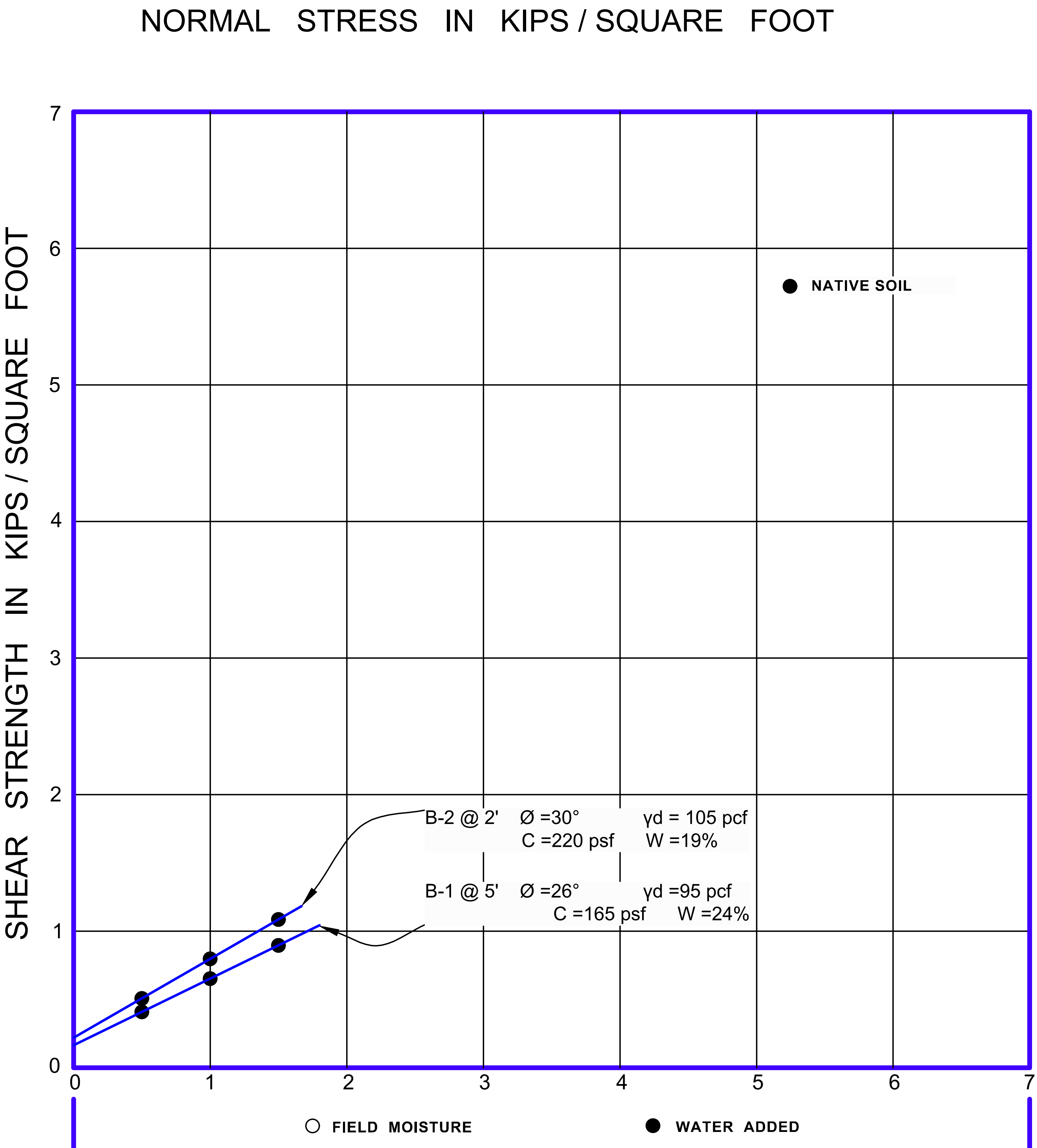
Shear tests were made with a direct shear machine at a constant rate of strain. The machine is designed to test the materials without completely removing the samples from the brass rings. The rate of shear was determined through determination of the rate of consolidation of the foundation bearing materials. Considering that such soils are essentially granular in nature with a t90 value of less than 10 seconds, the rate of shearing was selected as 0.01 inches per minute.

A range of normal stresses was applied vertically, and the shear strength was progressively determined at each load in order to determine the internal angle of friction and the cohesion. The tests were performed using ASTM D 3080 Laboratory Direct Shear Test Method. The Ultimate shear strength results of direct shear tests are presented on Figure No. II-1 within this Appendix.

Consolidation

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water. ASTM D 2435 Laboratory Consolidation Test Method.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.



B-2 @ 2' Ø =30° γd = 105 pcf
C =220 psf W =19%

B-1 @ 5' Ø =26° γd =95 pcf
C =165 psf W =24%

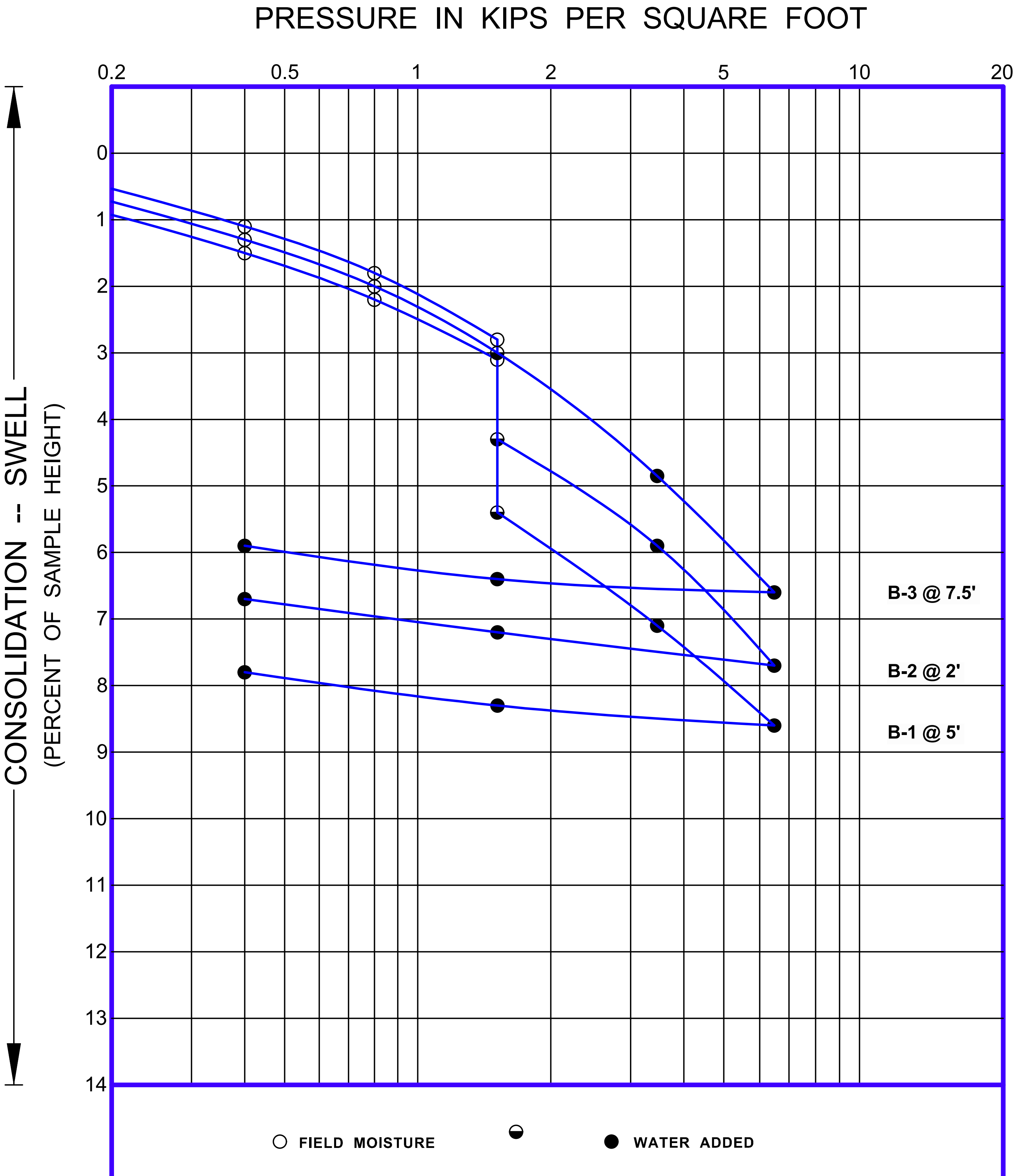
DIRECT SHEAR TESTS

PROJECT ADDRESS : 913 California Street, Redlands, CA 92374

JOB No. 23-536-02

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS
www.aessoil.com
(818) 552-6000

FIGURE No. II - 1



SWELL - CONSOLIDATION TESTS

PROJECT ADDRESS : 913 California Street, Redlands, CA 92374

JOB No. 23-536-02

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

www.aessoil.com
(818) 552-6000

FIGURE No. II - 2

Appendix III

Soft Copy of AES Soil Report dated April 15, 2005 (PDF Only)

Applied Earth Sciences
a division of Applied Soil Technology, Inc.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

March 26, 2008

05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Supplement No. 1
Geotechnical Investigation
Proposed Shopping Center
931 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

We are pleased to submit this Supplement No. 1 report presenting additional geotechnical engineering recommendations for the subject project. The original report of geotechnical investigation for the subject was issued by this office on December 8, 2005.

PROJECT CONSIDERATIONS

Since the issuance of our original report, some changes have been made to the proposed project. Initially, the proposed buildings were planned to be one story and partially two stories high. The current project calls for all buildings to be two stories in height. The shapes of the proposed buildings also have been changed. Our previous Site Plan; Drawing No. 1, has been modified to show the locations of the proposed buildings. The revised plan is enclosed with this Supplement No. 1.

It is further our understanding that, in order to protect the proposed building against channel erosion and possible undermining, it is required that the foundations of the proposed building closest to the channel, be in a form of solid wall extended some 2 feet below the base of the channel. See the sections presented on the enclosed Drawing No. 1.

In our original report, because of the assumption that the proposed buildings will be constructed near grade, recommendations for temporary excavation were not included. Based on the revised project, it is now believed that, in order to extend the footings of the proposed buildings (on the channel side) some 2 feet below the bottom of the channel, some 10 to 15 feet of excavation will be required. The planned line of excavation will be extended to close proximity of the south property line beyond which a road exits. On this basis, during the course of grading and construction of the subject project, temporary excavation will be made.

Where adequate horizontal spacing beyond the planned line of excavation is available, unsupported/open excavation slopes (with inclinations as recommended in this Supplement No. 1) can be used. Where adequate space is not available, temporary shoring should be used. The temporary shoring should be in a form of cantilevered soldier piles. The temporary shoring can then be incorporated into the subsurface walls and be part of the permanent structure. The portion of the piles below the base of the excavation can then provide vertical support for the subsurface wall through skin friction, therefore, eliminating the need to use a relatively large "L" footing. Proper structural connections should be made between the shoring piles and the subsurface walls.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived during our original investigation, it is believed that the proposed construction (with the current changes) may be made as planned. Except for the changes presented in this Supplement No. 1, all previous recommendations for foundations, grading, slabs, etc., will remain valid.

The following sections present our specific recommendations for temporary excavation, pile foundations, subsurface walls and observation during construction.

TEMPORARY EXCAVATION

Unshored Excavations: Where space limitations permit, unshored temporary excavation slopes could be used. Based upon the engineering characteristics of the site upper soils, it is our opinion that temporary excavation slopes in accordance with the following table should be used:

Maximum Depth of Cut (Ft)	Maximum Slope Ratio (Horizontal:Vertical)
0-5	Vertical
>5	3/4:1

Water should not be allowed to flow over the top of the excavation in an uncontrolled manner. No surcharge should be allowed within a 45-degree line drawn from the bottom of the excavation. Excavation surfaces should be kept moist but not saturated to retard raveling and sloughing during construction.

It would be advantageous, particularly during wet season construction, to place polyethylene plastic sheeting over the slopes. This will reduce the chances of moisture changes within the soil banks and material wash into the excavation.

Cantilevered Soldier Piles: Cantilevered soldier piles should be as a means of temporary shoring where adequate horizontal distance is not available to make unsupported, open excavation slopes. Soldier piles consist of structural steel beams encased in concrete below the excavation bottom and slurry mix above. The lateral resistance for cantilevered soldier piles may be assumed to be offered by available passive pressure below the base of the excavation. An allowable passive pressure of 500 pounds per square foot per foot of depth may be used below the basement level for soldier piles having center-to-center spacing of at least 2-1/2 times the pile diameter. Maximum allowable passive pressure should be limited to 4,000 pounds per square foot. The maximum center-to-center spacing of the vertical shafts should be maintained no greater than 10 feet.

For design of temporary support, active pressure on piles may be computed using an equivalent fluid density of 30 pounds per cubic foot. Uniform surcharge may be computed using an active pressure coefficient of 0.30 times the uniform load.

When using cantilevered soldier piles for temporary shoring, the point of fixity (for the purpose of moment calculations), may be assumed to occur at some 2 feet below the base of the excavation. In order to limit local sloughing, it is recommended that lagging be used between the soldier piles. All wood members left in ground should be pressure treated.

It should be noted that the recommendations presented in this section of the report are for use in design and for cost estimating purposes prior to construction. The contractor is solely responsible for safety during construction.

FRICTION PILES

Friction piles should be used for support of the deep wall footing of the proposed buildings closer to the channel. Piles should be spaced no greater than 12 feet (center-to-center) and have a minimum length of 15 feet below the base of the subsurface wall. For the purpose of estimating vertical capacity of the individual piles, an allowable maximum skin friction value of 550 pounds per square foot may be used for the top 10 feet of the native soils. The allowable maximum skin friction value can be increased to 750 pounds per square foot for the portion of piles extended deeper than 10 feet into native soils. Uplift capacity may be assumed one half of the downward capacity.

The above given allowable maximum bearing and skin friction values are for the total of dead, plus frequently applied live loads. For short duration transient loading; wind or seismic forces, the given value may be increased by one third.

For design, the weight of the shafts can be assumed to be taken by end-bearing, therefore, need not be added to the structural loads. All piles should be concreted as soon as they are excavated and, for safety, should not be left open overnight .

During the course of our field investigation, no caving was experienced in the test holes. On this basis, caving is expected not to occur within the drilled holes.

Total and differential settlements of the proposed buildings and the associated subsurface walls are expected to be within tolerable limits; less than 3/8 and 1/4 of one inch, respectively. The major portion of the settlements are expected to occur during construction.

SUBSURFACE WALLS

The subsurface wall should be designed assuming that the soil on the channel side will be totally erode. Therefore, a "restrained against rotation" assumption should be made.

Static design of the subsurface walls (being restrained against rotation) could be based on an equivalent fluid pressure of 48 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the retaining walls. This will require that proper subdrain be installed behind the subsurface walls on the building side. Subdrain normally consists of 4-inch diameter perforated pipes encased in free-draining gravel (at least one cubic foot per lineal foot of the pipes). In order to reduce the chances of siltation and drain clogging, the free-draining gravel should be wrapped in filter fabric proper for the site soils.

In addition to the lateral earth pressure, the basement garage walls should also be designed for any applicable uniform surcharge loads imposed by the proposed building. Uniform surcharge effects may be computed using a coefficient of 0.30 times the assumed uniform loads.

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all shoring piles and foundation excavations (spread footings and piles) will be observed by a representative of this office before reinforcing is placed. It is essential to assure that all excavations are made at proper dimensions, are established in the recommended bearing material and are free of loose and disturbed soils.

-oOo-

Thank you for the opportunity to be of continued service on this project. Should you have any questions regarding this Supplement No. 1, or wish to discuss the project further, please do not hesitate to call us.

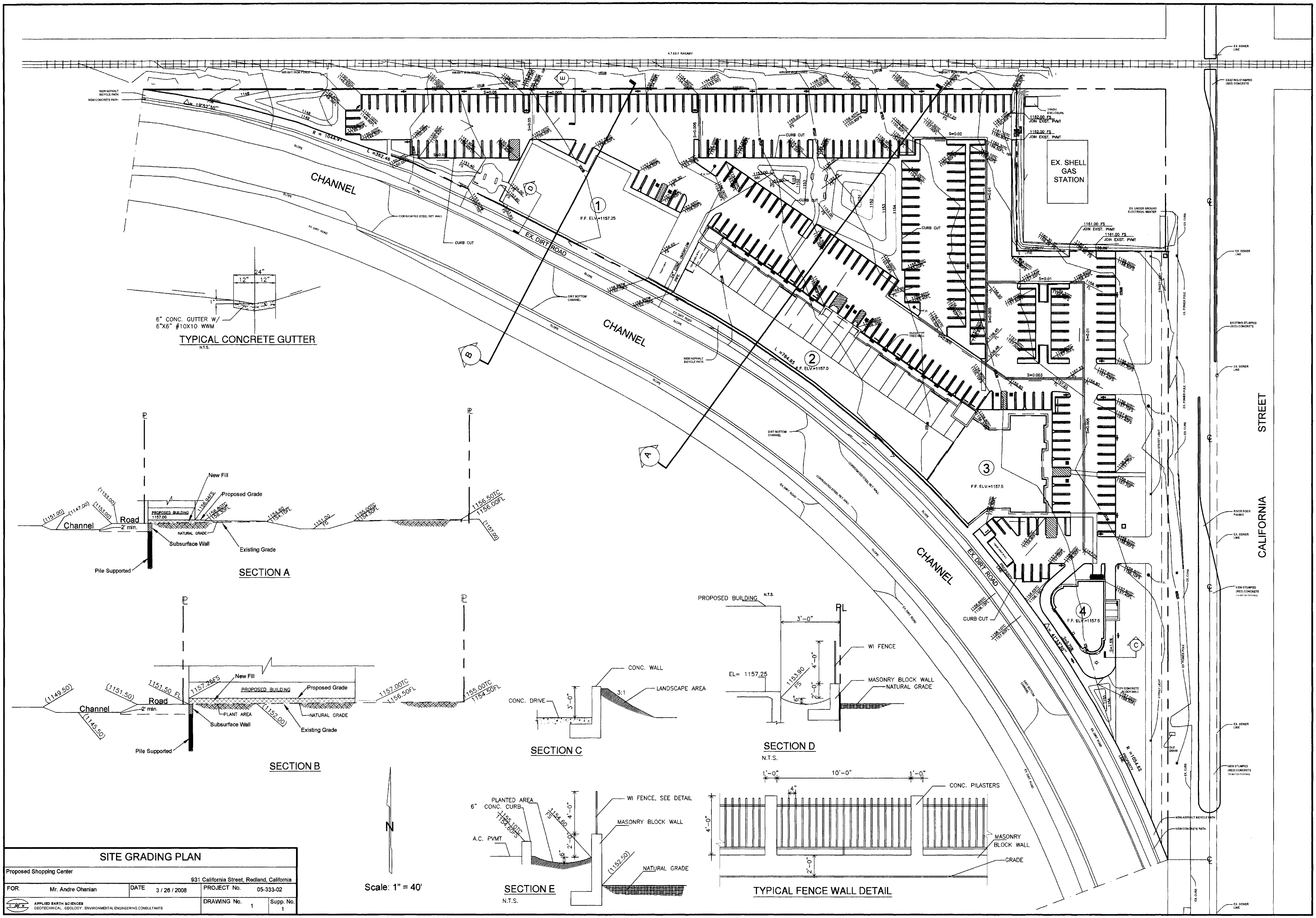
Respectfully Submitted,
APPLIED EARTH SCIENCES

Caro J. Minas, President,
Geotechnical Engineer
GE 601

CJM/ra

Enclosure: Site Plan - Drawing No. 1

Distribution: (4)



SITE GRADING PLAN

Proposed Shopping Center

931 California Street, Redland, California

FOR. Mr. Andre Ohanian	DATE 3 / 26 / 2008	PROJECT No. 05-333-02	
APPLIED EARTH SCIENCES GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS		DRAWING No. 1	Supp. No. 1

SOILS SOUTHWEST, INC.

SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

May 2, 2007

Project No. 07045BSN.

Mr. Andre Ohanian
1042 E. Orange Grove Avenue
Burbank, California 91501

Subject:
Soil Percolation Rate for
BMP Detention/Filtration Basin Design
Proposed Shopping Center
910 California Street
Redlands, California

Dear Mr. Ohanian:

For BMP design, six (6) soil percolation testing is performed by using 8-inch diameter test explorations excavated by using a Hollow-Stem Auger (HSA) drillrig advanced to maximum 25 feet below grade. The selected test locations are as suggested by the project civil engineer. Following logging and pre-soaking, field percolation testing is performed in general conformance to the California Stromwater BMP design guidelines and as per the published booklet "Detention Basin Design Criteria for San Bernardino County".

Based on the testing completed for the locations as described, the following information is provided for your use. Approximate test locations and test boring logs are attached.

Test Location	Test Depth (ft)	Soil Type	Percolation Rate (min/inch)
P-1	20	SP-SM/SP	1.75
p-2	25	SP/SP-SM	2.35
P-3	15	SP/SP-SM	2.25
P-4	20	SP/SP-SM	1.95
P-5	20	SP/SP-SM	2.47
P-6	20	SP/SP-SM	2.50

Conclusion:

1. Based on the current explorations and the excavations completed for the site in the past, it is our opinion that the soils existing within the planned disposal areas primarily consist of silty fine sand and fine sand. No shallow depth bedrock or strata considered impermeable to water is encountered. Accordingly, it is our opinion that, in general, the subgrade soils existing as described should be considered homogeneous and fairly uniform.

2. Based on percolation testing completed at this time, it is our opinion that for BMP design, a soil percolation rate of 1.75"/minute may be considered.

3. The BMP detention/infiltration basin installation should conform to the requirements of WQMP and the County Detention Basin Design Criteria.

Should you have any questions regarding the above, please call the undersigned at your convenience.

Respectfully submitted,
Soils Southwest, Inc.

Moloy Gupta, RCE 31708

REGISTERED PROFESSIONAL ENGINEER
MOLOY K. GUPTA
No. 31708
EXP. 12-31-08
STATE OF CALIFORNIA

attached: Test location, Plate
Test Boring Logs

dist/ 5-addressee (by 1 by Fax: 8[illegible])

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 1

Project: Soil Percolation Testing for BMP Design **Job No.:** 07045BSN.
Logged By: J. Flippin **Boring Diam.:** 8" HSA **Date:** 4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP-SM			Minor weed & grass
								Sand-lt. brn., silty, fine, loose, dry
							4	
								-dry to damp
							8	
					SP			-color change to lt. grayish brn., fine, dry to damp
							12	
					SP-SM			-silty, fine
							16	
							20	
								End of test boring @ 20' No bedrock No groundwater Installed perc. pipe
							24	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: N/A
Elevation: N/A

Site Location
NWC California St. & Flood Control Channel
Redlands., California

Plate #
P-1

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 2

Project: Soil Percolation Testing for BMP Design **Job No.:** 07045BSN.
Logged By: J. Flippin **Boring Diam.:** 8" HSA **Date:** 4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass Sand-lt. brn., fine, loose, dry
							4	
					SP-SM			-color change to lt. gray, silty, fine, dry
					SP			-scattered rocks to 1", dry to damp
							8	
								-color change to grayish brn, dry to damp
							12	
							16	
					SP-SM			-silty, fine
							20	
							24	
								End of test boring @ 25' No bedrock No groundwater Installed per. pipe

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: N/A
Elevation: N/A

Site Location
NWC California St. & Flood Control Channel
Redlands., California

Plate #
P-2

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 3

Project: Soil Percolation Testing for BMP Design		**Job No.:**	07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:**	4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass Sand-grayish brn., fine, dry
							4	
					SP-SM			-silty, fine, dry to damp
							8	
							12	
							16	End of test boring @ 15' No bedrock No groundwater Installed perc. pipe
							20	
							24	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: N/A
Elevation: N/A

Site Location
NWC California St. & Flood Control Channel
Redlands., California

Plate #
P-3

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 4

Project: Soil Percolation Testing for BMP Design **Job No.:** 07045BSN.
Logged By: J. Flippin **Boring Diam.:** 8" HSA **Date:** 4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass
								Sand-lt. brn., fine, dry, w/rootlets
							4	
					SP-SM			-color change to grayish brn., slightly silty, fine
							8	
							12	-some scattered rocks to 1/2"
							16	-some caving
							20	End of test boring @ 20' No bedrock No groundwater Installed perc. pipe
							24	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: N/A
Elevation: N/A

Site Location
NWC California St. & Flood Control Channel
Redlands., California

Plate #
P-4

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 5

Project: Soil Percolation Testing for BMP Design **Job No.:** 07045BSN.

Logged By: J. Flippin **Boring Diam.:** 8" HSA **Date:** 4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass
								Sand-lt. brn., fine, dry to damp
							4	
					SP-SM			-color change to grayish brn., traces of silt/silty, fine, dry to damp
							8	-color change to lt. gray, dry to damp, some caving
					SP		12	-color change to grayish brn, fine, damp
							16	
							20	End of test boring @ 20' No bedrock No groundwater Installed perc. pipe & presoaked
							24	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: N/A
Elevation: N/A

Site Location
NWC California St. & Flood Control Channel
Redlands., California

Plate #
P-5

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 6

Project: Soil Percolation Testing for BMP Design		**Job No.:**	07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:**	4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content In %	Dry Density In PCF	Percent Compaction	Unified Classification System	Graphic	Depth In Feet	Description and Remarks
					SP	▨		Weed & grass Sand-lt. brn., fine, dry, loose
						▨	4	-color change to lt. ghrayish brn., fine, dry
					SP-SM	▨		-silty, fine, dry to damp
						▨	8	
					SP	▨		-fine, dry
						▨	12	
						▨	16	
							20	End of test boring @ 20' No bedrock No groundwater Installed perc. pipe
							24	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: N/A
Elevation: N/A

Site Location
NWC California St. & Flood Control Channel
Redlands., California

Plate #
P-6

Applied
Earth
Sciences

a division of Applied Soil Technology, Inc.

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

March 17, 2006

05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Supplement No. 1
Geotechnical Investigation
Soil Permeability Considerations
Proposed Shopping Center
931 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

We are pleased to submit this Supplement No. 1 report presenting the results of our additional geotechnical engineering evaluation or the subject project. The original report of geotechnical investigation for the subject project was issued by this office on December 8, 2005.

PROJECT CONSIDERATIONS

Based on the newly provided grading data, it is believed that, as part of the proposed project, certain areas of the site should be used as basin for dissipating surface water. The areas will include the surface/open parking and the landscape zones. It is also believed that the accumulated water on the site, resulting from precipitation, should be dissipated into the subgrade within less than 48 hours.

DISCUSSION OF RESULTS AND SUPPLEMENTAL RECOMMENDATIONS

Based on the results of our review of the Site Grading Plan, it is believed that the areas of the propose d buildings will be raised by less than 5 feet. Therefore, imported soils will be required to accomplish the site grading work. All imported soils should granular in nature (sand with little silt) having a coefficient of permeability of no less than 1000 feet per year.

Through our review of the boring logs made at the site, it appears that a silt layer extends to some 15 feet in the area of the north parking lot. Below the silt layer, the subgrade consists of relatively clean sand having very high permeability coefficient.

For the purpose of this project, it is recommended that the silt layer in the area of the parking lot be excavated to expose the relatively clean sand soils. The silt layer can be used to rains the grade in the areas of the proposed building. The sandy imported soils should then be used to fill the resulting cavities.

With the above recommended grading procedure, it is our opinion that surface water from regular precipitation will dissipate into the subgrade within the less than 48 hours. It should be noted, however, that the quality and permeability coefficient of the imported sand soils should be determined by this office during site grading to assure that it meets the recommended criteria.

All the other recommendations presented in or original report will remain applicable.

-oOo-

Thank you for the opportunity to be of continued service on this project. Should you have any questions regarding this Supplement No. 1, or wish to discuss the project further, please do not hesitate to call us.

Respectfully Submitted,
APPLIED EARTH SCIENCES

Caro J. Minas, President
Geotechnical Engineer
GE 601

CJM/RCJ/mg

Distribution: (4)

REPORT OF
GEOTECHNICAL INVESTIGATION
PROPOSED SHOPPING CENTER
931 CALIFORNIA STREET
REDLAND, CALIFORNIA

FOR

MR. ANDRE OHANIAN

PROJECT NO. 05-333-02

DECEMBER 8 , 2005

Applied Earth Sciences

a division of Applied Soil Technology, Inc.

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

December 8, 2005

05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Geotechnical Investigation
Proposed Shopping Center
931 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

This report presents the results of a geotechnical investigation performed at the subject site. During the course of this investigation, the engineering properties of the subsurface materials were evaluated in order to provide recommendations for design and construction of foundations, grade slabs, and grading. The investigation included subsurface exploration, soil sampling, laboratory testing, engineering evaluation and analysis, consultation and preparation of this report.

The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries. The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries and the proposed buildings. The attached Appendix I, describes the method of field exploration. Figure Nos. I-1 through I-5 present summaries of the materials encountered at the locations of our borings. Figure No. I-6 presents the Uniform Soil Classification System Chart; a guide to the Log of Exploratory Boring.

The attached Appendix II describes the laboratory testing procedures. Figure Nos. II-1 And II-2 present the results of direct shear and consolidation tests performed on selected undisturbed samples.

Appendix III present the results of chemical testing as received from the offices of American Environmental Testing Laboratory, Inc.

PROJECT CONSIDERATION

It is our understanding that the proposed project would consist of construction of a shopping center at the subject site. The center will consist of three separate buildings. Two of the proposed buildings (the large ones) will be partially two-story structures with lower floors constructed of concrete block walls and the upper floors being constructed of wood frame. The small (drive-through) building will be constructed of wood frame. The flooring systems of all structures will be in a form of concrete grade slabs established at or near the present grades (no basement is planned).

It is believed that the subject site occurs within a potential flood zone. Therefore, the building pad may need to be raised above the potential flood zone level.

Parking for the proposed facility will be provided in a form of open surface parking. (parking lot).

Structural loading data was not available during the course of our investigation. For the purpose of this study, it is assumed that the magnitude of the collected loads would be on the order of 50 kips, combined dead plus frequently applied live loads. Continuous footings are expected to exert loads of on the order of 2 kips per lineal foot.

SITE GRADING

The grading is expected to involve removal and recompaction of any surficial fill and loose native soils (a maximum thickness of 2 to 3 feet; to be determined by the Soil Engineer). The recompacted soils can then be used to receive new fill for support of foundations and grade slabs. The required grading in the areas of surface parking will be limited to removal and recompaction of the top 12 inches of the existing soils.

The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill. The property line footings should be extended through any surficial fill and be established at least 12 inches into native soils.

Note that some 15 percent shrinkage should be considered when reusing the excavated materials in the areas of new fill (to higher densities). Considering this and the planned raise of the site grade above the potential flood zone, imported soils will be required to accomplish the site grading work. All imported soils should be non-expansive and granular in nature (similar to the site upper soils).

SITE CONDITIONS

SURFACE CONDITIONS

The site of the proposed commercial/shopping center is the existing vacant lot located at 941 California Street, Redland, California. The site is triangular in shape and covers a plan area of about 6 acres. See the enclosed Site Plan; Drawing No. 1 for site location.

At the time of our field investigation, the site was vacant and covered with dirt. The site was noted to be generally level.

An existing service station occurs to the northeast of the subject site. An unimproved floo~~r~~d control channel also occurs to the south of the site. See the enclosed Site Plan; Drawing No. 1.

SUBSURFACE CONDITIONS

Correlation of the subsoil between the test borings was considered to be good. Generally, the site, to the depths explored, was found to be covered by surficial fill underlain by natural deposits of silty sand, sandy and/or clayey silt, and relatively clean sand soils. Thickness of the existing fill was found to be less than 12 inches at the location of our borings. Deeper fill, however, may be present between and beyond our borings and closer to the storm drain channel.

The surficial fill and top 2 feet of the site native soils were found to be generally porous and compressible. At their present state, such soils should not be use for support of new fill, structural foundations and grade slabs. The existing fill, however, may be excavated and reused in the areas of compacted fill.

The native soils found below the surficial fill were found to be generally firm in-place. The results of our laboratory testing indicated that the site native soils were of moderate strengths and moderately compressible.

The site upper soils (including the existing fill) were found to be granular in nature. Such soils were found to be virtually non-expansive.

During the course of our field investigation, no groundwater was encountered in our borings drilled to a maximum depth of 51.5 feet. Due to method of drilling, no caving was detected. Due to silty nature of the upper soils, however, forming will not be required during foundation construction.

EVALUATION OF LIQUEFACTION POTENTIAL

As part of our field exploration, one boring was drilled at the subject site to a maximum depth of 51 feet. No groundwater was encountered in our deep borings. For the purpose of evaluating liquefaction potential, SPT (Standard Penetration Test) were conducted from a depth of 15 feet. The results of our in-situ testing indicated that the sand layers below the site were generally dense to very dense in-place (having minimum SPT value of 30). See the Log Of Exploratory Borings in Appendix I. The fine grained (silts and clays) layers with SPT blow counts of less than 30 were found to contain more than 15 percent clay by weight. See the Grain Size Distribution Chart; Figure No. II-3 in the enclosed Appendix II. On this basis, it is our opinion that soil liquefaction will not occur at the subject site.

SEISMIC DESIGN CONSIDERATIONS

The subject site is located within UBC Seismic Zone 4. Based on the results of our field exploration, the subject site can be assumed to have a soil profile type of Sd in accordance with Table 16-J of 1997 Uniform Building Code.

The closest active fault to the subject site is the San Jacinto (San Bernardino) which is designated as Type B seismic source in accordance with CDMG (California Division of Mines and Geology). The subject site occurs some 5 kilometers from this near source zone in accordance with Map M-32 of ICBO (International Conference of Building Officials February 1998). At this distance, for a seismic source B, the near source factors Na and Nv would be 1.0 and 1.3, respectively, in accordance with Tables 16-S and 16-T of the 1997 UBC.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived from this investigation, the site is considered to be suitable for the proposed development. The surficial fill and top zone of porous native soils (a total thickness of on the order of 2 to 3 feet) should be excavated until non-porous native soils (to be determined by the Soil Engineer) are exposed. The zone of removal should be extended beyond the exterior walls of the proposed building a horizontal distance equal to the thickness of fill.

After proper surface preparation (scarification and compaction in-place to a relative compaction of at least 90 percent at optimum moisture content) the excavated materials should be placed back and compacted, under engineering observation and testing until the proposed finished grades are established.

After proper site grading, conventional spread footing foundation system can be used for support of the proposed structures. The foundation bearing soils are expected to be properly compacted fill soils.

Grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

The following sections present our specific recommendations for site grading, foundations, lateral design, grade slabs, minor walls, and observation during construction.

SITE GRADING

All surficial fill the disturbed soils generated from demolition of the existing building/paving should be excavated until native soils are exposed. Prior to placement of any fill on the site, the Soil Engineer should observe the excavation bottoms. The areas to receive compacted fill should be scarified to a depth of about 8 inches, moistened as required to bring to optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM Designation D 1557-02 Compaction Method.

All import soils should be free of organic matter and rocks larger than 6 inches in diameter. Before import soils are brought to the site, a 40-pound sample of the proposed import soils should be submitted to the Soil Engineer (at least 48 hours in advance) so that the maximum density and expansion character of the import materials can be determined. All fill soils should be placed in layers not exceeding 8 inches in loose thickness and compacted to at least 90 percent of the maximum dry unit weight as determined by ASTM Designation D 1557-02 Compaction Method.

General guidelines regarding site grading are presented below in an itemized form which may be included in the earthwork specification. It is recommended that all fill be placed under engineering observation and in accordance with the following guidelines:

I. All vegetation and debris should be collected and hauled off-site. In the areas of new fill, the existing fill should be excavated until native soils are exposed.

2. The excavated areas should be observed and approved by the Soil Engineer prior to placing any fill.

3. The excavated materials from the site are considered to be satisfactory for reuse in the compacted fill areas. Due to potentially expansive character, it would be desirable to use the site soils in deeper fill areas.

4. Fill material, approved by the Soil Engineer, should be placed in controlled layers. Each layer should be compacted to at least 90 percent of the maximum unit weight as determined by ASTM designation D 1557- 02 for the material used.

5. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer.

6. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the moisture content is near optimum.

7. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading or other satisfactory methods until near optimum moisture condition is achieved.

8. Inspection and field density tests should be conducted by the Soil Engineer during grading work to assure that adequate compaction is attained. Where compaction of less than 90 percent is indicated, additional compactive effort should be made with adjustment of the moisture content or layer thickness, as necessary, until at least 90 percent compaction is obtained.

SITE DRAINAGE

Site drainage should be provided to divert roof and surface waters from the property through nonerodible drainage devices to the street. In no case should the surface waters be allowed to pond adjacent to building or behind the retaining walls. A minimum slope of one and two percent is recommended for paved and unpaved areas, respectively.

FOUNDATIONS

Conventional spread footing foundation systems on firm native and/or properly compacted fill soils are expected to provide adequate support for the proposed building. Exterior and interior footings should be a minimum of 12 inches wide and should be placed at a minimum depth of 24 inches below the lowest adjacent final grades.

Properly designed and constructed spread footings may be based on an allowable maximum bearing pressure of 1,800 pounds per square foot. This value can be increased at a rate of 100 and 200 pounds per square foot for each additional foot of footing width and depth, to a maximum value of 2,400 pounds per square foot. The footings for this project should be connected in both directions using tie beams.

The above given values are for the total of dead and frequently applied live loads. For short duration transient loading, such as wind or seismic forces, these values may be increased by one-third.

Under the allowable maximum soil pressure, footings carrying the assumed maximum concentrated loads of 50 kips is expected to settle on the order of 3/4 of an inch. Continuous footings, with loads of about 2 kips per lineal foot are expected to settle on the order of 1/2 of an inch. Maximum differential settlements are expected to be on the order of 1/4 of an inch. Major portion of the settlements are expected to occur during construction.

LATERAL DESIGN

Lateral resistance at the base of footings in contact with native soils may be assumed to be the product of the dead load forces and a coefficient of friction of 0.3. Passive pressure on the face of footings may also be used to resist lateral forces. A passive pressure of zero at the ground surface and increasing at a rate of 200 pounds per square foot per foot of depth to a maximum value of 1,750 pounds per square foot may be used for footings poured against native and/or properly compacted fill soils.

GRADE SLABS

Assuming that site grading will be made in accordance with the recommendations in the preceding sections, grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

In the areas where moisture sensitive floor covering is used and slab dampness cannot be tolerated, a vapor-barrier should be used beneath the slabs. This normally consists of a 6-mil polyethylene film covered with 2 inches of clean sand.

RETAINING WALLS

Static design of minor retaining walls may be based on an equivalent fluid pressure of 40 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the walls. Hydrostatic pressures should be relieved from the back of the retaining walls through properly designed and constructed subdrain. This normally consists of 4-inch in diameter perforated pipes encased in free draining gravel (at least one cubic foot per lineal foot of the pipe). To reduce the chances of siltation, an approved filter fabric should be used around the gravel.

Uniform surcharge effects may be computed using a coefficient of 0.30 times the uniform loads. For allowable vertical and lateral pressures refer to the preceding sections.

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all structural foundations will be established in native and/or properly compacted fill soils. All footing excavations should be observed by a representative of this office before reinforcing is placed.

All site grading work should be observed and tested by a representative of this office. Please notify this office at least 24 hours before any observation work is required.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either express or implied.

It is noted that the conclusions and recommendations presented are based on exploration "window" borings and excavations which is in conformance with accepted engineering practice. Some variations of subsurface conditions are common between "windows" and major variations are possible.

-o0o-

The following Figures and Appendices are attached and complete this report:

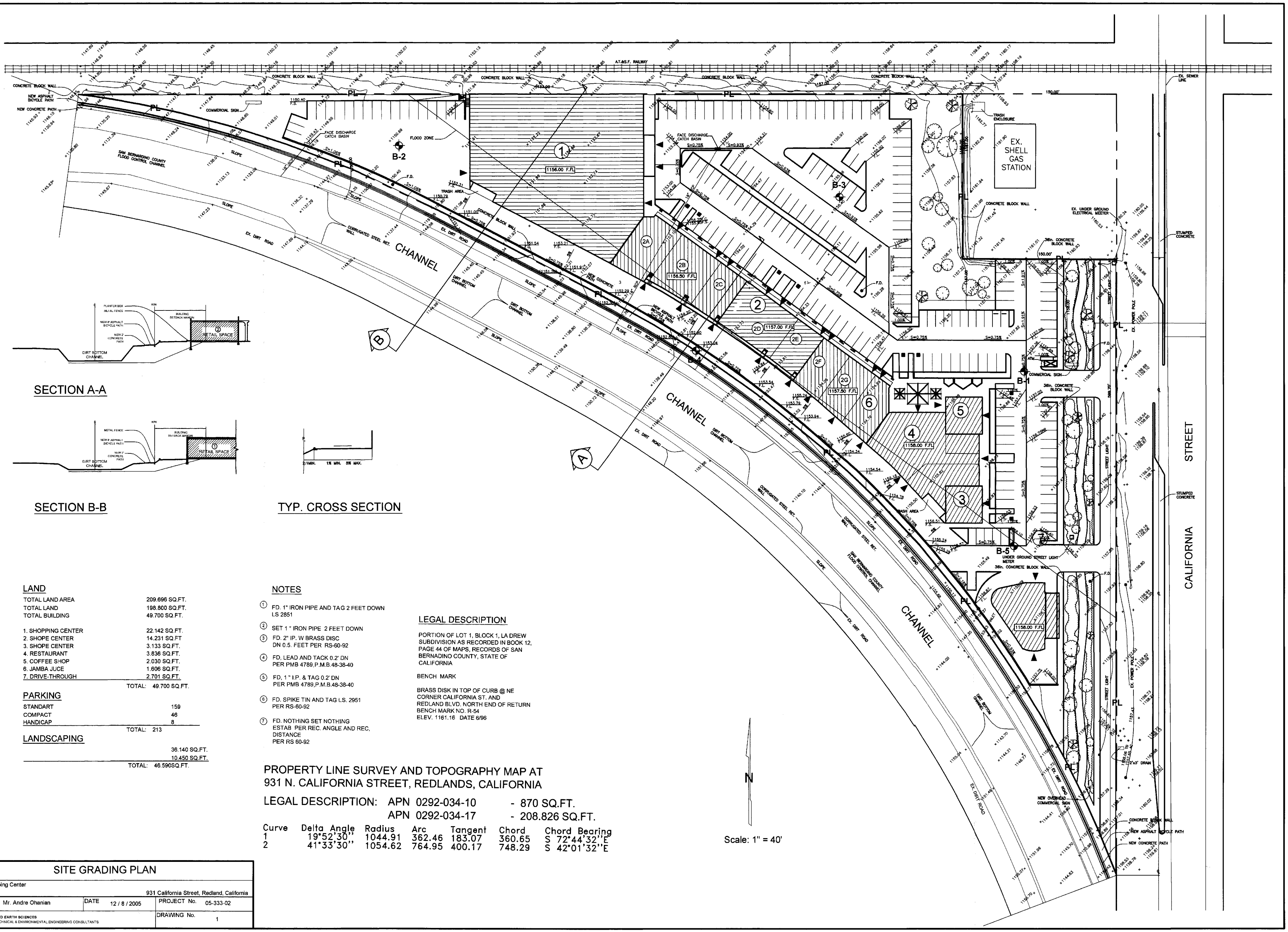
Site Plan - Drawing No. 1
    Appendix I-Method of Field Exploration
        Figure Nos. I-1 through I-6
    Appendix II-Methods of Laboratory Testing
        Figure Nos. II-1 and II-2
    Grain Size Distribution Chart - Figure No. III
Appendix III - Results Of Chemical Testing

Respectfully submitted,

Applied Earth Sciences

Caro J. Minas
Geotechnical Engineer
GE 601

CJM/mg



Scale: 1" = 40'

LAND

TOTAL LAND AREA	209.696 SQ.FT.
TOTAL LAND	198.800 SQ.FT.
TOTAL BUILDING	49.700 SQ.FT.
1. SHOPPING CENTER	22.142 SQ.FT.
2. SHOPE CENTER	14.231 SQ.FT
3. SHOPE CENTER	3.133 SQ.FT.
4. RESTAURANT	3.836 SQ.FT.
5. COFFEE SHOP	2.030 SQ.FT.
6. JAMBA JUCE	1.606 SQ.FT.
7. DRIVE-THROUGH	2.701 SQ.FT.
TOTAL:	49.700 SQ.FT.

PARKING

STANDART	159
COMPACT	46
HANDICAP	8
TOTAL:	213

LANDSCAPING

	36.140 SQ.FT.
	10.450 SQ.FT.
TOTAL:	46.590SQ.FT.

NOTES

① FD. 1" IRON PIPE AND TAG 2 FEET DOWN LS 2851

② SET 1 " IRON PIPE 2 FEET DOWN

③ FD. 2" IP. W BRASS DISC DN 0.5. FEET PER RS-60-92

④ FD, LEAD AND TACK 0.2' DN PER PMB 4789,P.M.B.48-38-40

⑤ FD, 1 " I.P. & TAG 0.2' DN PER PMB 4789,P.M.B.48-38-40

⑥ FD. SPIKE TIN AND TAG LS. 2951 PER RS-60-92

⑦ FD. NOTHING SET NOTHING ESTAB PER REC. ANGLE AND REC, DISTANCE PER RS 60-92

LEGAL DESCRIPTION

PORTION OF LOT 1, BLOCK 1, LA DREW SUBDIVISION AS RECORDED IN BOOK 12, PAGE 44 OF MAPS, RECORDS OF SAN BERNADINO COUNTY, STATE OF CALIFORNIA

BENCH MARK

BRASS DISK IN TOP OF CURB @ NE
CORNER CALIFORNIA ST. AND
REDLAND BLVD. NORTH END OF RETURN
BENCH MARK NO. R-54
ELEV. 1161.16 DATE 6/96

PROPERTY LINE SURVEY AND TOPOGRAPHY MAP AT 931 N. CALIFORNIA STREET, REDLANDS, CALIFORNIA

LEGAL DESCRIPTION: APN 0292-034-10 - 870 SQ.FT.
APN 0292-034-17 - 208.826 SQ.FT.

Curve	Delta Angle	Radius	Arc	Tangent	Chord	Chord Bearing
1	19°52'30"	1044.91	362.46	183.07	360.65	S 72°44'32"E
2	41°33'30"	1054.62	764.95	400.17	748.29	S 42°01'32"E

SITE GRADING PLAN

Proposed Shopping Center
931 California Street, Redland, California

FOR. Mr. Andre Ohanian
DATE 12 / 8 / 2005
PROJECT No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

DRAWING No. 1

APPENDIX I

METHOD OF FIELD EXPLORATION

In order to define subsurface conditions, five borings were drilled on the site. The approximate locations of the drilled borings are shown on the enclosed Site Plan. The borings were extended to a maximum depth of 51.5 feet below the existing grade. The borings were drilled using a hollow stem drilling machine.

Logs of the subsurface materials, as encountered in the borings, were recorded in the field and are presented Figure Nos. I-1 and I-2 within Appendix I. These figures also show the number and approximate depths of each of the recovered soil and rock samples.

Relatively undisturbed samples of the subsoil were obtained by driving a steel sampler with successive drops of a 140-pound sampling hammer free-falling a vertical distance of about 30 inches. The number of blows required for one foot of sampler penetration was recorded at the time of drilling and are shown on the log of exploratory borings. The relatively undisturbed soil samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

Field investigation for this project was performed on February 26, 2005. The material excavated from the borings was placed back and compacted upon completion of the field work. Such material may settle. The owner should periodically inspect these areas and notify this office if the settlement creates a hazard to persons or property.

BORING No. 1

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
5	98	13		5	SILT (ML)		Firm, moist, olive brown, silt with sand
10	99	13		7	(ML)		
15	94	21	71.1	10 (SPT)	(ML)		Grades to clayey
20	117	6	25.3	30 (SPT)	SAND (SM)		Dense, very moist, olive brown, silty sand
25	101	4	19.5	17 (SPT)	(SM)		Grades to clayey
30	104	15	65.7	22 (SPT)	SILT (ML)		Stiff, moist, grayish brown, sandy silt, slightly clayey

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-1.1

BORING No. 1 (CONTINUED)

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	115	2	11	33 (SPT)	SAND (SP)	▨	Very dense, wet, gray, poorly graded sand
40	113	3	7.9	43 (SPT)	(SW)	▨	Grades to very dense, wet, gray, well graded sand
45	111	10	37.6	55 (SPT)	(SW-SM)	▨	Grades to well graded sand wilth silt
50	113	3	10.6	54 (SPT)	(SP)	▨	Grades to poorly graded sand
							End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-1.2

BORING No. 2

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
	98	12		6	SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
5	99	18		9	SILT (ML)		Firm, very moist, olive brown, silt with sand
10	96	17		10	(ML)		
15	95	21		11	(ML)		
20	96	8		25	SAND (SP)		Medium dense, moist, brown, poorly graded sand
25	94	24		17	SILT (ML)		Firm, moist, brown, silt with sand
30	100	20	57.5	30 (SPT)	(ML)		Grades to stiff, grayish brown, sandy silt

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-2.1

BORING No. 2 (CONTINUED)

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	104	20	48	32 (SPT)	(ML)		
40	126	9	18.5	34 (SPT)	SAND (SP-SM)		Dense, moist, olive brown, poorly graded sand with silt
45	110	4	11.4	38 (SPT)	(SP)		Grades to poorly graded sand
50	111	5	9.1	41 (SPT)	(SP)		
							End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-2.2

BORING No. 3

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	99	12		6			
5	100	12		11	SILT (ML)		Firm, moist, light brown, sandy silt
10	101	11		14	(ML)		
15	103	3		15	SAND (SP)		Medium dense, moist, grayish brown, poorly graded sand
20	102	10		18	(SP-SM)		Grades to poorly graded sand with silt
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-3

BORING No. 4

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
	99	12		6	SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
5	98	11		11	SILT (ML)		Firm, moist, brown, sandy silt
10	97	13		14	(ML)		
15	100	3		15	SAND (SP)		Medium dense, moist, grayish brown, poorly graded sand
20	101	4		18	(SP)		
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-4

BORING No. 5

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	102	9		6			
5							
	100	8		8	(SP-SM)		
10							
	102	7		11	(SP-SM)		
15							
	98	14		13	SILT (ML)		Firm, moist, brown, sandy silt
20							
	101	10		14	(ML)		
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-5

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - Sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelty sands, little or no fines.
			SP	Poorly graded sands or gravelty sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Organic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Organic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possesing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 $3/4$ in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

JOB NAME: Mr. Andre Ohanian
JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE No. I-6

APPENDIX II

LABORATORY TESTING PROCEDURES

MOISTURE DENSITY

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on the log of exploratory borings.

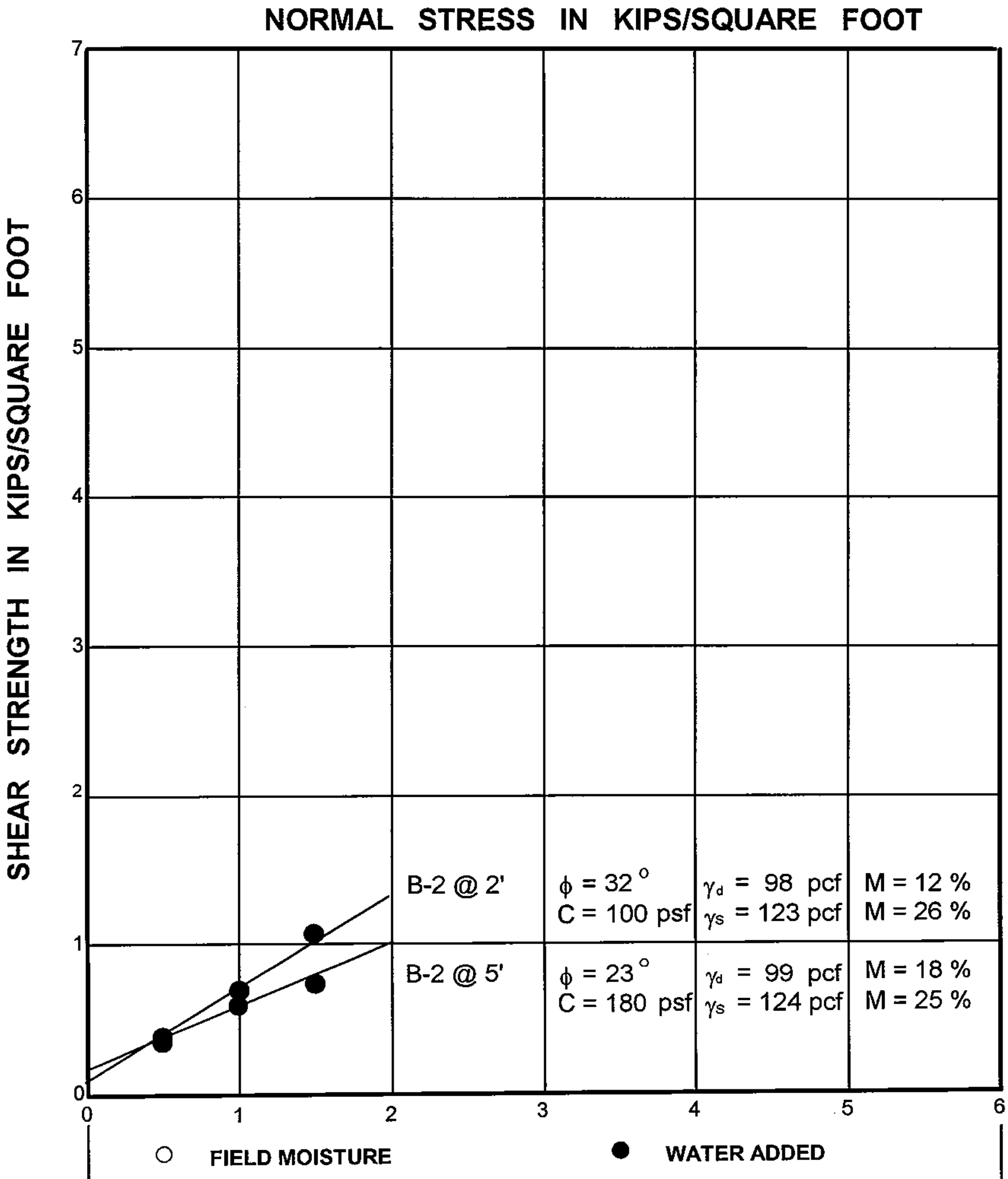
SHEAR TESTS

Shear tests were made with a direct shear machine at a constant rate of strain. The machine is designed to test the soil without completely removing the samples from the brass rings. A range of normal stresses were applied vertically, and the shear strength was progressively determined at each load in order to determine the internal angle of friction and the cohesion. The results of direct shear tests are presented on Figure No. II-1 within this Appendix.

CONSOLIDATION

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at selected time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.



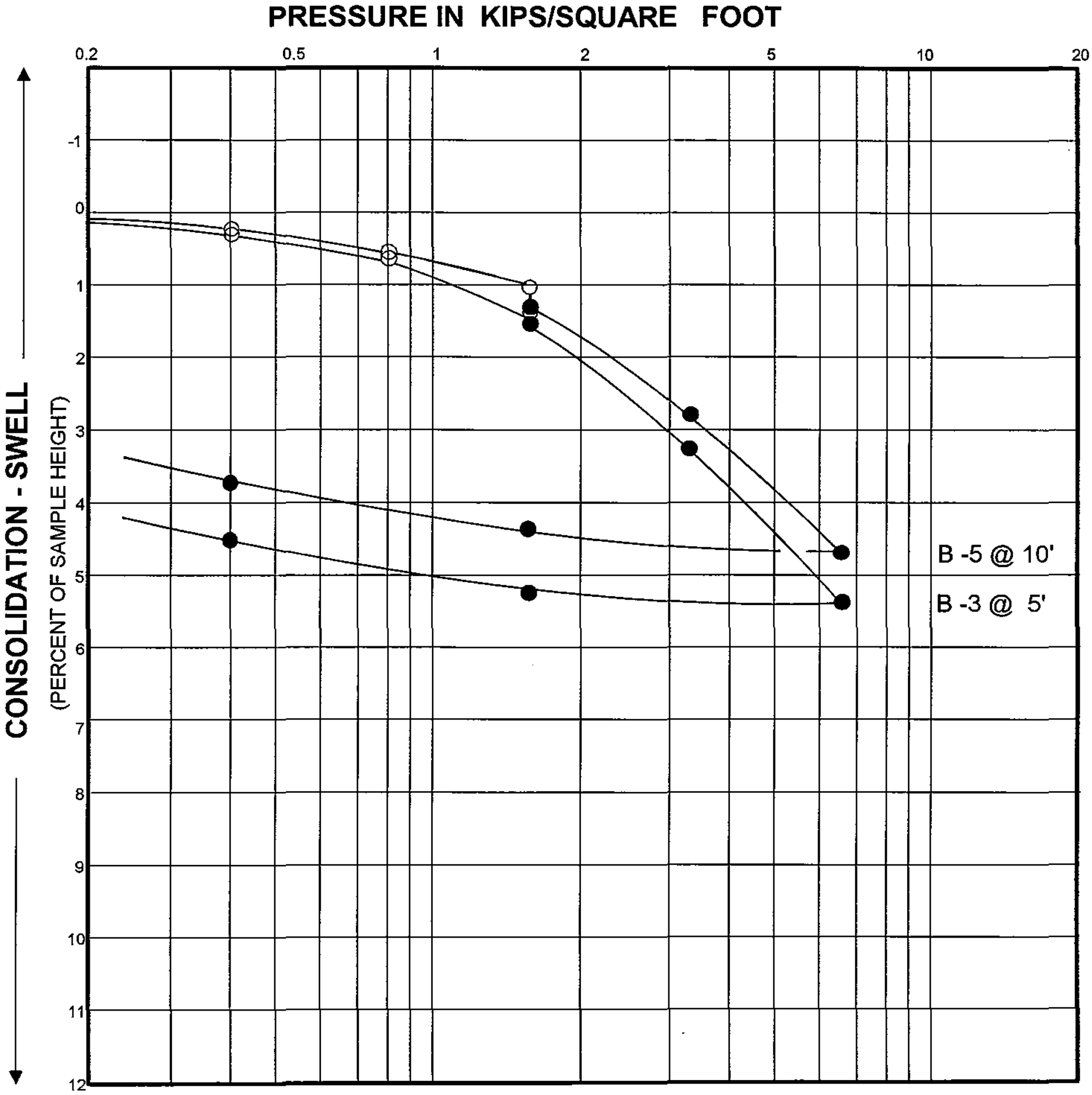
DIRECT SHEAR TESTS

JOB NAME: Mr. Andre Ohanian

JOB NO. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO. II-1



○ **FIELD MOISTURE** ● **WATER ADDED**

SWELL-CONSOLIDATION TESTS

JOB NAME: Mr. Andre Ohanian

JOB NO. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO. II-2

APPENDIX III

RESULTS OF CHEMICAL TESTING

BY

AMERICAN ENVIRONMENTAL TESTING LABORATORY, INC.

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 2

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QC Batch No: 030205

Our Lab I.D.			Method Blank	**32568.01**	**32568.03**	**32568.06**	**32568.08**
Client Sample I.D.				B1@25'	B1@35'	B2@30'	B2@40'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
Benzene	2.5	5.0	ND	ND	ND	ND	ND
Ethylbenzene	2.5	5.0	ND	ND	ND	ND	ND
Toluene (Methyl benzene)	2.5	5.0	ND	ND	ND	ND	ND
Xylenes (Total)	5.0	10.0	ND	ND	ND	ND	ND
Our Lab I.D.				**32568.01**	**32568.03**	**32568.06**	**32568.08**
Surrogates	**%Rec.Limit**		**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**
Bromofluorobenzene	75-125		95	112	114	95	114
Trifluorotoluene	75-125		95	111	115	95	113

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 3

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	**32568.02**	**32568.04**	**32568.05**	**32568.07**
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			3550B	3550B	3550B	3550B	3550B
Date Analyzed			03/03/2005	03/03/2005	03/03/2005	03/03/2005	03/03/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
TPH as Diesel (C13-C22)	5.0	10.0	ND	ND	ND	ND	ND
TPH as Heavy Hydrocarbons (C23-C40)	5.0	10.0	ND	ND	ND	ND	ND
TPH Total as Diesel and Heavy HC.C13-C40	5.0	10.0	ND	ND	ND	ND	ND
Our Lab I.D.				**32568.02**	**32568.04**	**32568.05**	**32568.07**
Surrogates	%Rec.Limit		% Rec.	% Rec.	% Rec.	% Rec.	% Rec.
Chlorobenzene	75-125		92	96	94	99	89

American Environmental Testing Laboratory Inc.

2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: **4**

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	**32568.02**	**32568.04**	**32568.05**	**32568.07**
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	MDL	PQL	Results	Results	Results	Results	Results
TPH as Gasoline and Light HC. (C4-C12)	0.500	1.000	ND	ND	ND	ND	ND
Our Lab I.D.				**32568.02**	**32568.04**	**32568.05**	**32568.07**
Surrogates	%Rec.Limit		% Rec.	% Rec.	% Rec.	% Rec.	% Rec.
Bromofluorobenzene	75-125		88	89	89	88	90

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 5
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 030205 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: ug/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
Benzene	0.0	50.00	41.50 X	83	50.00	41.50 X	83	<1	75-125	<20
Ethylbenzene	0.0	50.00	43.00 X	86	50.00	42.00 X	84	2.4	75-125	<20
Toluene (Methyl benzene)	0.0	50.00	40.50 X	81	50.00	40.00 X	80	1.2	75-125	<20
o-Xylene	0.0	50.00	43.50 X	87	50.00	42.50 X	85	2.3	75-125	<20
m,p-Xylenes	0.0	100.00	77.00 X	77	100.00	75.00 X	75	2.6	75-125	<20

American Environmental Testing Laboratory Inc.
2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 6
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Diesel (C13-C22)	0.0	500.00	500.00	100	500.00	505.00	101	<1	75-125	<20

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit						
TPH as Diesel (C13-C22)	500.00	510.00	102	75-125						

American Environmental Testing Laboratory Inc.
2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 7
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Gasoline and Light HC. (C4-C12)	0.0	2.50	2.00	80	2.50	2.10	84	4.9	75-125	<20

QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit
TPH as Gasoline and Light HC. (C4-C12)	2.50	2.08	83	75-125

REPORT OF
GEOTECHNICAL INVESTIGATION
PROPOSED SHOPPING CENTER
941 CALIFORNIA STREET
REDLAND, CALIFORNIA

FOR

MR. ANDRE OHANIAN

PROJECT NO. 05-333-02

APRIL 15, 2005

Applied Earth Sciences GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

April 15, 2005

05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Geotechnical Investigation
Proposed Shopping Center
941 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

This report presents the results of a geotechnical investigation performed at the subject site. During the course of this investigation, the engineering properties of the subsurface materials were evaluated in order to provide recommendations for design and construction of foundations, grade slabs, and grading. The investigation included subsurface exploration, soil sampling, laboratory testing, engineering evaluation and analysis, consultation and preparation of this report.

The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries. The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries and the proposed buildings. The attached Appendix I, describes the method of field exploration. Figure Nos. I-1 through I-5 present summaries of the materials encountered at the locations of our borings. Figure No. I-6 presents the Uniform Soil Classification System Chart; a guide to the Log of Exploratory Boring.

The attached Appendix II describes the laboratory testing procedures. Figure Nos. II-1 And II-2 present the results of direct shear and consolidation tests performed on selected undisturbed samples.

Appendix III present the results of chemical testing as received from the offices of American Environmental Testing Laboratory, Inc.

PROJECT CONSIDERATION

It is our understanding that the proposed project would consist of construction of a shopping center at the subject site. The center will consist of two separate structures. Each building will be one or two-story wood frame structure. The flooring system will be in a form of concrete grade slabs established at or near the present grade (no basement is planned).

It is believed that the subject site occurs within a potential flood zone. Therefore, the building pad may need to be raised above the potential flood zone level.

Parking for the proposed facility will be provided in a form of open surface parking. (parking lot).

Structural loading data was not available during the course of our investigation. For the purpose of this study, it is assumed that the magnitude of the collected loads would be on the order of 50 kips, combined dead plus frequently applied live loads. Continuous footings are expected to exert loads of on the order of 2 kips per lineal foot.

SITE GRADING

The grading is expected to involve removal and recompaction of any surficial fill and loose native soils (a maximum thickness of 2 to 3 feet; to be determined by the Soil Engineer). The recompacted soils can then be used to receive new fill for support of foundations and grade slabs. The required grading in the areas of surface parking will be limited to removal and recompaction of the top 12 inches of the existing soils.

The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill. The property line footings should be extended through any surficial fill and be established at least 12 inches into native soils.

Note that some 15 percent shrinkage should be considered when reusing the excavated materials in the areas of new fill (to higher densities). Considering this and the planned raise of the site grade above the potential flood zone, imported soils will be required to accomplish the site grading work. All imported soils should be non-expansive and granular in nature (similar to the site upper soils).

SITE CONDITIONS

SURFACE CONDITIONS

The site of the proposed commercial/shopping center is the existing vacant lot located at 941 California Street, Redland, California. The site is triangular in shape and covers a plan area of about 6 acres. See the enclosed Site Plan; Drawing No. 1 for site location.

At the time of our field investigation, the site was vacant and covered with dirt. The site was noted to be generally level.

An existing service station occurs to the northeast of the subject site. An unimproved floor control channel also occurs to the south of the site. See the enclosed Site Plan; Drawing No. 1.

SUBSURFACE CONDITIONS

Correlation of the subsoil between the test borings was considered to be good. Generally, the site, to the depths explored, was found to be covered by surficial fill underlain by natural deposits of silty sand, sandy and/or clayey silt, and relatively clean sand soils. Thickness of the existing fill was found to be less than 12 inches at the location of our borings. Deeper fill, however, may be present between and beyond our borings and closer to the storm drain channel.

The surficial fill and top 2 feet of the site native soils were found to be generally porous and compressible. At their present state, such soils should not be use for support of new fill, structural foundations and grade slabs. The existing fill, however, may be excavated and reused in the areas of compacted fill.

The native soils found below the surficial fill were found to be generally firm in-place. The results of our laboratory testing indicated that the site native soils were of moderate strengths and moderately compressible.

The site upper soils (including the existing fill) were found to be granular in nature. Such soils were found to be virtually non-expansive.

During the course of our field investigation, no groundwater was encountered in our borings drilled to a maximum depth of 51.5 feet. Due to method of drilling, no caving was detected. Due to silty nature of the upper soils, however, forming will not be required during foundation construction.

EVALUATION OF LIQUEFACTION POTENTIAL

As part of our field exploration, one boring was drilled at the subject site to a maximum depth of 51 feet. No groundwater was encountered in our deep borings. For the purpose of evaluating liquefaction potential, SPT (Standard Penetration Test) were conducted from a depth of 15 feet. The results of our in-situ testing indicated that the sand layers below the site were generally dense to very dense in-place (having minimum SPT value of 30). See the Log Of Exploratory Borings in Appendix I. The fine grained (silts and clays) layers with SPT blow counts of less than 30 were found to contain more than 15 percent clay by weight. See the Grain Size Distribution Chart; Figure No. II-3 in the enclosed Appendix II. On this basis, it is our opinion that soil liquefaction will not occur at the subject site.

SEISMIC DESIGN CONSIDERATIONS

The subject site is located within UBC Seismic Zone 4. Based on the results of our field exploration, the subject site can be assumed to have a soil profile type of Sd in accordance with Table 16-J of 1997 Uniform Building Code.

The closest active fault to the subject site is the San Jacinto (San Bernardino) which is designated as Type B seismic source in accordance with CDMG (California Division of Mines and Geology). The subject site occurs some 5 kilometers from this near source zone in accordance with Map M-32 of ICBO (International Conference of Building Officials February 1998). At this distance, for a seismic source B, the near source factors Na and Nv would be 1.0 and 1.3, respectively, in accordance with Tables 16-S and 16-T of the 1997 UBC.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived from this investigation, the site is considered to be suitable for the proposed development. The surficial fill and top zone of porous native soils (a total thickness of on the order of 2 to 3 feet) should be excavated until non-porous native soils (to be determined by the Soil Engineer) are exposed. The zone of removal should be extended beyond the exterior walls of the proposed building a horizontal distance equal to the thickness of fill.

After proper surface preparation (scarification and compaction in-place to a relative compaction of at least 90 percent at optimum moisture content) the excavated materials should be placed back and compacted, under engineering observation and testing until the proposed finished grades are established.

After proper site grading, conventional spread footing foundation system can be used for support of the proposed structures. The foundation bearing soils are expected to be properly compacted fill soils.

Grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

The following sections present our specific recommendations for site grading, foundations, lateral design, grade slabs, minor walls, and observation during construction.

SITE GRADING

All surficial fill the disturbed soils generated from demolition of the existing building/paving should be excavated until native soils are exposed. Prior to placement of any fill on the site, the Soil Engineer should observe the excavation bottoms. The areas to receive compacted fill should be scarified to a depth of about 8 inches, moistened as required to bring to optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM Designation D 1557-02 Compaction Method.

All import soils should be free of organic matter and rocks larger than 6 inches in diameter. Before import soils are brought to the site, a 40-pound sample of the proposed import soils should be submitted to the Soil Engineer (at least 48 hours in advance) so that the maximum density and expansion character of the import materials can be determined. All fill soils should be placed in layers not exceeding 8 inches in loose thickness and compacted to at least 90 percent of the maximum dry unit weight as determined by ASTM Designation D 1557-02 Compaction Method.

General guidelines regarding site grading are presented below in an itemized form which may be included in the earthwork specification. It is recommended that all fill be placed under engineering observation and in accordance with the following guidelines:

I. All vegetation and debris should be collected and hauled off-site. In the areas of new fill, the existing fill should be excavated until native soils are exposed.

2. The excavated areas should be observed and approved by the Soil Engineer prior to placing any fill.

3. The excavated materials from the site are considered to be satisfactory for reuse in the compacted fill areas. Due to potentially expansive character, it would be desirable to use the site soils in deeper fill areas.

4. Fill material, approved by the Soil Engineer, should be placed in controlled layers. Each layer should be compacted to at least 90 percent of the maximum unit weight as determined by ASTM designation D 1557- 02 for the material used.

5. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer.

6. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the moisture content is near optimum.

7. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading or other satisfactory methods until near optimum moisture condition is achieved.

8. Inspection and field density tests should be conducted by the Soil Engineer during grading work to assure that adequate compaction is attained. Where compaction of less than 90 percent is indicated, additional compactive effort should be made with adjustment of the moisture content or layer thickness, as necessary, until at least 90 percent compaction is obtained.

SITE DRAINAGE

Site drainage should be provided to divert roof and surface waters from the property through nonerodible drainage devices to the street. In no case should the surface waters be allowed to pond adjacent to building or behind the retaining walls. A minimum slope of one and two percent is recommended for paved and unpaved areas, respectively.

FOUNDATIONS

Conventional spread footing foundation systems on firm native and/or properly compacted fill soils are expected to provide adequate support for the proposed building. Exterior and interior footings should be a minimum of 12 inches wide and should be placed at a minimum depth of 24 inches below the lowest adjacent final grades.

Properly designed and constructed spread footings may be based on an allowable maximum bearing pressure of 1,800 pounds per square foot. This value can be increased at a rate of 100 and 200 pounds per square foot for each additional foot of footing width and depth, to a maximum value of 2,400 pounds per square foot. The footings for this project should be connected in both directions using tie beams.

The above given values are for the total of dead and frequently applied live loads. For short duration transient loading, such as wind or seismic forces, these values may be increased by one-third.

Under the allowable maximum soil pressure, footings carrying the assumed maximum concentrated loads of 50 kips is expected to settle on the order of 3/4 of an inch. Continuous footings, with loads of about 2 kips per lineal foot are expected to settle on the order of 1/2 of an inch. Maximum differential settlements are expected to be on the order of 1/4 of an inch. Major portion of the settlements are expected to occur during construction.

LATERAL DESIGN

Lateral resistance at the base of footings in contact with native soils may be assumed to be the product of the dead load forces and a coefficient of friction of 0.3. Passive pressure on the face of footings may also be used to resist lateral forces. A passive pressure of zero at the ground surface and increasing at a rate of 200 pounds per square foot per foot of depth to a maximum value of 1,750 pounds per square foot may be used for footings poured against native and/or properly compacted fill soils.

GRADE SLABS

Assuming that site grading will be made in accordance with the recommendations in the preceding sections, grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

In the areas where moisture sensitive floor covering is used and slab dampness cannot be tolerated, a vapor-barrier should be used beneath the slabs. This normally consists of a 6-mil polyethylene film covered with 2 inches of clean sand.

RETAINING WALLS

Static design of minor retaining walls may be based on an equivalent fluid pressure of 40 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the walls. Hydrostatic pressures should be relieved from the back of the retaining walls through properly designed and constructed subdrain. This normally consists of 4-inch in diameter perforated pipes encased in free draining gravel (at least one cubic foot per lineal foot of the pipe). To reduce the chances of siltation, an approved filter fabric should be used around the gravel.

Uniform surcharge effects may be computed using a coefficient of 0.30 times the uniform loads. For allowable vertical and lateral pressures refer to the preceding sections.

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all structural foundations will be established in native and/or properly compacted fill soils. All footing excavations should be observed by a representative of this office before reinforcing is placed.

All site grading work should be observed and tested by a representative of this office. Please notify this office at least 24 hours before any observation work is required.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either express or implied.

It is noted that the conclusions and recommendations presented are based on exploration "window" borings and excavations which is in conformance with accepted engineering practice. Some variations of subsurface conditions are common between "windows" and major variations are possible.

-o0o-

The following Figures and Appendices are attached and complete this report:

Site Plan - Drawing No. 1
  Appendix I-Method of Field Exploration
    Figure Nos. I-1 through I-6
  Appendix II-Methods of Laboratory Testing
    Figure Nos. II-1 and II-2
  Grain Size Distribution Chart - Figure No. III
Appendix III - Results Of Chemical Testing

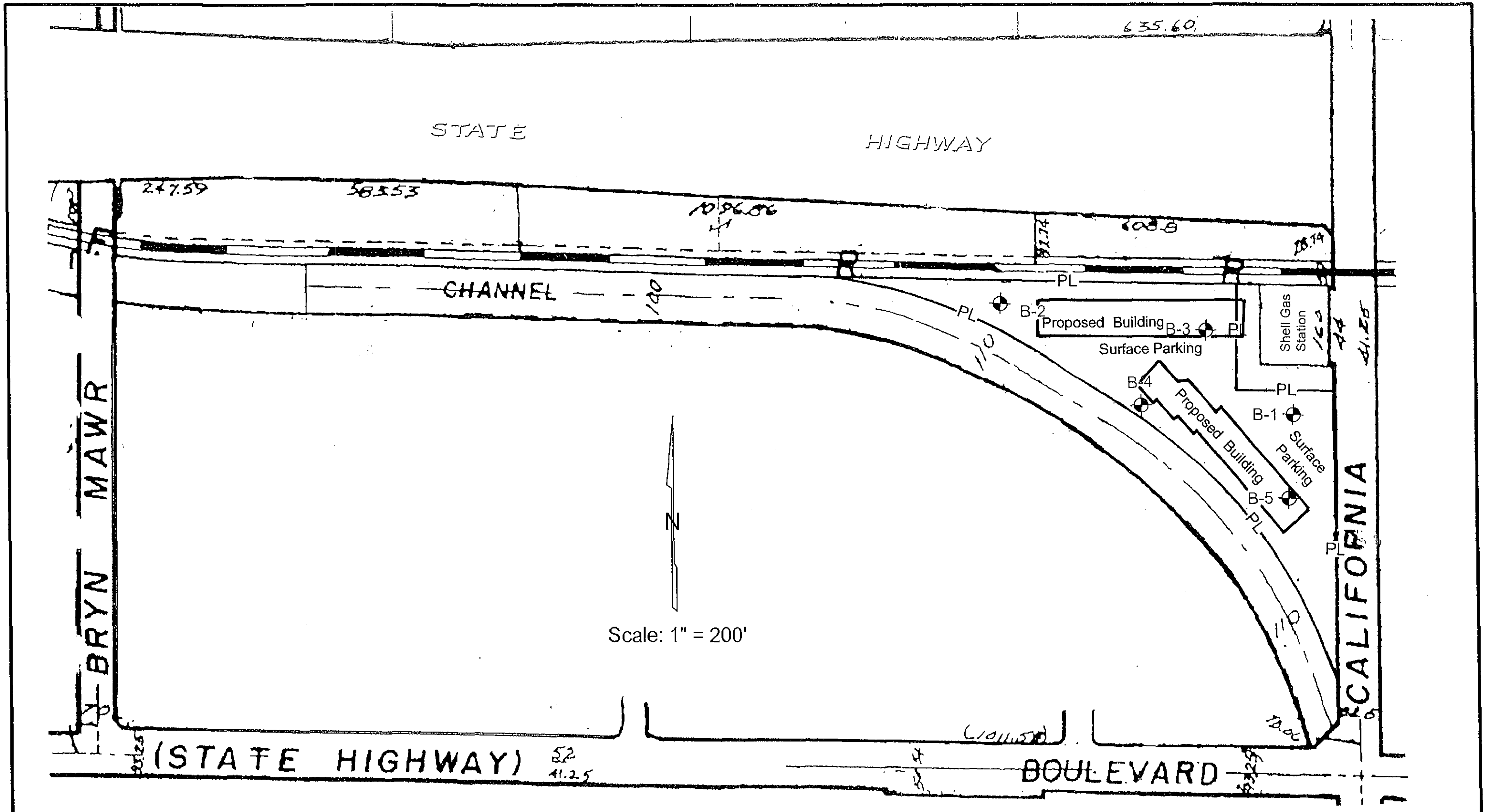
Respectfully submitted,

Applied Earth Sciences

Caro J. Minas
Geotechnical Engineer
GE 601

REGISTERED PROFESSIONAL ENGINEER
CARO J. MINAS
NO. 601
EXP. 12/2006
GEOTECHNICAL
STATE OF CALIFORNIA

CJM/mg



SITE PLAN

Proposed Shopping Center

941 California Street, Redland, California

FOR. Mr. Andre Ohanian	DATE 4/15/2005	PROJECT No.	05-333-02
APPLIED EARTH SCIENCES GEOTECHAL ENGINEERING CONSULTANTS		DRAWING No.	1

APPENDIX I

METHOD OF FIELD EXPLORATION

In order to define subsurface conditions, five borings were drilled on the site. The approximate locations of the drilled borings are shown on the enclosed Site Plan. The borings were extended to a maximum depth of 51.5 feet below the existing grade. The borings were drilled using a hollow stem drilling machine.

Logs of the subsurface materials, as encountered in the borings, were recorded in the field and are presented Figure Nos. I-1 and I-2 within Appendix I. These figures also show the number and approximate depths of each of the recovered soil and rock samples.

Relatively undisturbed samples of the subsoil were obtained by driving a steel sampler with successive drops of a 140-pound sampling hammer free-falling a vertical distance of about 30 inches. The number of blows required for one foot of sampler penetration was recorded at the time of drilling and are shown on the log of exploratory borings. The relatively undisturbed soil samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

Field investigation for this project was performed on February 26, 2005. The material excavated from the borings was placed back and compacted upon completion of the field work. Such material may settle. The owner should periodically inspect these areas and notify this office if the settlement creates a hazard to persons or property.

BORING No. 1

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
5	98	13		5	SILT (ML)		Firm, moist, olive brown, silt with sand
10	99	13		7	(ML)		
15	94	21	71.1	10 (SPT)	(ML)		Grades to clayey
20	117	6	25.3	30 (SPT)	SAND (SM)		Dense, very moist, olive brown, silty sand
25	101	4	19.5	17 (SPT)	(SM)		Grades to clayey
30	104	15	65.7	22 (SPT)	SILT (ML)		Stiff, moist, grayish brown, sandy silt, slightly clayey

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-1.1

BORING No. 1 (CONTINUED)

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	115	2	11	33 (SPT)	SAND (SP)		Very dense, wet, gray, poorly graded sand
40	113	3	7.9	43 (SPT)	(SW)		Grades to very dense, wet, gray, well graded sand
45	111	10	37.6	55 (SPT)	(SW-SM)		Grades to well graded sand wilth silt
50	113	3	10.6	54 (SPT)	(SP)		Grades to poorly graded sand
							End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-1.2

BORING No. 2

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
	98	12		6			
5							
	99	18		9	SILT (ML)		Firm, very moist, olive brown, silt with sand
10							
	96	17		10	(ML)		
15							
	95	21		11	(ML)		
20							
	96	8		25	SAND (SP)		Medium dense, moist, brown, poorly graded sand
25							
	94	24		17	SILT (ML)		Firm, moist, brown, silt with sand
30							
	100	20	57.5	30 (SPT)	(ML)		Grades to stiff, grayish brown, sandy silt

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-2.1

BORING No. 2 (CONTINUED)

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	104	20	48	32 (SPT)	(ML)		
40	126	9	18.5	34 (SPT)	SAND (SP-SM)		Dense, moist, olive brown, poorly graded sand with silt
45	110	4	11.4	38 (SPT)	(SP)		Grades to poorly graded sand
50	111	5	9.1	41 (SPT)	(SP)		
							End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-2.2

BORING No. 3

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	99	12		6			
5	100	12		11	SILT (ML)		Firm, moist, light brown, sandy silt
10	101	11		14	(ML)		
15	103	3		15	SAND (SP)		Medium dense, moist, grayish brown, poorly graded sand
20	102	10		18	(SP-SM)		Grades to poorly graded sand with silt
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-3

BORING No. 4

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)	▨	Medium dense, moist, dark brown, poorly graded sand with silt
	99	12		6		▨	
5	98	11		11	SILT (ML)	▥	Firm, moist, brown, sandy silt
10	97	13		14	(ML)	▥	
15	100	3		15	SAND (SP)	▨	Medium dense, moist, grayish brown, poorly graded sand
20	101	4		18	(SP)	▨	
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-4

BORING No. 5

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	102	9		6			
5	100	8		8	(SP-SM)		
10	102	7		11	(SP-SM)		
15	98	14		13	SILT (ML)		Firm, moist, brown, sandy silt
20	101	10		14	(ML)		
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-5

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - Sand mixfures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelty sands, little or no fines.
			SP	Poorly graded sands or gravelty sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Organic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Organic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possesing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 $3/4$ in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

JOB NAME: Mr. Andre Ohanian

JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE No. I-6

APPENDIX II

LABORATORY TESTING PROCEDURES

MOISTURE DENSITY

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on the log of exploratory borings.

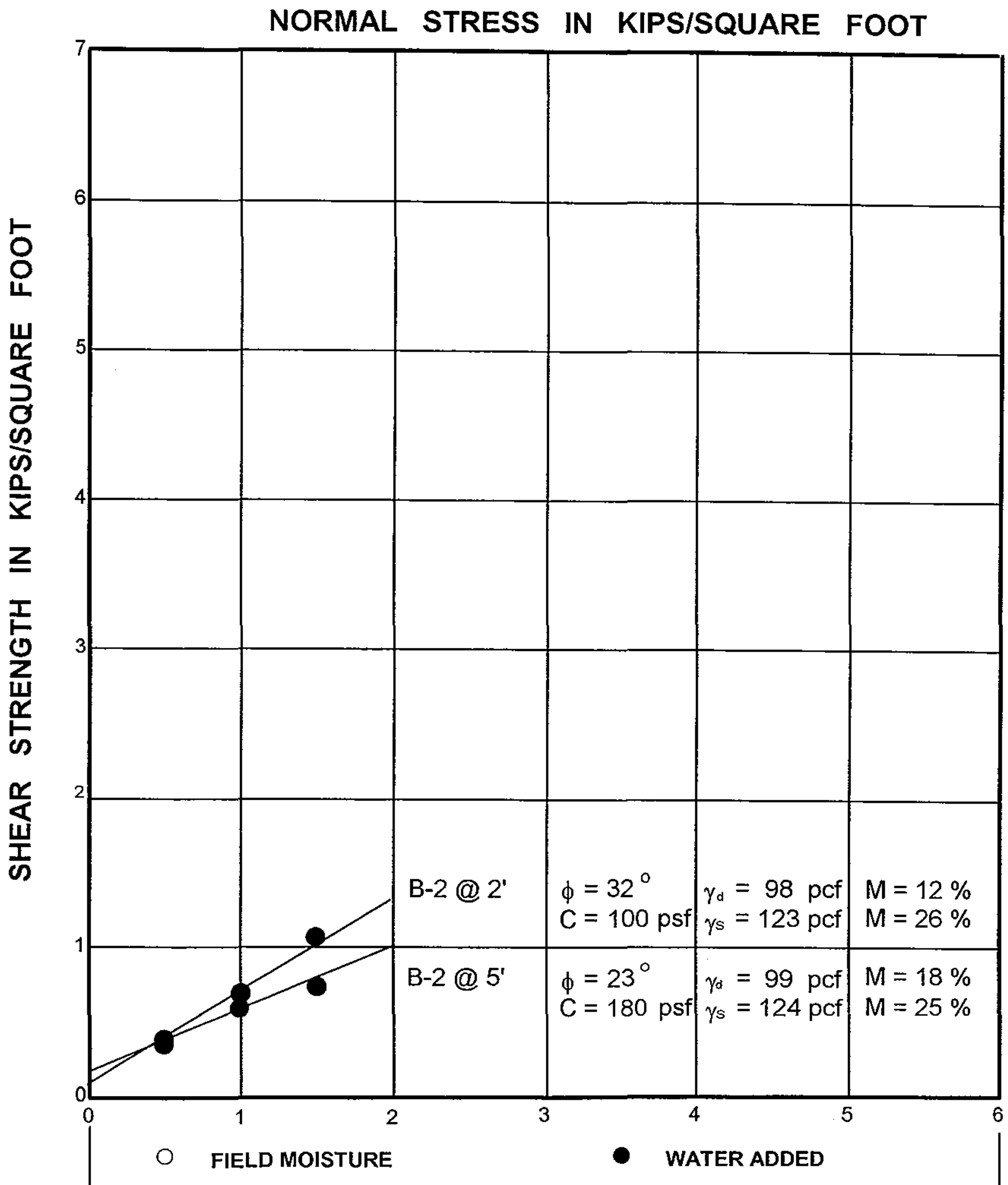
SHEAR TESTS

Shear tests were made with a direct shear machine at a constant rate of strain. The machine is designed to test the soil without completely removing the samples from the brass rings. A range of normal stresses were applied vertically, and the shear strength was progressively determined at each load in order to determine the internal angle of friction and the cohesion. The results of direct shear tests are presented on Figure No. II-1 within this Appendix.

CONSOLIDATION

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at selected time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.



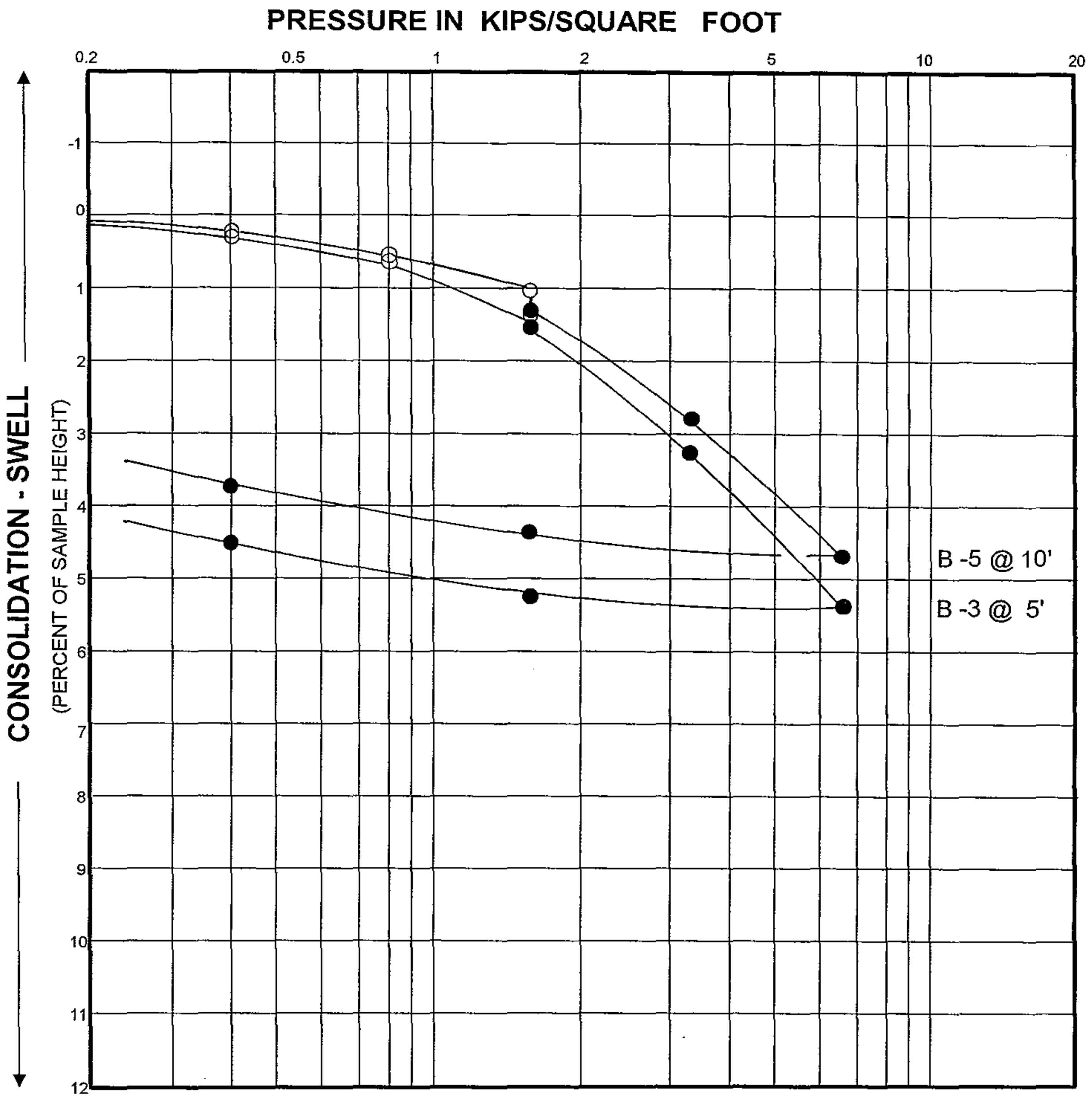
DIRECT SHEAR TESTS

JOB NAME: Mr. Andre Ohanian

JOB NO. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO. II-1



○ **FIELD MOISTURE** ● **WATER ADDED**

SWELL-CONSOLIDATION TESTS

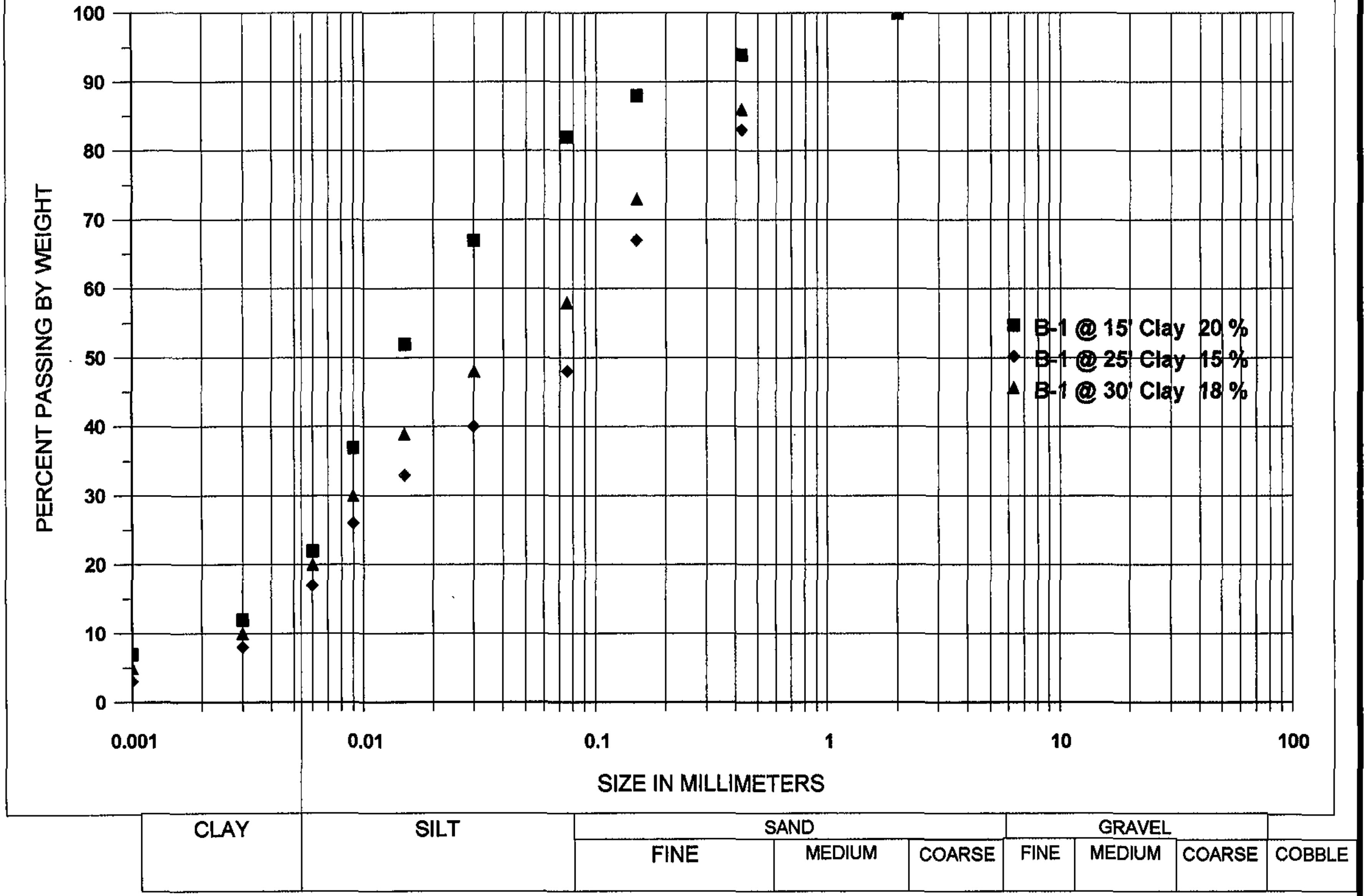
JOB NAME: Mr. Andre Ohanian

JOB NO. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO. II-2

Grain Size Distribution Chart

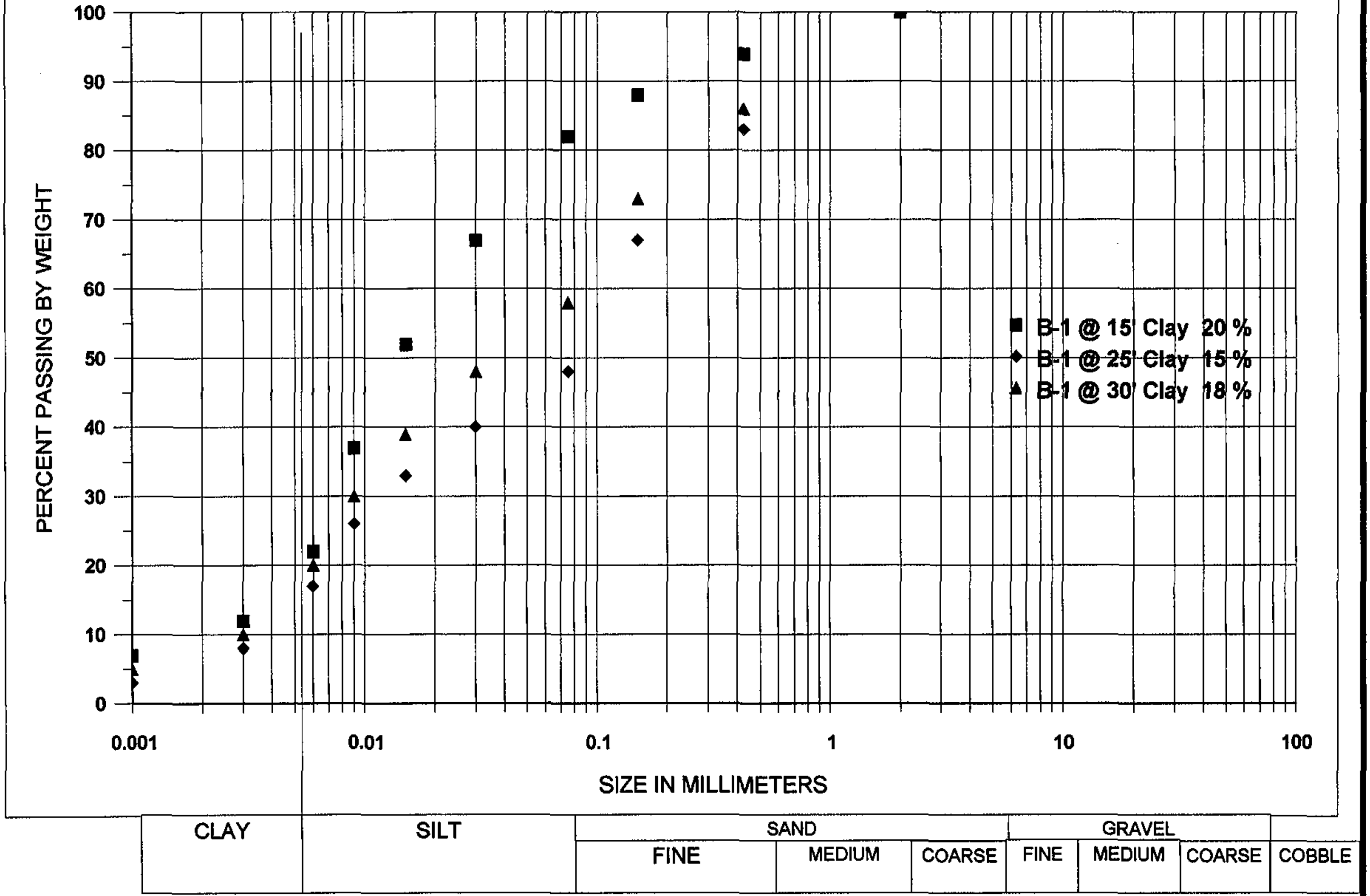


Project Name: **Mr. Andre Ohanian** Date: **04/12/05** Project No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE No. II-3

Grain Size Distribution Chart



Project Name: **Mr. Andre Ohanian** Date: **04/12/05** Project No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE No. II-3

APPENDIX III

RESULTS OF CHEMICAL TESTING

BY

AMERICAN ENVIRONMENTAL TESTING LABORATORY, INC.

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 2

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QC Batch No: 030205

Our Lab I.D.			Method Blank	**32568.01**	**32568.03**	**32568.06**	**32568.08**
Client Sample I.D.				B1@25'	B1@35'	B2@30'	B2@40'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dilution Factor			1	1	1	1	1
Analytes	MDL	PQL	Results	Results	Results	Results	Results
Benzene	2.5	5.0	ND	ND	ND	ND	ND
Ethylbenzene	2.5	5.0	ND	ND	ND	ND	ND
Toluene (Methyl benzene)	2.5	5.0	ND	ND	ND	ND	ND
Xylenes (Total)	5.0	10.0	ND	ND	ND	ND	ND
Our Lab I.D.				**32568.01**	**32568.03**	**32568.06**	**32568.08**
Surrogates	%Rec.Limit		% Rec.	% Rec.	% Rec.	% Rec.	% Rec.
Bromofluorobenzene	75-125		95	112	114	95	114
Trifluorotoluene	75-125		95	111	115	95	113

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 3

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	**32568.02**	**32568.04**	**32568.05**	**32568.07**
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			3550B	3550B	3550B	3550B	3550B
Date Analyzed			03/03/2005	03/03/2005	03/03/2005	03/03/2005	03/03/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	MDL	PQL	Results	Results	Results	Results	Results
TPH as Diesel (C13-C22)	5.0	10.0	ND	ND	ND	ND	ND
TPH as Heavy Hydrocarbons (C23-C40)	5.0	10.0	ND	ND	ND	ND	ND
TPH Total as Diesel and Heavy HC.C13-C40	5.0	10.0	ND	ND	ND	ND	ND

Our Lab I.D.				**32568.02**	**32568.04**	**32568.05**	**32568.07**
Surrogates	%Rec.Limit		% Rec.	% Rec.	% Rec.	% Rec.	% Rec.
Chlorobenzene	75-125		92	96	94	99	89

Ameri[illegible] Environmental Testing Lab[illegible]ry Inc.

2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: **4**

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	**32568.02**	**32568.04**	**32568.05**	**32568.07**
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
TPH as Gasoline and Light HC. (C4-C12)	0.500	1.000	ND	ND	ND	ND	ND

Our Lab I.D.				**32568.02**	**32568.04**	**32568.05**	**32568.07**
Surrogates	%Rec.Limit		% Rec.	% Rec.	% Rec.	% Rec.	% Rec.
Bromofluorobenzene	75-125		88	89	89	88	90

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 5
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 030205 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: ug/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
Benzene	0.0	50.00	41.50 X	83	50.00	41.50 X	83	<1	75-125	<20
Ethylbenzene	0.0	50.00	43.00 X	86	50.00	42.00 X	84	2.4	75-125	<20
Toluene (Methyl benzene)	0.0	50.00	40.50 X	81	50.00	40.00 X	80	1.2	75-125	<20
o-Xylene	0.0	50.00	43.50 X	87	50.00	42.50 X	85	2.3	75-125	<20
m,p-Xylenes	0.0	100.00	77.00 X	77	100.00	75.00 X	75	2.6	75-125	<20

Amer[illegible] Environmental Testing Lab[illegible]ory Inc.
2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 6
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Diesel (C13-C22)	0.0	500.00	500.00	100	500.00	505.00	101	<1	75-125	<20

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit						
TPH as Diesel (C13-C22)	500.00	510.00	102	75-125						

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 7
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Gasoline and Light HC. (C4-C12)	0.0	2.50	2.00	80	2.50	2.10	84	4.9	75-125	<20

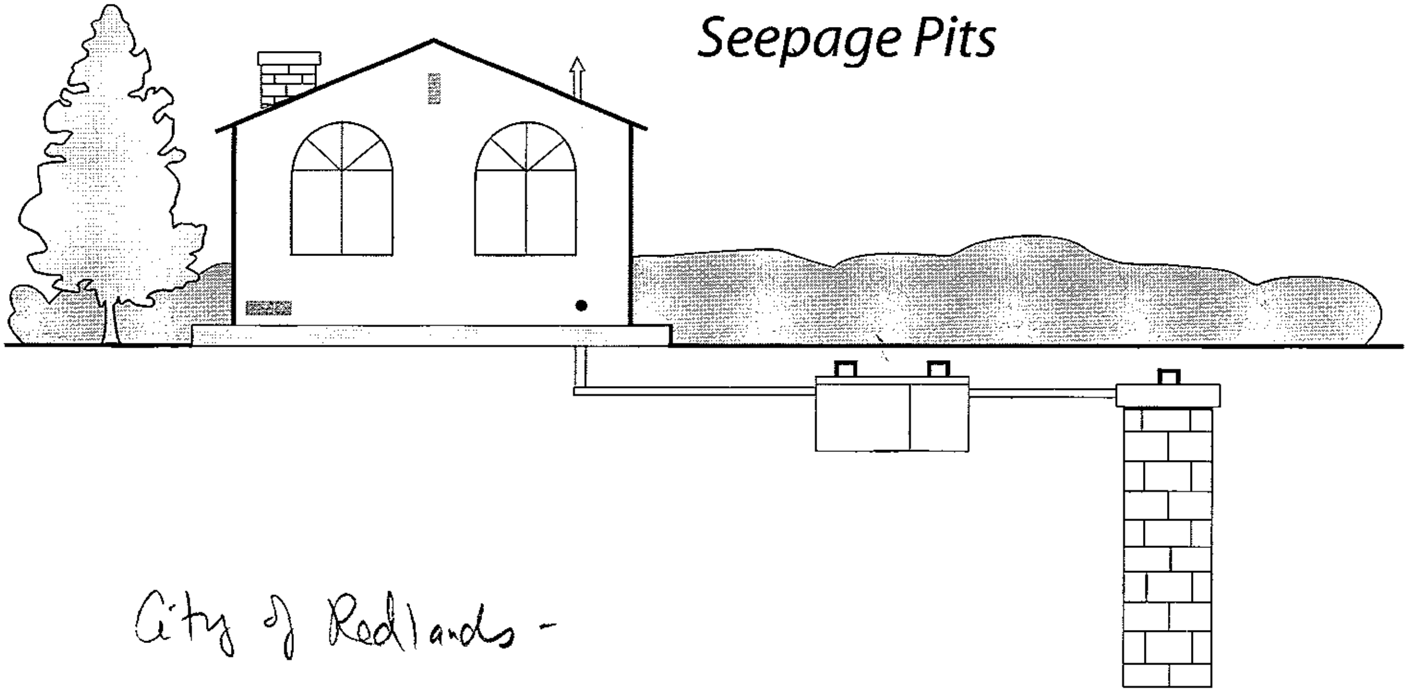
QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit						
TPH as Gasoline and Light HC. (C4-C12)	2.50	2.08	83	75-125						

Corwin Porter

On-Site Waste Water Disposal System

Soil Percolation (PERC) Test Report Standards: *Suitability of Lots and Soils for Use of Leachlines or Seepage Pits*



City of Redlands -

DEHS

County of San Bernardino Department of Public Health
DIVISION OF ENVIRONMENTAL HEALTH SERVICES

http://www.sbcounty.gov/dehs

August 1992

FOREWORD

A soil percolation report is a technical document which establishes whether on-site sewage disposal systems can be used for a specific parcel of land to serve a given type of development (such as single/multiple family dwellings, restaurant, campground, etc.).

The soil's percolation condition is determined by testing at the specific site and topographical, geologic, and hydrologic conditions are determined and described in the report. The on-site system is then designed in accordance with this information and County Standards. A properly installed, operated and maintained system should not be subject to premature failure causing nuisances, odors or public health hazards.

Complete reports must be submitted, and all appropriate fees paid to the Division of Environmental Health Services (DEHS), prior to the approval of the use of any on-site percolation system and the application of the design rate.

CONTENTS

APPENDIX

Joy
Corwin

what region for RWQCB
see A-17.

S.B. County Flood Control Channel (see A-8)

SAN BERNARDINO COUNTY
DIVISION OF ENVIRONMENTAL HEALTH SERVICES

385 North Arrowhead Avenue
San Bernardino, CA 92415-0160
Telephone: (909) 387-4666
FAX Number: (909) 387-4323
http://www.sbcounty.gov/dehs

SOIL PERCOLATION (PERC) TEST REPORT STANDARDS

SUITABILITY OF LOTS AND SOILS FOR
USE OF LEACHLINES OR SEEPAGE PITS

NOTICE:

At least two working days before conducting routinely scheduled percolation tests, you must contact the Division of Environmental Health Services. Please provide the following: assessor's parcel number, firm's name and person to contact, date(s) of testing, and telephone number. At the option of the specialist, a field inspection during testing or shortly thereafter may be conducted. The date that the specialist (or DEHS Water/ Wastewater Section) was contacted must be stated in the report.

I. A perc report is required by DEHS:

a) For all subdivisions of land, except those for which a waiver has been granted. (see pg A-10, item 4 for criteria.)

b) For any parcel or land division where existing data will not allow the county liquid waste specialist to set a sewage disposal rate.

c) For any single lot where space or soil conditions for on-site sewage disposal are critical (i.e., very small or steep lots, very slow perc times, shallow groundwater with fast perc times, etc.)

d) For all new on-site septic systems within the San Bernardino or Angeles National Forest boundaries and in other mountain areas.

e) For all on-site septic systems requiring an exemption from California Regional Water Quality Control Board (CRWQCB) wastewater discharge prohibitions. (Check with Specialist/ RWQCB for designated areas.)

f) For any commercial or sanitary wastes from industrial developments utilizing on-site percolation systems.

g) For a replacement system where existing data will not allow the county liquid waste specialist to set a design rate.

II. Those who prepare perc reports must have professional experience and be knowledgeable in assessing the site's on-site sewage disposal feasibility. They assume responsibility for the report's contents in accordance with the obligations of their professional registration and may be held liable if false or misleading information is presented. Preparers must possess one of the following professional registrations:

a) A State of California Registered Civil Engineer,

b) A State of California Certified Engineering Geologist,

c) A State of California Registered Environmental Health Specialist,

d) A State of California Registered Geologist,

e) A State of California Geotechnical Engineer

Reports must be properly documented with the original signature, stamp, professional registration number and license expiration date of the preparer. Photo copied signatures are not acceptable. Preparers shall be identified by name, field technicians by initial.

III. Format and other requirements:

1. DESCRIPTION OF SITE AND OF PROPOSAL

1.0 Date/individual that was notified of testing.

1.1 Prepared for: Name of client, address and phone number.

1.2 Location of land:

a) Provide a sufficiently detailed vicinity map, township, range, section, assessor's parcel map or subdivision map, and/or legal description of property. Make sure you have the right parcel; state how the property is identified. (Owner's word alone is not acceptable.) Indicate landmarks and street addresses when possible. Specify those survey monuments found and if the property lines were surveyed, by whom.

1.3 Proposed Development/Project/Land use:

a) State the type of project: i.e., condominium, subdivision tract, lot sale, parcel map, shopping center, etc.
b) State the total acreage, the number of lots, and the average and range of the lot sizes.
c) State the type of sewage disposal system: i.e., septic tank or package plant, leachline(s),or seepage pit(s), separate or common system, other.
d) State if grading is proposed for the development, and how much.

1.4 Description of site and surroundings: (A photograph is often useful.)

a) Topography: Include a topographic map prepared by a Registered Civil Engineer or Licensed Land Surveyor, unless the site and the surroundings are flat or have a uniform, constant slope (+ or - 1% variation) of less than 20%. For instance, "slope of 10% downward from north property line to south property line".

% Slope	Maximum Interval of Contours in Feet For Topo Map
0-2	2
>2-10	4
>10	10

Describe the topography in the area of the proposed disposal site(s) and its location relative to the proposed development.

b) Water courses: Indicate and show on the plot plan any floodway, floodplain, spring(s), stream(s), and drainage course(s) which encroach within a distance of 1 ½ times the required minimum setback from the disposal area(s).

c) Vegetation type and density (especially groundwater indicators such as willows, reed grasses, cattails, and smoke trees) as well as trees in general, area(s) of proposed system(s).

d) Existing structures: (1) General description of proximity, density, probable kind and number of neighboring septic systems. (2) Indicate whether the proposed system could adversely impact any existing structure's disposal system(s) or replacement area on or in the vicinity of the parcel being tested where known. (3) Indicate location of nearest sewer, and any sewer manholes observed.

e) Indicate the location of any active or inactive well(s) (and their construction details where known) located within 300 feet of the proposed disposal area. Indicate proposed source of domestic water. Identify future well sites, when appropriate.

f) Rock outcroppings: Specify the type of rock (shale, slate, schist, granite).

g) Indicate the depth to historic groundwater and how it was determined. Provide the date and source of information used (Flood Control Agency, local water companies, California Department of Water Resources Bulletin, USGS, DEHS Water/ Wastewater Section, etc.)

h) Any other feature that may affect sewage disposal: fill material, spots of vegetation, obvious signs of slope instability, fractured bedrock, root channels, cracks in the soil profile, suspected infiltration galleries or old mine tunnels, proposed grading over the system, etc.

2. EQUIPMENT

Describe in detail equipment used to perform perc test - backhoe with 12" bucket, rig with 8" diameter, screw-type auger (identify type), 6" posthole digger, shovel, fork and spoon, measuring tape with 1/8" divisions, wire-onfloat sliding on 1/10" gradation scale, etc.

3. METHODOLOGY AND PROCEDURES

3.1 Location of borings and trenchings. Under most circumstances, the random grid method should be utilized. In the event that other methods are used, explain the method and state the specific reason(s) it was used in lieu of the grid method. It is the report preparer's responsibility to ensure that tests were conducted where described in the report. Indicate locations on the plot plan. For easy identification leave three-foot laths marked with your initials, hole/trench number, and the date the test was conducted at each backfilled hole. Estimate theoretical cuts and fills and perform the tests and borings at the depths at which percolation will occur when the system is installed. When final grading is unknown, indicate that leachlines will be located in natural soil ± two (2) feet of cut or fill (± five (5) feet if pits) or at tested depths. If the final system design is not located within the stated range, additional testing will be required prior to final recordation or issuance of a building permit.

3.2 Soil characteristics to determine number of borings or trenchings and tests. Unless deviations are permitted in advance by the county liquid waste specialist, the minimum number of explorations and tests in Tables 3.3, 3.4, and 3.5 is determined based on the following soil characteristics:

A. **Favorable** is defined by the following:
   1. Ideal soil conditions are anticipated.
   2. There is no visual evidence of shallow groundwater, bedrock, impervious materials, etc. Tests and borings performed agree with the visual evidence. Natural or finished slope of the disposal area is 20% or less.

B. **Moderate** is defined by the following:
   1. Only isolated areas of the property are suspected to encounter problems due to groundwater, bedrock, impervious materials, etc.
   2. No more than 10% of the tests and deep borings fail to meet standards.
   3. The minimum number of tests and borings should be spaced in a random grid, the additional tests describe the limits of the problem area(s).
   4. Natural or finished slope of the disposal area is less than 30%.

C. **Severe** is defined by the following:
   1. Obvious surface features indicating site conditions that will hinder subsurface disposal are present.
   2. Through random testing, more than 10% of the tests and borings do not meet standards.
   3. Acceptable testing rates approach the upper limit of approval, or a nonuniform pattern of test rates develop.
   4. Natural or finished slopes of the disposal area equal or exceed 30%.

3.3 Minimum number of exploratory borings

	Gross Lot Size	Soil Conditions	
		Favorable to Moderate	Severe
Subdivisions and individual lot sales	<1 acre	3 borings first 10 lots 1 boring every 10 thereafter	8 borings first 10 lots 5 borings every 10 thereafter
	1-5 acres	5 borings first 10 lots 3 borings every 10 thereafter	2 per lot*
	>5 acres	1 boring per lot*	2 per lot*
Residential lot		1 boring*	2 per lot*
Commercial lot, confluent systems under one ownership		1 boring per 4,000 gallons septic tank capacity*	1 boring per 2,000 gallons septic tank capacity*
Parcel Map	5 acres or less	1 boring in the center of the undivided parcel	2 borings evenly spaced in the undivided parcel

*** In the area of the disposal system, if known.**

3.3.1 Boring/Trenching Results - Number each hole or excavation. Graphically describe soil strata at each hole or excavation.

a) Soil profile descriptions shall be written under the supervision of the registrant for all of the excavations. The thickness (in inches or tenths of a foot) of the different soil horizons observed shall be indicated. Soil horizons shall be described on the basis of color, field texture analyses, soil mottles, bedrock, structure, roots, and pores. Depths shall be measured from the existing ground surface.

b) Where the soil lithology is stratified and low-permeability layers such as sandy silts and clays, or caliche could affect the on-site disposal system performance (leachlines and seepage pits bottomed less than 20 feet below grade), the soil profile shall be described by direct visual observation: i.e., in a backhoed trench, road cut, suitable large (> two (2) feet diameter) boring, or splitspoon sampling.

c) Textures - Use any of the classifications in Appendix pages Al-4. State the approximate percentage of cobbles, gravel, sand, silt, and clay.

d) Colors (dry/moist), reduction-oxidation mottling. (See Appendix.) The Munsell soil color chart shall be the descriptive tool utilized to determine the background soil color.

e) Presence and extent of small/large roots.

f) Ease of excavating/drilling, depth to bedrock and rock competency (soft, firm, hard, refusal).

g) Moisture - If soil at or near the point of saturation is encountered in the exploratory boring, observe the borehole after 24 hours to determine the presence of free water.

h) Free water - The depth to groundwater, if present, shall be reported. Observed groundwater shall be reported at the level groundwater reaches in the excavation, or at the highest level of sidewall seepage into the excavation after 24 hours. Measurements shall be made from the ground level. Soil above the water level in the excavation shall be checked for conditions associated with saturation (mottles).

i) Structural characteristics, stratigraphy, and geologic origin shall be described when determined necessary by the consultant for severe sites only.

j) Indicate method of boring abandonment.

3.4 Minimum Number of Tests for Leachlines:

	Gross Lot Size	Soil Conditions		
		Favorable	Moderate	Severe
Subdivisions (Note-Individual lot sales requires 100% lot testing)	<2.5 acres	6 tests first 10 lots, 1 test every 10 thereafter	9 first 10, 6 next 10	1/lot
	2.5 acres to 5 acres	8 tests first 10 lots, 3 tests every 10 thereafter	10 first 10, 7 next 10	1/lot
	>5 acres	1/lot	1/lot	1/lot
Residential lot		Minimum 4 tests*	4*	6*
Commercial lot, confluent systems under one ownership		4 tests/3,000 gallons septic tank capacity*, 1 test for each additional 2, 000 gallons septic tank capacity	5/3, 000* 2/2,000	6/3,000* 3/2,000
Parcel Map		Minimum one test for each lot in the area of the disposal system or County assigned rate per waiver criteria (minimum 4 tests)	2 tests per 1ot* (minimum 6 tests)	3/lot* (minimum 8 tests)

Note: *In the general area of the disposal systems (primary and expansion); if known or where proposed.

3.4.1 Standard Percolation Test Procedure for Leachlines

✓ 25" – 36" deep

Excavation: Test holes shall be augered or excavated to within 13 inches of the actual test depth which corresponds to the anticipated depth of the leachline or the bed trench bottom. Vary depths to include testing of side wall if the disposal system will be more than three feet below the ground surface. In addition, perform one test in the least permeable soil stratum found during the deep excavation if the soil type changes within 5 feet of the proposed trench bottom.

Test Hole: 1. A hole of diameter 5.5" - 8" (D) or square 5" - 7" (S) should normally be used.

2. Larger holes than stipulated in coarse soils with a rate of less than 8 minutes/inch (mpi) will require a correction factor using the formula:

$$\frac{\text{mpi (test) x 6}}{\text{actual "D" or "S" dimension}} = \text{mpi corrected}$$

Rates greater than 8 mpi do not need to be corrected.

3. Depth - The minimum test hole depth is 13". All sides to be vertical. (Below the test excavation bottom or at least 5 feet horizontal distance to daylight in a trench bench.)

how?

4. All loose material must be removed from the test hole and the bottom of the hole should be in natural, undisturbed soil.

5. Place two (2) inches of 1/4" to 3/4" gravel over the bottom of the test hole. A perforated can may be placed over the gravel. (Note: if the can has a bottom, gravel may not be necessary.)

Pre-Soak: Fill the hole with 12" of clear water (10" above the gravel or the bottom of the perforated can.)

1. If ten (10) inches of clear water seeps away in two consecutive readings in less than ten (10) minutes each <u>and</u> the soil is of coarse texture, testing can be conducted immediately. Otherwise:

2. Pre-soak by:

   a. Maintain the water level in the test hole at ten (10) inches above the gravel, for at least four (4) hours, or;

   b. For augered test holes with a total depth over four (4) feet from the surface to the gravel, fill the entire hole to the surface. This pre-soak method may require recleaning of the hole and new gravel placement prior to testing, or;

   c. For augered test holes of less than four (4) feet total depth, fill the test hole to the surface and invert a five (5) gallon bottle of water in the hole. This pre-soak method may require recleaning of the hole and new gravel placement prior to testing.

   NOTE: All of the above procedures are designed to allow a minimum of five (5) gallons of water to percolate and saturate the lower 12 inches of the test hole. Other pre-soak methods that also accomplish this may be used, but should be fully described in the final report.

Testing: 1. Begin testing 15-26 hours after the beginning of soaking (except for sandy soils as noted), to allow time for swelling of clays but prevent soil from drying out.

2. Fill or refill the hole with clear water to eight (8) inches from the bottom of the hole, (6) six inches over the gravel.

Readings:

1. If more than five (5) inches of water is gone in 30 minutes, take readings every 10 minutes for one hour minimum. Refill after each reading. All final time intervals shall provide a <u>minimum</u> of a one (1) inch drop and not more than a three (3) inch drop.
2. If less than one (1) inch is gone in 30 minutes, take 60 minute readings for three (3) hours minimum. Do not refill until <u>at least</u> a one (1) inch drop has occurred.
3. For all other cases, take 30 minute readings for three (3) hours minimum. Refill after each reading. All readings shall provide a <u>minimum</u> 1 inch drop, and a <u>maximum</u> 3 inch drop.

Accuracy: All measurements will be read to the closest 1/8". If the difference between the last two readings is greater than 10%, additional measurements shall be made.

Results: The reported results shall be the most conservative reading in minutes/inch drop.

3.4.2 Continuous Pre-Soak Percolation Test Procedure-Leachlines

<u>DESCRIPTION</u>

This method requires the use of a water reservoir to provide a continuous volume of water in the hole during the pre-soak period. After a predetermined volume of water has seeped through the test hole, the measurement of the percolation rates may commence.

The method described in the following procedure utilizes a 5-gallon water bottle inverted in the test hole. This procedure can be modified to use a reservoir and a float device to control the water level as described:

<u>PROCEDURE</u>:

Excavation: The test excavation shall be constructed so as to facilitate the placement of the 5-gallon reservoir of water over the test hole. The excavation shall reach to within 13 inches of the actual test depth which corresponds to the approximate depth of the leachline or the bed trench bottom. Vary the depths in order to include testing of the sidewall if the disposal system is to be more than three feet below the ground surface. In addition, perform one test if the soil type changes within 5 feet of the proposed trench bottom.

Test Hole:

1. Auger or hand excavation.
2. A hole of diameter 5.5" - 8" (D) or square 5" - 7" (S) shall normally be used.
3. Larger holes than stipulated in coarse soils with a rate of less than 8 minutes/inch (mpi) will require a correction factor using the formula:

$$\text{mpi corrected} = \frac{\text{mpi (test) x 6}}{\text{actual “D” or “S” dimension}}$$

Rates greater than 8 mpi do not need to be corrected.

4. The minimum test hole depth is 13 inches.

5. All loose material must be removed from the test hole and the bottom of the hole should be in natural, undisturbed soil.

6. Place 2 inches of 1/4" to 3/4" gravel over the bottom of the test hole. A perforated pipe is then placed in the hole to prevent caving and to support the water bottle. The pipe length shall be approximately the same as the test hole depth.

Pre-Soaking: To start, fill the test hole with water to 8 inches above the gravel. Invert a full 5-gallon bottle of clear water over the hole (in a bottle support) so that the hole is filled continuously to approximately 8 inches over the gravel.

When the 5 gallons of water has percolated through the test hole, or after 15 hours but before 26 hours from initiating pre-soak, testing may commence.

Testing:

A. Same day testing - When the 5 gallons has percolated while the tester is present, the test may proceed the same day as the pre-soak.

   1. Remove the bottle and adjust the water level to 6 inches above the gravel:

   2. Take a minimum of four (4) consecutive measurements at timed intervals that provide not less than a one (1) inch nor more than a 3 inch drop. Refill the water level to 6 inches above the gravel after each measurement.

B. Next day testing - (15-26 hours after starting pre-soak)

   1. If water is still present in the test hole, the test shall not start less than 15 hours from initiating the pre-soak.
      a. Remove the bottle and adjust the water level to 6 inches above the gravel.
      b. Take a minimum of two (2) consecutive measurements at time intervals that provide not less than a 1 inch nor more than a 3 inch drop in the water level. Refill the water level to 6 inches above the gravel after each measurement.
   2. If no water is left in the test hole, the test shall begin within 26 hours from starting the pre-soak. (Repeat the pre-soak procedure if more than 26 hours have passed.)
      a. Remove the bottle and adjust the water level to 6 inches above the gravel.

      b. Take a series of readings for a minimum of two hours, or four consecutive readings at time intervals that provide not less than a 1 inch nor more than a 3 inch drop in the water level. Refill the water level to 6 inches above the gravel after each measurement.

Accuracy: All measurements shall be read to 1/8". If the difference between the last two readings is greater than 10%, additional measurements shall be made.

Results: The reported results shall be the most conservative reading in minutes/inch drop.

3.4.3 Leachline Test Results

3.4.3.1 Tabulate all the results, including all tests that "failed" to meet the minimum acceptable standards.

3.4.3.2 Provide copies of all the field data and calculations using the following format:

Leachline Test:

1. Hole No:
2. Diameter in inches:
3. Hours presaturation; gallons used, time presoak initiated:
4. Depth (of bottom) below grade:
5. Types of strata tested:
6. Condition of hole: caving or siltation?
7. Any method used to prevent sidewall caving? ?
8. Name of tester:
9. Date tested:

Provide numerical values for each of these parameters

t_1 | depth$_1$ | t_2 | depth$_2$ | ^t | ^d | $\frac{{}^\wedge t}{{}^\wedge d}$ mpi (or mpc)

Where:

t_1 = initial time when filling or refilling is completed - minutes

d_1 = initial depth of water in hole

t_2 = final time in minutes

d_2 = final depth of water in hole

^t = change in time - minutes

^d = change in depth - inches

3.5 Minimum Number of Tests for Seepage Pits:

	Gross Lot Size	Soil Conditions		
		Favorable	Moderate	Severe
Subdivisions (Note: Individual lot sales require 100% testing)	<1 acre	3 tests first 10 lots; 2 tests for every 10 lots thereafter	6 first 10 3 next 10	1/lot*
	1 acre to 2.5 acres	4 tests first 10 lots; 2 tests for every 10 lots thereafter	7 first 10 4 next 10	1/lot*
	>2.5 acres to 5 acres	5 tests first 10 lots; 3 tests for every 10 lots thereafter	8 first 10 5 next 10	1/lot*
	>5 acres	6 tests for first 10 lots; 4 tests for every 10 lots thereafter	1/lot*	2/lot*
Residential lot		2 tests*2 tests*	3 tests*	
Commercial lot, confluent systems under one ownership		2 tests/4,000* gallons septic tank capacity in sewage disposal area	2/3,000* 1/2,000	2/3,000* 2/2,000
		1 additional test per 2,000 gallons of septic tank capacity or fractional part thereof		
Parcel Map		2 tests evenly spaced on the undivided parcel	3 tests evenly spaced on the undivided parcel	4 tests evenly spaced

17,500 gal
+
24,000 gal

Note: *In the general area of the disposal systems (primary and expansion); if known or where proposed.

3.5.1 Seepage Pit, Weighted Average Percolation Test Procedure

Test each stratum as for leachlines, in Section 3.4.1. Multiply the thickness of each stratum by its perc time; add the results. Divide the total by the sum of all the thicknesses. The result is the average mpi for the given total depth. Exclude all strata with pi > 30. This is not an easy procedure to perform without very accurate instruments.

3.5.2 Sewage Pit, Falling Head Percolation Test Procedure

☆ not suitable for markedly diff. strata unless each strata tested separately

Test Holes:

a) Holes are 6" to 8" in diameter. Exploratory borings (6"-8") may be backfilled at least 10 feet and used for testing. When backfilling, if soils are too coarse (less than 20% fines) mix top of backfill with driller's mud or other material approved by the Division of Environmental Health Services; cover with one (1) foot of gravel.

b) Depth - Same as the depth estimated for the pit based on the soil log. If distinctly lower permeable stratum (strata) are found with higher permeable stratum within the test boring, the lower permeable stratum should be tested separately. Vary depths when unsure.

c) Because caving may invalidate the results in anticipated adverse areas of percolation, precautions, such as gravel packing, should be used.

Measurements

a) Carefully fill the hole with clear water until the water level is even with the surface of the ground. Refill to the surface for all but the last two (2) readings. The final refills shall be to the proposed depth of the inlet or a minimum of 4 feet below the ground surface.

b) In very sandy soils, where the water on two consecutive readings seeps faster than half the initial wetted depth in 30 minutes, the time intervals shall be 10 minutes or shorter and measurements shall be taken for at least one additional hour until three consecutive readings do not vary by more than 10%. Gravel packed holes must have four (4) consecutive readings where the water seeps faster than half the initial wetted depth in 30 minute intervals to compensate for the reduced water volume of each pre-soak.

c) In soils with fines, soak the hole and let it set overnight. The perc rate measurements shall be made on the day following the soaking, not more than 26 hours after the pre-soak. From the reference point, measure the drop in water level over thirty minute.periods for at least six hours. For the final two readings, read every 30 minutes without refilling and check for possible nonuniform absorption; measure how fast the water level keeps on falling until it gets down to the bottom or slows down. The consultant must determine if the minimum six hour testing should be extended for another 30-60 minutes.

d) Remeasure the depth of the hole with each reading to see if caving has occurred. Caving in excess of 15% of total depth may invalidate the results of shallow test holes.

3.5.3 Seepage Pit Test Results

3.5.3.1 Tabulate all the final results, including all tests that "failed" to meet the standards.

3.5.3.2 Provide copies of all the field data and calculations using the following format:

a) Seepage Pit Test (Falling Head):

1. Boring number
2. Diameter of hole in feet:
3. Hours presaturation, time presoak initiated:
4. Depth (of bottom) below grade
5. Strata peculiarities:
6. Name of tester:
7. Date tested:
8. Method to prevent sidewall caving: Gravel Packed. See Appendix, page A-13.

Provide numerical values for each of these parameters

t_i | t_f | ^t | d_b | d_i | d_f | $F=d_f-d_i = $ ^d | Lave = | Q = $\frac{F\ D\ 9}{\text{Lave^t}}$ | pit mpi = $\frac{180}{Q}$

Where:

t_i = initial time when filling or refilling is completed, hour: minute

t_f = final, end-time of fall, hour: minute

^t = usually .5 or .166 hour 10 min

d_b = depth to water bottom, feet

d_i = depth to water surface at t_i, feet

d_f = depth to water surface at t_f, feet

Lave = average length of water column, feet $d_b - (d_i + d_f)/2$

D = diameter of hole in feet

Q = gallons of sewage (or septic tank capacity, whichever is greater) per square foot per day (g/sf/d).

Of sewage pit ?

Show your work!!

b) Seepage pit - weighted average method - use format per 3.4.3.2

4. Discussion of Results

4.1 Discuss the uniformity of the soils in regards to the soil classification (favorable, moderate or severe) and percolation times obtained. (Uniform is defined as 4 test results falling within + 1/4 of their mean percolation time.) Based on boring/trenching data, discuss how the most restrictive layer below the disposal area was tested, or can be avoided by proper separation or design. For a given system, at least 3/4 of tests must show acceptable results. For example, if there is a failing test on a lot in a proposed tract/minor subdivision, three additional acceptable tests must be shown on that lot.

4.2 Discuss possible sources of error or variability of results such as: measurement accuracy, cavings, one atypical location, etc. Siltation or caving of test holes may require special construction measures to prevent the soil absorption system from suffering the same fate. Discuss in #7 under Recommendations.

4.3 Especially if seepage pit testing was done by procedure 3.5.2, interpret the results in light of the soils profile and the final readings. Do not rely only on the formula results. The falling head test is not a suitable test procedure for markedly different strata, unless the strata are tested separately, or mounding analyses performed. (Check references) Discuss under 7.3.

5. Design

5.1 General Criteria

5.1.1 For uniform soil units, use a mpi between mean and most conservative mpi(s), i.e., average mpi = 7, most conservative mpi = 9, design mpi = 8. If there are no uniform soil units, use the most conservative mpi for the entire area. (See 4.1 - Note: Use pit mpi, not Q, for averaging.)

5.1.2 Unless an area has been determined to have degraded groundwater by a CRWQCB, there shall be a minimum of 5 feet (leachlines) or 10 feet (seepage pits) of original soil between the bottom of the soil absorption system and groundwater. If a soil has a perc time less than 5 mpi, then the soil for a total thickness of five (5) feet below the bottom of a leachline to groundwater shall contain at least 15% of material passing the #200 U.S. standard sieve (and less than one fourth (1/4) of the representative soil cross-section shall be occupied by stones larger than 6"). Where this requirement is not met, a 40-foot separation shall be maintained below the bottom of the leachline and the highest historic groundwater level based on recorded data or on observed mottling. Fairly uniform coarse-textured soils (SM or more coarse) shall not be used for seepage pits when a "pit mpi" is less than 10 and where a sieve analysis shows less than 15% fines passing the #200 U.S. standard sieve for a thickness of 10 feet and the separation to groundwater is less than 40 feet. Lahontan Region criteria are more stringent; Board clearance is required.

Basis for 100% passing - 3/8" sieve.

5.1.3 The design Q for seepage pits must be > 1.1 g/sf/day of sewage, but < 4 g/sf/day. Q's greater than 4 g/sf/d will not be credited. Caving seepage pit test holes in coarse textured soils shall not be credited with rates greater than 3 g/sf/day.

?

5.1.4 Gallons per day are calculated per the most current addition of the UPC Table 1-4/UBC Table 33A and either UPC Table I-2 or Table I-3. 5.2

5.2 Convert percolation times to leachline design rates See p. 16 ?

5.2.1 Leachline application rates for domestic sewage (Source: EPA's Design Manual, 1980) minimum square feet of absorption area per gallon of effluent per day

UTILIZE GRAPH FOR APPLICATION RATE

For single homes you may use:

Bedrooms	Gallons of Effluent Per Day	Gallons of Septic Tank Capacity
1-2	500	750
3	670	1,000
4	800	1,200
5-6	1,000	1,500

5.3 Convert Q to seepage pit design rates

5.3.1 Seepage Pit Design - Falling Head Method

Square feet/ gallons septic tank capacity (sf/gstc)

1/Q X 100 = sf/100 gstc

Design depth below inlet = $\frac{\text{septic tank capacity}}{\text{Q x D ä}}$

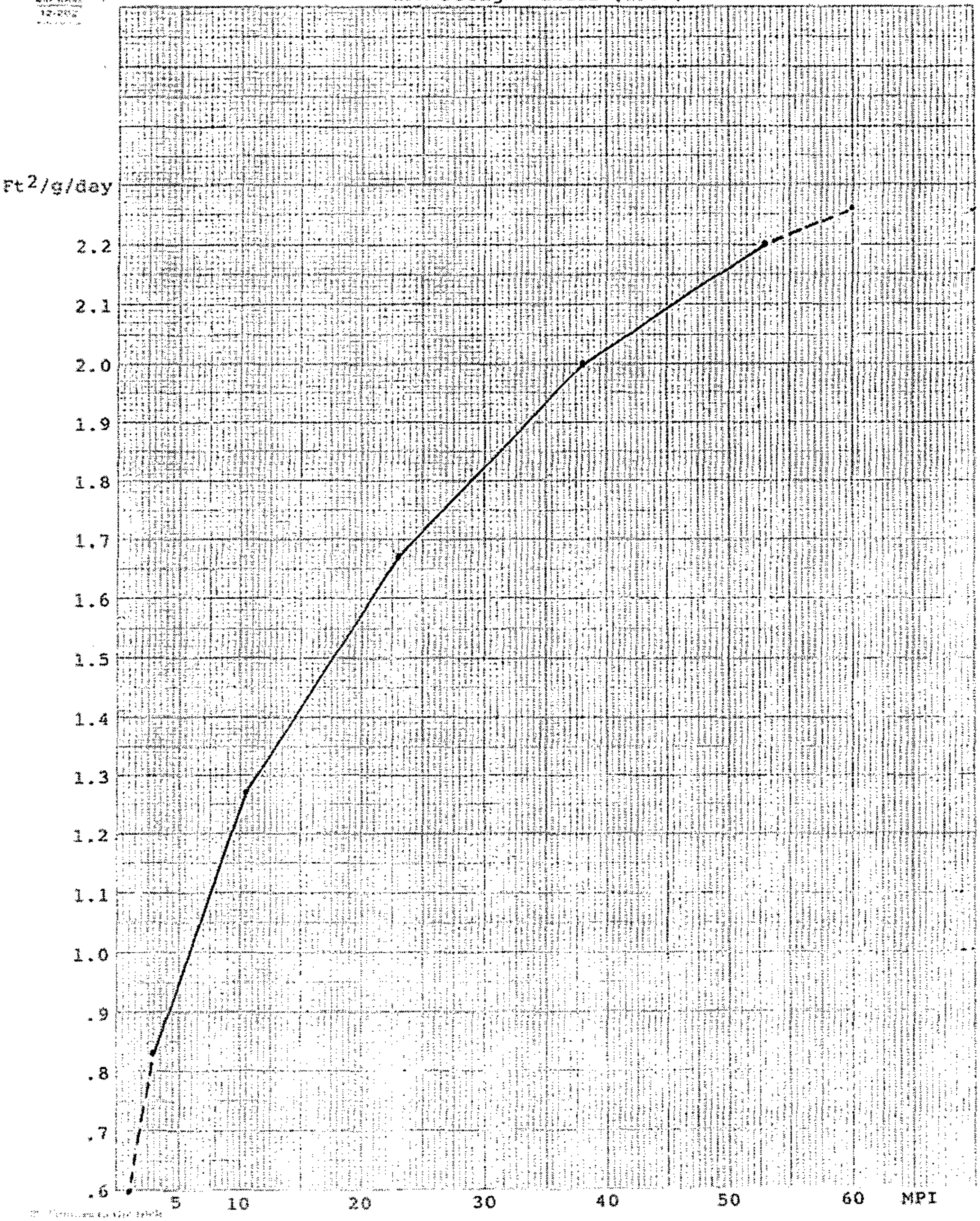
D = Diameter of pit in feet ä = 3.14

Depth below inlet shall be limited to tested depth or by groundwater.

5.3.2 Seepage Pit Design - Weighted Average Method.
Use EPA Design Graph for square feet of pit sidewall.

5.4 Special Criteria

5.4.1 If leachlines or pits serve a common system for two or more units, add 30% more square footage.



Midpoints of ranges for leachfield design, from the EPA Design Manual (1980)

5.4.2 For laundromats, restaurants, and confluent systems serving mobilehome parks or shopping centers (three or more retail shops), or if septic tank volume is calculated for flows > 2000 gpd with Vol = .75 flow +1125, multiply square footage by 2.5.

5.4.3 Credit for Alternating Fields:
A credit of 10% reduction in square footage may be given for installation of alternating leach fields or seepage pits (unless the consultant specifies otherwise).

Single houses on lots less than 10,000 square feet in area or with leach fields on ground naturally sloping >30% (with CRWQCB approval) may require alternating leach fields. The 100% expansion area can be used for one of the alternating leach fields. The report preparer must recommend that adequate future access to install the replacement system be maintained. Alternating systems, as well as standard systems, are not recommended in areas where mechanical obstruction of the system(s) may occur due to root intrusion.

Alternating systems may be considered when future access, or critical soils are limiting factors.

5.4.4 Special considerations: See Appendix page A-7, Section B.l.a.

6. Plot System Per Currently Adopted Uniform Plumbing Code

Draw tested property to scale:

Single Family Home, Small Commercial Minimum 1" = 30'
Parcel Map, Subdivision, Large Commercial Minimum 1" = 40'

6.1 Plot system and 100% expansion area, show existing and potential structures, wells, streams, etc. (Check Appendix for allowable separations.) Include contours, significant vegetation (including trees), rock outcropping, location of all borings and tests, and the proposed house pad.

6.2 For lot sales zoned for single family homes (lot sale subdivisions) show a hypothetical system for a five (5) bedroom home on each and every lot; if zoned for multi-unit development, show a hypothetical system sufficient for the effluent discharged by an average of three bedrooms per unit.

6.3 Where grading is expected, include original and finished elevations. If the grading plan was prepared by others, comment as it regards the recommendations set forth in the report. If grading is unknown, include qualifying statements in area(s) for the primary and expansion systems (see 3.1), or title the report "Preliminary". (Preliminary reports must still be adequate for purposes of recordation with recommendations to be followed for building permit purposes.)

6.4 The proposed dwelling/development shall be located so that the initial subsurface sewage disposal system and the required 100% expansion area shall function by gravity flow unless otherwise approved.

6.5 A pump system will be considered only under the following hardship conditions:

a. To salvage an existing structure when an adequate disposal area cannot be reached by gravity flow.

b. To allow new house construction on an existing lot when there is absolutely no other alternative to pumping. This hardship consideration will be based on reasonable site development.

c. See Appendix, Page A-9.

6.6 All designed systems construction details are subject to review by the DEHS and approval by the Department of Building & Safety. Minimum conventional construction details are to be found in the currently adopted Uniform Plumbing Code.

7. General Discussion and Conclusions or Recommendations

7.1 Specify any pertinent CRWQCB requirements and state whether they are being met. All systems must meet the CRWQCB requirements. See Appendix pages A-17-A-22.

7.2 State whether each lot has sufficient area to support an individual sewage disposal system that will meet DEHS standards for the use intended. Include a qualifying statement if swimming pools, building expansions, etc. are or may be allowed; also if grading must be restricted, or if grading plans must be reviewed prior to grading, and installation inspected after grading by soils consultant, or if special construction techniques are required.

7.3 ? Discuss sewage mounding if lots are to be developed commercially or industrially with flows of 1500 g/d or greater and/or as determined necessary under 4.3. In addition, for commercial and industrial discharges, discuss the on-site system's ability to adequately treat harmful waste constituents prior to entering the groundwater if other than sanitary wastes may be discharged. Indicate if a special treatment process study should be done after the exact nature of the discharge(s) has been determined.

7.4 Recommend that a copy of the DEHS septic system handout *Taking Care of Your Septic System* be obtained by the owner/developer, or provide a copy in report Appendix.

** APPENDIX **

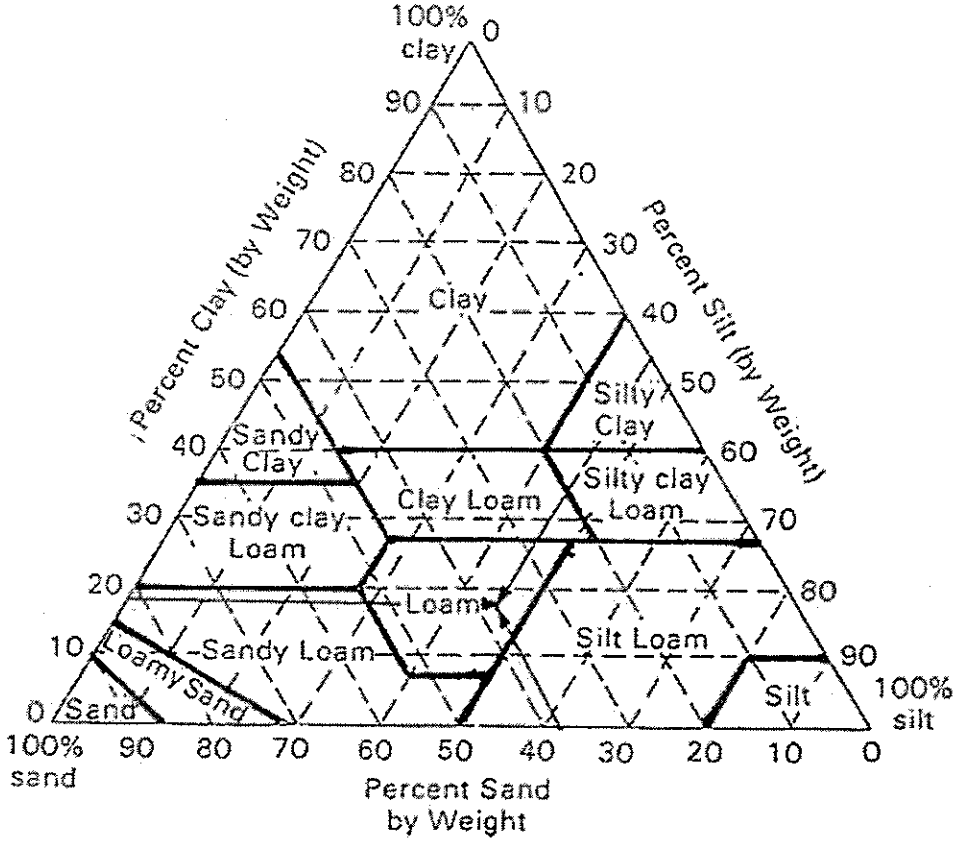
August 1992

Note: The Regional Water Quality Control Board criteria are current at time of publication, but may change. It is the consultant's responsibility to be aware of the minimum criteria. Changes will be made as necessary to the Appendix by the Department.

SOURCE: EPA DESIGN MANUAL FOR ON-SITE SYSTEMS
TEXTURAL PROPERTIES OF MINERAL SOILS

	Characteristics & Appearance	
Soil Class	Dry Soil	Moist Soil
	MINIMUM REQUIREMENTS FOR LOCATION OF	
Sand	Loose, single grains which feel gritty. Squeezed in the hand, the soil mass falls apart when the pressure is released.	Squeezed in the hand, it forms a cast which crumbles when touched. Does not form a ribbon between thumb and forefinger.
Sandy Loam	Aggregates easily crushed; very faint velvety feeling initially but with continued rubbing the gritty feeling of sand soon dominates.	Forms a cast which bears careful handling without breaking. Does not form a ribbon between thumb and forefinger.
Loam	Aggregates are crushed under moderate pressure; clods can be quite firm. When pulverized, loam has velvety feel that becomes gritty with continued rubbing. Casts bear careful handling.	Cast can be handled quite freely without breaking. Very slight tendency to ribbon between thumb and forefinger. Rubbed surface is rough.
Silt Loam	Aggregates are firm but may be crushed under moderate pressure. Clods are firm to hard. Smooth, flour-like feel dominates when soil is pulverized.	Cast can be freely handled without breaking. Slight tendency to ribbon between thumb and forefinger. Rubbed surface has a broken or rippled appearance.
Clay Loam	Very firm aggregates and hard clods that strongly resist crushing by hand. When pulverized, the soil takes on a somewhat gritty feeling due to the harshness of the very small aggregates which persist.	Cast can bear much handling without breaking. Pinched between the thumb and forefinger, it forms a ribbon whose surface tends to feel slightly gritty when dampened and rubbed. Soil is plastic, sticky and puddles easily. (Thumbprints visible)
Clay	Aggregates are hard; clods are extremely hard and strongly resist crushing by hand. When pulverized, it has a grit-like texture due to the harshness of numerous very small aggregates which persist.	Casts can bear considerable handling with breaking. Forms a flexible ribbon between thumb and forefinger and retains its plasticity when elongated. Rubbed surface has a very smooth, satin feeling. Sticky when wet and easily puddled.

TEXTURAL TRIANGLE DEFIINING TWELVE TEXTURAL CLASSES OF THE USDA (ILLUSTRATED FOR A SAMPLE CONTAINING 37% SAND, 45% SILT, AND 18% CLAY)



S = sand
M = silt
C = clay

METHOD OF SOIL CLASSIFICATION
(ASTM D 2487)

COARSE-GRAINED SOILS

LESS THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES	
GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% FINES	
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES	
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, MORE THAN 12% FINES	

NOTE:
Coarse-grained soils receive dual symbols if they contain 5 to 12% fines (e.g. SW-SM, GP-GC, etc.)

FINE-GRAINED SOILS

MORE THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	SILTS AND CLAYS Liquid limit less than 50
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
OL	ORGANIC SILTS OR ORGANIC SILTY-CLAYS OF LOW PLASTICITY	
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit more than 50
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
PT	PEAT, MUCK, AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

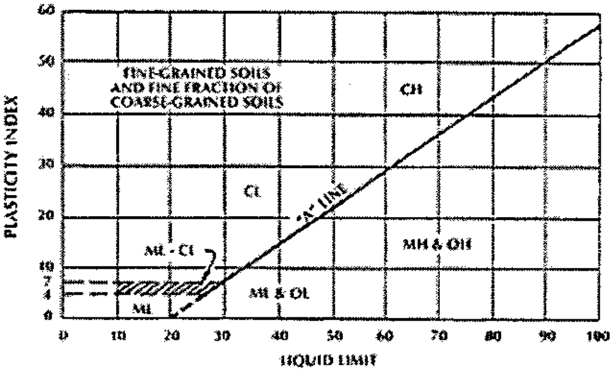
NOTE:
Fine-grained soils receive dual symbols if their limits plot in the hatched zone on the Plasticity Chart (ML-CL)

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 in.
COBBLES	3 in. to 12 in.
GRAVEL	No. 4 to 3 in.
Coarse	¾ in. to 3 in.
Fine	No. 4 to ¾ in.
SAND	No. 200 to No. 4
Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No. 40
*Fines (Silt or Clay)	BELOW No. 200

NOTE:
Only sizes smaller than three inches are used to classify soils.

PLASTICITY CHART



MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	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.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

<u>BOUNDARY CLASSIFICATIONS</u>: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 IN 3 IN (12 IN)

U S STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

Reference
The United Soil Classification System, Corps of Engineers, U. S. Army Technical Memorandum No. 3-357 Vol. 1, March, 1953 (Revised April, 1960)

LIQUID WASTE DISPOSAL SYSTEMS

The minimum requirements for the installation of new sewage disposal systems for either new or existing structures shall generally be as follows:

A. Minimum Separations

1. Septic tank to:

a.	Water supply well	100 feet
b.	Buildings or structures[1]	5 feet
c.	Property line adjoining private property	5 feet
d.	Perennial streams[2]	50 feet
e.	Ephemeral streams[3]	50 feet
f.	Large trees[4]	10 feet
g.	Seepage pits or disposal fields	5 feet
h.	Private domestic water lines (building service line)	5 feet
i.	Public domestic water lines (water purveyor's line)	10 feet
j.	Groundwater	5 feet

S.B. County Flood Control Channel

2. Soil absorption system to: (Leachfield or sewage pit)

a.	Water supply well - 100, 150, or 200 ft. depending on whether system has a:	
	Leaching field	100 feet
	Seepage pit	150 feet
	Any system discharging 5,000 gallons/day or more	200 feet
b.	Building or structures[1]	8 feet
c.	Property line adjoining private property (leachlines)	5 feet
d.	Property line adjoining private property (seepage pits)	8 feet
e.	Large trees[4] (seepage pits)	10 feet
f.	Perennial streams[2]	100 feet
g.	Colorado River/Mojave River	200 feet
h.	Ephemeral streams/ Drainage Courses[3]	50 feet
i.	Septic tank	5 feet
j.	Distribution box	5 feet

k.	Private domestic water line (building service line)	5 feet
l.	Public domestic water line (water purveyor's line)	10 feet
m.	High groundwater table level[5]	
	Leachline	5 feet
	Seepage pit	10 feet
n.	Ground surface on sloping ground (When disposal fields and/or seepage pits are installed in sloping ground, the minimum horizontal distance between any part of the leaching system and ground surface shall be 15 feet.) Also see page A-16.	15 feet
o.	Lakes, water reservoirs	200 feet

3. The minimum separations listed herein are largely derived from the Uniform Plumbing Code. In some cases, additions or changes have been made in order to adequately protect the public health. Where differences exist, the greater separation prevails unless specifically waived for cause by the Department of Environmental Health Services.

Footnotes:

[1] Includes porches and steps whether covered or uncovered, breezeways, roofed porte cocheres, roofed patios, carports, covered walls, covered driveway, and similar structures or appurtenances.

[2] A listing of perennial streams will be maintained by the Division of Environmental Health Services. See pages A-14.

[3] An ephemeral stream/drainage course is any stream not listed as a perennial stream by the Division of Environmental Health Services (see Footnote 2). To determine where the setback restrictions should be applied, the U. S. Geological Survey Maps are used as a guide. If a stream is designated on the USGS Map by a blue dash/dotted line, the setback requirements must be met. If not shown, but there is obvious visual evidence of water flow, the setback is determined by the topography and the geology of the proposed site, but is not less than 25'. Distances are measured from the edge of the channel or assumed 0- 100 year flow.

[4] Any tree with a trunk diameter of one foot or more within 5' of the system that are not to be removed during construction.

[5] The highest known level to which groundwater is known to have occurred rather than the level at the time when testing occurred.

B. Other Factors

1. Special Soil Conditions

a. Special soil conditions may require special consideration by the Division of Environmental Health Services and must be considered on a case-by-case basis, particularly in areas of high rainfall or in proximity to water sources.

b. In the Carbon Canyon area for an individual system, the area of the disposal system tests must be located and tested such that borings are spaced 25 feet or less from proposed disposal area(s).

c. San Bernardino County is known to be criss-crossed with flood control channels, water infiltration basins, perc ponds, tunnels and pipelines which supply water to water districts. Special care must be taken in siting the disposal systems. Check with county liquid waste specialist during notification.

d. Mottled soil - A mottled soil is a soil that is marked with spots or blotches of contrasting color which is usually caused by saturation for some period during a normal year.

If this process has prevailed for significant periods over the recent geologic past, the resulting mottled soil colors can be readily observed.

Zones of seasonal or periodic soil saturation shall be estimated at the highest level of soil mottles. However, soil mottles can occur that are not due to zones of seasonal or period soil saturation; therefore, consult with County Specialist. Monitoring wells may be required to verify lack of groundwater. The abundance, size, contrast and color of the soil mottles shall be described in the following manner: (except frozen soils and soils with rapid permeability).

Abundance shall be described as "few" if the mottled color occupies less than 2% of the exposed surface; "common" if the mottled color occupies from 2% to 20% of the exposed surface; or "many" if the mottled color occupies more than 20% of the exposed surface.

Size refers to the length of the mottle measured along the longest dimension and shall be described as fine if the mottle is less than 5 millimeters (mm); medium if the mottle is from 5-15 mm; or coarse if the mottle is greater than 15 mm.

Contrast refers to the difference in color between the soil mottle and the background color of the soil and is described as faint if the mottle is evident, but recognizable with close examination; distinct if the mottle is readily seen but not striking; or prominent if the mottle is obvious and one of the outstanding features of the horizon. The color(s) of the mottle(s) shall be indicated.

e. A leachline test hole 12 inches (30.5 cm) in diameter is used only when the soil is so stoney or coarse-textured that it is not feasible to dig or bore a standard diameter test hole. The results obtained with this larger diameter hole in minutes per inch or minutes per centimeter are multiplied by the correction factor contained in the leachline formula.

See A-13

f. Technical Modifications

Where sidewall soil materials may slough into the test hole during soaking, two techniques are applied: gravel packing and manual removal.

For gravel packing, a perforated open-top cylinder is placed over the 2 inch (5.1 cm) layer of gravel at the bottom of the test hole. The cylinder is centered in the test hole. The 1 to 2 inch (2.5 to 5.1 cm) space between the hole sidewall and the cylinder is filled with loose, uncompacted, pea-sized gravel. The cylinder may be made out of a perforated piece of pipe, tin can, or hardware cloth. The measured water level drops must be corrected after calculating the effect of the gravel volume.

2. Special discharge conditions:

   a. Local hydrogeological conditions may necessitate more separation of the sewage disposal system for protection of special resources (drinking water supply, recreation areas, water storage reservoirs, lakes, etc).

   b. Fractured bedrock (decomposed granite is not included) and impervious strata are not suitable for sewage disposal. Impervious is defined for design purposes as a stratum with perc times of >120 mpi.

   c. The discharge of surface, rain or other clear water into a sewage disposal system is prohibited.

   d. Water softener and iron filter discharge to a sewage disposal system or on the ground surface is prohibited unless specifically approved by RWQCB. Discharge shall be by physical or manual removal to an approved disposal site.

   e. Discharge of toxic or hazardous chemicals to a domestic system is prohibited. Industrial developments shall have individual monitoring ports for each unit connected to a confluent sewage disposal system if there is a single owner of the development. Multi-owner industrial units (condo type) shall have a separate system for each unit.

   f. Other (Sand and grease interceptors and traps will be considered on a case-by-case basis).

3. Alternative On-Site Sewage Disposal Options

   a. Pump systems - All proposals for pumping shall be detailed in the perc report and shall be subject to DEHS and Building & Safety approval. A pump system may be approved when it is determined that the proposal is a hardship as defined. The following information is required for review:

      1. Percolation data
      2. Pump data
      3. Design of the pump chamber, to include a storage volume equal to 24 hours design flow, in the event of a power outage or a pump failure, or make provision for overflow to an adequately sized back-up gravity disposal area.
      4. Alarm system design
      5. Force main and backflow prevention design certified by AWWA Grade II cross-

connection specialist

6. Design of a receiving chamber at the disposal site which allows the simulation of gravity flow to the disposal system. In all cases, gravity flow to the septic tank is required, such that only settled effluent is pumped from the pump chamber. All components shall comply with the latest edition of the UPC and UBC standards.

b. Where site conditions are such that individual septic systems are not feasible for the proposed development, the use of a multiple ownership septic system may be used, complying with the San Bernardino County Code, Title 3, Chapter 8, Article 7, and Water Quality Control Board Waste Discharge Requirements.

c. The use of designed (demonstration) sewage disposal systems may be allowed with the concurrent approval of the appropriate Regional Water Quality Control Board, DEHS and the Department of Building & Safety. Designed sewage disposal systems include, but are not limited to: mound systems, evapotranspiration systems, denitrifying systems, and sand filtration systems. These systems shall not be approved for the creation of new lots unless specifically approved first by the Board of Supervisors and California Water Quality Control Board, but as a remediation for otherwise unsuitable existing lots on a case by case basis.

   The conditions of approval and any required monitoring shall be part of the property's recorded deed.

d. The use of holding tanks shall not be approved for subdivision purposes except if there is documented evidence that a sewer connection will be available within 24 months and the use of the holding tanks complies with San Bernardino County Code, Title 3, Chapter 8, Article 4.

e. Utilization of advanced wastewater package treatment plants may be utilized on or off site for those developments which do not meet the Regional Board's guidelines for septic systems. A percolation report will be required for all developments. Siting of the system and the design of the disposal system shall meet DEHS and the Department of Building & Safety standards. The plant shall have a Waste Discharge Requirement (WDR) or National Pollutant Discharge Elimination System (NPDES) permit from the Regional Water Quality Control Board. The plant shall be under the control of: 1) a public entity or 2) serviced on a regular basis by qualified, certified wastewater treatment plant personnel.

4. <u>Percolation Report Waiver Criteria</u>

The percolation report requirement for non-critical area development (minor subdivision parcel maps) may be waived by the Division of Environmental Health Services upon presentation of the following:

a. The person or consultant requesting the waiver shall refer to actual approved percolation tests performed on the land in question, or a contiguous parcel, and submit copies of the percolation reports (with the property owner's and consultant's written permission), or,

b. The consultant shall provide a soil horizon identification study per the following criteria.

   (1) The study shall be performed by a qualified professional: a Registered Civil

Engineer, Certified Engineering Geologist, Registered Environmental Health Specialist, Registered Geologist, or Geotechnical Engineer.

(2) The site evaluation shall include soil descriptions, properties and expected permeabilities per 3.3.1, depth to zones of soil saturation, depth to impermeable material (s), slope, potential for flooding and type(s) of vegetation.

(3) The depth of the soil profile shall be a minimum 8 feet below the proposed depth of the leachline and 10 feet below the proposed depth of a seepage pit, and shall be of sufficient dimension to be accessible for soil evaluation: in addition, a minimum of two excavations for each lot will be required. Use a backhoe for leachlines, use a bucket rig for seepage pits (or sample in place the soils).

c. The consultant shall provide a statement that there are no factors (list mitigation measures) which would adversely affect the installation of a subsurface sewage disposal system. These would include: water table levels (historic, source of information), drainage channels, cuts and fills, rock ledges and outcrops, steep slopes, and the location of any wells.

d. The document shall include the assessor parcel number, size of the parcels in acres or square feet, location of the property, proposed development on the property, and a plot plan showing building pad, sewage disposal area and 100% expansion.

e. The consultant shall state that the proposed sewage disposal system meets RWQCB standards, DEHS standards, shall not cause a public health nuisance nor degrade surface and/or groundwater. The consultant shall sign the document and include his/her stamp with registration number.

f. A fee shall be paid to the Division of Environmental Health Services as determined by the current fee schedule for review.

DAYLIGHT REQUIREMENTS

Any portion of the disposal field located to the top of a cut or on sloping ground shall maintain a 15 foot horizontal distance from daylight to any portion of the leachline or leach bed. The table gives the minimum cover required versus the percent of slope in the area of the disposal field to meet the 15 foot requirement. This table also gives a factor "f" by which to increase the length of the trench due to the assumed loss in evapotranspiration caused by the added cover.

Slope of the Ground in the Area of the Disposal System	Minimum Cover Over the Drain Lines	f
5%	1.00 ft	1.0
10%	1.50 ft	1.0
15%	2.25 ft	1.0
20%	3.00 ft	1.0
25%	3.75 ft	1.1
30%	4.50 ft	1.2
35%	5.25 ft	1.3
40%	6.00 ft	1.4
45%	7.00 ft	1.5

(Slopes greater than 30% require CRWQCB approval)

Note: If for design purposes additional cover is required over drain lines (e.g.; below fill), the cover factor is still applicable.

SPECIAL CONSIDERATIONS FOR ABSORPTION FIELD PLACEMENT IN SLOPING GROUND

1. If ground slope is > 30%, any portion of an absorption field (except solid pipe) shall be a minimum of 10 feet (horizontally) from the downslope property line(s). It is the report preparer's responsibility to certify that this minimum is applied or expanded if the slope is less than or equal to 30%, but the soil conditions are such that a basement or curtain drain already built 5 feet downslope from the lower property line(s) may be affected by sewage effluent. Show setback on plot.
2. The minimum horizontal distance between any portion of an absorption field (except solid pipe) and an exposed downward sloping impermeable stratum or bedrock in "cut" slope shall be 50 feet. It is the report preparers responsibility to make recommendations so that systems do not daylight. It is the owner/contractor(s) responsibility to install systems per the recommendations. The consultant may wish to inspect installations to be assured that recommendations are followed. If so desired by consultant, make it a requirement of approval. Upon presentation of pertinent engineering data, the County Specialist may stipulate this requirement.

GRAVEL PACKING CORRECTIONS

If gravel packing was used, correct rates for the effect of the gravel volume. Show in detail measurements of the gravel volume and the calculations. The easiest way to calculate per cent gravel voids in the field is as follows:

Fill a 23½ oz. cylindrical tin can "A" with gravel. The gravel should be loose, uncompacted, just like in the test hole. Don't shake the can.* If the gravel is fine (pea size), fill with water and then drain thoroughly. Fill another identical can "B" with water; pour this water into can "A" until water barely drips out of its rim. (No spillages.) Per cent gravel void is equal to height of water missing in B divided by total height of can, times 100. Add formula correction factor to seepage pit or leachline design.

Correction Factor

Formula = $[1 + P (C^2 - 1)] / C^2$

$C = r_2 / r_1$

r_2 = radius of hole

r_1 = radius of pipe

P = % of voids

Another method for gravel packing corrections is by weighing the can with gravel, with gravel+water and with water using the formula below. By using this method, you do not have to assume to have two identical cans.

1. Weigh the can = A
2. Fill can with water to top; weigh = B
3. Empty can and fill with gravel (wet or dry as in other method); weigh = C
4. Fill gravel-packed can with water to top; weigh = D
5. Calculate the gravel correction factor using the following equation:

$$\frac{D - C}{B - A} = \text{Gravel Correction Factor (i.e. - \% voids)}$$

* If during field testing the gravel in the test hole is observed to compact, shake the can.

PERENNIAL STREAMS OF SAN BERNARDINO COUNTY

The following list of streams has been provided to the Department by the Regional Water Quality Control Boards. These are the streams which they consider to be wholly or in part perennial. The list may be amended from time to time in order to reflect better or more complete information as it becomes known to the Department.

A. California Regional Water Quality Control Board, Lahontan Region
(Regional Board No. 6)

1. East Fork of the West Fork of the Mojave River
2. Seeley Canyon Creek
3. Houston Creek
4. Deep Creek
5. Holcomb Creek
6. Hooks Creek
7. Shale Creek
8. Crab Creek
9. Little Bear Creek (Lake Arrowhead Dam to confluence with Deer Creek)
10. Salt Creek (North of Baker, California)
11. Heath Canyon Creek
12. Swarthout Creek
13. Sheep Creek (North of Highway 2)

B. California Regional Water Quality Control Board
Colorado River Basin Region (Regional Board No. 7)

1. Colorado River
2. Whitewater River
3. San Gorgonio River
4. Pinto Creek
5. Copper Basin Creek
6. Arrastre Creek

C. California Regional Water Quality Control Board,
Santa Ana Region (Regional Board No. 8)

1. Santa Ana River - Reach 6 (Above confluence with Bear Creek)
    - a. Deer Creek
    - b. Hamilton Creek
    - c. Wildhorse Creek
    - d. Cienaga Seca Creek
    - e. Coon Creek
    - f. Fish Creek
    - g. Lost Creek
    - h. South Fork - Santa Ana River
    - i. Frog Creek
    - j. Barton Creek (east and west forks)
    - k. Forsee Creek
    - 1. Schneider Creek
    - m. Gold Creek

PERENNIAL STREAMS OF SAN BERNARDINO COUNTY (Cont'd)

2. Mill Creek (above upper powerhouse)
    a. Mountain Home Creek
    b. Monkey Face Creek
    c. Alger Creek
    d. Falls Creek
    e. Vivian Creek

3. Oak Glen Creek (above Oak Glen)
    a. Birch Creek

4. Bear Creek
    a. North Fork - Bear Creek
    b. Grout Creek
    c. Caribou Creek
    d. Rathbone Creek
    e. Metcalf Creek
    f. Kidd Creek
    g. Siberia Creek

5. Lytle Creek (above upper powerhouse)
    a. Middle Fork - Lytle Creek

6. Devil Canyon Creek (east and west forks above power plant)

7. Cajon Creek (above Keenbrook)

8. Waterman Canyon Creek

9. City Creek (above gaging stations)
    a. West Fork - City Creek
    b. East Fork - City Creek
    c. Middle Fork - City Creek

10. Plunge Creek (above gaging stations)
    a. Little Mill Creek
    b. Fredalba Creek

11. Alder Creek (tributary to Santa Ana Reach 5)
    a. Middle Fork - Alder Creek
    b. Hemlock Creek
    c. Keller Creek

PERENNIAL STREAMS OF SAN BERNARDINO COUNTY (Cont'd)

12. East Twin Creek (above gaging stations)
    a. Strawberry Creek
13. East Etiwanda Creek (within National Forest)
14. Day Canyon Creek (above gaging station)
15. Cucamonga Creek (above gaging station)
16. San Antonio Creek (1 mile above community of Mt. Baldy)
    a. Ice House Canyon Creek
17. Chino Creek (from confluence with Santa Ana River to Pine Avenue)
18. Carbon Canyon

Redlands

951-320-6396 Mohamad

REGIONAL WATER QUALITY CONTROL BOARD (RWQCB)
MINIMUM ON-SITE SEWAGE DISPOSAL CRITERIA

SANTA ANA REGION 951-782-4130 ~~Erin~~ (~~Stormwater/~~ ~~Coastal Unit~~)
Nam (inland)
Keith

A. Unless the developer demonstrates by substantial evidence or the local health authority finds that a pollution, nuisance, or contamination will not occur as a result of the discharge of domestic wastes, the following criteria are considered necessary for the protection of water quality objectives, to prevent impairment of beneficial uses, to prevent pollution, nuisance, or contamination, and to prevent unreasonable degradation of water quality:

1. Depth of soil between ground surface and anticipated high groundwater in the disposal area shall not be less than 10 feet.
2. Depth of soil containing at least 10 percent of the particles smaller than 0.08 millimeters between the bottom of the disposal facilities and anticipated high groundwater shall not be less than 5 feet.
3. Depth of soil between the bottom of any leaching system and impermeable strata shall not be less than 8 feet.
4. Natural or finished ground slope in the disposal area shall not be greater than 30 percent.
5. The percolation rate in the disposal area shall not be greater than 60 minutes per inch if the discharge is to be leachfield, and not less than 1.1 gallons of effluent per square foot per day if the discharge is through a seepage pit. If the percolation rates are faster than 5 minutes per inch, additional testing will be required to determine compliance with 2., or if percolation rates are faster than 5 minutes per inch, minimum depth to groundwater between the bottom of ,the disposal facilities and the anticipated high groundwater shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate public agency.)
6. Compliance is required with all applicable local requirements, including but not limited to requirements on lot size, distance from wells, streams, drainage courses, reservoirs, adjoining properties, or other points.

B. Minimum lot size requirements and exemption criteria for new developments using on-site septic tank-subsurface leaching/percolation systems:

1. A minimum lot size of one-half acre (average gross) per dwelling unit is required for new developments in the Region using on-site septic tank-subsurface leaching/percolation systems.
    a. The term "one-half acre" specified as the minimum lot size requirement means an average gross area of land of one-half acre per dwelling unit. In the calculation of the average lot size, areas set aside for streets, curbs, commons, greenbelts, and other easements may be included.

b. A "new" development is defined as a proposed tract, parcel, industrial or commercial development that has not been granted one or more of the following on or prior to September 7, 1989:

  1. Conditional approval or approval of a tentative parcel or tract map by the local agency such as the county/city Planning Commission, City Council, or the Board of Supervisors.
  2. A conditional use permit.
  3. Conditional approval or approval by the San Bernardino County Division of Environmental Health Services, Riverside County Department of Health, Orange County Health Care Agency, or other local agency.

c. The minimum lot size requirement does not apply to existing developments where septic tank-subsurface disposal systems have been installed on or prior to September 7, 1989.

d. Those tracts, parcels, industrial or commercial developments which have received one or more of the approvals listed in "b", above, on or prior to September 7, 1989 are exempt from minimum lot size requirements for use of septic tank-subsurface disposal systems.

e. A residential tract or parcel of five acres or less which is completely surrounded by tract(s) and/or parcel(s) with high density (i.e., less than one-half acre gross average per dwelling unit) residential developments and which has received zoning identical to that of the surrounding developments may be granted an exemption from the minimum lot size requirement, provided that all of the surrounding tract(s) and/or parcel(s) have been granted one or more of the approvals identified in "b", above, on or prior to September 7, 1989. Non-residential property such as schools, churches, public utilities, shopping centers, etc. which border the tracts/parcels in questions are to be disregarded when conformance with this criterion is determined; conformance is to be based solely on the nature of the remaining developments surrounding the property.

This exemption criterion expires after December 31, 1991.

f. For new industrial/commercial developments utilizing septic tank-subsurface disposal systems, the wastewater flow for each one-half acre of land may not exceed that from a three-bedroom, two-bath house as specified in the Uniform Plumbing Code (20 fixture units).

g. This minimum lot size requirement does not affect the lot size criterion for continuing exemptions in prohibition areas (1 acre minimum).

h. This minimum lot size requirement does not preclude the prescription of more stringent lot size requirements in specific areas if it is determined necessary to protect water quality.

i. No exemptions may be granted for new developments on tracts/parcels which are 660 feet or less from a sewer which could serve that tract/parcel, barring legal impediments to such use.

j. New lots of less than one-half acre may be formed by combining two or more lots which have received one of the approvals specified in Section l.bl, above, on or prior to September 7, 1989. Individually, these existing lots would be eligible for an exemption from the minimum lot size requirement. Developments on the combined lots may also be granted an exemption provided that the total number of units proposed for the new parcel is equal to or less than the total number of units proposed for the existing parcel. For the purposes of this subsection, a combined lot of less than one-half acre formed from two or more existing lots shall not be considered a new development.

COLORADO RIVER BASIN REGION

1. In areas overlying groundwaters which are usable or potentially usable for domestic purposes:
   a. Depth of soil between ground surface and high groundwater level or impervious strata in the disposal area shall not be less than 10 feet.

   b. Depth of soil between the bottom of the disposal facility and fractured rock or high groundwater level shall be at least five feet for leachlines and 10 feet for seepage pits where the soil strata consists of at least 10 percent of the material passing a No. 200 sieve. Additional soil depth will be required as the effective grain size of the soil increases.

   c. Natural or finished ground slope in the disposal area shall not exceed 30 percent.

   d. The percolation rate in the disposal area shall not be greater than 60 minutes per inch if the discharge is to a leachfield, and not less than 1.1 gallons of effluent per square foot per day if the discharge is through a seepage pit. If the percolation rates are faster than 5 minutes per inch, additional testing will be required to determine compliance with 1-b, or if percolation rates are faster than 5 minutes per inch, minimum depth to groundwater between the bottom of the disposal facilities and the anticipated high groundwater shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate public agency.)

2. Other structural limitations, such as horizontal distance between a sewage leaching facility and a water well used for domestic purposes, a surface water used for domestic purposes or for water-contact sports, or other surface impoundment accessible to the public shall be as specified by the local regulatory agency.

3. In areas overlying groundwaters which are unusable for domestic or agricultural purposes:
   a. Depth of permeable soil between ground surface and groundwater level shall not be less than four feet.
   b. Depth of permeable soil between the bottom of the disposal facility and impervious strata shall not be less than four feet.
   c. The acceptable percolation rate shall be determined by the county regulatory agency in

consideration of the required disposal area and other technical factors, in consultation with the Regional Board's Executive Officer or his designee.

d. Compliance with the above-listed Criteria 1 through 3, as well as compliance with local codes and/or policies regulating sewage disposal, will be as determined technically by the appropriate county regulatory agency, subject to review by the Regional Board as to the provisions of said Criteria 1 through 3.

LAHONTAN REGION

1. Maximum Density

Individual waste disposal systems associated with new developments which have a gross density greater than two (2) single family equivalent dwelling units per acre will be required to have secondary-level treatment of wastewater. Equivalent dwelling units (EDUs) are defined as a unit of measure used for sizing a development based on the amount of waste generated from that development; the value used in implementation of these criteria is 250 gallons per day per EDU. For the purposes of these criteria, the discharge from a single family dwelling is equal to one EDU. For the purposes of these amendments, senior citizen dwelling units and second units as defined in Government Code Sections 65852.1 and 65852.2 will not be considered as additional dwelling units. In addition to residential developments, this secondary level treatment policy also applies to wastewater discharges from commercial, industrial, recreational and all other developments with wastewater discharge volumes exceeding two EDU per acre density (500/gal/day/acre based on 250 gal/day/EDU). Use of new septic systems is permitted in existing developments as of June 16, 1988 with lot sizes having a net area greater than or equal to 15,000 square feet. The net area is that contained within the boundaries as set forth in the legal lot description.

2. Minimum Distances

The Board has established the minimum distances (see Table entitled, "Minimum Distances for Siting Individual Waste Disposal Systems") necessary to provide protection to water quality and/or public health.

RWQCB MINIMUM ON-SITE SEWAGE DISPOSAL CRITERIA CONT'D

3. Additional Minimum Criteria

   a. The percolation rate in the disposal area shall not be slower than 60 minutes per inch if the discharge is to a leachfield or 30 minutes per inch if discharge is to a seepage pit. If percolation rates are faster than 5 minutes per inch, minimum distance to groundwater between the bottom of the disposal facilities and the anticipated high groundwater shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate local public health agency.)

   b. Clay, bedrock, or other material impermeable to the passage of water shall not be less than 5 feet below the bottom of the leaching trench or less than 10 feet below the bottom of the seepage pit.

   c. Depth to anticipated high groundwater below the bottom of the leaching trench shall not be less than 5 feet. Depth to anticipated high groundwater below the bottom of the seepage pit shall not be less than 10 feet. Greater depths are required if native material does not provide adequate filtration.

   d. Natural ground slope in the disposal area shall not be greater than 30 percent.

Exemptions to the Criteria for Individual Waste Disposal Systems

In certain locations and under special circumstances, the Board or its Executive Office may waive individual criteria.

1. Waiver of one or more individual criteria may occur if:

   a. The area beneath the proposed septic system discharge has no significant amount of groundwater having present or future beneficial uses; or

   b. It can be proven that no pollution, nuisance or unreasonable degradation of either surface or groundwaters will occur as a result of the proposed septic system density when considered individually or cumulatively with other discharges in the area; or

   c. Construction of a community collection, treatment, and disposal system is imminent. Short term, interim use of individual waste disposal systems may be allowed.

MINIMUM DISTANCES FOR SITING INDIVIDUAL WASTE DISPOSAL SYSTEMS (in feet)

Facility	Domestic Well	Public Well	Flowing Stream[1]	Drainage Course or Ephermeral Stream[2]
Septic tank or sewer line	100	100	50	25
Leaching field	100	100	100	50
Seepage pit	150	150	100	50

Facility	Cut or Fill Bank[3]	Property Line[4]	Lake or Reservoir[5]
Septic tank or sewer line	10	25	50
Leaching field	4h	50	200
Seepage pit	4h[6]	75	200

---

[1] As measured from the line which defines the limit of a 100-year frequency flood.

[2] As measured from the edge of the channel.

[3] Distance in feet equals four times the vertical height of the cut or fill bank. Distance is measured from the top edge of the bank.

[4] When individual wells are used on the same lot. (Distances are to those property lines contiguous with neighboring lots and not street easements.)

[5] As measured from the high water line.

[6] As measured from the high seepage level.

ADDITIONAL REQUIREMENTS FOR SAN BERNARDINO MOUNTAIN AREAS

PER BOARD ORDERS 6-84-93, 6-81-3

1. Depth of soil* between ground surface and bedrock or any other material of low permeability shall not be less than 10 feet (3.0 m).

2. Depth of soil* between the bottom of the disposal facilities and groundwater shall not be less than 10 feet (3.0 m).

3. All facilities used for collection, transport, treatment or disposal of waste shall be adequately protected against either structural damage or a significant reduction in efficiency resulting from a storm or flood having a recurrence interval of once in 100 years.

* Soil is defined as a granular or weathered material having an effective porosity of greater than 15 percent.

Suggested References

EHS	Our Current "Standards" Booklet
UPC	Current Edition
US EPA	(1980) Design Manual, Onsite Wastewater Treatment and Disposal Systems. EPA 625/1-80-012. Available from NTIS, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22151.
Canter & Knox	(1985) Septic Tank Systems Effects on Ground Water Quality - Lewis Publishers
Kaplan	(1987) Septic Systems Handbook - Lewis Publishers
Winneberger, J.T.	(1984 Septic Tank Systems, Ann Arbor Science (Butterworth Publ.) Boston

American Society of Agricultural Engineers, On-Site Wastewater Treatment Proceedings of the Third, Fourth, Fifth and Sixth National Symposia on Individual and Small Community Sewage Systems, ASAE Publications 1-82, 07-85, 10-87, 10-91, ASAE, 2950 Niles Road, St. Joseph, Michigan 49085-9659

Perkins	(1989) On-site Wastewater Disposal, Lewis Publishers

All of the cited references are of interest, none is the last word on the subject.

Attachment A - Santa Ana

MINIMUM LOT SIZE REQUIREMENTS AND EXEMPTION CRITERIA FOR NEW DEVELOPMENTS USING ON-SITE SEPTIC TANK-SUBSURFACE LEACHING PERCOLATION SYSTEMS

On October 13, 1989, the Regional Board adopted Resolution No. 89-157, amending the Water Quality Control Plan to add a one-half acre minimum lot size requirement for new developments using on-site septic tank-subsurface leaching/percolation systems regionwide. Certain exemptions from the minimum lot size requirement were specified in Resolution No. 89-157. On December 7, 1990, the Regional Board adopted Resolution No. 90-158, which revised the exemption criteria. However, on June 7, 1991, the Regional Board adopted Resolution No. 91-51, rescinding Resolution No. 90-158 and revising the exemption criteria in Resolution No. 89-157. On July 16, 1993, the Regional Board adopted Resolution No. 93-40, revising the requirements and exemption criteria in Resolution No. 89-157, as amended by Resolution No. 91-51. Resolution No. 89-157, as amended by Resolution No. 93-40, stipulates the following:

I. A minimum lot size of one-half acre (average gross) per dwelling unit is required for new developments in the Region using on-site septic tank-subsurface leaching/percolation systems.

   A. The term "one-half acre" specified as the minimum lot size requirement means an average gross area of land of one-half acre per dwelling unit. Easements (including streets, curbs, commons, and greenbelts), or those portions thereof which are part of the property proposed for development shall be included in the calculation of the average gross area of land.

   B. A "new" development is defined as a proposed tract, parcel, industrial or commercial development for which:

      1. One or more of the following has not been granted on or prior to September 7, 1989:

         a. Conditional approval or approval of a tentative parcel or tract map by the local agency such as the county/city Planning Commission, City Council or the Board of Supervisors.

         b. A conditional use permit.

         c. Conditional approval or approval by the San Bernardino County Department of Environmental Health Services, Riverside County Department of Health, Orange County Health Care Agency or other local agency; or

      2. One or more of the conditional approvals or approvals listed under B.1., above, were granted on or prior to September 7, 1989 but had expired prior to September 7, 1989.

   C. The minimum lot size requirement does not apply to existing developments where septic tank-subsurface disposal systems have been installed on or prior to September 7, 1989. Replacement of the existing septic tank-subsurface disposal systems shall be exempt from the minimum lot size requirements under the following conditions.

1. For Residential. Commercial and Industrial Developments
   Replacement of the existing septic tank-subsurface disposal systems is necessary to bring the system up to code as required by the local health care agencies and/or the building and safety departments.

2. For Single Family Residential Only
   Replacement of the existing septic tank-subsurface disposal systems is proposed to allow additional flows resulting from additions to the existing dwelling unit. (This does not include any free-standing additional structures.)
   (Note: Board staff does not consider the number of bedrooms and/or bathrooms for existing or proposed single-family dwelling units in determining compliance with the exemption criteria.)
   a. An existing development on land zoned single-family residential will be considered as a new development if the addition of any free-standing structures which will result in additional wastewater flows to the septic system is proposed. Commercial and/or industrial developments will be considered as new development if any additions to the existing structures are proposed which will result in additional wastewater flows to the septic system.
   b. For single-family residential developments, if the existing septic system could accommodate additional wastewater flows, then additional installations (rooms/ bathroom) to these developments shall be exempt from the minimum lot size requirements.

D. Those tracts, parcels, industrial or commercial developments which have received one or more of the approvals listed in B.1 ., above, on or prior to September 7, 1989 are exempt from minimum lot size requirements for use of septic tank-subsurface disposal systems. However, those tracts, parcels, industrial or commercial developments which had received one or more of the approvals listed in B.1., above, but for which the approval had expired prior to September 7, 1989 are considered as new development and are subject to the minimum lot size requirements.

E. Industrial/commercial developments are developments other than single-family residential developments. For new industrial/commercial developments utilizing septic tank-subsurface disposal systems, the wastewater flow for each one-half acre gross area of land may not exceed that from a three-bedroom, two-bathroom single-family dwelling unit. For determining compliance with this criterion, a flow rate of 300 gallons per day shall be considered as the flow equivalent to that from a 3-bedroom, 2-bathroom single family dwelling. For industrial/commercial developments with lots smaller than one-half acre, this flow rate requirement shall be prorated. (For example, an industrial/commercial development on a one-quarter (1/4) acre parcel will be in compliance with this requirement if the wastewater flow does not exceed 150 gallons per day.)

F. This minimum lot size requirement does not affect the lot size criterion for continuing exemptions in prohibition areas (1-acre minimum).

G. This minimum lot size requirement does not preclude the prescription of more stringent lot size requirements in specific areas if it is determined necessary to protect water quality.

H. No exemptions shall be granted for new developments on lots less than one-half acre which are 200 feet or less from a sewer which could serve that tract/parcel, barring legal impediments to such use.

All other developments shall be considered on a sliding scale, e.g., for each additional unit (any development which is more than a single family dwelling), this requirement should be increased by 100-feet per dwelling unit. For example, a 10-lot subdivision shall be required to connect to a sewer if the sewer is within 1,100 feet (200 + 9 x 100 feet = 1,100 feet) of the proposed development barring legal impediments to connection to the sewer. For this subsection, a commercial/industrial development which produces a wastewater flow of up to 300 gallons per day would be considered equivalent to a single family dwelling unit.

I. New lots of less than one-half acre may be formed by combining two or more lots which have received one of the approvals specified in Section B.1., above, on or prior to September 7, 1989. Individually, these existing lots would be eligible for an exemption from the minimum lot size requirement. Developments on the combined lots may also be granted an exemption provided that the total number of units proposed for the new parcel is equal to or less than the total number of units proposed for the existing parcel. For the purposes of this subsection, a combined lot of less than one-half acre formed from two or more existing lots shall not be considered a new development.

J. Exemptions from the minimum lot size requirements for the use of septic tank-subsurface disposal systems on lots smaller than one-half acre may be granted if the following conditions are met:

1. The project proponent implements an acceptable offset program. Under an offset program, the project proponent can proceed with development using septic systems on lots smaller than one-half acre if the proponent connects an equivalent number of septic systems to the sewer. The unsewered developments must be those which would not otherwise be required to connect to the sewer.

2. If the septic systems (developments) proposed are not identical to the ones connected to the sewer (the offset), an engineering report shall be submitted certifying that the nitrogen loading rate from the proposed development(s) is(are) equivalent to or less than the nitrogen loading rate from the septic systems in the offset program.

3. The proposed use of septic tank-subsurface disposal systems complies with the Regional Board's "Guidelines for Sewage Disposal from Land Developments."

K. The project proponent may propose an alternative treatment system for sewage disposal as the basis for an exemption from the minimum lot size requirement. Each request for use of an alternative treatment system shall be reviewed on a case-by-case basis and submitted to the Regional Board for consideration.

Attachment B - Lahontan

Individual Wastewater Treatment Systems (Septic Systems)

The following principles and policies will be applied by the Regional Board in review of water quality factors relating to land developments and waste disposal from individual waste disposal systems:

1. The following criteria will be applied as the minimum to ensure continued adequate protection of water quality, protection of present and future beneficial uses, and prevention of pollution, contamination and nuisance conditions. The Regional Board will prohibit the discharge from individual disposal systems which do not conform to these criteria.

2. These criteria prescribe minimum conditions for waste disposal from individual on-site systems and do not preclude the establishment of more stringent criteria by local agencies or the Regional Board. The Regional Board does not intend to preempt the authority of local agencies and wilt support local agencies to the fullest extent possible, particularly in the implementation of more stringent regulations.

3. Detailed procedures to implement these criteria and to process exemptions to these criteria are included in "Regional Board Guidelines for Implementation of Criteria for Individual Waste Disposal Systems" (see Appendix C).

4. The criteria contained herein are applicable to the entire Lahontan Region and pertain to any and all proposed building that involves wastewater discharges to other than a community sewer system. The criteria apply to: (1) proposed building on lots within new subdivisions or parcels, and (2) proposed building on existing subdivided lots or parcels, and (3) proposed subdivisions. The criteria do not apply to: (1) existing individual waste disposal systems, or (2) projects which have final building permits prior to June 16, 1988, unless evidence exists which necessitates retrofit of septic systems to conform with current criteria. The "Regional Board Guidelines for Implementation of Criteria for Individual Waste Disposal Systems" specifies separate exemption procedures for existing developments and for new developments. Existing development includes projects for which final development plans, such as a final tract map, were approved by local agencies prior to June 16, 1988. New development includes subdivisions or individual parcels which do not have final development plans approved by local agencies prior to June 16, 1988.

5. These criteria do not apply to projects within septic system prohibition areas where the criteria are more stringent (for prohibitions, see Section 4.1 of this Chapter); and these criteria will preempt less stringent criteria in septic system prohibition areas.

6. Where community sewer systems are available, the Board will encourage connection to the sewer system in lieu of use of individual disposal systems.

Criteria for Individual Waste Disposal Systems

1. *Maximum Density*

Individual waste disposal systems associated with new developments which have a gross density greater than two (2) single family equivalent dwelling units per acre will be required to have secondary level treatment of wastewater. Equivalent dwelling units (EDUs) are defined as a unit of measure used for sizing a development based on the amount of waste generated from that development; the value used in implementation of these criteria is 250 gallons per day per EDU. For the purposes of these criteria, the discharge from a single family dwelling is equal to one EDU. Senior citizen dwelling units and second units as defined in Government Code Sections 65852.1 and 65852.2 will not be considered as additional dwelling units. In addition to residential developments, this secondary level treatment policy also applies to wastewater discharges from commercial, industrial, recreational and all other developments with wastewater discharge volumes exceeding two EDU per acre density (500/gal/day/acre based on 250 gal/day/EDU). Use of new septic systems is permitted in existing developments with lot sizes having a net area greater than or equal to 15,000 square feet. The net area is that contained within the boundaries as set forth in the legal lot description.

2. *Minimum Distances*

The Regional Board has established the minimum distances (see Table 4.4-1 entitled, "Minimum Distances For Siting Individual Waste Disposal Systems") necessary to provide protection to water quality and/or public health. Local hydrogeological conditions may necessitate greater separation of the sewage disposal system from a well or watercourse for protection of beneficial uses (e.g., drinking supply and water contact recreation).

3. *Additional Minimum Criteria*

a. The percolation rate in the disposal area shall not be slower than 60 minutes per inch if the discharge is to a leachfield or 30 minutes per inch if discharge is to a seepage pit. If percolation rates are faster than 5 minutes per inch, then the soil for a total thickness of five feet below the bottom of the leaching trench shall contain at least 15% of material passing the No. 200 U.S. Standard Sieve and less than one-fourth of the representative soil cross-section shall be occupied by stones larger than 6 inches in diameter. Where the percolation rates are faster than 5 minutes per inch and the above requirement is not met, the minimum distance to ground water between the bottom of the disposal facilities and the anticipated high ground water shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate local public health agency.)

b. Clay, bedrock, other material impervious to the passage of water, or fractured bedrock, shall not be less than 5 feet below the bottom of the leaching trench or less than 10 feet below the bottom of the seepage pit. Impervious is defined for design purposes as a stratum with percolation times of greater than 120 minutes per inch.

c. Depth to anticipated high ground water below the bottom of the leaching trench shall not be less than 5 feet. Depth to anticipated high ground water below the bottom of the seepage pit shall not be less than 10 feet. Greater depths are required if native material does not provide adequate filtration.

d. Ground slope in the disposal area shall not be greater than 30 percent.

e. Minimum criteria specified above must be met within the area of the proposed system and within the 100% expansion area for the proposed system.

Exemptions to the Criteria for Individual Waste Disposal Systems

In certain locations and under special circumstances, the Board or its Executive Officer may waive individual criteria.

1. Waiver of one or more individual criteria may occur if:
    a. The area beneath the proposed septic system discharge has no significant amount of ground water having present or future beneficial uses; or
    b. It can be proven that no pollution, nuisance or unreasonable degradation of either surface or ground waters will occur as a result of the proposed septic system density when considered individually or cumulatively with other discharges in the area; or
    c. Construction of a community collection, treatment, and disposal system is imminent. Short-term, interim use of individual waste disposal systems may be allowed.

Implementation of Criteria for Individual Waste Disposal Systems

1. The Regional Board and the local agencies have adopted, through Memoranda of Understanding, criteria which are compatible with or more stringent than these criteria.
2. The Memoranda of Understanding include the procedures of the review and processing of applications for proposed discharge of wastewater from land developments which only discharge domestic waste, including single-family-unit residential, multi-unit residential, commercial, industrial and recreational developments. The Memoranda of Understanding include provisions for Regional Board review and processing of specific application (e.g., for industrial waste discharges).
3. For those local agencies which have adopted these or more stringent criteria, land developments which only discharge domestic waste, including single-family-unit residential, multi-unit residential, commercial, industrial and recreational developments, will be permitted entirely by the local agency. (However, the Regional Board reserves the authority to take action, if necessary, as described in item 6 below.)
4. Whenever the proposed development will not meet the minimum criteria and no Memorandum of Understanding or other equivalent document exists between the Regional Board and the local agency, applications for all projects shall be transmitted to the Regional Board along with a complete report of waste discharge and a filing fee.
5. The Regional Board will review, on a project-by-project basis, proposals for commercial, industrial, recreational and all other types of developments which discharge industrial waste. If required, the report of waste discharge will contain information on estimated wastewater flows, types of wastes, and occupancy rates which will enable the Regional Board to evaluate the discharge in terms of EDUs.
6. In any case, the Regional Board will prohibit the discharge of wastes from land developments which will result in violation of water quality objectives, will impair present or future beneficial uses of water, or will cause pollution, nuisance, or contamination, or will unreasonably degrade quality of any waters of the State.

Implementation for Other Types of Waste Disposal from Land Developments

1. Severe impact on water quality can result from failure to implement adequate measures to control storm drainage and erosion. Land developers must provide plans for the control of such runoff from initial construction up to the complete build-out of the development. (See "Land Development" section.)
2. The disposal of solid waste can have adverse impacts on water quality and public health. Land developers must submit a plan which conforms to the regional or county master plan and contains adequate provisions for solid waste disposal for complete build-out of the development.

3. The disposal of septic tank sludge is an important part of any area-wide master plan for waste disposal. Land developers must submit a plan which conforms to the regional or county master plan and contains adequate provisions for septic tank sludge disposal for complete build-out of the development.

4. The responsibility for the timely submittal of information necessary for the Board to determine compliance with these guidelines rests with persons submitting proposals for development or discharge. The Porter-Cologne Water Quality Control Act provides that no person shall initiate discharges of waste prior to filing a report of waste discharge and prior to (1) issuance of waste discharge requirements, (2) the expiration of 120 days after submittal of an adequate report of waste discharge, or (3) the issuance of a waiver by the Regional Board.

Alternative Individual Waste Disposal Systems

In areas where conditions do not support the use of conventional individual subsurface waste disposal systems (e.g., septic systems), the use of engineered alternative systems can be considered. Alternative waste disposal systems include, but are not limited to, mound systems, evapotranspiration beds, sand filters (intermittent and/or recirculating), and lined evaporation ponds. The Regional Board supports the use of engineered alternative systems for waste disposal as a remedy for otherwise unsuitable existing lots. However, the Regional Board discourages the use of engineered alternative systems for new construction, lots, or subdivisions.

Several factors the Local Health Officer and/or the Regional Board staff will consider when evaluating a proposal for the use of an alternative system include, but are not limited to:

1. **size of parcel**
2. **density of surrounding development**
3. **depth to ground water and bedrock**
4. **depth of soils** suitable for waste disposal as classified under the USDA classification system
5. **climate**
6. **access**
   (a) for maintenance and pumping year-round
   (b) control to prevent public contact
7. **emergency contingency plans** (including plans for expansion, replacement or repair)
8. **operation and maintenance requirements**
9. **distance to sewer**

Criteria for Alternative Systems

1. The conditions (soils, ground water, slope) which limit the use of conventional septic tank systems may also apply to alternative systems which rely on soil absorption for treatment and/or disposal of all or most of the wastewater generated (see Criteria for Individual Waste Disposal Systems).

2. **Mound Systems**. Mound systems shall be installed in accordance with criteria established in the State Board's Guidelines for Mound Systems (1980) or other criteria acceptable to the Executive Officer in conformance with standard engineering practices.

3. **Evapotranspiration Systems**. Evapotranspiration systems shall be installed in accordance with criteria contained in the State Board's Guidelines for Evapotranspiration Systems (1980) or other criteria acceptable to the Executive Officer in conformance with standard engineering practices.

4. **Sand Filters**. Sand filters shall be installed in accordance with the specifications for sand fitters in the State of Oregon, Department of Environmental Quality's On-site Sewage Disposal Rules (July 1, 1991) or other criteria acceptable to the Executive Officer in conformance with standard engineering practices.

5. **Grey Water Systems.** Under certain circumstances, grey water systems may be an acceptable method of disposal in conjunction with a composting toilet or holding tank to handle black water. Examples of appropriate applications include recreational areas such as campgrounds, day use facilities, and trailheads. Grey water systems shall be installed in accordance with the California Plumbing Code (24 Cal. Code of Regs., Part 5) and the local administrative authority. If properly constructed and operated, grey water systems are not expected to create a nuisance or pollution.
6. Other proposals for alternative systems shall be evaluated jointly by the local regulatory agency and Regional Board staff on a case-by-case basis. Some engineered systems may be considered experimental by the Regional Board. Experimental systems will be handled with caution. A trial period of at least one year should be established whereby proper system operation must be demonstrated. Under such an approach, experimental systems are granted a one-year conditional approval.
7. All proposals for alternative systems shall be designed by a Civil Engineer, Engineering Geologist or Sanitarian licensed to practice in California.

Maintenance Requirements

System designers should be responsible for developing specifications and procedures for proper system operation. Designers should provide to system owners an informational operation and maintenance document that includes: (1) clear and concise procedures for operation and maintenance, and (2) instructions for repair and/or replacement of critical items within forty-eight hours following failure. Engineered systems should be inspected by a licensed Civil Engineer, Engineering Geologist or Sanitarian during installation to insure conformance with approved plans.

Permitting Authority

The County Health Officer may approve alternative systems when **all** of the following conditions are met:

1. The Health Officer has found the system to be in compliance with criteria approved by the Regional Board Executive Officer (see Criteria for Individual Waste Disposal Systems and Criteria for Alternative Systems above); and
2. The Health Officer has either: (1) informed the Regional Board Executive Officer of the proposal to use the alternative system and the Executive Officer agrees that it complies with the finding in (a) above; or (2) a written agreement that the Executive Officer has delegated approval authority to the County Health Officer; ***and***
3. A public or private entity has agreed in writing to assume responsibility for the inspection, monitoring, maintenance, and eventual decommissioning/reclamation of the system.

If all of the above conditions cannot be met, the Regional Board will consider issuing waste discharge requirements for alternative systems.

6.4.2 Precipitation Data

NOAA Atlas 14, Volume 6, Version 2
Location name: Redlands, California, USA*
Latitude: 34.0652°, Longitude: -117.2274°
Elevation: 1158 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	**0.097** (0.081-0.118)	**0.126** (0.104-0.153)	**0.164** (0.136-0.200)	**0.195** (0.161-0.240)	**0.239** (0.190-0.304)	**0.273** (0.212-0.355)	**0.308** (0.233-0.410)	**0.344** (0.254-0.472)	**0.395** (0.279-0.565)	**0.434** (0.296-0.644)
10-min	**0.139** (0.116-0.169)	**0.180** (0.150-0.219)	**0.235** (0.195-0.286)	**0.280** (0.230-0.344)	**0.342** (0.272-0.435)	**0.391** (0.304-0.508)	**0.441** (0.335-0.588)	**0.494** (0.364-0.677)	**0.566** (0.399-0.810)	**0.623** (0.424-0.923)
15-min	**0.168** (0.140-0.204)	**0.218** (0.181-0.265)	**0.284** (0.235-0.346)	**0.339** (0.278-0.416)	**0.414** (0.329-0.527)	**0.473** (0.368-0.615)	**0.534** (0.405-0.711)	**0.597** (0.440-0.819)	**0.684** (0.483-0.979)	**0.753** (0.513-1.12)
30-min	**0.249** (0.207-0.302)	**0.322** (0.268-0.392)	**0.420** (0.348-0.512)	**0.501** (0.412-0.616)	**0.613** (0.487-0.779)	**0.700** (0.544-0.909)	**0.790** (0.599-1.05)	**0.883** (0.651-1.21)	**1.01** (0.715-1.45)	**1.11** (0.759-1.65)
60-min	**0.364** (0.303-0.442)	**0.472** (0.393-0.574)	**0.616** (0.511-0.750)	**0.734** (0.604-0.902)	**0.898** (0.713-1.14)	**1.03** (0.797-1.33)	**1.16** (0.877-1.54)	**1.30** (0.954-1.78)	**1.48** (1.05-2.12)	**1.63** (1.11-2.42)
2-hr	**0.523** (0.435-0.634)	**0.669** (0.556-0.813)	**0.863** (0.716-1.05)	**1.02** (0.841-1.26)	**1.24** (0.986-1.58)	**1.41** (1.10-1.83)	**1.59** (1.20-2.11)	**1.77** (1.30-2.42)	**2.01** (1.42-2.88)	**2.21** (1.50-3.27)
3-hr	**0.644** (0.536-0.781)	**0.821** (0.683-0.997)	**1.06** (0.874-1.28)	**1.25** (1.02-1.53)	**1.51** (1.20-1.92)	**1.71** (1.33-2.22)	**1.92** (1.46-2.56)	**2.14** (1.57-2.93)	**2.43** (1.72-3.48)	**2.66** (1.81-3.94)
6-hr	**0.902** (0.751-1.09)	**1.15** (0.953-1.39)	**1.47** (1.22-1.79)	**1.73** (1.42-2.13)	**2.09** (1.66-2.66)	**2.37** (1.84-3.08)	**2.65** (2.01-3.53)	**2.94** (2.17-4.03)	**3.34** (2.36-4.78)	**3.65** (2.48-5.40)
12-hr	**1.19** (0.994-1.45)	**1.52** (1.27-1.85)	**1.96** (1.62-2.38)	**2.31** (1.90-2.84)	**2.79** (2.22-3.54)	**3.16** (2.45-4.10)	**3.53** (2.68-4.70)	**3.91** (2.88-5.36)	**4.43** (3.13-6.34)	**4.83** (3.29-7.16)
24-hr	**1.59** (1.41-1.83)	**2.05** (1.82-2.37)	**2.65** (2.34-3.07)	**3.14** (2.75-3.66)	**3.80** (3.22-4.58)	**4.31** (3.57-5.30)	**4.82** (3.90-6.07)	**5.34** (4.21-6.92)	**6.05** (4.58-8.16)	**6.60** (4.83-9.20)
2-day	**1.95** (1.73-2.25)	**2.55** (2.26-2.95)	**3.35** (2.95-3.87)	**4.00** (3.50-4.66)	**4.88** (4.13-5.88)	**5.56** (4.61-6.83)	**6.25** (5.06-7.87)	**6.96** (5.49-9.01)	**7.93** (6.00-10.7)	**8.68** (6.35-12.1)
3-day	**2.10** (1.86-2.42)	**2.79** (2.47-3.22)	**3.70** (3.26-4.28)	**4.45** (3.90-5.19)	**5.49** (4.65-6.61)	**6.29** (5.22-7.74)	**7.11** (5.76-8.96)	**7.97** (6.28-10.3)	**9.14** (6.92-12.3)	**10.1** (7.36-14.0)
4-day	**2.24** (1.98-2.58)	**3.01** (2.66-3.47)	**4.02** (3.55-4.66)	**4.87** (4.26-5.68)	**6.03** (5.11-7.27)	**6.94** (5.76-8.54)	**7.88** (6.38-9.92)	**8.86** (6.98-11.5)	**10.2** (7.72-13.8)	**11.3** (8.25-15.7)
7-day	**2.59** (2.29-2.99)	**3.52** (3.11-4.06)	**4.76** (4.20-5.51)	**5.79** (5.07-6.76)	**7.22** (6.12-8.70)	**8.34** (6.92-10.3)	**9.50** (7.70-12.0)	**10.7** (8.44-13.9)	**12.4** (9.37-16.7)	**13.7** (10.0-19.1)
10-day	**2.81** (2.49-3.24)	**3.85** (3.41-4.45)	**5.25** (4.63-6.07)	**6.41** (5.60-7.47)	**8.02** (6.79-9.66)	**9.28** (7.70-11.4)	**10.6** (8.58-13.3)	**12.0** (9.43-15.5)	**13.9** (10.5-18.7)	**15.4** (11.3-21.4)
20-day	**3.46** (3.06-3.99)	**4.79** (4.24-5.53)	**6.59** (5.81-7.62)	**8.09** (7.08-9.44)	**10.2** (8.63-12.3)	**11.8** (9.83-14.6)	**13.6** (11.0-17.1)	**15.4** (12.1-19.9)	**17.9** (13.6-24.2)	**19.9** (14.6-27.8)
30-day	**4.08** (3.62-4.71)	**5.66** (5.01-6.53)	**7.79** (6.87-9.02)	**9.58** (8.39-11.2)	**12.1** (10.2-14.6)	**14.1** (11.7-17.3)	**16.2** (13.1-20.4)	**18.4** (14.5-23.8)	**21.5** (16.2-28.9)	**23.9** (17.5-33.4)
45-day	**4.91** (4.35-5.66)	**6.76** (5.98-7.80)	**9.28** (8.19-10.7)	**11.4** (9.98-13.3)	**14.4** (12.2-17.3)	**16.8** (13.9-20.6)	**19.3** (15.6-24.3)	**21.9** (17.3-28.4)	**25.7** (19.4-34.6)	**28.7** (21.0-40.0)
60-day	**5.77** (5.11-6.65)	**7.87** (6.96-9.08)	**10.7** (9.46-12.4)	**13.1** (11.5-15.3)	**16.6** (14.0-20.0)	**19.3** (16.0-23.7)	**22.2** (18.0-27.9)	**25.2** (19.9-32.7)	**29.5** (22.3-39.8)	**33.0** (24.1-46.0)

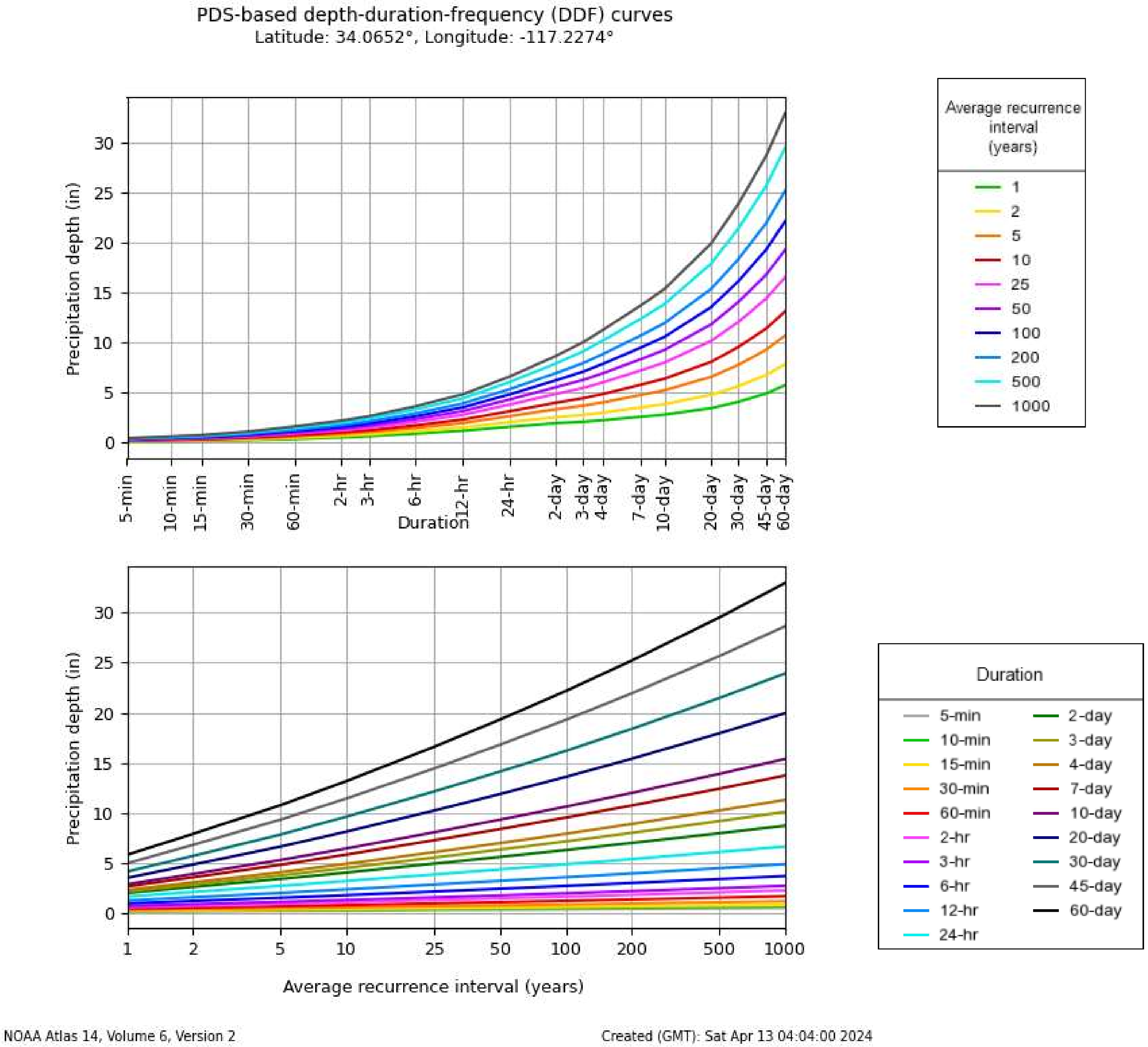
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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



Back to Top

Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

Large scale aerial

[Back to Top](#)

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

Disclaimer

6.4.6 Educational Materials

1. SD-10 (Site Design & Landscape Planning)
2. SD-12 (Efficient Irrigation)
3. SD-13 (Storm Drain Signage)
4. SD-32 (Trash Storage Areas)
5. SD-33 (Vehicle Washing Areas)
6. TC-11 (Infiltration Basin)
7. SC-60 (Housekeeping Practices)
8. SC-70 (Road & Street Maintenance)
9. SC-73 (Landscape Maintenance)
10. SC-74 (Storm Drain System Maintenance)

San Bernardino Flood Control NDPES Educational Handouts

Site Design & Landscape Planning SD-10

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

CASQA
California Stormwater Quality Association

Designing New Installations

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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.

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

CASQA
California
Stormwater
Quality
Association

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Design Objectives

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

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.

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.

- 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.

Vehicle Washing Areas SD-33

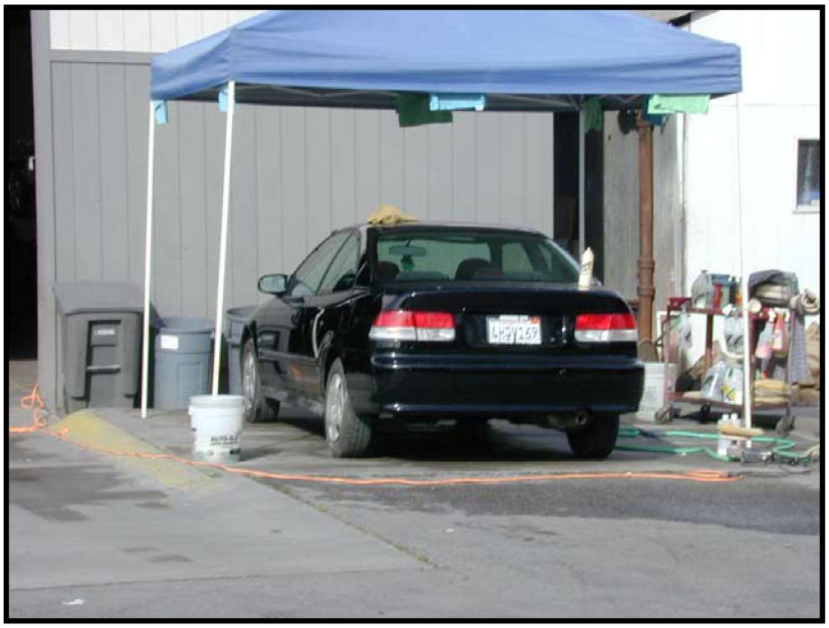


Photo Credit: Geoff Brosseau

Design Objectives

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

Description

Vehicle washing, equipment washing, and steam cleaning may contribute high concentrations of metals, oil and grease, solvents, phosphates, and suspended solids to wash waters that drain to stormwater conveyance systems.

Approach

Project plans should include appropriately designed area(s) for washing-steam cleaning of vehicles and equipment. Depending on the size and other parameters of the wastewater facility, wash water may be conveyed to a sewer, an infiltration system, recycling system or other alternative. Pretreatment may be required for conveyance to a sanitary sewer.

Suitable Applications

Appropriate applications include commercial developments, restaurants, retail gasoline outlets, automotive repair shops and others.

Design Considerations

Design requirements for vehicle maintenance are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. Design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Areas for washing/steam cleaning should incorporate one of the following features:

- Be self-contained and/or covered with a roof or overhang
- Be equipped with a clarifier or other pretreatment facility
- Have a proper connection to a sanitary sewer

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Include other features which are comparable and equally effective

CAR WASH AREAS - Some jurisdictions' stormwater management plans include vehicle-cleaning area source control design requirements for community car wash racks in complexes with a large number of dwelling units. In these cases, wash water from the areas may be directed to the sanitary sewer, to an engineered infiltration system, or to an equally effective alternative. Pre-treatment may also be required.

Depending on the jurisdiction, developers may be directed to divert surface water runoff away from the exposed area around the wash pad (parking lot, storage areas), and wash pad itself to alternatives other than the sanitary sewer. Roofing may be required for exposed wash pads.

It is generally advisable to cover areas used for regular washing of vehicles, trucks, or equipment, surround them with a perimeter berm, and clearly mark them as a designated washing area. Sumps or drain lines can be installed to collect wash water, which may be treated for reuse or recycling, or for discharge to the sanitary sewer. Jurisdictions may require some form of pretreatment, such as a trap, for these areas.

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.

Additional Information

Maintenance Considerations

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Infiltration Basin TC-11

General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually infiltrates into the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

Inspection/Maintenance Considerations

Infiltration basins perform better in well-drained permeable soils. Infiltration basins in areas of low permeability can clog within a couple years, and require more frequent inspections and maintenance. The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system.

Scarification or other disturbance should only be performed when there are actual signs of clogging or significant loss of infiltrative capacity, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor. This BMP may require groundwater monitoring. Basins cannot be put into operation until the upstream tributary area is stabilized.

Maintenance Concerns, Objectives, and Goals

- Vector Control
- Clogged soil or outlet structures
- Vegetation/Landscape Maintenance
- Groundwater contamination
- Accumulation of metals
- Aesthetics

Targeted Constituents

✓	Sediment	■
✓	Nutrients	■
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■
✓	Oxygen Demanding	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

CASQA California Stormwater Quality Association

Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Inspection Activities	**Suggested Frequency**
■ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained. ■ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary.	Post construction
■ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition	Semi-annual and after extreme events
Maintenance Activities	**Suggested Frequency**
■ Factors responsible for clogging should be repaired immediately. ■ Weed once monthly during the first two growing seasons.	Post construction
■ Stabilize eroded banks. ■ Repair undercut and eroded areas at inflow and outflow structures. ■ Maintain access to the basin for regular maintenance activities. ■ Mow as appropriate for vegetative cover species. ■ Monitor health of vegetation and replace as necessary. ■ Control mosquitoes as necessary. ■ Remove litter and debris from infiltration basin area as required.	Standard maintenance (as needed)
■ Mow and remove grass clippings, litter, and debris. ■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. ■ Replant eroded or barren spots to prevent erosion and accumulation of sediment.	Semi-annual
■ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment. ■ Seed or sod to restore ground cover. ■ Disc or otherwise aerate bottom. ■ Dethatch basin bottom.	3-5 year maintenance

Additional Information

In most cases, sediment from an infiltration basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children. Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

Light equipment, which will not compact the underlying soil, should be used to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This also prevents smearing of the basin floor.

References

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: ftp://dnr metrokc.gov/wlr/dss/spcm/SPCM.HTM

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

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

Housekeeping Practices SC-60

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Objectives

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

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
http://www.nalms.org/bclss/bmphome.html#bmp

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Road and Street Maintenance SC-70

Objectives

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

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

Approach

Pollution Prevention

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

Suggested Protocols

Street Sweeping and Cleaning

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
  - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
  - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
  - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
  - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
  - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
  - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

Street Repair and Maintenance

Pavement marking

- Schedule pavement marking activities for dry weather.

- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Provide drop cloths and drip pans in paint mixing areas.
- Properly maintain application equipment.
- Street sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- Paints containing lead or tributyltin are considered a hazardous waste and must be disposed of properly.
- Use water based paints whenever possible. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

Concrete installation and repair

- Schedule asphalt and concrete activities for dry weather.
- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small onsite vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Patching, resurfacing, and surface sealing

- Schedule patching, resurfacing and surface sealing for dry weather.

- Stockpile materials away from streets, gutter areas, storm drain inlets or watercourses. During wet weather, cover stockpiles with plastic tarps or berm around them if necessary to prevent transport of materials in runoff.

- Pre-heat, transfer or load hot bituminous material away from drainage systems or watercourses.

- Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered maintenance holes and storm drain inlets when the job is complete.

- Prevent excess material from exposed aggregate concrete or similar treatments from entering streets or storm drain inlets. Designate an area for clean up and proper disposal of excess materials.

- Use only as much water as necessary for dust control, to avoid runoff.

- Sweep, never hose down streets to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains.

- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Equipment cleaning maintenance and storage

- Inspect equipment daily and repair any leaks. Place drip pans or absorbent materials under heavy equipment when not in use.

- Perform major equipment repairs at the corporation yard, when practical.

- If refueling or repairing vehicles and equipment must be done onsite, use a location away from storm drain inlets and watercourses.

- Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mud jacking equipment at the end of each day. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

Bridge and Structure Maintenance

Paint and Paint Removal

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.

- Do not transfer or load paint near storm drain inlets or watercourses.

- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.

- Plug nearby storm drain inlets prior to starting painting where there is significant risk of a spill reaching storm drains. Remove plugs when job is completed.

- If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.

- Perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters if the bridge crosses a watercourse. If sanding, use a sander with a vacuum filter bag.

- Capture all clean-up water, and dispose of properly.

- Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of unused paint at an appropriate household hazardous waste facility.

Graffiti Removal

- Schedule graffiti removal activities for dry weather.

- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.

- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.

- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles, and debris out of storm drains.

- If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.

- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

Repair Work

- Prevent concrete, steel, wood, metal parts, tools, or other work materials from entering storm drains or watercourses.

- Thoroughly clean up the job site when the repair work is completed.

- When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in SC-71 Plaza & Sidewalk Cleaning fact sheet.

- If painting is conducted, follow the painting and paint removal procedures above.
- If graffiti removal is conducted, follow the graffiti removal procedures above.
- If construction takes place, see the Construction Activity BMP Handbook.
- Recycle materials whenever possible.

Unpaved Roads and Trails

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- For roadside areas with exposed soils, the most cost-effective choice is to vegetate the area, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets; a comma straw, or gravel as appropriate.
- If sediment is already eroded and mobilized in roadside areas, temporary controls should be installed. These may include: sediment control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

Non-Stormwater Discharges

Field crews should be aware of non-stormwater discharges as part of their ongoing street maintenance efforts.

- Refer to SC-10 Non-Stormwater Discharges
- Identify location, time and estimated quantity of discharges.
- Notify appropriate personnel.

Training

- Train employees regarding proper street sweeping operation and street repair and maintenance.
- Instruct employees and subcontractors to ensure that measures to reduce the stormwater impacts of roadway/bridge maintenance are being followed.
- Require engineering staff and/or consulting A/E firms to address stormwater quality in new bridge designs or existing bridge retrofits.
- Use a training log or similar method to document training.
- Train employees on proper spill containment and clean up, and in identifying non-stormwater discharges.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Densely populated areas or heavily used streets may require parking regulations to clear streets for cleaning.
- No currently available conventional sweeper is effective at removing oil and grease. Mechanical sweepers are not effective at removing finer sediments.
- Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters.

Requirements

Costs

- The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices.
- The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between $60,000 and $120,000. Newer technologies might have prices approaching $180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.
- A street sweeping program may require the following.
  - Sweeper operators, maintenance, supervisory, and administrative personnel are required.
  - Traffic control officers may be required to enforce parking restrictions.
  - Skillful design of cleaning routes is required for program to be productive.
  - Arrangements must be made for disposal of collected wastes.

- If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

Maintenance

- Not applicable

Supplemental Information

Further Detail of the BMP

Street sweeping

There are advantages and disadvantages to the two common types of sweepers. The best choice depends on your specific conditions. Many communities find it useful to have a compliment of both types in their fleet.

Mechanical Broom Sweepers - More effective at picking up large debris and cleaning wet streets. Less costly to purchase and operate. Create more airborne dust.

Vacuum Sweepers - More effective at removing fine particles and associated heavy metals. Ineffective at cleaning wet streets. Noisier than mechanical broom sweepers which may restrict areas or times of operation. May require an advance vehicle to remove large debris.

Street Flushers - Not affected by biggest interference to cleaning, parked cars. May remove finer sediments, moving them toward the gutter and stormwater inlets. For this reason, flushing fell out of favor and is now used primarily after sweeping. Flushing may be effective for combined sewer systems. Presently street flushing is not allowed under most NPDES permits.

Cross-Media Transfer of Pollutants

The California Air Resources Board (ARB) has established state ambient air quality standards including a standard for respirable particulate matter (less than or equal to 10 microns in diameter, symbolized as PM10). In the effort to sweep up finer sediments to remove attached heavy metals, municipalities should be aware that fine dust, that cannot be captured by the sweeping equipment and becomes airborne, could lead to issues of worker and public safety.

Bridges

Bridges that carry vehicular traffic generate some of the more direct discharges of runoff to surface waters. Bridge scupper drains cause a direct discharge of stormwater into receiving waters and have been shown to carry relatively high concentrations of pollutants. Bridge maintenance also generates wastes that may be either directly deposited to the water below or carried to the receiving water by stormwater. The following steps will help reduce the stormwater impacts of bridge maintenance:

- Site new bridges so that significant adverse impacts to wetlands, sensitive areas, critical habitat, and riparian vegetation are minimized.

- Design new bridges to avoid the use of scupper drains and route runoff to land for treatment control. Existing scupper drains should be cleaned on a regular basis to avoid sediment/debris accumulation.

- Reduce the discharge of pollutants to surface waters during maintenance by using suspended traps, vacuums, or booms in the water to capture paint, rust, and paint removing agents. Many of these wastes may be hazardous. Properly dispose of this waste by referring to CA21 (Hazardous Waste Management) in the Construction Handbook.

- Train employees and subcontractors to reduce the discharge of wastes during bridge maintenance.

De-icing

- Do not over-apply deicing salt and sand, and routinely calibrate spreaders.

- Near reservoirs, restrict the application of deicing salt and redirect any runoff away from reservoirs.

- Consider using alternative deicing agents (less toxic, biodegradable, etc.).

References and Resources

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

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

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Fresh Concrete and Mortar Application Best Management Practices for the Construction Industry. June.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Roadwork and Paving Best Management Practices for the Construction Industry. June.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Roadway and Bridge Maintenance. On-line http://www.epa.gov/npdes/menuofbmps/poll_13.htm

Landscape Maintenance SC-73

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.

- Choose low water using flowers, trees, shrubs, and groundcover.

- Consider alternative landscaping techniques such as naturescaping and xeriscaping.

- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.

- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.

- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.

- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.

- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:

  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.

  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.

  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.

  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.

  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).

  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.

  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.

- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a know in location

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.

- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.

- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Drainage System Maintenance SC-74

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
    - Is there evidence of spills such as paints, discoloring, etc.
    - Are there any odors associated with the drainage system
    - Record locations of apparent illegal discharges/illicit connections
    - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
    - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
    - Illegal dumping hot spots
    - Types and quantities (in some cases) of wastes
    - Patterns in time of occurrence (time of day/night, month, or year)
    - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
    - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.

- Only properly trained individuals are allowed to handle hazardous materials/wastes.

- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.

- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.

- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a known location.

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 1999. Stormwater O&M Fact Sheet Catch Basin Cleaning. EPA 832-F-99-011. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line: http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line: http://www.epa.gov/npdes/menuofbmps/poll_16.htm

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

Regulatory Information

The Federal Water Pollution Control Act prohibits the discharge of any pollutant to navigable waters from a point source unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. The 1987 passage of the Water Quality Act established NPDES permit requirements for discharges of storm water. The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Industrial facilities and construction sites are regulated by the Regional Water Quality Control Board and State Water Resources Control Board, through general storm water permits. Most industrial, manufacturing or transportation businesses that store materials, products or equipment outdoors, or conduct vehicle washing or process operations outdoors are required to obtain coverage under the State Water Resources Control Board's General Industrial Activities Stormwater Permit. For more information about this permit, visit *http://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/industrial.shtml* or contact your local storm water coordinator.

If your business conducts construction activities, including clearing, grading, stockpiling or excavation that results in soil disturbances of at least one acre, you are subject to the State Water Resources Control Board's General Construction Activities Stormwater Permit. To find out more about this storm water permit for construction, visit
https://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/construction_new.shtml.
Cities and counties are regulated through permits issued by the Regional Boards. Since 1990 operators of large storm drain systems such as San Bernardino County's have been required to:

- Develop a storm water management program designed to prevent harmful pollutants from being dumped or washed by storm water runoff, into the storm water system, then discharged into local water bodies; and
- Obtain a National Pollutant Discharge Elimination System (NPDES) permit.

The NPDES permit programs in California are administered by the State Water Resources Control Board and by nine regional boards that issue NPDES permits and enforce regulations within their respective region.

San Bernardino County lies within the jurisdiction of the Santa Ana Region. This regional board issues a permit to the San Bernardino County Permittees, which includes the County of San Bernardino, San Bernardino County Flood Control District and incorporated cities of San Bernardino County. Since the program's inception, the County of San Bernardino has served as the principal permittee.

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER
MEETS COMMUNITY

Documents & Reports:

The following documents describe the regulations and programs for water quality in San Bernardino County. You can review the latest Basin Plan. National Pollutant Discharge Elimination System (NPDES) Permit and Drainage Area Management Plan (DAMP).

- **Basin Plans:** The document for each region of the State Water Quality Board's jurisdiction, including Santa Ana, is the Water Quality Control Plan, commonly referred to as the Basin Plan. It is the foundation for the regulatory programs of each regional board. The Basin Plan documents the beneficial uses of the region's ground and surface waters, existing water quality conditions, problems, and goals, and actions by the regional board and others that are necessary to achieve and maintain water quality standards.

Water Control Plan for the Santa Ana River Basin

- **Municipal National Pollutant Discharge Elimination System (NPDES) Permits:** The permits of each region outline additional steps for a storm water management program and specify requirements to help protect the beneficial uses of the receiving waters. They require permittees to develop and implement Best Management Practices (BMPs) to control/reduce the discharge of pollutants to waters of the United States to the maximum extent practicable (MEP).

Santa Ana Regional Water Quality Control Board Municipal NPDES Permit Order No. R8-2002-0Q12

- **Report of Waste Discharge:** The Report of Waste Discharge (ROWD) describes the San Bernardino Stormwater Program, implemented by the County and cities to comply with their jointly held stormwater permit. It is the principle policy and guidance document for the NPDES Stormwater Program.

Report of Waste Discharge 2000

- **San Bernardino County Storm Water Program Annual Status Report:** The Annual Status Report is a requirement of the NPDES permit for submittal to the Regional Boards and United States Environmental Protection Agency. The report presents an analysis and assessment of permit compliance activities.

Annual Report - will be posted soon

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

STORMWATER POLLUTION PREVENTION

Best Management Practices for San Bernardino County
Homeowner's Associations, Property Managers
and Property Owners

Your Guide To Maintaining Water Friendly Standards In Your Community

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

TABLE OF CONTENTS

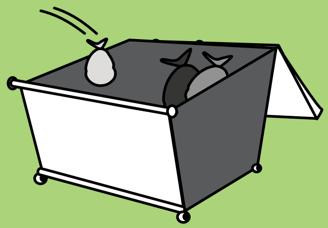
GENERAL HOA

COMMERCIAL
TRASH ENCLOSURES
REQUIREMENTS

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

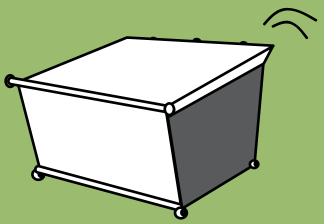
FOLLOW THESE REQUIREMENTS TO KEEP OUR WATERWAYS CLEAN

PUT TRASH INSIDE



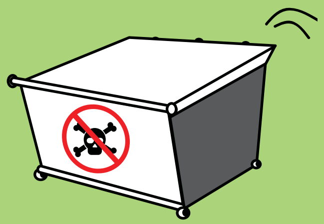
Place trash inside the bin (preferably in sealed bags).

CLOSE THE LID



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

KEEP TOXICS OUT



NO:

- **Paint**
- **Grease**
- **Fats**
- **Used Oils**
- **Batteries**
- **Electronics**
- **Fluorescent Lights**

These items should be disposed of at a local hazardous waste collection center

SWEEP FREQUENTLY

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

FIX LEAKS

Address trash bin leaks immediately by using dry clean-up methods and reporting to your waste hauler to receive a replacement.

CONSTRUCT ROOF

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

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

SIDEWALK + PARKING LOT CLEANING

Littering and vehicle use can leave behind pollutants on sidewalks, plazas, and other pedestrian traffic areas. Properly inspecting, cleaning, and repairing pedestrian areas and HOA-owned surfaces and structures can reduce pollutant runoff from these areas.

Maintain these areas by following the best management practices listed below.

LITTER CONTROL

- Enforce anti-litter laws.
- Place trash cans in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Ensure trash cans remain covered at all times.
- Clean out trash cans frequently to prevent leaking/spillage or overflow.

TIP: POST "NO LITTERING" SIGNS.

SIDEWALKS AND PLAZAS

- When cleaning sidewalks and plazas, use dry methods such as sweeping, vacuuming, and using backpack blowers whenever practical, rather than hosing, pressure washing, or steam cleaning.
- **DO NOT** sweep or blow material into the street or gutter.

PARKING AREAS, DRIVEWAYS, DRIVE-THRU

- Sweep or vacuum parking facilities on a regular basis.
- Sweep all parking lots at least once before the onset of the wet season.
- Use absorbents to pick up oil; then dry sweep.
- Appropriately dispose of spilled materials and absorbents.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, and proximity to water courses.

TIP: IF WATER MUST BE USED, BLOCK STORM DRAIN INLETS TO CONTAIN RUNOFF. WHEN DONE, DISCHARGE WASH WATER TO LANDSCAPING OR CONTAIN AND DISPOSE OF PROPERLY.

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

SURFACE CLEANING

Proper inspection, cleaning, and repair of pedestrian areas and HOA-owned surfaces and structures can reduce pollutant runoff from these areas. Discharges of wash water to the stormwater drainage system from cleaning or hosing of impervious surfaces is prohibited.

Maintain these areas by following the best management practices listed below.

WHEN CLEANING BUILDING SURFACES

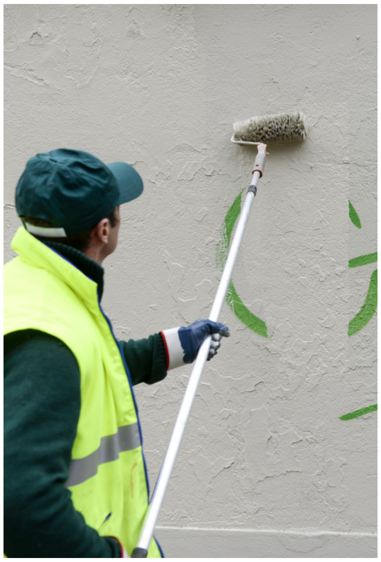
If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

BUILDING SURFACES, DECKS, ETC., WITHOUT LOOSE PAINT

- Use high-pressure water, no soap.

UNPAINTED BUILDING SURFACES, WOOD DECKS, ETC.

- If using a biodegradable or another cleaning agent to remove deposits, contain and dispose of them properly.



GRAFFITI REMOVAL

- Avoid graffiti abatement activities during rain events.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterward by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- Take care when disposing of water since it may need to be disposed of as hazardous waste.

TIP: CONSIDER USING A WATERLESS AND NON-TOXIC CHEMICAL CLEANING METHOD FOR GRAFFITI REMOVAL (E.G. GELS OR SPRAY COMPOUNDS).

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

CONCRETE + SIDEWALK REPAIR

Properly inspecting and repairing pedestrian areas and HOA-owned surfaces and structures can reduce pollutant runoff.

Maintain these areas by following the best management practices listed below.

CONCRETE INSTALLATION + REPAIR

- Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.
- Wash concrete trucks off-site or in designated areas on-site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other stormwater conveyance structures.
- Store dry and wet concrete materials under cover, protected from rainfall and runoff, and away from drainage areas. After the job is complete, remove temporary stockpiles such as asphalt materials and sand as soon as possible.
- Return leftover materials to the transit mixer. Dispose of small amounts of excess concrete, grout, and mortar in the trash.
- When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal.
- **DO NOT** wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose of in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has hardened.

SIDEWALK REMOVAL + REPAIR

- Schedule surface removal activities for dry weather.
- Avoid creating excess dust when breaking asphalt or concrete.

PROTECT NEARBY STORM DRAIN INLETS

- Prior to breaking up asphalt or concrete, take measures such as placing straw waddles or gravel bags around inlets. Clean afterward by sweeping up material.
- During the sawing operation, cover each storm drain inlet with filter fabric and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets.

CLEAN UP

- Designate an area for clean-up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible.
- When making saw cuts in the pavement, use as little water as possible. After the liquid drains, shovel or vacuum the slurry, remove it from the site, and dispose of it properly.
- Once dry sweeping is complete, the area may be hosed down if needed.
- Discharge wash water to landscaping, pump to the sanitary sewer if permitted to do so, or contain and dispose of properly.
- **ALWAYS** dry sweep first with a street sweeper or vacuum truck to clean up tracked dirt. **DO NOT** dump vacuumed liquid in storm drains.

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

When Working Outdoors Use the 3Cs

CUANDO TRABAJE AL AIRE LIBRE UTILICE LAS 3Cs

CONTROL • CONTROL

Locate the nearest storm drain and ensure nothing can enter or be discharged into it.

Ubique el desagüe de aguas pluviales más cercano y asegúrese de que nada pueda ingresar a éste ni descargarse en él.

CONTAIN • CONTENER

Isolate your area to prevent material from potentially flowing or being blown away.

Aísle su área para evitar que el material pueda discurrirse o ser llevado por el viento.

CAPTURE • CAPTURAR

Sweep up debris and place it in the trash. Clean up spills with an absorbent material (e.g. kitty litter) or vacuum with a Wet-Vac and dispose of properly.

Recoja los restos y colóquelos en la basura. Limpie los derrames con un material absorbente (como la arena para gatos) o aspírelos con una Wet-Vac (aspiradora de humedad) y deséchelos correctamente.

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

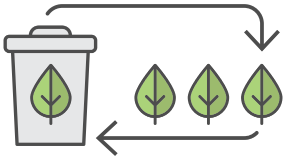
Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

DISCHARGE TO THE STORM DRAIN, ACCIDENTAL OR NOT, COULD LEAD TO ENFORCEMENT ACTIONS AND FINES

Sustainable Practices for Landscape Maintenance

Your contributions make a difference in the way you maintain your yard. Learn how to truly be a "green" thumb and prevent stormwater pollution.

Recycle Yard Waste



Yard waste, like grass and leaves, can block the storm drain or carry harmful chemicals into it.

- Recycle yard waste by placing them into your greenwaste container.
- Do not blow, sweep, rake, or hose yard waste into the street or catch basin.
- Try grasscycling by leaving clippings on the lawn when mowing.

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

Use Safe Products

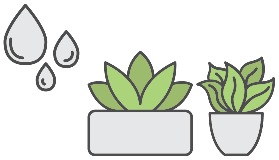
Fertilizers, herbicides, and pesticides are often carried into the storm drain by sprinkler runoff.

- Use natural and non-toxic alternatives as often as possible.
- Spot-apply, rather than blanketing entire areas.

Apply chemicals directly to the area that needs treatment.

- Read the product label and use only as directed.
- Never apply before a rain.

Use Water Wisely



Conserving water minimizes the amount of urban runoff going into the street.

- Control the amount of water and direction of sprinklers.

The average lawn only needs about an inch of water a week or 10 to 20 minutes of watering.

- Periodically inspect and fix sprinklers for leaks.

Realign sprinkler heads to make sure water is distributed onto the lawn and not onto the sidewalk.

- Plant native vegetation to reduce the need of water.

HOMEOWNERS

Keep these tips in mind when hiring professional landscapers and remind them as necessary.

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

For more information on proper disposal, call 1 (800) OILYCAT or visit tootoxictotrash.com.

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

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

POOL MAINTENANCE

When discharged to the street, gutters, or storm drains, pool chemicals and filter solids **DO NOT GET TREATED** before reaching the Santa Ana River.

FOLLOW THESE TIPS FOR PROPER DISPOSAL OF POOL WATER:

- **De-chlorinate** – Chlorine naturally dissipates over time and should be completely gone if the water is left standing for 3-5 days. Use a pool testing kit prior to discharge to ensure the concentration of chlorine is zero.
- **Check pH** – determine the pH of the pool water before discharging on your own or ask your pool maintenance company to check it for you. It should be between 6.5 and 8.5.
- **Free and clear** – Make certain the water is free of any discoloration, dirt or algae.
- **Use your grass** – When discharging to a grassy area, the flow should be controlled so it doesn't cause any erosion problems or enter a neighbor's property.
- **Avoid metal-based algaecides** (i.e. copper sulfate). If used, empty your pool or spa into the sewer.

Chlorine, acid cleaning chemicals and metal-based algaecides used in pools can kill beneficial organisms in the food chain and pollute our drinking water.

WHEN ACID CLEANING OR OTHER CHEMICAL CLEANING:

- Neutralize the pool water to pH of 6.5 to 8.5, then discharge to the sewer.

WHEN DRAINING YOUR POOL:

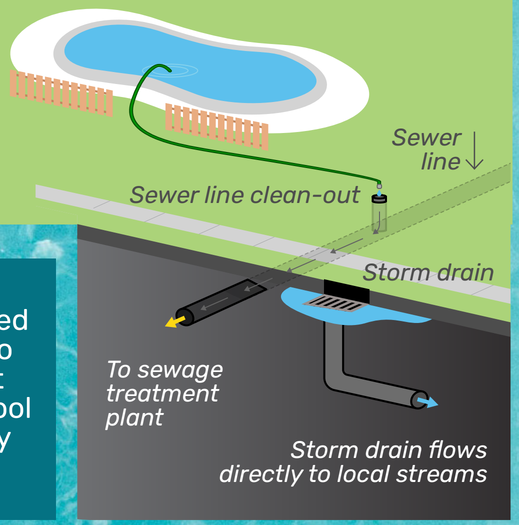
- Before draining your pool, contact your city for approval to drain your pool water into the sewer or storm drain.
- Saltwater pools must only be drained to the sewer or hauled away. Check with your pool maintenance company for draining requirements.

FOR SWIMMING POOL AND SPA FILTER BACKWASH:

- Dispose of solids into trash bag, then wash filter into a landscape area. Discharge water to the sewer, never to the storm drain.

! Many pools are plumbed to discharge directly to the sanitary sewer but call your plumber or pool maintenance company if you are unsure.

What's the difference between discharging to the sewer vs storm drain?



To report illegal dumping or toxic spills, call **(877) WASTE18** or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

HHW RESOURCES

Here are some resources with useful information for your HOA residents. You may add these free resources to your newsletters, websites, and any other communication channels you use.

DO YOU HAVE THE FOLLOWING ITEMS IN YOUR HOME?

Automotive Fluids	Household Cleaners
Batteries	Medicine
Cooking Oil	Motor Oil & Filters
Fertilizers & Pesticides	Paint Products
Fluorescent Bulbs	Pool Chemicals

PROTECT YOUR COMMUNITY!
Take your toxic products to a local waste collection center.

Find your closest location and a full list of items, visit **tootoxictotrash.com**

**No business waste accepted. Must be a San Bernardino County resident.*

SAN BERNARDINO COUNTY STORMWATER PROGRAM WHERE WATER MEETS COMMUNITY

HHW Materials Insert
Ideal for newsletters

DO YOU HAVE THE FOLLOWING ITEMS IN YOUR HOME?

Automotive FluidsHousehold Cleaners
BatteriesMedicine
Cooking OilMotor Oil & Filters
Fertilizers & PesticidesPaint Products
Fluorescent BulbsPool Chemicals

PROTECT YOUR COMMUNITY!
Take your toxic products to a local waste collection center:

Big Bear LakeRedlands
ChinoRialto
FontanaSan Bernardino
OntarioUpland
Rancho Cucamonga

**No business waste accepted. Must be a San Bernardino County resident.*

For locations and a full list of items, visit **tootoxictotrash.com**

WHERE WATER MEETS COMMUNITY

HHW Locations Insert
Ideal for newsletters

DO YOU WANT A TOTE BIN FOR TRANSPORTING YOUR TOXIC WASTE TO A COLLECTION CENTER?

You may be able to pick one up for **FREE** at your City!

Step 1: Visit **sbcountystormwater.org/request-a-bin** to see if your City is offering free bins

Step 2: Request a bin through the form

Step 3: A city representative will contact you to schedule your tote bin pickup

For a list of collection centers near you, visit **TooToxicToTrash.com**

Must be a San Bernardino County resident.

SAN BERNARDINO COUNTY STORMWATER PROGRAM WHERE WATER MEETS COMMUNITY

HHW Tote Bin Insert
Ideal for newsletters

BRING US YOUR TOXIC WASTE

Take toxic household products to your local household hazardous waste collection center.

IT'S EASY!

1 Make sure products are **properly sealed, labeled, and spill-proof.***

2 Take them to a **FREE** collection center in:

Big Bear Lake	Redlands
Chino	Rialto
Fontana	San Bernardino
Ontario	Upland
Rancho Cucamonga	

TOXIC HOUSEHOLD PRODUCTS INCLUDE:

Automotive Fluids	Household Cleaners
Batteries	Medicine
Cooking Oil	Motor Oil & Filters
Fertilizers & Pesticides	Paint Products
Fluorescent Bulbs	Pool Chemicals

WHY CAN'T I THROW THESE ITEMS IN THE TRASH?
It is illegal and poses health risks to humans, pets, the environment, and our waterways.

For more information, locations and a full list of items, visit
tootoxictotrash.com

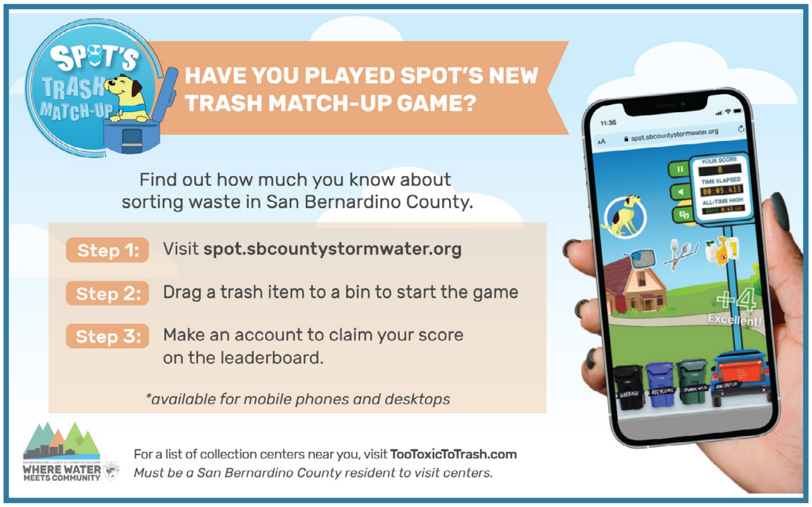
** You can bring 15 gallons or 125 pounds in containers no larger than 5 gallons per visit. No business waste accepted. Must be a San Bernardino County resident.*

SAN BERNARDINO COUNTY STORMWATER PROGRAM WHERE WATER MEETS COMMUNITY

HHW Flyer
Ideal for printing

PET WASTE DISPOSAL RESOURCES

Here are some resources with useful information for your HOA residents. You may add these free resources to your newsletters, websites, and any other communication channels you use.



HAVE YOU PLAYED SPOT'S NEW TRASH MATCH-UP GAME?

Find out how much you know about sorting waste in San Bernardino County.

Step 1: Visit **spot.sbcountystormwater.org**

Step 2: Drag a trash item to a bin to start the game

Step 3: Make an account to claim your score on the leaderboard.

**available for mobile phones and desktops*

For a list of collection centers near you, visit **TooToxicToTrash.com**
Must be a San Bernardino County resident to visit centers.

Spot's Trash Match-Up Game Insert
Ideal for newsletters

GET A **FREE** DOGGIE WASTE BAG FOR YOU AND YOUR FRIEND

Step 1 Visit **FreeDoggieBags.com**
Step 2 Request a **FREE** canister from us
Step 3 Send a **FREE** canister to a friend
Step 4 Use your canister to pick up after your dog anytime, anyplace!

Thanks for being a responsible pet owner and contributing to a beautiful San Bernardino County.

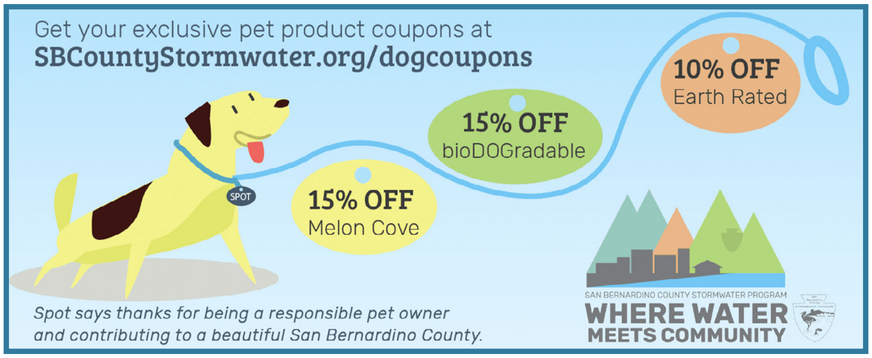
Dog Waste Insert
Ideal for newsletters

GET A **FREE** DOGGIE WASTE BAG FOR YOU AND YOUR FRIEND

Step 1 Visit **FreeDoggieBags.com**
Step 2 Request a **FREE** canister from us
Step 3 Send a **FREE** canister to a friend
Step 4 Use your canister to pick up after your dog anytime, anyplace!

Thanks for being a responsible pet owner and contributing to a beautiful San Bernardino County.

Dog Waste Insert
Ideal for newsletters



Get your exclusive pet product coupons at
SBCountyStormwater.org/dogcoupons

10% OFF Earth Rated

15% OFF bioDOGradable

15% OFF Melon Cove

Spot says thanks for being a responsible pet owner and contributing to a beautiful San Bernardino County.

Dog Waste Coupon Insert
Ideal for newsletters

RESIDENTS

WE DID IT OURSELVES **AND WE DID IT RIGHT**

WHEN PAINTING YOUR HOME, PROTECT YOUR FAMILY AND COMMUNITY.

PAINTS that are water-based are less toxic and should be used whenever possible.

BRUSHES with water-based paint should be washed in the sink. Those with oil-based paint should be cleaned with paint thinner.

SAFELY dispose of unwanted paint and paint thinner at a household hazardous waste collection center near you.

For a list of acceptable materials, location information, and hours of operation, visit TooToxicToTrash.com.

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

Vehicle Cleaning and Maintenance

Discharge into storm drain, accidental or not, can lead to enforcement actions which can include fines.

Follow these best practices to prevent polluted water and other materials from flowing into the street, gutter, and storm drain. Residents should first check HOA rules to see if vehicle maintenance is allowed on site.

Wash Water Disposal

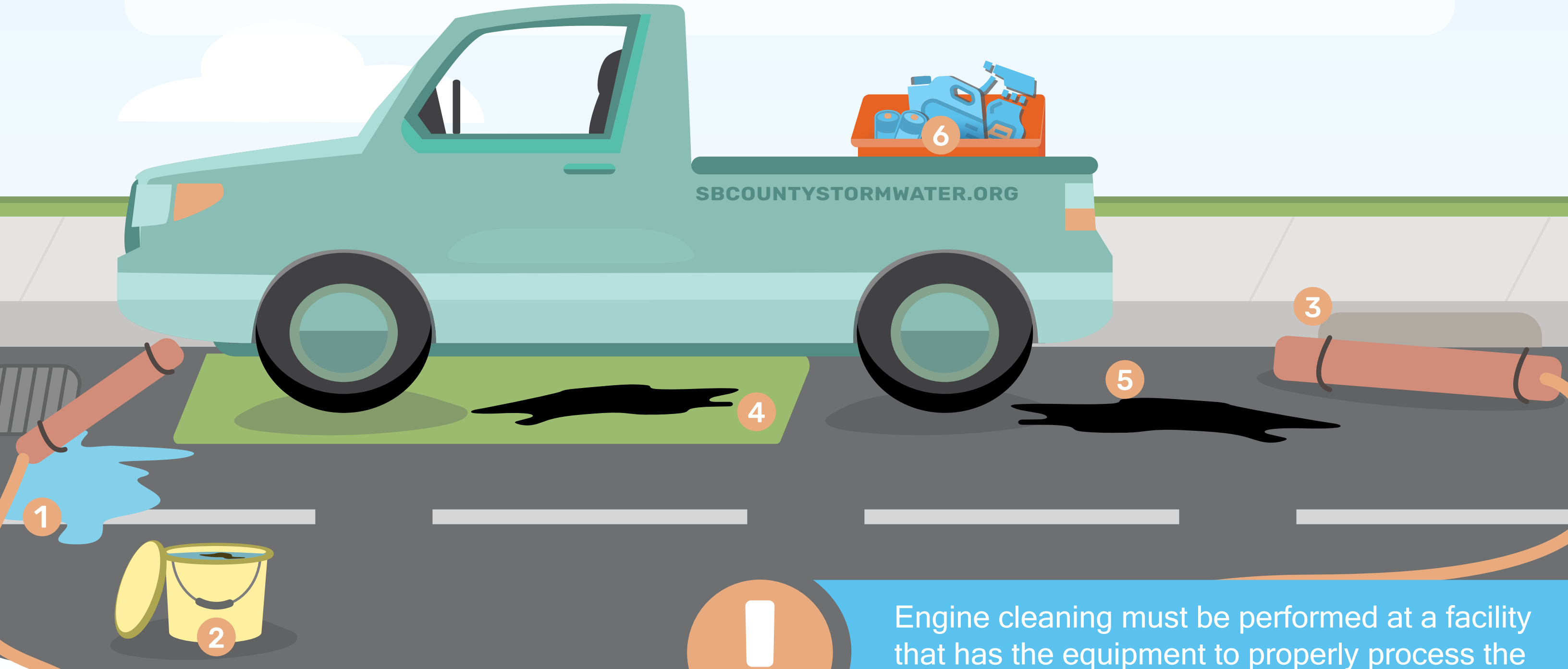
1. Wash in a contained area that has been bermed up to contain the wash water.
2. If washing items contaminated by hazardous materials, ensure the wash water is collected and hauled off-site for proper disposal.
3. Locate the nearest storm drain and place a barrier in front to ensure nothing can enter or be discharged into it.

Hazardous Waste Spill Clean-Up and Disposal

4. Use a tarp to catch drips and contain spills.
5. If a spill occurs, use absorbent material like kitty litter or absorbent pads to soak up the spill, then place in a bucket and properly dispose of at a local household hazardous waste facility.
6. Properly dispose of toxic materials at your local household hazardous waste facility.

Motor Oil
Oil Filters
Antifreeze

Batteries
Gasoline



Engine cleaning must be performed at a facility that has the equipment to properly process the contaminated wash water runoff.

To report illegal dumping, call **(877) WASTE18**
To report toxic spills, call **(800) 33 TOXIC**
To dispose of hazardous waste from a business, call San Bernardino County Fire at **(909) 386-8401**

sbcountystormwater.org

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

PICK UP AFTER YOUR PET

BAG IT AND TRASH IT!

Steps and Tips

Step 1: Keep a supply of bags tied to your dog leash.

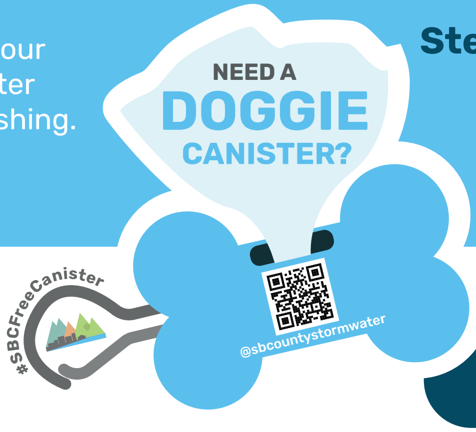
Step 2: Bag the poop and tie the bag.

Step 3: Dispose of the tied bag properly by throwing it into a trash can.

WHY SHOULD I PICK UP?

- Dog waste can infect children and adults with disease-causing bacteria and parasites.
- Your dog can get infected from the waste of other dogs.
- Dog waste can affect the quality of our rivers and oceans and make the water unsafe for swimming, drinking, or fishing.

NEED A **DOGGIE** CANISTER?



Scan code for a **FREE CANISTER**

freedoggiebags.com

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

GET IN TOUCH WITH US ONLINE!

Website
sbcountystormwater.org

Facebook
facebook.com/sbcountystormwater

Instagram
instagram.com/sbcountystormwater

Youtube
youtube.com/sbcountystormwater

Report Pollution Violations
sbcountystormwater.org/report

Email
info@sbcountystormwater.org

STORMWATER Pollution Prevention

Important Phone Numbers

San Bernardino County Flood Control
(909) 387-8112

County of San Bernardino
(909) 387-8109

City of Big Bear Lake
(909) 866-5831

City of Chino (909) 591-9850

City of Chino Hills (909) 364-2722

City of Colton (909) 370-6128

City of Fontana (909) 350-6772

City of Grand Terrace
(909) 824-6671 x 226

City of Highland (909) 864-8732 x 230

City of Loma Linda (909) 799-4405

City of Montclair (909) 625-9470

City of Ontario (909) 395-2025

City of Rancho Cucamonga
(909) 477-2740 x 4063

City of Redlands (909) 798-7655

City of Rialto (909) 421-4921

City of San Bernardino (909) 384-5154

City of Upland (909) 931-4370

City of Yucaipa (909) 797-2489 x 243

San Bernardino County
Stormwater Program
825 East Third Street • Room 201
San Bernardino, CA 94215-0835

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

INDUSTRIAL AND COMMERCIAL FACILITIES

San Bernardino County STORMWATER PROGRAM

STORMWATER

Pollution Prevention

Industrial and Commercial Facilities

To reduce the amount of pollutants reaching our storm drain system, which leads to the Santa Ana River and Pacific Ocean, the San Bernardino County Stormwater Program has developed Best Management Practices (BMPs) for Industrial and Commercial Facilities. City and County ordinances require that businesses comply with these BMPs, where applicable, to protect local water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

- Discontinue all non-stormwater discharges to the storm drain system. It is prohibited to discharge any chemicals, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, except when in direct use.
- Sweep outdoor areas instead of using a hose or pressure washer.

Outdoor Processes

- Move all process operations including vehicle and equipment maintenance inside of the building or into a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to city standards, then discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Ups

- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials and followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors, vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the County Fire Department at (909) 386-8401.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator either at (800) CLEANUP or as listed at www.sbcounty.gov/stormwater.
- Report hazardous materials spills to (800) 33 TOXIC and your local Fire Department Hazmat Team at 911.

Training

Train employees in spill response procedures and prohibited discharges to the storm drain system, as prescribed in your local Stormwater Ordinance and in applicable Best Management Practices available at www.cabmphandbooks.com and www. sbcounty.gov/stormwater.

Permitting

Stormwater discharges associated with specific categories of commercial and industrial facilities are regulated by the State Water Resources Control Board (SWRCB) through an Industrial Storm Water General Permit. A copy of the General Permit and application forms are available at:
www.waterboards.ca.gov/stormwtr/industrial.html

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

1 (800) CLEANUP

or visit our websites at:

www.sbcounty.gov/stormwater
www.1800cleanup.org

San Bernardino County
STORMWATER PROGRAM

San Bernardino County Stormwater Program
825 East Third Street · Room 127
San Bernardino, CA 94215-0835

STORMWATER
Pollution Prevention

LANDSCAPE MAINTENANCE

San Bernardino County STORMWATER PROGRAM

STORMWATER

Pollution Prevention

Stormwater Management Practices for Commercial Landscape Maintenance

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

Recycle Yard Waste

Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Try grasscycling - the natural recycling of grass by leaving clippings on the lawn when mowing. Grass clippings will quickly decompose, returning valuable nutrients to the soil. Further information can be obtained at www.ciwmb.ca.gov/Organics.

Use Fertilizers, Herbicides and Pesticides Safely

Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use of natural, non-toxic alternatives to the traditional fertilizers, herbicides and pesticides is highly recommended. If you must use chemical fertilizers, herbicides, or pesticides:

- Spot apply pesticides and herbicides, rather than blanketing entire areas.
- Avoid applying near curbs and driveways, and never apply before a rain.
- Apply fertilizers as needed, when plants can best use it, and when the potential for it being carried away by runoff is low.

Recycle Hazardous Waste

Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility, which accepts these types of materials. For information on proper disposal call, (909) 386-8401.

Use Water Wisely

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

Prevent Erosion

Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways.

- Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff.
- Avoid excavation or grading during wet weather.

Store Materials Safely

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

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

1 (800) CLEANUP

or visit our websites:

www.co.san-bernardino.ca.us/flood/npdes
www.1800cleanup.org

San Bernardino County
STORMWATER PROGRAM

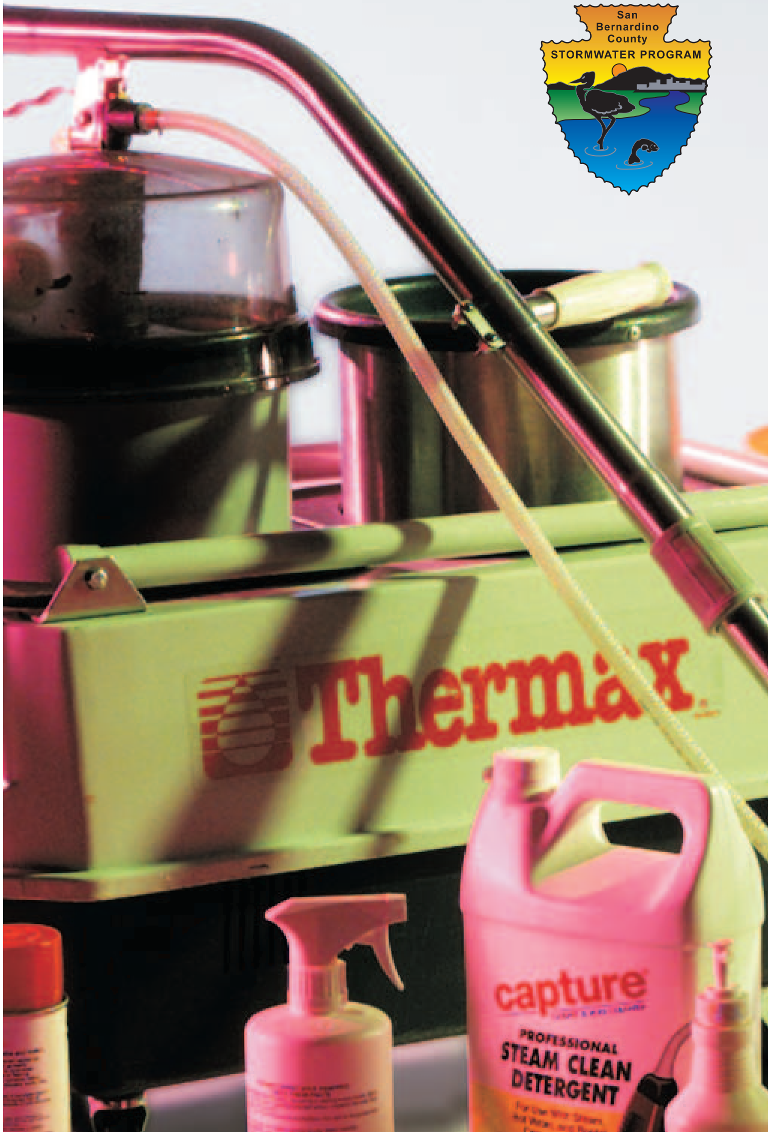
PRESORTED
STANDARD
U.S. POSTAGE
PAID
SACRAMENTO, CA
PERMIT# 000

San Bernardino County Stormwater Program
825 East Third Street · Room 127
San Bernardino, CA 94215-0835

STORMWATER
Pollution Prevention

CARPET CLEANING ACTIVITIES

San Bernardino County
STORMWATER PROGRAM



STORMWATER

Pollution Prevention

Stormwater Management Practices for Carpet Cleaning Activities

Toxic chemicals and discharged waste water from carpet, drapery, furniture and window cleaning often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Following these best management practices will prevent pollution, comply with regulations and protect public health.

These guidelines apply even if the cleaning products are labeled "nontoxic" or "biodegradable". Although these products may be less harmful to the environment, they can still have harmful effects if they enter the storm drain untreated.

Dispose of Wastewater Properly

Wastewater from cleaning equipment must be discharged into a sink, toilet, or other drain connected to the sanitary sewer system within sanitary sewer discharge limits, hauled off and disposed of properly, or may be discharged to a pervious area, for example, a lawn area, as long as it does not overflow into the street, gutter, parking lot or storm drain. Wastewater should never be discharged into a street, gutter, parking lot or storm drain.

Filter Wastewater

Carpet cleaning wastewater should be filtered before discharging it to the sanitary sewer since fibers and other debris in the wastewater can clog pipes. The filtered material can be disposed of in the garbage, provided that the waste is not contaminated with hazardous pollutants.

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

1 (800) CLEANUP

or visit our websites:

www.co.san-bernardino.ca.us/flood/npdes
www.1800cleanup.org

San Bernardino County
STORMWATER PROGRAM

MANAGING
FATS, OIL AND GREASE

THE RIGHT WAY
LA FORMA CORRECTA

1

Wipe pots, pans, and cooking areas prior to washing.

Limpie con una toallita las ollas, cazuelas, y areas de trabajo antes de lavarlos.

2

Dispose of food waste into organics container.

Deseche los restos de comida en su contenedor de orgánicos.

3

Collect waste oil and store it for recycling.

Junte el desperdicio de aceite y guardelo para que sea reciclado.

4

Clean mats inside over a utility sink.

Limpie los tapetes de piso detro de un lavabo o fregador.

THE WRONG WAY
LA FORMA INCORRECTA

1

Do not pour cooking residue directly into the drain.

No vierta residuos de cocinar directamente en el desague.

2

Do not dispose of food waste into the garbage disposal.

No ponga desperdicios de comida en el triturador de comida.

3

Do not pour waste oil directly into the drain.

No ponga desperdicio de aceite directamente en el desague.

4

Do not wash floor mats where water will run off directly into the storm drain.

No lave tapetes de piso en un lugar donde el agua corra hacia el desague.

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**
To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Commercial landscape maintenance:

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

- **Recycle Yard Waste:** Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Let your customers know about grass cycling --the natural recycling of grass by leaving clippings on the lawn when mowing instead of using a grass catcher. Grass clippings will quickly decompose, returning valuable nutrients to the soil. You can get more information at www.ciwmb.ca.gov/Organics.
- **Use Fertilizers, Herbicides & Pesticides Safely:** Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural, non-toxic alternatives to traditional garden chemicals. If you must use chemical fertilizers, herbicides, or pesticides spot apply rather than blanketing entire areas, avoid applying near curbs and driveways and never apply before a rain.
- **Recycle Hazardous Waste:** Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility. For information on proper disposal, call (909) 386-8401.
- **Use Water Wisely:** Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads.
- **Planting:** Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.
- **Prevent Erosion:** Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways. Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff. Avoid excavation or grading during wet weather.
- **Store Materials Safely:** Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials should be covered with plastic sheeting to protect from rain, wind and runoff.

For more information about how you can prevent stormwater pollution:

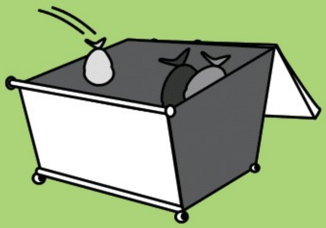
www.sbcountystormwater.org

COMMERCIAL **TRASH ENCLOSURES** REQUIREMENTS

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

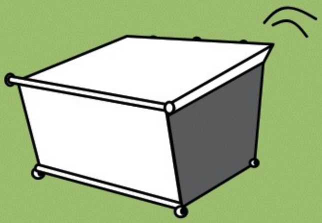
FOLLOW THESE REQUIREMENTS TO KEEP OUR WATERWAYS CLEAN

PUT TRASH INSIDE



Place trash inside the bin (preferably in sealed bags).

CLOSE THE LID



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

KEEP TOXICS OUT

NO:

- **Paint**
- **Grease**
- **Fats**
- **Used Oils**
- **Batteries**
- **Electronics**
- **Fluorescent Lights**

These items should be disposed of at a local hazardous waste collection center

SWEEP FREQUENTLY

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

FIX LEAKS

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

CONSTRUCT ROOF

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

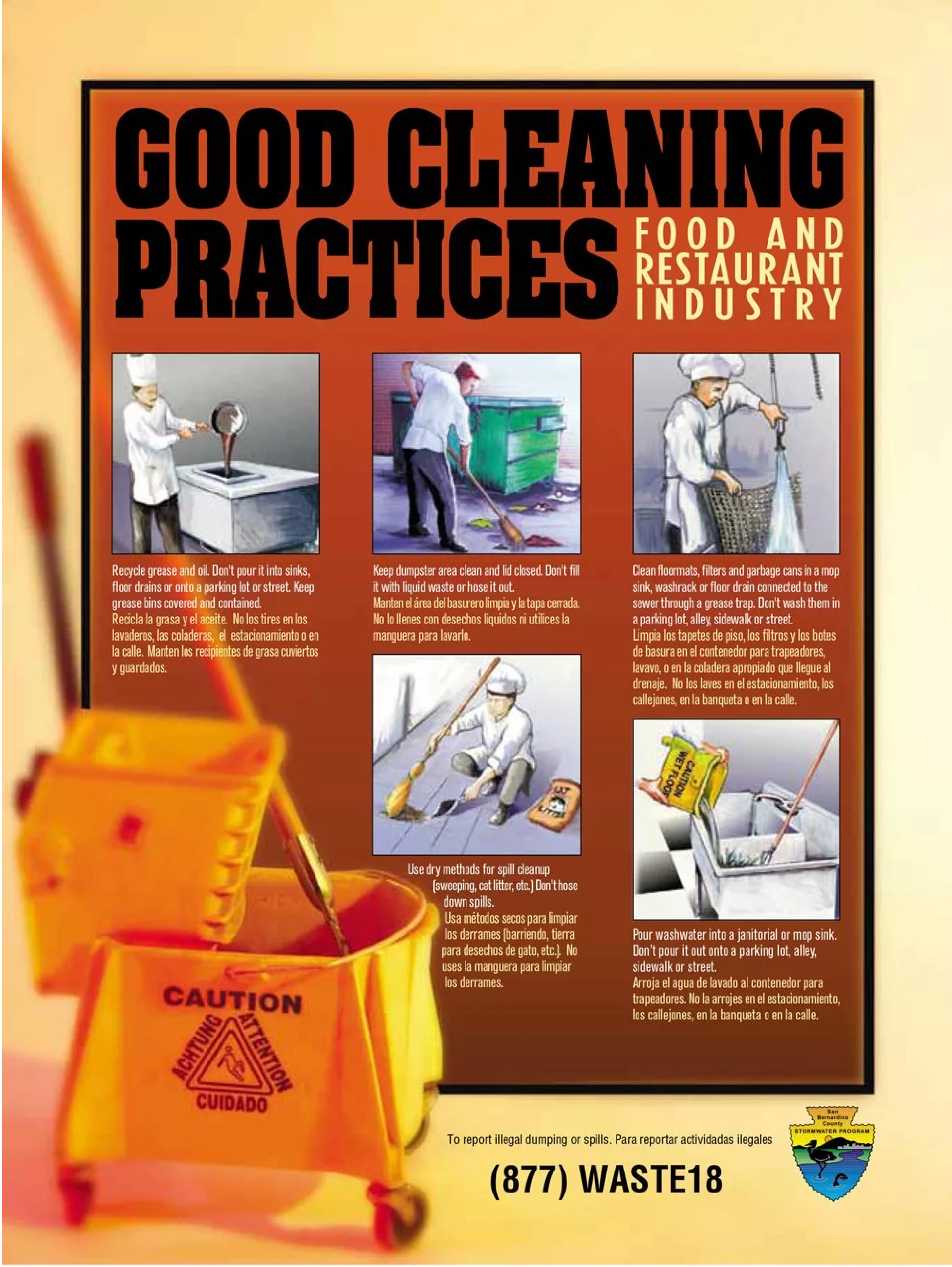
To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa



GOOD CLEANING PRACTICES

FOOD AND RESTAURANT INDUSTRY

Recycle grease and oil. Don't pour it into sinks, floor drains or onto a parking lot or street. Keep grease bins covered and contained.
Recicla la grasa y el aceite. No los tires en los lavaderos, las coladeras, el estacionamiento o en la calle. Manten los recipientes de grasa cuviertos y guardados.

Keep dumpster area clean and lid closed. Don't fill it with liquid waste or hose it out.
Manten el área del basurero limpia y la tapa cerrada. No lo llenes con desechos líquidos ni utilices la manguera para lavarlo.

Use dry methods for spill cleanup (sweeping, cat litter, etc.) Don't hose down spills.
Usa métodos secos para limpiar los derrames (barriendo, tierra para desechos de gato, etc.). No uses la manguera para limpiar los derrames.

Clean floormats, filters and garbage cans in a mop sink, washrack or floor drain connected to the sewer through a grease trap. Don't wash them in a parking lot, alley, sidewalk or street.
Limpia los tapetes de piso, los filtros y los botes de basura en el contenedor para trapeadores, lavavo, o en la coladera apropiado que llegue al drenaje. No los laves en el estacionamiento, los callejones, en la banqueta o en la calle.

Pour washwater into a janitorial or mop sink. Don't pour it out onto a parking lot, alley, sidewalk or street.
Arroja el agua de lavado al contenedor para trapeadores. No la arrojes en el estacionamiento, los callejones, en la banqueta o en la calle.

To report illegal dumping or spills. Para reportar actividadas ilegales

(877) WASTE18

Ad title: Food & restaurant poster **Actual size:** 18” x 24”
Advertiser: San Bernardino County Storm Water Program **Agency:** Industrial Strength Advertising **Date:** 8/20/03

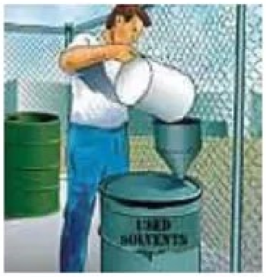
SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Food & Restaurants:

Food waste, grease, cleaning fluids, mop water and trash from restaurant operations often make their way into the San Bernardino County storm drain system, and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.

- **Cleaning & Maintenance:** Clean equipment, floor mats, filters and garbage cans in a mop sink, wash rack or floor drain connected to the sewer through a grease trap. Don't wash them or pour wash water in a parking lot, alley, sidewalk or street. Sweep outside areas and put the debris in the garbage, instead of sweeping or hosing it into the parking lot or street.
- **Recycle oil & grease:** Oil and grease wastes can be recycled. Look in the yellow pages for rendering companies, or call (909) 386-8401 for disposal information. Don't pour oil or grease into sinks, floor drains or onto a parking lot or street. Keep grease bins covered and contained.
- **Dumpster areas:** Keep dumpster lids closed and the areas around them clean. Do not fill with liquid waste or hose them out. Call your trash hauler to replace any dumpsters that are damaged or leak. Do not wash down or steam clean trash enclosure area or trash bin unless you collect the water and dispose of it into the sanitary sewer. Hire a mobile pressure wash business that is familiar with the storm water regulations to clean these areas and make sure they provide you with a record of proper wastewater disposal.

- **Managing spills:** Use dry methods for spill cleanup, sweeping and using cat litter instead of hosing. Have spill containment and cleanup kits available for possible spills on your property. To report serious toxic spills, call (800) 33-TOXIC.
- **Handling toxic chemicals:** Dispose of all unwanted toxics materials like cleaners, solvents and detergents through a hazardous waste hauler. These items are not trash. Use non-toxic cleaning products whenever possible. For information on hazardous waste pickup, call (909) 386-8401.



For more information about how you can prevent stormwater pollution:

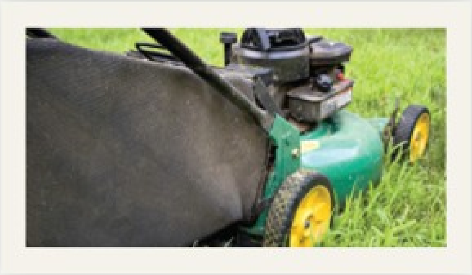
www.sbcountystormwater.org

LANDSCAPE MAINTENANCE

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

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

RECYCLE YARD WASTE



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

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

USE FERTILIZERS, HERBICIDES AND PESTICIDES SAFELY

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

USE WATER WISELY

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

HOMEOWNERS

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

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

For more information on proper disposal call,

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

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

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

sbcountystormwater.org

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

CAR WASHING DO’S AND DONT’S

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

WHEN POSSIBLE, GO TO A PROFESSIONAL CARWASH

Water that travels through the street can pick up pollutants from our cars (oil, grease, and other chemicals) and carry them to our waterways without being treated. We can help protect the community and wildlife that live in it from contamination.

DO: Use eco-friendly cleaning products (non-toxic, phosphate-free, or biodegradable).

DO: Use as little soap as possible and wipe dust off wheels/tires before rinsing.

DO: Wash in a contained area, on the grass**, gravel, or another permeable surface that allows water to seep into the ground. Dispose of any leftover soapy water into the sanitary sewer (toilet or sink) or on the grass.

DO: Conserve water by using a high-pressure hose and turning off the water when not in use.

DON’T: Create excess water that flows into the streets.

DON’T: Wash your car where the leftover water could go into a nearby storm drain. Similarly, don’t pour leftover soapywater into the storm drain.

DON’T: Throw away unwanted car cleaning products in the trash. Instead, locate your local Household Hazardous Waste facility: Call (800) OILY CAT or visit TooToxicToTrash.com.

**Check if local ordinances allow for cars to be parked on the lawn. Contact your city’s Building and Code Department if you’re unsure.