Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING

PRELIMINARY
WATER QUALITY MANAGEMENT PLAN
(WQMP)

FOR:
IDI ECKHOFF
ECKHOFF STREET
ORANGE, CA 92868

PREPARED FOR:
IDI ECKHOFF ORANGE LLC
840 APOLLO STREET, SUITE 343
EL SEGUNDO, CA 90245
PHONE: (213) 330-8066

MARCH 26, 2021
AUGUST 10, 2021
OCTOBER 15, 2021
APRIL 4, 2022
NOVEMBER 3, 2022

JOB NO. 3910

PREPARED BY:
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PRELIMINARY
WATER QUALITY MANAGEMENT PLAN
(WQMP)

For:
IDI Eckhoff
Eckhoff Street
Orange, CA 92868

Prepared for:
IDI Eckhoff Orange LLC
840 Apollo Street, Suite 343
El Segundo, CA 90245
(213) 330-8066

Prepared by:
Thienes Engineering, Inc.
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Job No. 3910

REGISTERED PROFESSIONAL ENGINEER
REINHARD STENZEL
R.C.E. NO. 56155
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

1st Submittal: March 26, 2021
2nd Submittal: August 10, 2021
3rd Submittal: October 15, 2021
4th Submittal: April 4, 2022
5th Submittal: November 3, 2022

Public Works Director	**Date**
City Engineer	**Date**

OWNER'S CERTIFICATION

WATER QUALITY MANAGEMENT PLAN

FOR

IDI Eckhoff

This Water Quality Management Plan (WQMP) for the **IDI Eckhoff** has been prepared for **IDI Eckhoff Orange LLC**. This WQMP is intended to comply with the requirements of the City of Orange's **Parcel Map #XX** requiring preparation of a Water Quality Management Plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the City of Orange Local Implementation Plan (LIP), and the intent of NPDES Permit and Waste Discharge Requirements for the City of Orange, County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region.

This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party having responsibility for implementing portions of this WQMP. Maintenance requirements within Section V and Appendix D will be adhered to with particular emphasis on maintaining the BMPs described within Sections IV and V. The Owner's Annual Self Certification Statement along with a BMP maintenance implementation table will be submitted by June 30th every year following project completion. At least one copy of the approved WQMP shall be available on the subject property in perpetuity.

Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. The City of Orange will be notified of the change of ownership and the new owner will submit a new certification.

Signature:		Date:	
Name:	Charles McPhee		
Title:	Sr. VP and Regional Director		
Company:	IDI Eckhoff Orange LLC		
Address:	840 Apollo Street, Suite 343, El Segundo, CA 90245		
Telephone Number:	(213) 330-8066		

Notice of Transfer of Responsibility

Water Quality Management Plan (WQMP)

WQMP Number – As assigned by the City of Orange:________________________

Submission of this Notice of Transfer of Responsibility constitutes notice to the City that responsibility for the Water Quality Management Plan (WQMP) for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/her agent) of the site (or portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Responsible Party Information

Company/Individual:	IDI Eckhoff Orange LLC	Contact Person:	Charles McPhee
Street Address:	840 Apollo Street Suite 343	Title:	Sr. VP and Regional Director
City, State and Zip:	El Segundo, CA 90245	Phone:	(213) 330-8066

II. Information about Site Relevant to WQMP

Name of Project:	IDI Eckhoff
Title of WQMP applicable to site:	Water Quality Management Program for Eckhoff Street Proposed Buildings
Street Address of the site:	XX Eckhoff Street, Orange, CA 92868
Date of Transfer of Responsibility:	

III. New Owner/ Responsible Party Information

Company/Individual:		Contact Person:	
Street Address:		Title:	
City, State and Zip:		Phone:	

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Appendices

List of Tables

I. Discretionary Permit Number(s), Water Quality Condition Number(s) and Conditions of Approval

Tract No. XXX___ Lot No. XX____

GPS Coordinates (Google Maps): 33.800435, -117.872793

Water Quality Conditions (WQMP conditions listed below)

A complete copy of the signed Conditions of Approval, Resolution Number ______ dated _________ are included as Appendix A

All water quality conditions related to the project will be added in the Final WQMP after approval by City and governing body.

Conditions of Approval:

Insert text providing the discretionary permit numbers and the conditions of approval related to water quality (stated verbatim).

Conditions of approval pending.

Prior to the issuance of any grading permits the applicant shall submit a Project WQMP for review and approval to the Public Works Department that:

- Prioritizes the use of Low Impact Development principles as follows: preserves natural features; minimizes runoff and reduces impervious surfaces; and utilizes infiltration of runoff as the method of pollutant treatment. Infiltration BMPs to be considered include the use of permeable materials such as concrete and concrete pavers, infiltration trenches, infiltration planters, and other infiltration BMPs as applicable.
- Incorporates the applicable Routine Source and Structural Control BMPs as defined in the Drainage Area Management Plan (DAMP)
- Maintains the hydrologic characteristics of the site by matching time of concentration, runoff, velocity, volume and hydrograph for a 2-year storm event.
- Minimizes the potential increase in downstream erosion and avoids downstream impacts to physical structures, aquatic and riparian habitat.
- Generally describes the long-term operation and maintenance requirements for structural and Treatment Control BMPs
- Identifies the entity or employees that will be responsible for long-term operation, maintenance, repair and or replacement of the structural and Treatment Control BMPs and the training that qualifies them to operate and maintain the BMPs

- Describes the mechanism for funding the long-term operation and maintenance of all structural and Treatment Control BMPs.
- A copy of the forms to be used in conducting maintenance and inspection activities
- Recordkeeping requirements (forms to be kept for 5 years)
- A copy of the form to be submitted annually by the project owner to the Public Works Department that certifies that the project's structural and treatment BMPs are being inspected and maintained in accordance with the project's WQMP.

Prior to the issuance of certificates for use of occupancy, the applicant shall demonstrate the following to the Public Works Department:

- That all structural and treatment control best management practices (BMPs) described in the Project WQMP have been constructed and installed in conformance with the approved plans and specifications,
- That applicant is prepared to implement all non-structural BMPs described in the Project WQMP,
- That an adequate number of copies of the project's approved final Project WQMP are available for the future occupiers.

Prior to the issuance of certificates for use of occupancy or final signoff by the Public Works Department, the applicant shall demonstrate to the satisfaction of Public Works, that the preparer of the WQMP has reviewed the BMP maintenance requirements in Section V of the WQMP with the responsible person and that a copy of the WQMP has been provided to that person. A certification letter from the WQMP preparer may be used to satisfy this condition.

The project applicant shall maintain all structural, treatment and low impact development BMPs at the frequency specified in the approved water quality management plan (WQMP). Upon transfer of ownership or management responsibilities for the project site, the applicant shall notify the City of Orange Public Works Department of the new person(s) or entity responsible for maintenance of the BMPs.

II. Project Description

Planning Area: LI Light Industrial

Project Size (ac): 12.7 acres onsite and 1.20 acres of offsite run-on

Percent Change in Impermeable Surfaces: 9% decrease

SIC Code: 4225 – General Warehousing

Project Description

*P*roposed improvements consist of two warehouse type buildings. Building 1 is the westerly building and Building 2 is the easterly building. Each building has a truck yard area and vehicle parking around the site. There is landscaping adjacent to Eckhoff Street and smaller areas throughout the project site.

Three (3) flow-based proprietary biofiltration BMPs (Modular Wetlands Systems), with catch basin filter inserts for pretreatment, are used to address water quality requirements. Two of the three systems are located on the north and south sides of Building 1 and the third system is located on the south side of Building 2.

There is no outdoor storage on the project and no food preparation, cooking or eating area. There are no activities that are routinely conducted outdoors (ie. vehicle maintenance and associated activities).

Project Purpose and Activities

The project currently consists of two empty shell buildings with no tenant in mind during the preparation of this WQMP. However, the anticipated use would be for warehousing of finished goods and/or used for light industrial activities. If the future tenant’s business operations do not align themselves with this WQMP then an addendum to the WQMP will be required and specific tenant improvements may be necessary.

Potential Storm Water Pollutants

Potential Storm Water Pollutants			
Pollutant	Circle One: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E	N	Potentially expected due to landscaping
Nutrients	E	N	Potentially expected due to landscaping
Heavy Metals	E	N	Expected due to vehicles
Pathogens (Bacteria/Virus)	E	N	Potentially expected due to uncovered parking areas
Pesticides	E	N	Potentially expected due to landscaping
Oil and Grease	E	N	Expected due to vehicles
Toxic Organic Compounds	E	N	Expected due to solvents
Trash and Debris	E	N	Expected

Hydrologic Conditions of Concern

2 year, 24-hr Storm Event			
	Flowrate (cfs)	**Volume (cu-ft)**	**Time of Concentration (min)**
Pre-Development	20.6	74,257	9.0
Post-Development	18.4	74,305	9.5
Difference (%)	-10.68%	+0.06%	+5.55%

The 2-year, 24-hr storm event in proposed conditions does not change significantly compared to existing conditions since the site was already developed. In the proposed conditions, the storm volume will increase by 0.068% which is within the allowable 5% change. The time of concentration will increase by 5.55% which is generally allowable seeing as a longer time of concentration typically results in lower hydromodification impact. The peak flowrate has been reduced by 10.68% which also has a lower hydromodification impact.

The project is also exempt from HCOCs. See Attachment F for map of susceptibility analysis of the Santa Ana River.

Post Development Drainage Characteristics

Drainage from the project will surface flow into catch basins utilizing filter inserts for pretreatment. Filter inserts have 100% removal of trash and debris, meeting full capture requirements. Additionally, the filter is equipped with a floating hydrocarbon boom used to control and absorb oil and hydrocarbons. After pretreatment, the proposed onsite storm drain will direct runoff towards sump pumps. The sump pumps will then convey runoff into the MWS systems (primary BMPs) for treatment. The MWS' treatment capacities will exceed the stormwater quality design flowrate (SQDF); therefore, the MWS systems will utilize internal bypass weirs to discharge flows greater than the SQDF to the MWS' discharge chamber to outlet. Treated flows will be conveyed back to the main storm drain lines.

Proposed drainage conditions will alter the existing condition drainage patterns as well as drainage divides shown in the City's Master Plan of Drainage. The tributary runoff to Eckhoff Street will be reduced, thus providing relief to the street and downstream facilities. An onsite storm drain system is proposed to direct the majority of the project site easterly to a proposed storm drain in Poplar Street. This storm drain will continue southerly and connect to the existing 54" storm drain system. The site's runoff will ultimately discharge into Santa Ana River, Reach 2.

Santa Ana River, Reach 2 is a stabilized earthen channel not susceptible to Hydrologic Conditions of Concern (HCOC). See Attachment F for map of susceptibility analysis of the Santa Ana River.

The proposed project will not affect offsite drainage characteristics as the downstream MS4 is fully developed and managed.

Commercial Projects

N/A

Residential Projects

N/A

Site Ownership and any Easements

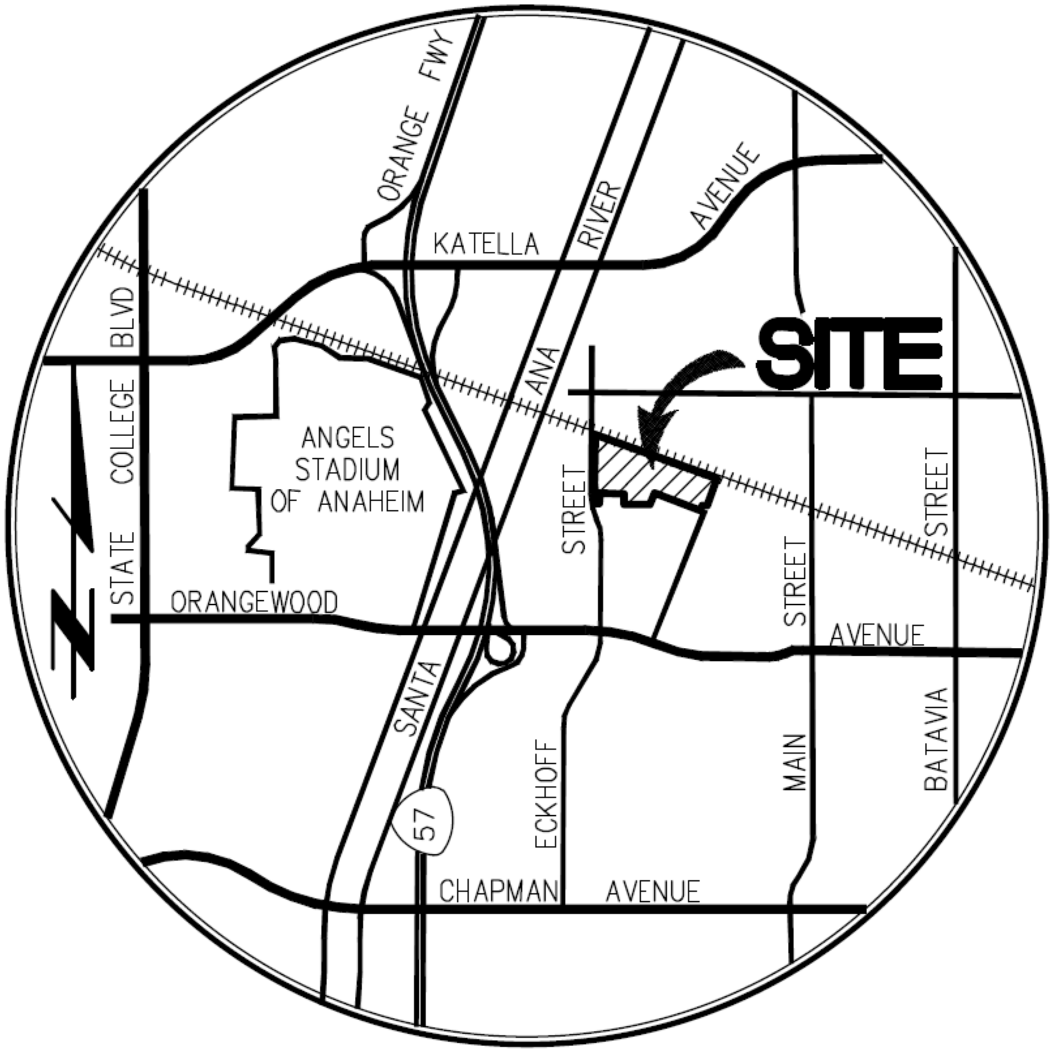
Owner Information:

IDI Eckhoff Orange LLC
840 Apollo Street, Suite 343
El Segundo, CA 90245
(213) 330-8066
Contact: Charles McPhee, Sr. VP and Regional Director

No easements by others.

III. Site Description

Reference Location Map:



Site Address: XX Eckhoff Street, Orange, CA 92868

Zoning: M-1

Predominant Soil type: A

Pre-project percent pervious: 1% **Post-project percent pervious:** 10%

Pre-project percent impervious: 99% **Post-project percent impervious:** 90%

Site Characteristics

The project site is an existing commercial/industrial development consisting of several large buildings and various smaller structures, sheds and storage areas. Existing drainage patterns differ from the City's Master Plan of Drainage.

The site is generally flat and lies on type A soils. Per the site-specific Geotechnical Investigation attached in Appendix E, measured infiltration rates resulted in 21.60 in/hr, 2.50 in/hr, and 1.80 in/hr. Additionally, groundwater was not encountered at any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 50 feet below existing site grades, at the time of the subsurface investigation.

Although infiltration BMPs are feasible from a geotechnical standpoint, per email correspondence with the City of Orange, the Orange County Water District (OCWD) does not recommend introducing (infiltrating) stormwater into the larger groundwater table near the site. OCWD has made this finding based on concerns from historical uses on the sites that are in the vicinity and up-gradient of the proposed project. Refer to the email correspondence in Appendix E.

Watershed Characteristics

Watershed: Lower Santa Ana Watershed

Downstream Receiving Waters:
Santa Ana River, Reach 2 via the County of Orange's Bitterbush Channel

Water Quality Impairments (if applicable):
Santa Ana River, Reach 2: None

Identify hydromodification susceptibility:

An onsite storm drain system is proposed to direct the majority of the project site easterly to a proposed storm drain in Poplar Street. This storm drain will continue southerly and connect to the existing 54" storm drain system. The site's runoff will ultimately discharge into Santa Ana River, Reach 2.

Santa Ana River, Reach 2 is a stabilized earthen channel not susceptible to Hydrologic Conditions of Concern (HCOC). See Attachment F for map of susceptibility analysis of the Santa Ana River.

The proposed project will not affect offsite drainage characteristics as the downstream MS4 is fully developed and managed.

Identify watershed management priorities:

N/A

IV. Best Management Practices

The project does not utilize HSCs or infiltration BMPs. Instead, the project proposes to treat the SQDF via flow-based proprietary biofiltration BMPs (MWS) that are suitable for the proposed light industrial warehouses.

LID BMPs must be selected based on a hierarchy of controls and sized to capture the maximum feasible portion of the DCV using the higher priority type control (e.g., retention), before attempting to address the remaining volume with the next lower priority control (biotreatment). Per email correspondence with the City of Orange (see Appendix E), the Orange County Water District (OCWD) does not recommend introducing (infiltrating) stormwater into the larger groundwater table near the site. OCWD has made this finding based on concerns from historical uses on the sites that are in the vicinity and up-gradient of the proposed project. Based on this, it is infeasible to retain any of the DCV and instead biotreatment BMPs are utilized.

IV.1 Site Design and Drainage Characteristics

Table 1

Site Design BMPs

Technique	Included? Yes	Included? No	If no, state justification.
Minimize Directly Connected Impervious Areas (DCIAs) (C-Factor Reduction)		X	The project is designed for the storage of finished goods (indoors), truck trailer parking, and by design maximizes impervious areas.
Create Reduced or "Zero Discharge" Areas (Runoff Volume Reduction)[1]		X	
Minimize Impervious Area/Maximize Permeability (C-Factor Reduction)[2]	X		
Conserve Natural Areas (C-Factor Reduction)		X	Not applicable, there are no natural areas to conserve.

1 Detention and retention areas incorporated into landscape design provide areas for retaining and detaining stormwater flows, resulting in lower runoff rates and reductions in volume due to limited infiltration and evaporation. Such Site Design BMPs may reduce the size of Treatment Control BMPs.

2 The "C Factor" is a representation of the ability of a surface to produce runoff. Surfaces that produce higher volumes of runoff are represented by higher C Factors. By incorporating more pervious, lower C Factor surfaces into a development, lower volumes of runoff will be produced. Lower volumes and rates of runoff translate directly to lowering treatment requirements.

- Minimize Directly Connected Impervious Areas: The project will minimize directly connected impervious areas by capturing and conveying stormwater from impervious areas to the MWS systems prior to discharging offsite and entering the public storm drain Poplar Street.
- Minimize Impervious Area/Maximize Permeability: Although the project by use/design is for maximum warehouse storage (indoors) and truck trailer parking, the layout of the site was adjusted to ensure that perimeter landscape was achieved, and that all drainage could reach the BMPs onsite.

IV.2 Source Control BMPs

IV.2.1 Routine Non-Structural BMPs

Table 2

Routine Non-Structural BMPs

BMP No.	Name	Check One		If not applicable, state brief reason.
		Included	Not Applicable	
N1	Education for Property Owners, Tenants and Occupants	X		
N2	Activity Restriction	X		
N3	Common Area Landscape Management	X		
N4	BMP Maintenance	X		
N5	Title 22 CCR Compliance		X	Not applicable, no hazardous waste anticipated onsite.
N6	Local Water Quality Permit Compliance		X	This BMP is not applicable. The City of Orange does not issue water quality permits.
N7	Spill Contingency Plan	X		
N8	Underground Storage Tank Compliance		X	Not applicable, no UST proposed.
N9	Hazardous Materials Disclosure Compliance		X	Not applicable on the site
N10	Uniform Fire Code Implementation	X		
N11	Common Area Litter Control	X		
N12	Employee Training	X		
N13	Housekeeping of Loading Docks	X		
N14	Common Area Catch Basin Inspection	X		
N15	Street Sweeping Private Streets and Parking Lots	X		

- **N1** Education for Property Owners, Tenants and Occupants: Property owner will familiarize him/herself with the educational materials in Appendix B and the contents of the WQMP. Practical information materials will be provided on general housekeeping practices that contribute to the protection of stormwater quality.
- **N2** Activity Restrictions: No outdoor work areas, processing, storage or wash areas. No maintenance of any vehicles. All activities must remain in compliance with the OMC at all times.

- **N3** Common Area Landscape Management: Maintenance personnel responsible for the activities that may impact water quality shall undergo certified BMP training and educational programs. Irrigation must be consistent with the City of Orange Landscape & Water Efficiency Ordinance. Fertilizer and pesticide usage will be consistent with EPA, DAMP, and manufacturer's Management Guidelines for Use of Fertilizers and Pesticides. IPM (integrated pest management) strategies will be implemented when applicable.
- **N4** BMP Maintenance: BMPs will be routinely inspected and maintained in order to preserve the functionality of each BMP. BMP maintenance, implementation schedules, and responsible parties are included in Section V.
- **N10** Uniform Fire Code Implementation: Owner will comply with Article 80 of the Uniform Fire Code enforced by the fire protection agency. The facility operators will be educated annually regarding requirements for handling, storage and proper disposal of hazardous substances.
- **N11** Common Area Litter Control: Owner will contract with their landscape maintenance firm to provide this service during regularly schedule maintenance. They are required to implement weekly trash management and litter control procedures in the parking lot aimed at reducing pollution of drainage water.
- **N12** Employee Training: The owner will ensure that employees are familiar with activities that impact water quality and BMPs to be used in conducting those activities. Owner will review all educational materials at least once a year and obtain new or updated educational materials to use these materials to train employees. Employees shall participate in ongoing maintenance. The WQMP requires annual employee training and new hires within 2 months.
- **N13** Housekeeping of Loading Docks: Loading docks must be swept regularly for trash, debris, and sediment. Docks will not be hosed down. Absorbent will be used for cleanup of small spills. Used absorbent will be properly disposed of.
- **N14** Common Area Catch Basin Inspection: Clear of trash, debris, and any accumulated sediment. Inspections will be conducted annually by October 1st (at minimum) and following any rain events.
- **N15** Street Sweeping Private Streets and Parking Lots: All landscape maintenance contractors will be required to sweep up all landscape cuttings, mowings and fertilizer materials off paved areas and dispose of properly. Parking areas and drive ways will be swept weekly by sweeping contractor, or more often as needed.

IV.2.2 Routine Structural BMPs

Table 3

Routine Structural BMPs

Name	Check One: Included	Check One: Not Applicable	If not applicable, state brief reason
Provide storm drain system stenciling and signage- "No Dumping – Drains to Ocean"	X		
Design and construct outdoor material storage areas to reduce pollution introduction		X	Not applicable, no outdoor storage is proposed.
Design and construct trash and waste storage areas to reduce pollution introduction	X		
Use efficient irrigation systems & landscape design	X		
Protect slopes and channels and provide energy dissipation		X	Not applicable, no slopes or channels proposed.
Incorporate requirements applicable to individual project features			
a. Dock areas	X		
b. Maintenance bays		X	Not applicable, no maintenance bays proposed.
c. Vehicle or community wash areas		X	Not applicable, vehicles wash areas are not proposed.
d. Outdoor processing areas		X	Not applicable, outdoor processing areas are not proposed.
e. Equipment wash areas		X	Not applicable, equipment wash areas are not proposed.
f. Fueling areas		X	Not applicable, fueling areas are not proposed.
g. Hillside landscaping		X	Not applicable, there are no hillsides onsite.
h. Wash water control for food preparation areas		X	Not applicable, there are no food preparation areas onsite.

- Storm drain system stenciling will contain a brief statement that prohibits the dump of improper materials into the municipal storm drain system.
- Trash enclosures will be paved with an impervious surface, designed not to allow run-on, walled to prevent off-site transport of trash, and roofed to prevent direct precipitation.
- Irrigation is proposed to meet the intent of efficient design by employing rain shutoff devices, landscape area's specific water requirements, shutoff valves, landscape plan consistent with Planning and Community Services standards for landscape and water use efficiency, timing application, plant similarity grouping, and mulch.

- Loading docks are designed aboveground and the anticipated materials loaded/unloaded are expected to be finished goods which do not have the potential to contribute to stormwater pollution.

IV.3 Low Impact Development BMP Selection

IV.3.1 Hydrologic Source Controls

Table 4

Hydrologic Source Control BMPs

Name	Check If Used
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☐
Street trees (canopy interception)	☐
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐

N/A

IV.3.2 Infiltration BMPs

Table 5

Infiltration BMPs

Name	Check If Used
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trench	☐
Infiltration basin	☐
Drywells	☐
Subsurface infiltration galleries	☐
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐
Other:	☐

N/A

Per email correspondence with the City of Orange (see Appendix E), the Orange County Water District (OCWD) does not recommend introducing (infiltrating) stormwater into the larger groundwater table near the site. OCWD has made this finding based on concerns from historical uses on the sites that are in the vicinity and up-gradient of the proposed project. Based on this, it is infeasible to retain any of the DCV and instead biotreatment BMPs are utilized.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

Table 6

Evapotranspiration, Rainwater Harvesting BMP

Name	Check If Used
All HSCs; *See Section IV.3.1*	☐
Surface-based infiltration BMPs	☐
Biotreatment BMPs	☐
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

Rainwater Harvesting BMPs are infeasible based on the calculations below.

Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing			
3	Landscape irrigation		X	
4	Other:			
5	What is the design capture storm depth? (Figure III.1)	d	0.85	inches
6	What is the project size?	A	12.70	ac
7	What is the acreage of impervious area?	IA	11.43	ac
	For projects with multiple types of demand (toilet flushing, irrigation demand, and/or other demand)			
8	What is the minimum use required for partial capture? (Table X.6)	n/a		gpd
9	What is the project estimated wet season total daily use (Section X.2)?	n/a		gpd
10	Is partial capture potentially feasible? (Line 9 > Line	n/a		

Worksheet J: Summary of Harvested Water Demand and Feasibility

	8?)		
	For projects with only toilet flushing demand		
11	What is the minimum TUTIA for partial capture? (Table X.7)	n/a	
12	What is the project estimated TUTIA?	n/a	
13	Is partial capture potentially feasible? (Line 12 > Line 11?)	n/a	
	For projects with only irrigation demand		
14	What is the minimum irrigation area required based on conservation landscape design? (Table X.8)	10.86	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)	1.27	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)	No	

Provide supporting assumptions and citations for controlling demand calculation:
EIATA = LA x KL / (IE x Tributary Impervious Area)

LA = landscape area irrigated with harvested water, sq-ft = 55,321 (1.27 acres)
K_L = Area-weighted landscape coefficient = 0.35
IE = irrigation efficiency (assume 0.90)
Imp area = 497,891 (11.43 acres)
= (55,321 x 0.35) / (0.9 x 497,891)
= 0.0432

Table X.8: Minimum Irrigated Area for Potential Partial Capture Feasibility

General Landscape Type	Conservation Design: K_L = 0.35			Active Turf Areas: K_L = 0.7		
Closest ET Station	*Irvine*	*Santa Ana*	*Laguna*	*Irvine*	*Santa Ana*	*Laguna*
Design Capture Storm Depth, inches	**Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac**					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.90	0.41	0.42	0.45
0.80	0.88	0.90	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.10	1.12	1.20	0.55	0.56	0.60

IV.3.4 Biotreatment BMPs

Table 7
Biotreatment BMPs

Bioretention with underdrains	☐
Storm water planter boxes with underdrains	☐
Rain gardens with underdrains	☐
Constructed wetlands	☐
Vegetated swales	☐
Vegetated filter strips	☐
Proprietary vegetated biotreatment systems	☒
Wet extended detention basin	☐
Dry extended detention basins	☐
Other:	☐
Other:	☐

MWS #	Area (ac)	Tc (mins)	i (in/hr)	imp	C	SQDF (cfs)	Modular Wetlands System			
							Treatment Per Unit (cfs)	QTY	Model	Total Treatment (cfs)
A	5.18	5.0	0.263	0.89	0.819	1.114	0.577	2	MWS-L-8-20-V @ 3.40' HGL	1.154
B	3.32	5.0	0.263	0.95	0.865	0.754	0.462	2	MWS-L-8-16-V @ 3.40' HGL	0.924
C	4.70	5.0	0.263	0.90	0.829	1.022	0.577	2	MWS-L-8-20-V @ 3.40' HGL	1.154

Drainage from the project will surface flow into catch basins utilizing filter inserts for pretreatment. Filter inserts have 100% removal of trash and debris, meeting full capture requirements. Additionally, the filter is equipped with a floating hydrocarbon boom used to control and absorb oil and hydrocarbons. After pretreatment, the proposed onsite storm drain will direct runoff towards sump pumps. The sump pumps will then convey runoff into the MWS systems (primary BMPs) for treatment. The MWS' treatment capacities will exceed the stormwater quality design flowrate (SQDF); therefore, the MWS systems will utilize internal bypass weirs to discharge flows greater than the SQDF to the MWS' discharge chamber to outlet. Treated flows will be conveyed back to the main storm drain line.

Per the MWS performance summary attached in Appendix C, MWS systems have medium/high effectiveness against sediment, nutrients, trash, metals, bacteria, oil and grease and organics.

IV.3.5 Hydromodification Control BMPs

N/A

IV.3.6 Regional/Sub-Regional LID BMPs

N/A

IV.3.7 Treatment Control BMPs

N/A

IV. 4 Water Quality Credits
N/A

IV.5 Alternative Compliance Plan
N/A

IV.6 Vector Control

Based on the current design (flow-based biotreatment BMPs), it is not anticipated to have ponded/nuisance water that would result in a need for vector control. All surface detention mitigating the 100-year storm event will drain offsite via the storm drain system shortly after the peak of the storm.

IV.7 Drainage Management Area (DMA)

Describe each DMA used in project, the BMPs in each DMA and the area treated.

DMA Number	BMPs	Area Treated
A & Offsite Run-on	Two (2) MWS-L-8-20-V units (at 3.4’ HGL) with filter inserts at all tributary catch basins.	4.83 + 0.35 (offsite)
B & Offsite Run-on	Two (2) MWS-L-8-16-V units (at 3.4’ HGL) with filter inserts at all tributary catch basins.	3.10 + 0.22 (offsite)
C & Offsite Run-on	Two (2) MWS-L-8-20-V units (at 3.4’ HGL) with filter inserts at all tributary catch basins.	4.45 + 0.25 (offsite)
Total Area		12.38 + 0.82 (offsite)

Total Project Area = 12.38 acres onsite and 0.82 acres of offsite run-on

DMA A will consist of the northerly two-thirds of Building 1, the northerly truck yard, vehicle parking areas along the northerly PL, and offsite run-on from the existing railroad right-of-way. Runoff will sheet flow into several catch basins with filter inserts (for pretreatment) in the truck yard area and then be conveyed easterly (via a storm drain) towards a diversion structure. Once here, a pipe set at a lower elevation will direct the SQDF to Pump “A”. Low flows/SQDF are then pumped into MWS “A”. This MWS will biofilter the SQDF to comply with water quality requirements. MWS “A” has a treatment capacity of 1.154 cfs which exceeds the SQDF; therefore, it will utilize an internal bypass weir to discharge flows greater than the SQDF to the MWS’ discharge chamber to outlet. Treated flows will be conveyed back to the main storm drain line.

DMA B will consist of the southerly one-third of Building 1, vehicle parking areas south of Building 1, the westerly half of the drive aisle between Building 1 and 2, and offsite run-on from the existing site south of the site. Runoff will sheet flow to several catch basins with filter inserts (for pretreatment) throughout DMA B and then conveyed easterly (via a storm drain) towards a diversion structure. Once here, a pipe set at a lower elevation will direct the SQDF to Pump “B”. Low flows/SQDF are then pumped into MWS “B”. This MWS will biofilter the SQDF to comply with water quality requirements. MWS “B” has a treatment capacity of 0.924 cfs which exceeds the SQDF; therefore, it will utilize an internal bypass weir to discharge flows greater than the SQDF to the MWS’ discharge chamber to outlet. Treated flows will be conveyed back to the main storm drain line.

DMA C will consist of Building 2, it’s truck yard, the drive aisle north of Building 2, vehicle parking areas surrounding Building 2, and offsite run-on from the existing railroad right-of-way. Runoff will sheet flow to several catch basins with filter inserts (for pretreatment) in the truck yard area and in the easterly vehicle parking area. Runoff will then be conveyed westerly (via a storm drain) towards a diversion structure. Once here, a pipe set at a lower elevation will direct the SQDF to Pump “C”. Low flows/SQDF are then pumped into MWS “C”. This MWS will biofilter the SQDF to comply with water quality requirements. MWS “C” has a treatment capacity of 1.154 cfs which exceeds the SQDF; therefore, it will utilize an internal bypass weir to discharge flows greater than the SQDF to the MWS’ discharge chamber to outlet. Treated flows will be conveyed back to the main storm drain line.

Approximately 0.32 acres of self-treating landscape located at the southwest corner of the site will sheet flow offsite without being routed through the onsite BMPs.

IV.8 Calculations

See following pages.

Table 2.7: Infiltration BMP Feasibility Worksheet
DMAs A, B and C

<table>
<tr><th></th><th>Infeasibility Criteria</th><th>Yes</th><th>No</th></tr>
<tr><td>1</td><td>Would Infiltration BMPs pose significant risk for groundwater related concerns? Refer to Appendix VII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: Per email correspondence with the City of Orange, the Orange County Water District (OCWD) does not recommend introducing (infiltrating) stormwater into the larger groundwater table near the site. OCWD has made this finding based on concerns from historical uses on the sites that are in the vicinity and up-gradient of the proposed project. Refer to the email correspondence in Appendix E.

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>2</td><td>Would Infiltration BMPs pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert):
The BMP can only be located less than 50 feet away from slopes steeper than 15 percent
The BMP can only be located less than eight feet from building foundations or an alternative setback.
A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>3</td><td>Would infiltration of the DCV from drainage area violate downstream water rights?</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
</table>

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	Partial Infeasibility Criteria	*Yes*	*No*
4	Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
5	Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in Appendix VII.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

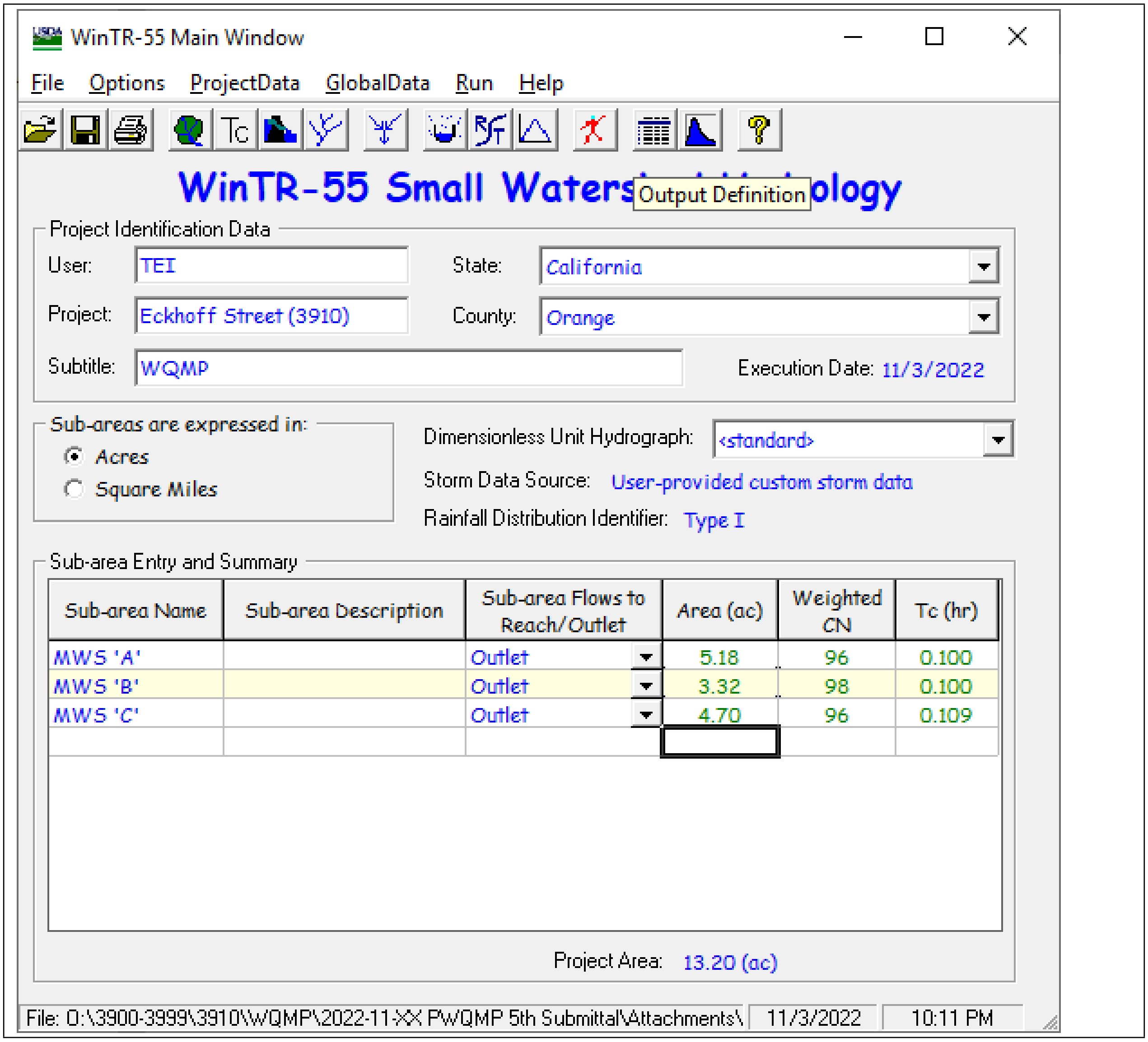
Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII) Provide narrative discussion and supporting evidence: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.	n/a
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis: Per email correspondence with the City of Orange, the Orange County Water District (OCWD) does not recommend introducing (infiltrating) stormwater into the larger groundwater table near the site. OCWD has made this finding based on concerns from historical uses on the sites that are in the vicinity and up-gradient of the proposed project. Refer to the email correspondence in Appendix E. Summarize findings of infeasibility screening	Yes
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis: Summarize findings of infeasibility screening	n/a
11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	Infiltration is Infeasible

Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA A - MWS "A"

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5	min
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.2625	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	--	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	--	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	--	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.2625	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	5.18	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.89	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.820	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	1.114	cfs
Supporting Calculations				
Describe system: MWS "A": Model: MWS-L-8-20-V @ 3.4' HGL QTY: 2 Treatment Rate: 0.577 cfs each Total Treatment Rate: 1.154 cfs > SQDF				
Provide time of concentration assumptions:				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA A - MWS "A"


WinTR-55 Main Window

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WinTR-55 Small Waters Output Definition ology

Project Identification Data

User: TEI State: California

Project: Eckhoff Street (3910) County: Orange

Subtitle: WQMP Execution Date: 11/3/2022

Sub-areas are expressed in:
- Acres
- Square Miles

Dimensionless Unit Hydrograph: <standard>

Storm Data Source: User-provided custom storm data

Rainfall Distribution Identifier: Type I

Sub-area Entry and Summary

Sub-area Name	Sub-area Description	Sub-area Flows to Reach/Outlet	Area (ac)	Weighted CN	Tc (hr)
MWS 'A'		Outlet	5.18	96	0.100
MWS 'B'		Outlet	3.32	98	0.100
MWS 'C'		Outlet	4.70	96	0.109

Project Area: 13.20 (ac)

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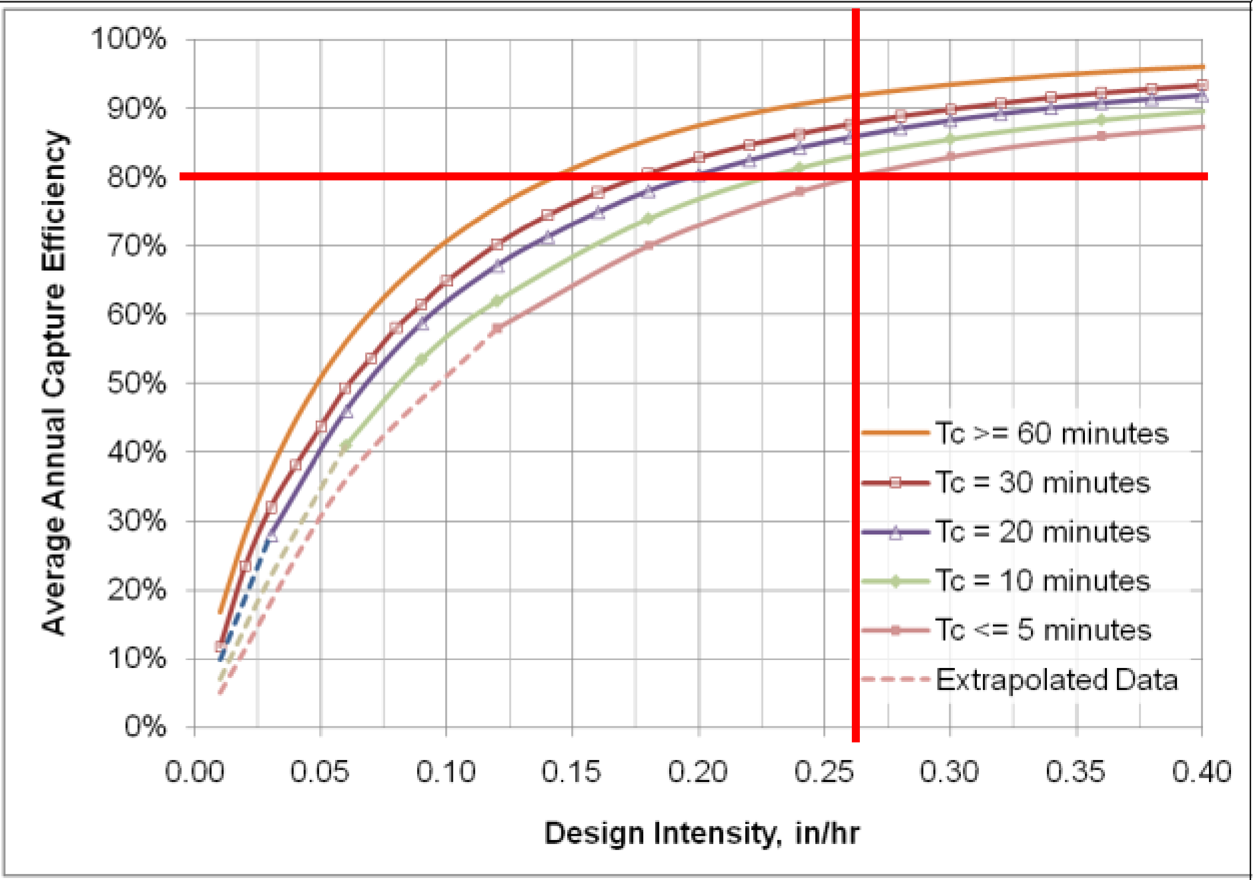
Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA A - MWS "A"

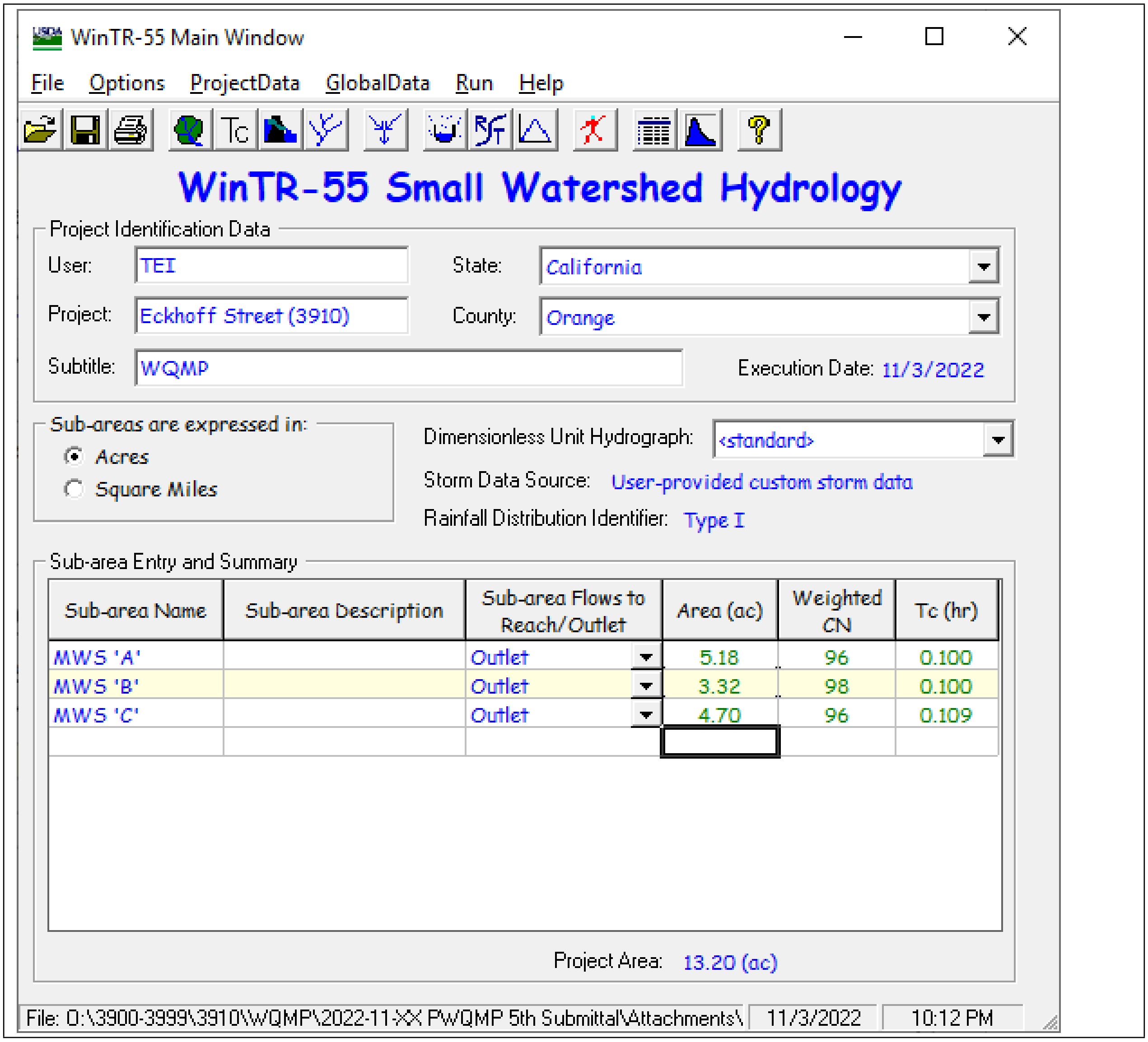
Graphical Operations

Provide supporting graphical operations. See Example III.7.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA B - MWS “B”

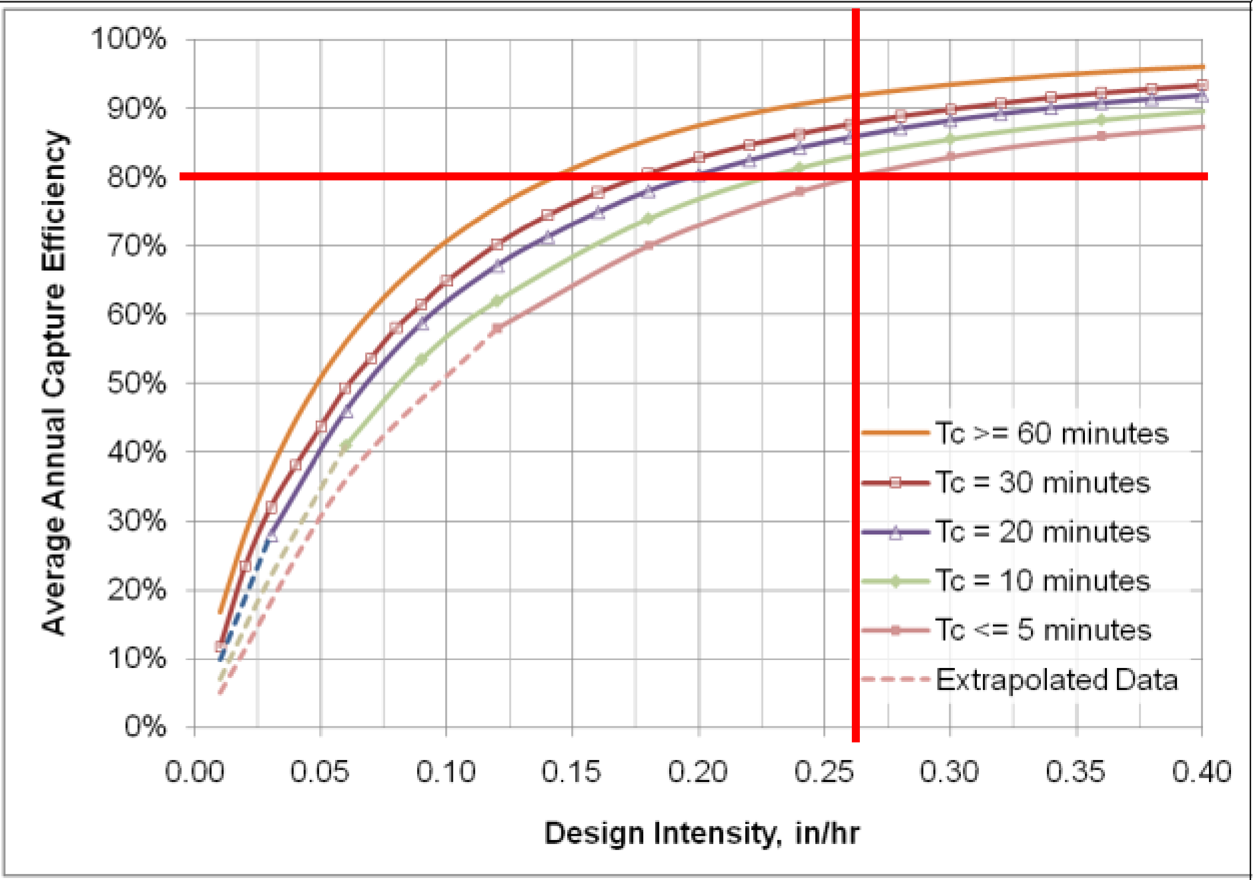
Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5	min
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.2625	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	--	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	--	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	--	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1 - I_2$	I_{design}=	0.2625	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.32	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.865	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.754	cfs
Supporting Calculations				
Describe system: MWS “B”: Model: MWS-L-8-16-V @ 3.4’ HGL QTY: 2 Treatment Rate: 0.462 cfs each Total Treatment Rate: 0.924 cfs > SQDF				
Provide time of concentration assumptions:				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

DMA B - MWS "B"



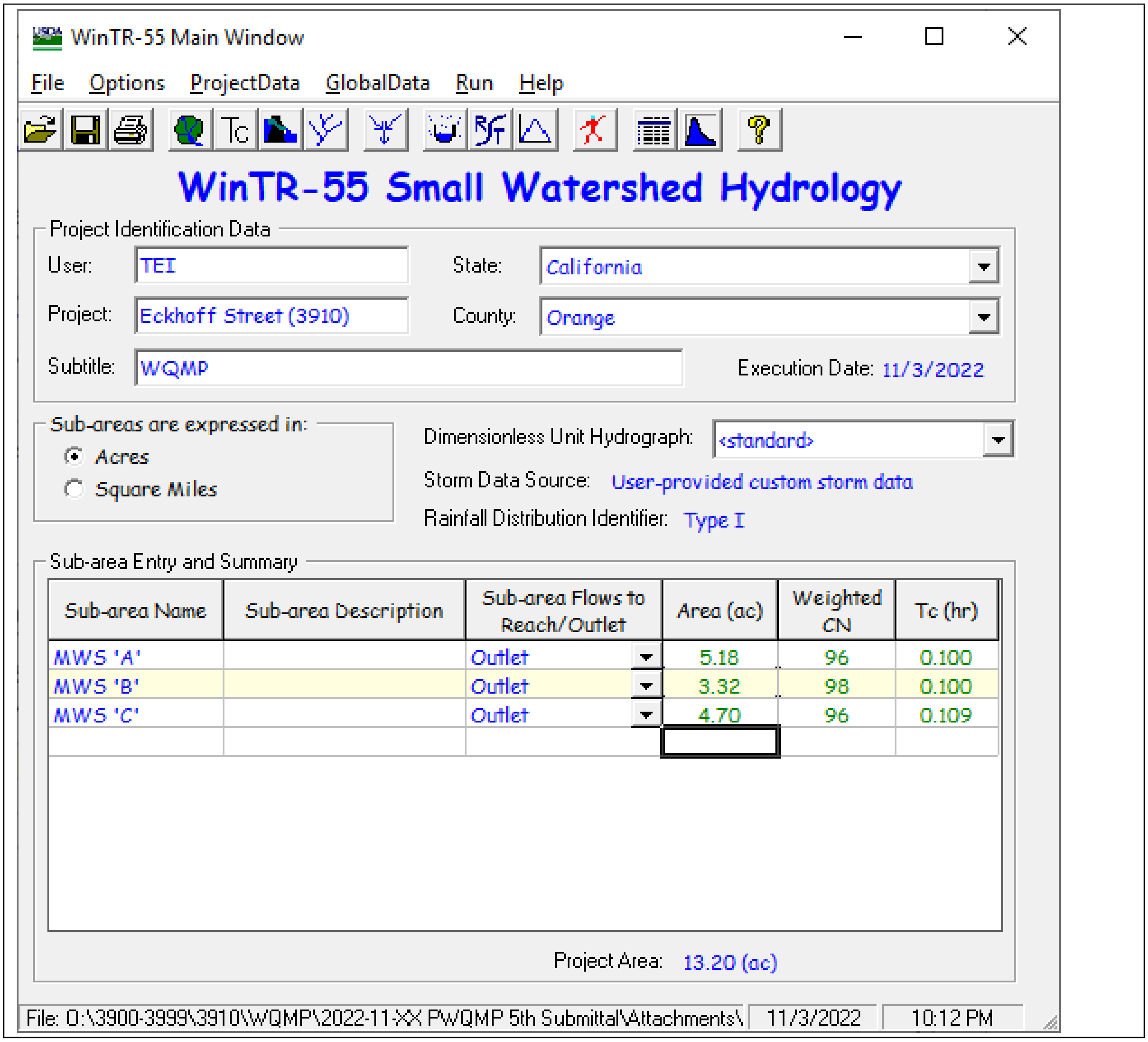
Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA B - MWS "B"

Graphical Operations

Provide supporting graphical operations. See Example III.7.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA C - MWS "C"

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5	min
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.2625	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	--	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	--	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	--	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1 - I_2$	I_{design}=	0.2625	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.70	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.829	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	1.022	cfs
Supporting Calculations				
Describe system: MWS "C": Model: MWS-L-8-20-V @ 3.4' HGL QTY: 2 Treatment Rate: 0.577 cfs each Total Treatment Rate: 1.154 cfs > SQDF				
Provide time of concentration assumptions:				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA C - MWS "C"


WinTR-55 Main Window

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WinTR-55 Small Watershed Hydrology

Project Identification Data

User: TEI
State: California
Project: Eckhoff Street (3910)
County: Orange
Subtitle: WQMP
Execution Date: 11/3/2022

Sub-areas are expressed in:
Acres
Square Miles

Dimensionless Unit Hydrograph: <standard>
Storm Data Source: User-provided custom storm data
Rainfall Distribution Identifier: Type I

Sub-area Entry and Summary

Sub-area Name	Sub-area Description	Sub-area Flows to Reach/Outlet	Area (ac)	Weighted CN	Tc (hr)
MWS 'A'		Outlet	5.18	96	0.100
MWS 'B'		Outlet	3.32	98	0.100
MWS 'C'		Outlet	4.70	96	0.109

Project Area: 13.20 (ac)

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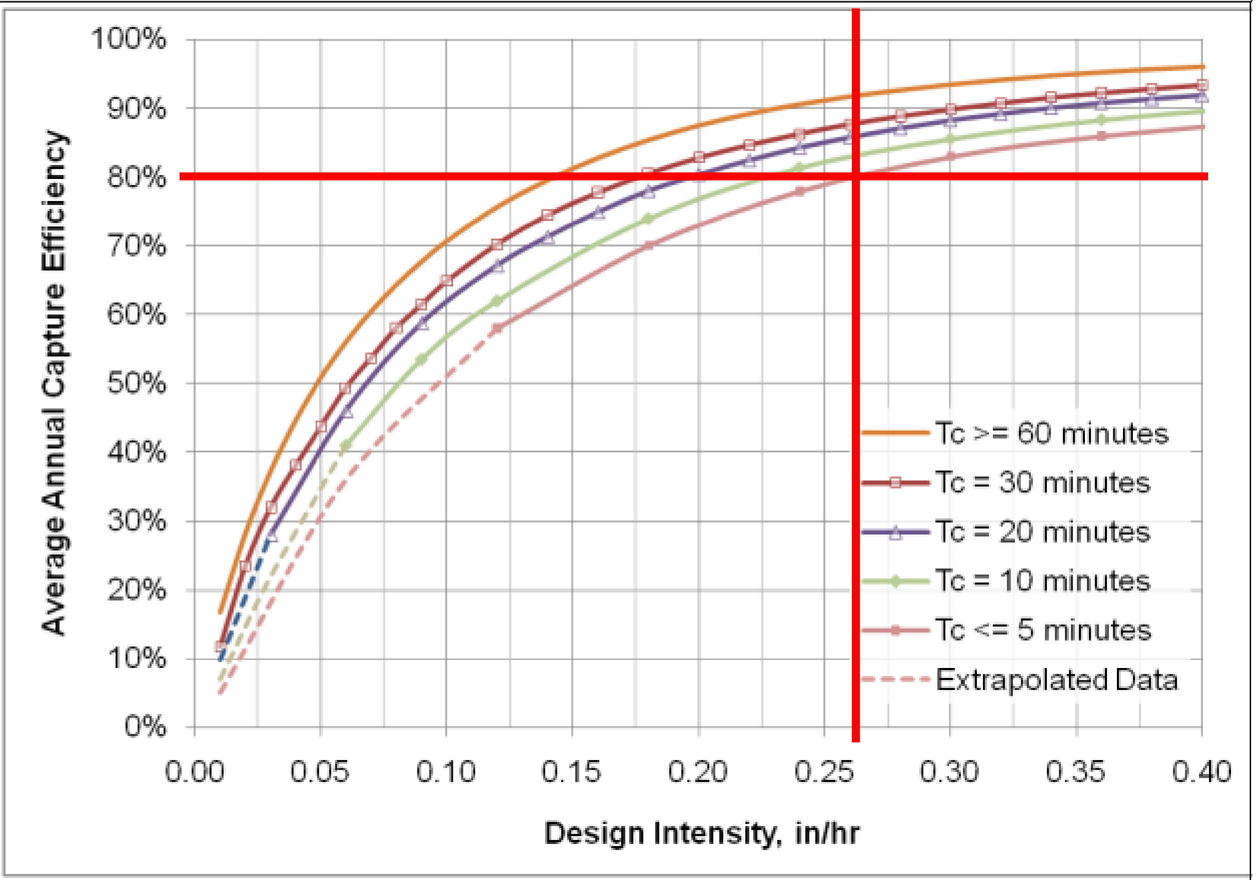
Worksheet D: Capture Efficiency Method for Flow-Based BMPs
DMA C - MWS "C"

Graphical Operations

Provide supporting graphical operations. See Example III.7.

Worksheet B: Simple Design Capture Volume Sizing Method
(DMA A – Offsite Runon)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.85	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.35	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.10	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.2250	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	243	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (Appendix VII)	$K_{observed}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	S_{total}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	K_{design}=	N/A*	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N/A*	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N/A*	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N/A*	sq-ft

*Due to infiltration being infeasible, the project proposes to use three proprietary biofiltration systems.

Worksheet B: Simple Design Capture Volume Sizing Method
(DMA A)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.85	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.83	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.8625	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	12,854	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (Appendix VII)	$K_{observed}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	S_{total}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	K_{design}=	N/A*	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N/A*	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N/A*	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N/A*	sq-ft

*Due to infiltration being infeasible, the project proposes to use three proprietary biofiltration systems.

Worksheet B: Simple Design Capture Volume Sizing Method
(DMA B – Offsite Runon)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.85	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.22	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.9000	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	611	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (Appendix VII)	$K_{observed}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	S_{total}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	K_{design}=	N/A*	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N/A*	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N/A*	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N/A*	sq-ft

*Due to infiltration being infeasible, the project proposes to use three proprietary biofiltration systems.

Worksheet B: Simple Design Capture Volume Sizing Method
(DMA B)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.85	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.10	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.8625	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	8,250	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (Appendix VII)	$K_{observed}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	S_{total}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	K_{design}=	N/A*	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N/A*	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N/A*	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N/A*	sq-ft

*Due to infiltration being infeasible, the project proposes to use three proprietary biofiltration systems.

Worksheet B: Simple Design Capture Volume Sizing Method
(DMA C – Offsite Runon)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.85	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.25	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.10	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.2250	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	174	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (Appendix VII)	$K_{observed}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	S_{total}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	K_{design}=	N/A*	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N/A*	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N/A*	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N/A*	sq-ft

*Due to infiltration being infeasible, the project proposes to use three proprietary biofiltration systems.

Worksheet B: Simple Design Capture Volume Sizing Method
(DMA C)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.85	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	4.45	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.8625	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	11,843	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (Appendix VII)	$K_{observed}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	S_{total}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	K_{design}=	N/A*	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	N/A*	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	N/A*	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N/A*	sq-ft

*Due to infiltration being infeasible, the project proposes to use three proprietary biofiltration systems.

V. Implementation, Maintenance and Inspection Responsibility for BMPs (O&M Plan)

Responsible Party Information (Local Contact Information)

Name:	Charles McPhee	Title:	Sr. VP and Regional Director
Company:	IDI Eckhoff Orange LLC		
Phone Number:	(213) 330-8066		

Table 8 - Frequency Inspection Matrix

BMP	Responsible Party	*Maintenance Activity	*Inspection/Maintenance Frequency
Source Control BMPs (Structural and Non-structural)			
N1 Education for Property Owners, Tenants and Occupants	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	To educate employees on stormwater pollution prevention.	Annually and within 2 weeks of being hired.
N2 Activity Restriction	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	There shall be no discharges of fertilizers, pesticides, wastes, or washing of pavement to streets or storm drains. All debris shall be collected and relocated to an approved landfill. No vehicle maintenance and no vehicle wash areas.	Daily

N3 Common Area Landscape management	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	Irrigation system shall be inspected monthly by landscape contractor to check for over-watering, leaks, or excessive runoff to paved areas and landscaping shall be maintained weekly and maintenance contractor shall properly dispose of all landscape wastes.	Landscaping should be inspected/maintained in a weekly basis. Irrigation system shall be inspected monthly.
N4 BMP Maintenance	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	See specific BMP maintenance at the end of this table.	See specific BMP maintenance at the end of this table.
N11 Common Area Litter Control	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	Clear of trash and debris.	Daily

N12 Employee Training	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	To educate employees on stormwater pollution prevention.	Annually and within two weeks of being hired.
N13 Housekeeping of Loading Docks	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	Loading docks must be swept regularly for trash, debris, and sediment. Docks will not be hosed down. Absorbent will be used for cleanup of small spills. Used absorbent will be properly disposed of.	Daily
N14 Common Area Catch Basin Inspection	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	Clear of trash, debris, and any accumulated sediment.	Inspect monthly and vacuum as necessary.
N15 Street Sweeping Private Streets and Parking Lots	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	The paved parking areas shall be mechanical broom swept on a regular basis to remove debris.	Weekly or more often as needed to remove visible trash and debris.
Low Impact Development and Treatment BMPs			

BIO-7: Modular Wetlands System	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	Per manufactures specifications all units shall remove trash from the screening device twice a year. Sediment will be removed from the separation chamber once a year. The cartridge filter media and the drain down filter media will be replaced once a year. The vegetation will be trimmed twice a year. The units shall be inspected and maintained by a qualified technician with proper disposal of all waste.	Per manufactures specifications and units shall be inspected twice a year and maintained at least once a year (replacement of media filter), prior to October 1.
PRE-2: Filter Inserts	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	Filter inserts will need to be inspected. Debris will be removed that may cause the drain to clog. Hydrocarbon booms needs to be replaced per manufacturer’s specifications.	Per manufacturer’s specifications; after September 1 and prior to October 1.

Sump Pump	Name: Charles McPhee Title: Sr. VP and Regional Director Company: IDI Eckhoff Orange LLC Phone Number: (213) 330-8066	Verify automatic and manual operation of pump. Inspect floats for proper elevation and movement. Correct any obstructions. Check incoming power and amperage for proper voltage. Hose down lift station to clean pump and floats. Inspect floats for proper elevation and movement. Correct any obstructions. Check incoming power and amperage for proper voltage. Hose down lift station to clean pump and floats.	One (1) per year per manufacturer's recommendations. Inspection of mechanical seals to be done once every two (2) years.

*Attach in appendix additional inspection, maintenance and operations information if required.

Regulatory Permits

City of Orange: Grading Permit
State: Water Discharge Identification (WDID #8 XXCXXXXXX)
State: Construction General Permit (CGP)
State: Industrial General Permit (IGP); Non-Exposure Certification

Funding

Funding for installation and on-going maintenance for all BMPs will be the responsibility of the owner.

OWNER SELF CERTIFICATION STATEMENT

As the owner representative of the **IDI Eckhoff** for which a Water Quality Management Plan (WQMP) was approved by the City, I hereby certify under penalty of law that all Best Management Practices contained within the approved Project WQMP have been maintained and inspected in accordance with the schedule and frequency outlined in the approved WQMP Maintenance Table.

The maintenance activities and inspections conducted are shown in the attached table and have been performed by qualified and knowledgeable individuals. Structural Treatment BMPs have been inspected and certified by a licensed professional engineer.

To the best of my knowledge, the information submitted is true and accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and citations for violating water quality regulations.

Signed: ___________________________________

Name: Charles McPhee

Title: Sr. VP and Regional Director

Company: IDI Eckhoff Orange LLC

Address: 840 Apollo Street, Suite 343, El Segundo, CA 90245

Telephone Number: (213) 330-8066

Date: _________________

BMP Implementation Tracking Table

BMP	Activity	Completion Dates or Frequency	Initial
Source Control BMPs (Structural and Nonstructural)			
N1 Education for Property Owners, Tenants and Occupants	To educate employees on stormwater pollution		
N2 Activity Restriction	There shall be no discharges of fertilizers, pesticides, wastes, or washing of pavement to streets or storm drains. All debris shall be collected and relocated to an approved landfill. No vehicle maintenance and no vehicle wash areas.		
N3 Common Area Landscape management	Clear area of trash, debris, weeds and any accumulated sediment.		
N4 BMP Maintenance	See BMP maintenance at the end of this table.		
N11 Common Area Litter Control	Clear of trash and debris. Dispose of all materials properly offsite.		
N12 Employee Training	To educate employees on stormwater pollution.		
N13 Housekeeping of Loading Docks	Loading docks must be swept regularly for trash, debris, and sediment. Docks will not be hosed down. Absorbent will be used for cleanup of small spills. Used absorbent will be properly disposed of.		
N14 Common Area Catch Basin Inspection	Clear of trash, debris, and any accumulated sediment.		
N15 Street Sweeping Private Streets and Parking Lots	The paved parking areas shall be mechanical broom swept every two weeks, or more often as needed, to remove pollutants from the site.		

Low Impact Development and Treatment BMPs			
BIO-7: Modular Wetlands System	Per manufactures specifications all units shall remove trash from the screening device twice a year. Sediment will be removed from the separation chamber once a year. The cartridge filter media and the drain down filter media will be replaced once a year. The vegetation will be trimmed twice a year. The units shall be inspected and maintained by a qualified technician with proper disposal of all waste.		
PRE-2: Filter Inserts	Filter inserts will need to be inspected. Debris will be removed that may cause the drain to clog. Hydrocarbon booms needs to be replaced per manufacturer's specifications.		
Sump Pump	Verify automatic and manual operation of pump. Inspect floats for proper elevation and movement. Correct any obstructions. Check incoming power and amperage for proper voltage. Hose down lift station to clean pump and floats. Inspect floats for proper elevation and movement. Correct any obstructions. Check incoming power and amperage for proper voltage. Hose down lift station to clean pump and floats.		

* This sheet is to be submitted annually with the Owner Self Certification Statement.

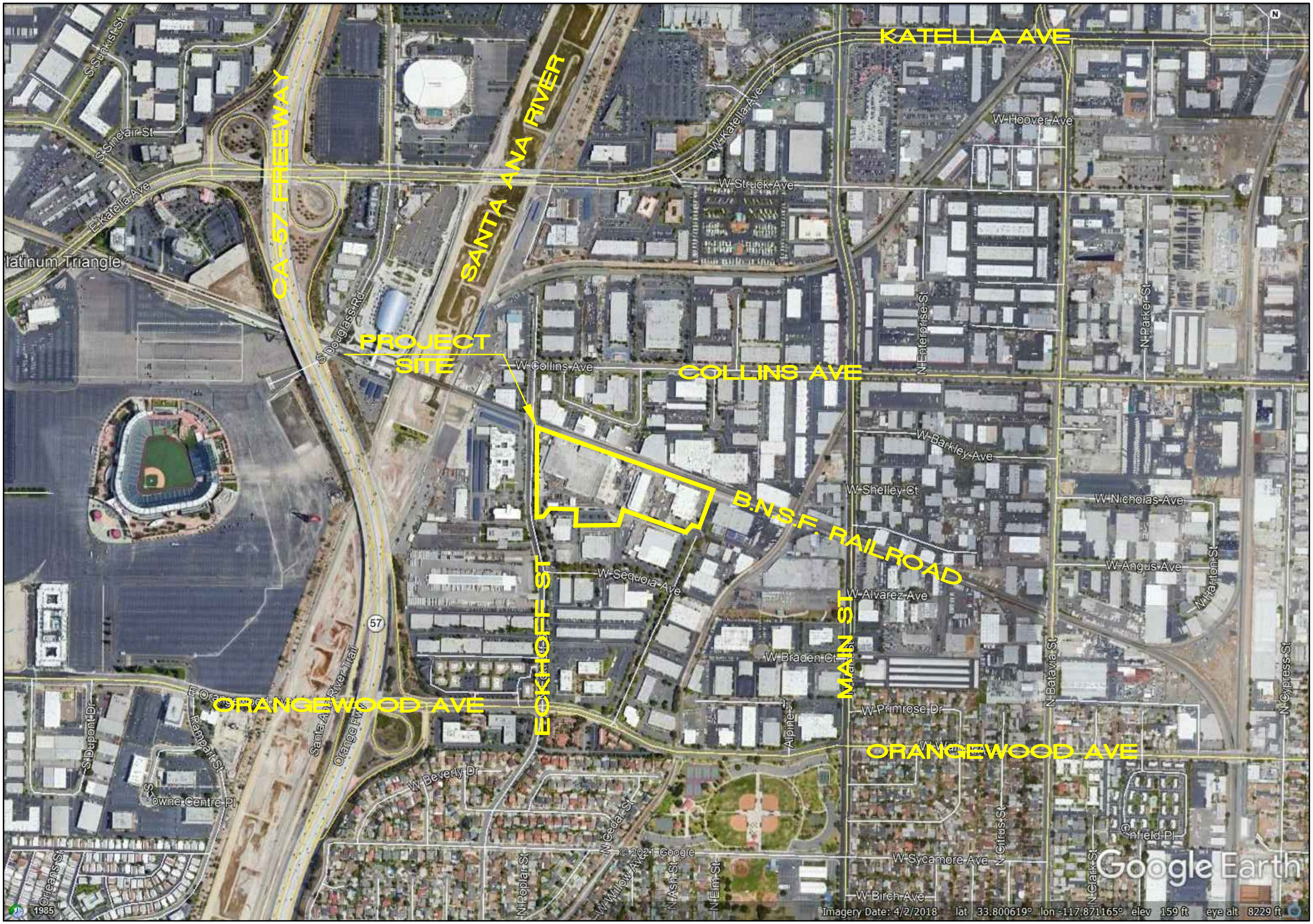
** Structural Treatment BMPs should be certified by a Licensed Professional Engineer.

VI. Location Map, Site Plan, and BMP Details

Include a location map that identifies project location and proximity to nearby water bodies. In an 11X17 sheet Identify land use, cover, feasibility constraints, structures, buildings, number of units, landscape areas, storm drain inlets, storm drain facilities, drainage flow direction, structural and treatment BMP locations, dumpsters, trash enclosures, wash areas, etc.

Delineate drainage management areas showing limits (acreage) of each drainage area for all structural, treatment and Low Impact Development BMPs used and provide BMP details on plan or in Appendix C.

- Location Map – Show downstream receiving waters
- Location Map – Show nearby/structures and uses
- Site plan including drainage pathways, on-site and of imperviousness/ perviousness, BMP locations, etc.
- BMP Detail Plans – Show unique features of all BMPs to be used on-site.



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Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

VICINITY MAP
FOR
ECKHOFF STREET

Last Update: 3/26/21
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"RECEIVING WATERS MAP"

FOR

ECKHOFF STREET

FLOW

N

Thienes Engineering, Inc.
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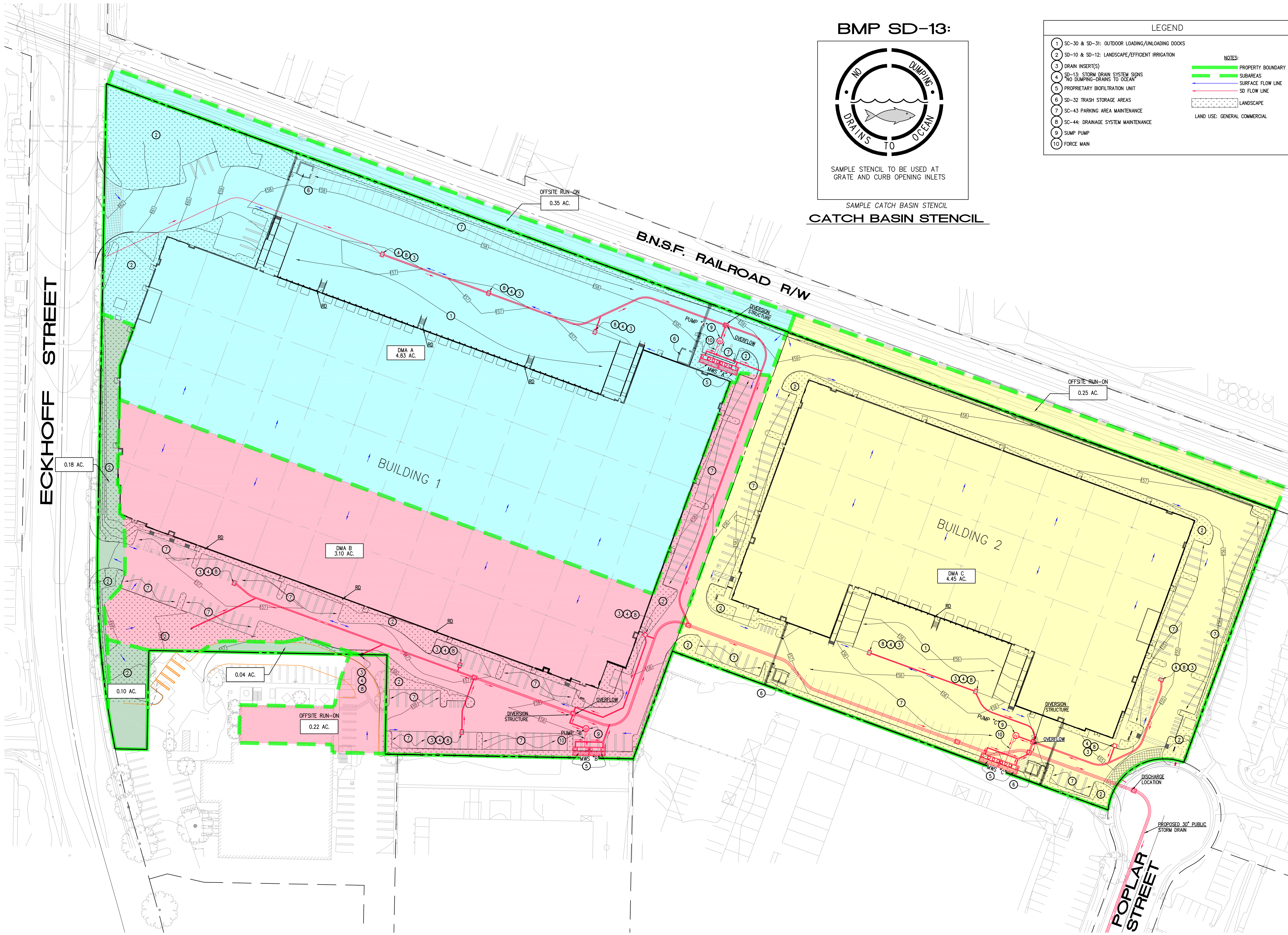


BMP SD-13:

SAMPLE STENCIL TO BE USED AT GRATE AND CURB OPENING INLETS

SAMPLE CATCH BASIN STENCIL

CATCH BASIN STENCIL

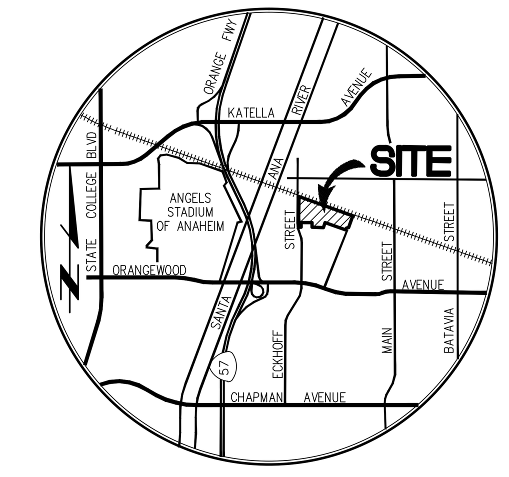
LEGEND

1. SC-30 & SD-31: OUTDOOR LOADING/UNLOADING DOCKS
2. SD-10 & SD-12: LANDSCAPE/EFFICIENT IRRIGATION
3. DRAIN INSERT(S)
4. SD-13: STORM DRAIN SYSTEM SIGNS "NO DUMPING-DRAINS TO OCEAN"
5. PROPRIETARY BIOFILTRATION UNIT
6. SD-32 TRASH STORAGE AREAS
7. SC-43 PARKING AREA MAINTENANCE
8. SC-44: DRAINAGE SYSTEM MAINTENANCE
9. SUMP PUMP
10. FORCE MAIN

NOTES:

PROPERTY BOUNDARY
SUBAREAS
SURFACE FLOW LINE
SD FLOW LINE
LANDSCAPE

LAND USE: GENERAL COMMERCIAL



VICINITY MAP

N.T.S.

0 20 40 80 120

SCALE: 1"=40'

Last Update: 11/3/22
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CITY OF ORANGE

PUBLIC WORKS DEPARTMENT

WQMP SITE MAP

IDI ECKHOFF

ECKHOFF STREET

PREPARED FOR:

IDI ECKHOFF ORANGE LLC
840 APOLLO STREET, STE. 343
EL SEGUNDO, CA. 90245
PHONE: (213) 330-8066

PREPARED BY:

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by ______
Date ______
Checked by ______
Date ______
Designed by ______
Date ______
Checked by ______
Date ______

Approved by ______ Date ______

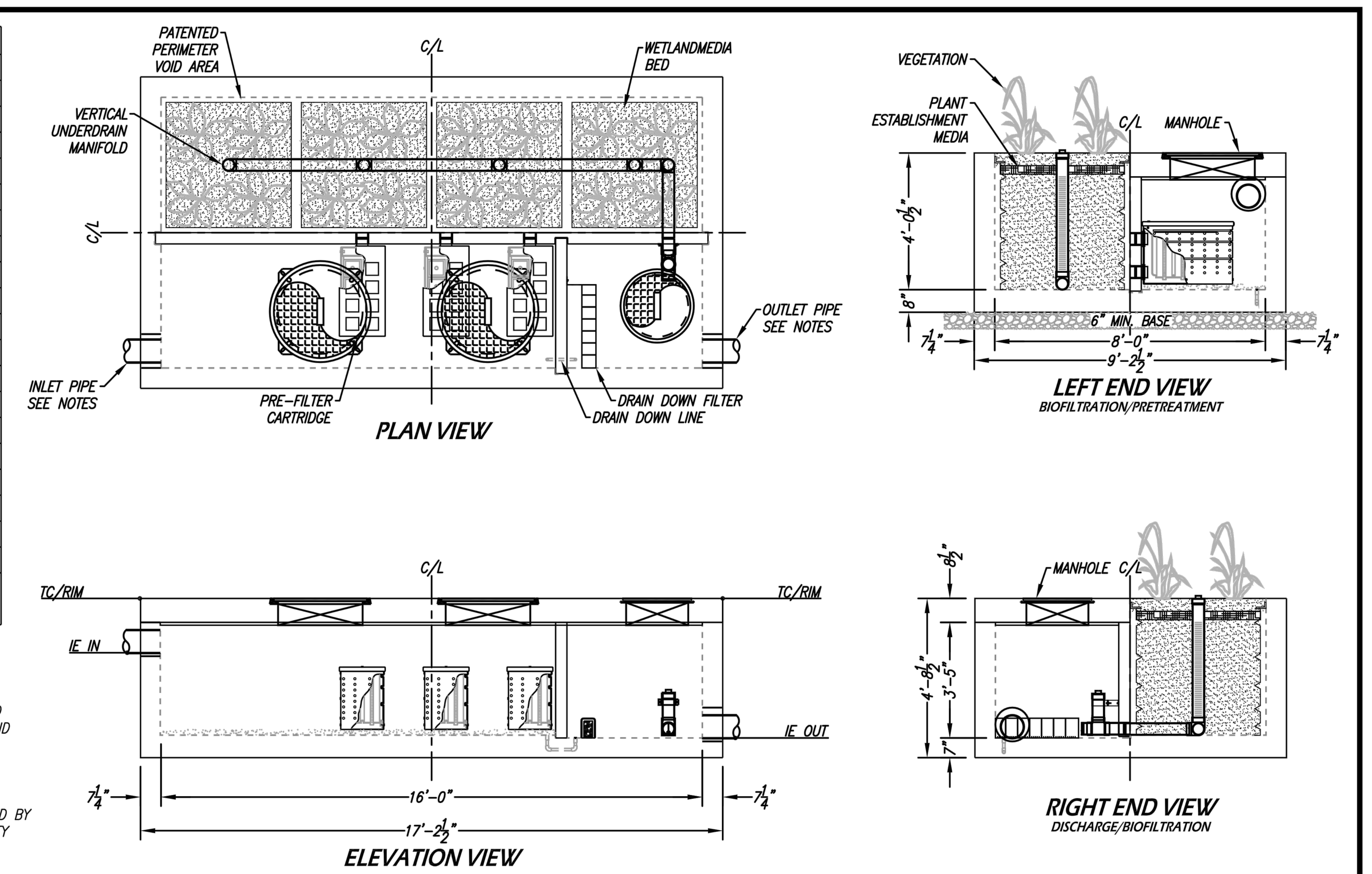
Public Works Director ______ R.C.E. ______

Sheet 1 of 2 Sheets

3910/1 OF 2 SHEET

SITE SPECIFIC DATA

PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			7.26
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø3.07"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.462
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

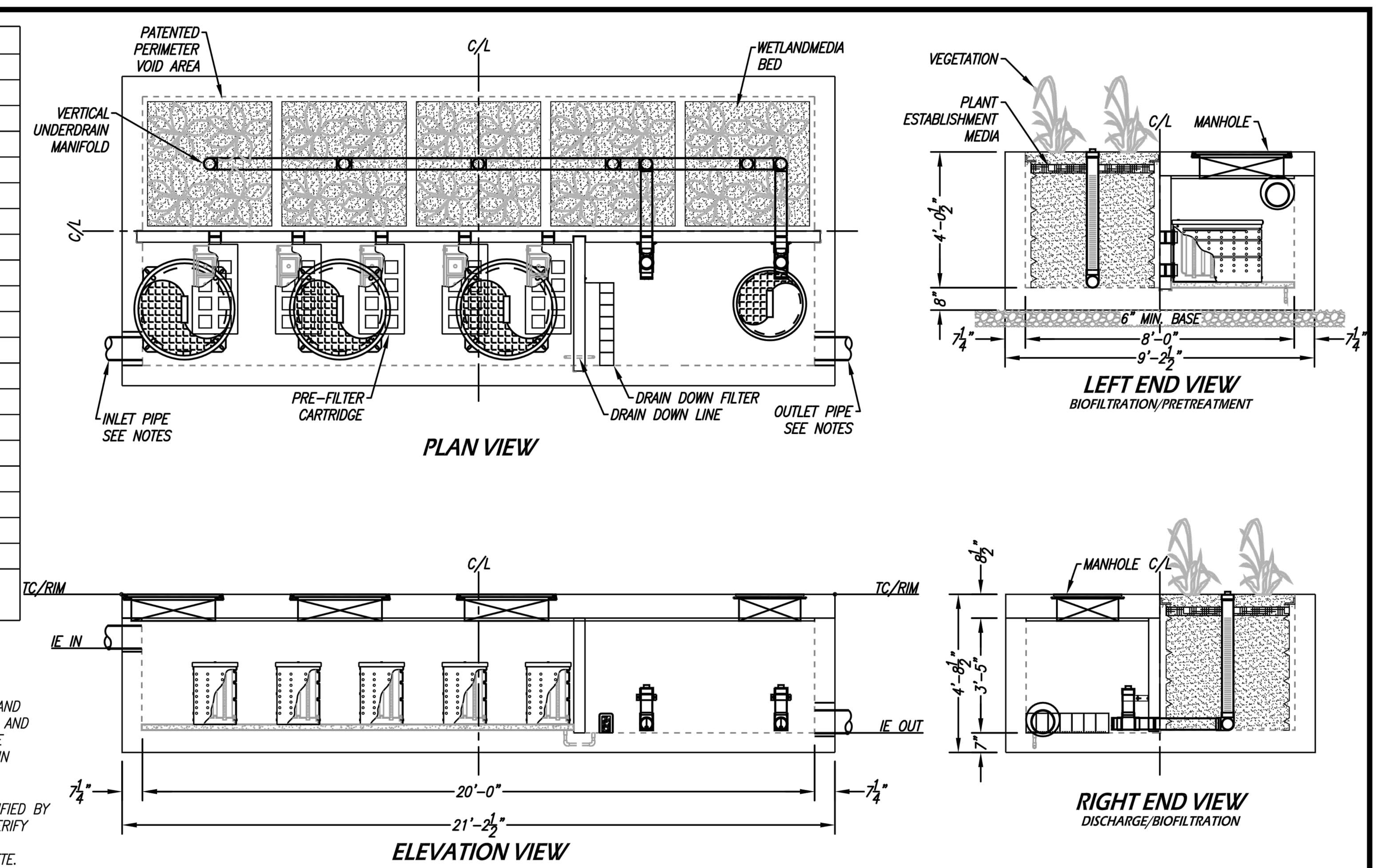
PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MODULAR WETLANDS SYSTEMS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MODULAR WETLANDS SYSTEMS IS PROHIBITED.

MODULAR WETLANDS

MWS-L-8-16-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA

PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			11.85
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.43"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:
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MODULAR WETLANDS

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

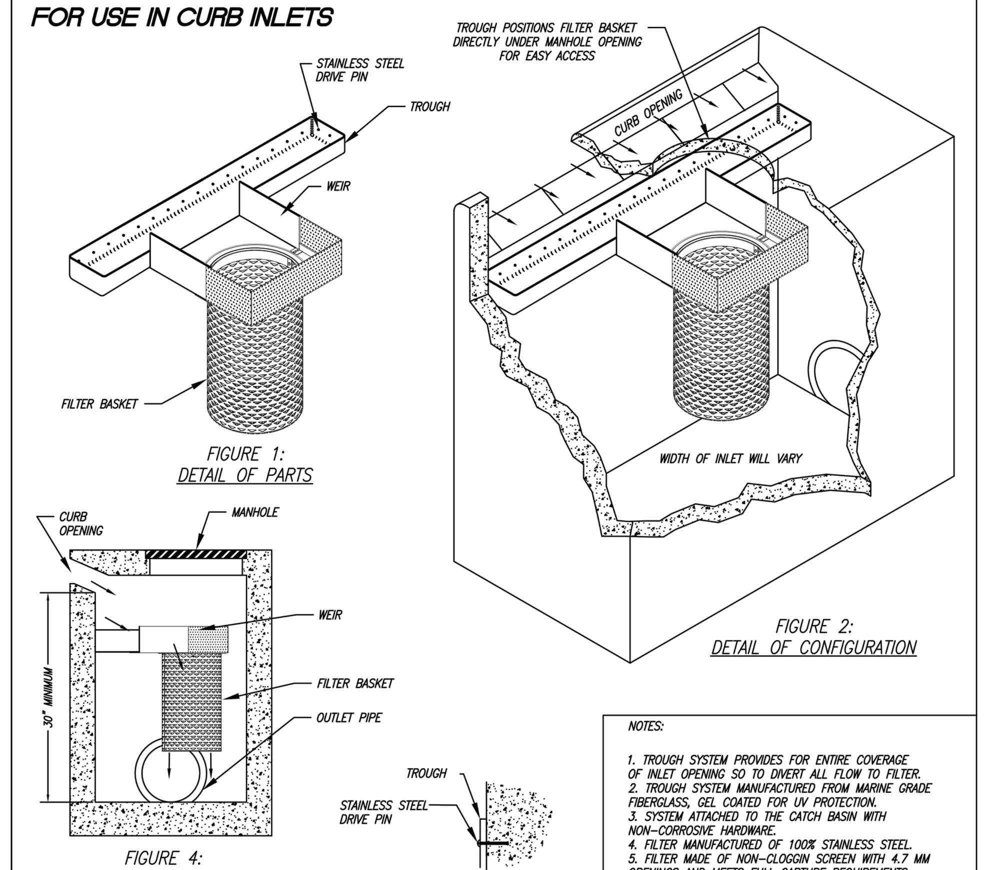


FIGURE 1:
DETAIL OF PARTS

FIGURE 2:
DETAIL OF CONFIGURATION

FIGURE 4:
DETAIL OF PROFILE

FIGURE 3:
DETAIL OF MOUNTING

NOTES:

1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 100% STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGIN SCREEN WITH 4.7 MM OPENINGS AND MEETS FULL CAPTURE REQUIREMENTS.
6. FILTER CAN BE FITTED WITH HYDROCARBON ABSORBENT BOOM
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS A SAFETY FACTOR OF 2.0
11. BYPASS IS FACILITATED VIA OVERFLOW OF THE TROUGH SYSTEM AND IS EQUAL TO THE CAPACITY OF THE CURB OPENING
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BIO-CURB-FULL-24	2.85	1.40
BIO-CURB-FULL-18	2.85	1.05
BIO-CURB-FULL-12	2.85	0.70

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

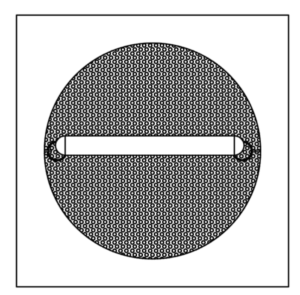
DRAWING: BIO CLEAN CURB INLET FILTER DETAILS		MEETS FULL CAPTURE REQUIREMENTS	
TREATMENT FLOW RATE: 2.85 cfs		MODEL #: BIO-CURB-FULL	
WARRANTY: 8 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 10/12/2017	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

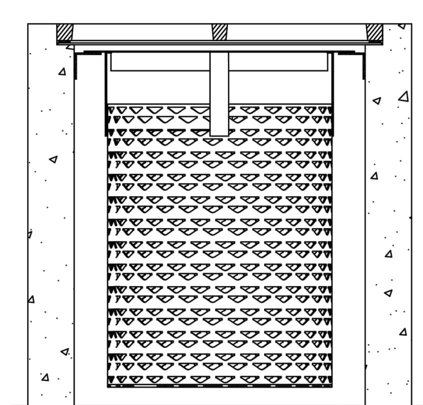
PAGE 1

BIO CLEAN FULL CAPTURE FILTER

FOR USE IN GRATE INLETS



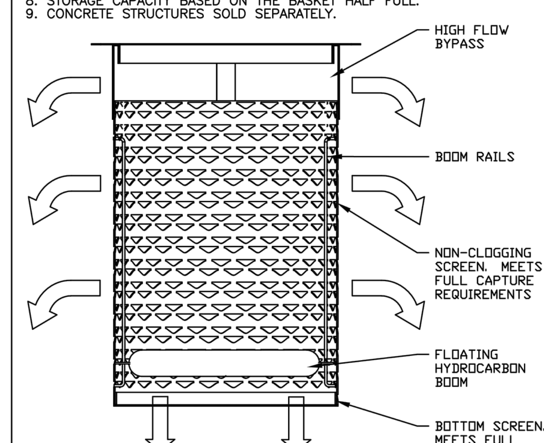
TOP VIEW



CONCRETE STRUCTURE

NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL
2. HYDROCARBON BOOM SHALL BE 2" DIAMETER AND CONNECTED, MECHANICALLY TO THE FILTER FRAME WITH RAILS ALLOWING IT TO FLOAT ON THE WATER SURFACE REGARDLESS OF HEIGHT
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDIING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.



FLOW SCHEMATIC

MODEL #	TREATMENT FLOW (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.55	1.55	0.27
BIO-GRATE-FULL 18-18-18	4.32	3.68	1.05
BIO-GRATE-FULL 24-24-24	7.67	4.83	2.41
BIO-GRATE-FULL 30-30-24	12.97	6.21	3.98
BIO-GRATE-FULL 25-38-24	13.53	6.59	4.16
BIO-GRATE-FULL 36-36-24	19.64	7.60	5.94
BIO-GRATE-FULL 48-48-18	25.59	10.13	7.92

DRAWING: BIO CLEAN GRATE INLET FILTER DETAILS		MEETS FULL CAPTURE REQUIREMENTS	
TYPICAL MODEL DETAIL			
WARRANTY: 8 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 10/12/17	SCALE: SF = 15	REVISIONS:	DATE:
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

PAGE 1

Last Update: 11/3/22
O:\3900-3999\3910\3910BMPSITEMAP.dwg

CITY OF ORANGE
PUBLIC WORKS DEPARTMENT

WQMP SITE MAP

IDI ECKHOFF

ECKHOFF STREET

PREPARED FOR:

IDI ECKHOFF ORANGE LLC
840 APOLLO STREET, STE. 343
EL SEGUNDO, CA. 90245
PHONE: (213) 330-8066

PREPARED BY:

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by ________
Date ________
Checked by ________
Date ________
Designed by ________
Date ________
Checked by ________
Date ________

Approved by ________ Date ________

Public Works Director ________ R.C.E. ________

Sheet 2 of 2 Sheets

3910/2 OF 2 SHEET

VII. Educational Materials

Refer to the City's website or the Orange County Stormwater Program (H2OC.org) for a library of materials available. Attach only the educational materials specifically applicable to the project.

Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☐	Proper Maintenance Practices for Your Business	☒
Household Tips	☐	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☐		
Recycle at Your Local Used Oil Collection Center (North County)	☐	IC3. Building Maintenance	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	IC7. Landscape Maintenance	☒
Recycle at Your Local Used Oil Collection Center (South County)	☐	IC15. Parking and Storage Area Maintenance	☒
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill Response	☒		☐
Tips for the Home Improvement Projects	☐		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☐		☐
Tips for Pet Care	☐		☐
Tips for Pool Maintenance	☐		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☐		☐

Appendix A:

Conditions of Approval
Resolution ______ dated _________

Appendix B:

Educational Material

The Ocean Begins at Your Front Door

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate- free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

The Ocean Begins at Your Front Door

Never allow pollutants to enter the street, gutter or storm drain!

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called "non-point source" pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.

The Effect on the Ocean

Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.

For More Information

Orange County Stormwater Program

California Environmental Protection Agency
www.calepa.ca.gov

- **Air Resources Board**
  www.arb.ca.gov
- **Department of Pesticide Regulation**
  www.cdpr.ca.gov
- **Department of Toxic Substances Control**
  www.dtsc.ca.gov
- **Integrated Waste Management Board**
  www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
  www.oehha.ca.gov
- **State Water Resources Control Board**
  www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept.	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works	(949)	724-6315
La Habra Public Services	(562)	905-9792
La Palma Public Works	(714)	690-3310
Laguna Beach Water Quality	(949)	497-0378
Laguna Hills Public Services	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev.	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	(949)	635-1800
San Clemente Environmental Programs	(949)	361-6143
San Juan Capistrano Engineering	(949)	234-4413
Santa Ana Public Works	(714)	647-3380
Seal Beach Engineering	(562)	431-2527 x317
Stanton Public Works	(714)	379-9222 x204
Tustin Public Works/Engineering	(714)	573-3150
Villa Park Engineering	(714)	998-1500
Westminster Public Works/Engineering	(714)	898-3311 x446
Yorba Linda Engineering	(714)	961-7138
Orange County Stormwater Program	(877)	897-7455

Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

Printed on Recycled Paper

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information,
please call
University of California Cooperative
Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen sample visit the Orange County Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

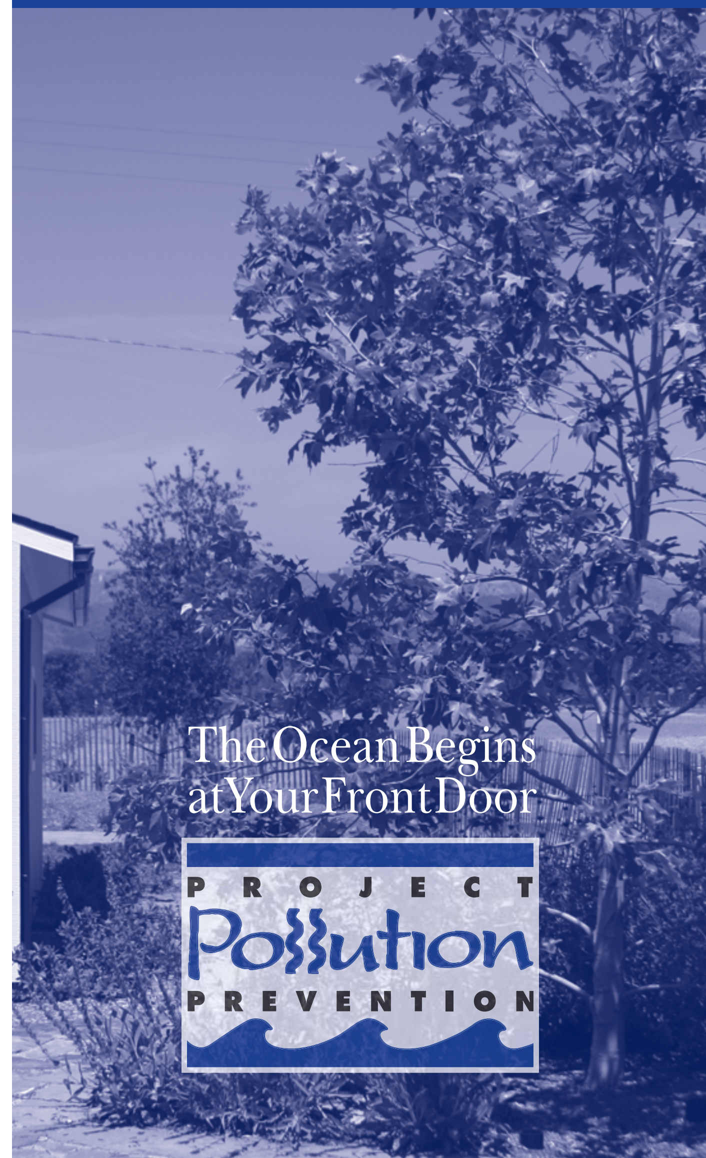
Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver, Watershed Management Advisor; Mary Louise Flint, IPM Education and Publication Director; Pamela M. Geisel, Environmental Horticulture Advisor; Carolyn L. Unruh, University of California Cooperative Extension staff writer. Photos courtesy of the UC Statewide IPM Program and Darren Haver.

Funding for this brochure has been provided in full or in part through an agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Prop. 13).

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Responsible Pest Control



Tips for Pest Control

Key Steps to Follow:

Step 1: Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.

Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

Step 2: Determine how many pests are present and causing damage.

Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

University of California Cooperative Extension

Step 3: If a pesticide must be used, choose the least toxic chemical.

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

Step 4: Wear appropriate protective clothing.

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

Step 5: Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

Step 6: In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

Step 7: Properly store and dispose of unused pesticides.

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

Household Hazardous Waste Collection Center
(714) 834-6752
www.oclandfills.com

Project Pollution Prevention

Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

Orange County Stormwater Program
24 Hour Water Pollution Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

- County and city water quality ordinances prohibit discharges containing pollutants.

Orange County Health Care Agency Environmental Health
(714) 433-6419

California Health and Safety Code, Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between $500–$1,000) and/or imprisonment for less than one year.

Regional Water Quality Control Board
Santa Ana Region (951) 782-4130
San Diego Region (858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

California Office of Emergency Services
(800) 852-7550

California Water Code, Article 4, Chapter 4, Sections 13268-13271
California Code of Regulations, Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than $20,000) and/or imprisonment for not more than one year.

DTP113 Rev 4/06
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Sewage Spill
Reference Guide

Your Responsibilities as a Private Property Owner

Residences
Businesses
Homeowner/Condominium Associations
Federal and State Complexes
Military Facilities

Orange County Sanitation District

Health Care Agency
Environmental Health

www.ocwatersheds.com

This brochure was designed courtesy of the Orange County Sanitation District (OCSD). For additional information, call (714) 962-2411, or visit their website at www.ocsd.com

What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

Common Causes of Sewage Spills

Grease builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

Structure problems caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

Infiltration and inflow (I/I) impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

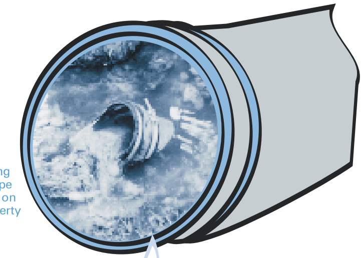
Time is of the essence in dealing with sewage spills. You are required to **immediately**:

Control and minimize the spill. Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

Use sandbags, dirt and/or plastic sheeting to prevent sewage from entering the storm drain system.

Clear the sewer blockage. Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

Always notify your city sewer/public works department or public sewer district of sewage spills. If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.



Overflowing cleanout pipe located on private property

You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

Caution

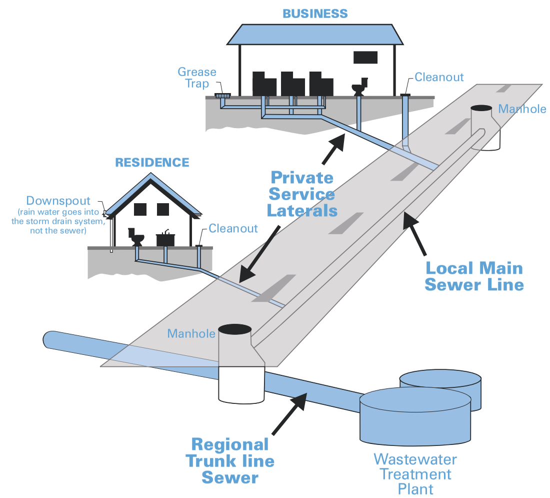
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!

How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.

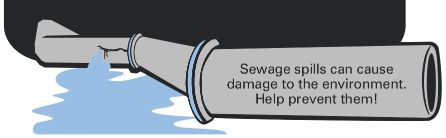


How You Can Prevent Sewage Spills

1 **Never put grease down garbage disposals, drains or toilets.**

2 **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**

3 **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**



Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

Orange County Agency Responsibilites

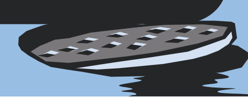
- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

A property owner may be charged for costs incurred by these agencies responding to spills from private properties.



Report Sewage Spills!

City Sewer/Public Works Departments

Aliso Viejo	(949) 425-2500
Anaheim	(714) 765-6860
Brea	(714) 990-7691
Buena Park	(714) 562-3655
Costa Mesa	(949) 645-8400
Cypress	(714) 229-6760
Dana Point	(949) 248-3562
Fountain Valley	(714) 593-4600
Fullerton	(714) 738-6897
Garden Grove	(714) 741-5375
Huntington Beach	(714) 536-5921
Irvine	(949) 453-5300
Laguna Beach	(949) 497-0765
Laguna Hills	(949) 707-2650
Laguna Niguel	(949) 362-4337
Laguna Woods	(949) 639-0500
La Habra	(562) 905-9792
Lake Forest	(949) 461-3480
La Palma	(714) 690-3310
Los Alamitos	(562) 431-3538
Mission Viejo	(949) 831-2500
Newport Beach	(949) 644-3011
Orange	(714) 532-6480
Orange County	(714) 567-6363
Placentia	(714) 993-8245
Rancho Santa Margarita	(949) 635-1800
San Clemente	(949) 366-1553
San Juan Capistrano	(949) 443-6363
Santa Ana	(714) 647-3380
Seal Beach	(562) 431-2527
Stanton	(714) 379-9222
Tustin	(714) 962-2411
Villa Park	(714) 998-1500
Westminster	(714) 893-3553
Yorba Linda	(714) 961-7170

Public Sewer/Water Districts

Costa Mesa Sanitary District	(714) 393-4433/ (949) 645-8400
El Toro Water District	(949) 837-0660
Emerald Bay Service District	(949) 494-8571
Garden Grove Sanitary District	(714) 741-5375
Irvine Ranch Water District	(949) 453-5300
Los Alamitos/Rossmoor Sewer District	(562) 431-2223
Midway City Sanitary District (Westminster)	(714) 893-3553
Moulton Niguel Water District	(949) 831-2500
Orange County Sanitation District	(714) 962-2411
Santa Margarita Water District	(949) 459-6420
South Coast Water District	(949) 499-4555
South Orange County Wastewater Authority	(949) 234-5400
Sunset Beach Sanitary District	(562) 493-9932
Trabuco Canyon Sanitary District	(949) 858-0277
Yorba Linda Water District	(714) 777-3018

Other Agencies

Orange County Health Care Agency	(714) 433-6419
Office of Emergency Services	(800) 852-7550

Preventing water pollution at your commercial/industrial site

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many landscape and building maintenance activities can lead to water pollution if you're not careful. Paint, chemicals, plant clippings and other materials can be blown or washed into storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour soap or fertilizers into the ocean, so why would you let them enter the storm drains? Follow these easy tips to help prevent water pollution.

Some types of industrial facilities are required to obtain coverage under the State General Industrial Permit. For more information visit: **www.swrcb.ca.gov/stormwater/industrial.html**

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline** at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

RECYCLE USED OIL

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Proper Maintenance Practices for Your Business

The Ocean Begins at Your Front Door

PROJECT POLLUTION PREVENTION

Proper Maintenance Practices for your Business

Landscape Maintenance

- Compost grass clippings, leaves, sticks and other vegetation, or dispose of it at a permitted landfill or in green waste containers. Do not dispose of these materials in the street, gutter or storm drain.
- Irrigate slowly and inspect the system for leaks, overspraying and runoff. Adjust automatic timers to avoid overwatering.
- Follow label directions for the use and disposal of fertilizers and pesticides.
- Do not apply pesticides or fertilizers if rain is expected within 48 hours or if wind speeds are above 5 mph.
- Do not spray pesticides within 100 feet of waterways.
- Fertilizers should be worked into the soil rather than dumped onto the surface.
- If fertilizer is spilled on the pavement or sidewalk, sweep it up immediately and place it back in the container.

Building Maintenance

- Never allow washwater, sweepings or sediment to enter the storm drain.
- Sweep up dry spills and use cat litter, towels or similar materials to absorb wet spills. Dispose of it in the trash.
- If you wash your building, sidewalk or parking lot, you **must** contain the water. Use a shop vac to collect the water and contact your city or sanitation agency for proper disposal information. Do not let water enter the street, gutter or storm drain.
- Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of materials in the trash.
- Use a ground cloth or oversized tub for mixing paint and cleaning tools.
- Use a damp mop or broom to clean floors.
- Cover dumpsters to keep insects, animals, rainwater and sand from entering. Keep the area around the dumpster clear of trash and debris. Do not overfill the dumpster.
- Call your trash hauler to replace leaking dumpsters.
- Do not dump any toxic substance or liquid waste on the pavement, the ground, or near a storm drain. Even materials that seem harmless such as latex paint or biodegradable cleaners can damage the environment.

NEVER DISPOSE OF ANYTHING IN THE STORM DRAIN.

- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit **www.oclandfills.com**.
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**
- Properly label materials. Familiarize employees with Material Safety Data Sheets.

PROJECT Pollution PREVENTION

IC3. BUILDING MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	
Oxygen Demanding	

MINIMUM BEST MANAGEMENT PRACTICES

<u>Pollution Prevention/Good Housekeeping</u>

- Properly collect and dispose of water when pressure washing buildings, rooftops, and other large objects.
- Properly prepare work area before conducting building maintenance.
- Properly clean and dispose of equipment and wastes used and generated during building maintenance.
- Store toxic material under cover when not in use and during precipitation events.

<u>Stencil storm drains</u>

<u>Training</u>

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Properly collect and dispose of water when pressure washing buildings, rooftops, and other large objects.
    - If pressure washing where the surrounding area is paved, use a water collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect the runoff and loose materials. Dispose of the collected runoff and solids properly. Refer to fact sheet *IC24 Wastewater Disposal* for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
    - If pressure washing on a landscaped area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the landscaping and not drain to pavement.
2. Properly prepare work area before conducting building maintenance.
    - Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
    - Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

3. Properly clean and dispose of equipment and wastes used and generated during building maintenance.
    - Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
    - Properly dispose of wash water, sweepings, and sediments.
    - Properly store equipment, chemicals, and wastes.
    - Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

    OPTIONAL:
    - Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable
4. Employ soil erosion and stabilization techniques when exposing large areas of soil.
    - Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.
    - Use chemical stabilization or geosynthetics to stabilize bare ground surfaces.
5. Store toxic material under cover when not in use and during precipitation events.
6. Properly dispose of fluids from air conditioning, cooling tower, and condensate drains.
7. Regularly inspect air emission control equipment under AQMD permit.
8. Switch to non-toxic chemicals for maintenance when possible.
    - If cleaning agents are used, select biodegradable products whenever feasible
    - Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).
9. Use chemicals that can be recycled.
    - Buy recycled products to the maximum extent practicable

Training
1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
4. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read “No Dumping Drains to Ocean”.

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

IC7. LANDSCAPE MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	x
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Properly store and dispose of gardening wastes.
- Use mulch or other erosion control measures on exposed soils.
- Properly manage irrigation and runoff.
- Properly store and dispose of chemicals.
- Properly manage pesticide and herbicide use.
- Properly manage fertilizer use.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Take steps to reduce landscape maintenance requirements.
   - Where feasible, retain and/or plant native vegetation with features that are determined to be beneficial. Native vegetation usually requires less maintenance than planting new vegetation.
   - When planting or replanting consider using low water use flowers, trees, shrubs, and groundcovers.
   - Consider alternative landscaping techniques such as naturescaping and xeriscaping.
2. Properly store and dispose of gardening wastes.
   - Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage at a permitted landfill or by composting.
   - Do not dispose of gardening wastes in streets, waterways, or storm drainage systems.
   - Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm and/or cover.
3. Use mulch or other erosion control measures on exposed soils.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. Properly manage irrigation and runoff.
    - Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded.
    - Inspect irrigation system regularly for leaks and to ensure that excessive runoff is not occurring.
    - If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
    - 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.
    - Use automatic timers to minimize runoff.
    - Use popup sprinkler heads in areas with a lot of activity or where pipes may be broken. Consider the use of mechanisms that reduce water flow to broken sprinkler heads.
5. Properly store and dispose of chemicals.
    - Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
    - Provide secondary containment for chemical storage.
    - Dispose of empty containers according to the instructions on the container label.
    - Triple rinse containers and use rinse water as product.
6. Properly manage pesticide and herbicide use.
    - Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of pesticides and herbicides and training of applicators and pest control advisors.
    - Follow manufacturers' recommendations and label directions.
    - Use pesticides only if there is an actual pest problem (not on a regular preventative schedule). When applicable use less toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible. Use the minimum amount of chemicals needed for the job.
    - Do not apply pesticides if rain is expected or if wind speeds are above 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 targeted pest.
    - Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.
    - Do not apply any chemicals directly to surface waters, unless the application is approved and permitted by the state. Do not spray pesticides within 100 feet of open waters.
    - Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
    - When conducting mechanical or manual weed control, avoid loosening the soil, which could lead to erosion.
    - Purchase only the amount of pesticide that you can reasonably use in a given time period.
    - Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.
7. Properly manage fertilizer use.
    - Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers.
    - Follow manufacturers' recommendations and label directions.
    - Employ techniques to minimize off-target application (e.g. spray drift) of fertilizer, including consideration of alternative application techniques. Calibrate fertilizer distributors to avoid excessive application.
    - Periodically test soils for determining proper fertilizer use.
    - Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
    - Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
    - Use slow release fertilizers whenever possible to minimize leaching

8. Incorporate the following integrated pest management techniques where appropriate:
   - Mulching can be used to prevent weeds where turf is absent.
   - Remove insects by hand and place in soapy water or vegetable oil. Alternatively, remove insects with water or vacuum them off the plants.
   - Use species-specific traps (e.g. pheromone-based traps or colored sticky cards).
   - Sprinkle the ground surface with abrasive diatomaceous earth to prevent infestations by soft-bodied insects and slugs. Slugs also 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, and tree trunk guards.
   - Promote beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders that prey on detrimental pest species.

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Educate and train employees on the use of pesticides and pesticide application techniques. Only employees properly trained to use pesticides can apply them.
3. Train and encourage employees to use integrated pest management techniques.
4. Train employees on proper spill containment and cleanup.
   - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
   - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
   - Fact sheet IC17 discusses Spill Prevention and Control in detail.
5. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
6. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read “No Dumping Drains to Ocean”.

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

Water Quality Handbook for Nurseries. Oklahoma Cooperative Extension Service. Division of Agricultural Sciences and Natural Resources. Oklahoma State University. E-951. September 1999.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

IC15. PARKING AND STORAGE AREA MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Conduct regular cleaning.
- Properly collect and dispose of wash water.
- Keep the parking and storage areas clean and orderly.
- Use absorbent materials and properly dispose of them when cleaning heavy oily deposits.
- When conducting surface repair work cover materials and clean paintbrushes and tools appropriately.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Conduct regular cleaning.
    - Sweeping or vacuuming the parking facility is encouraged over other methods.
    - Sweep all parking lots at least once before the onset of the wet season.
    - Establish frequency of sweeping based on usage and field observations of waste accumulation.
2. Properly collect and dispose of wash water.
    - Block the storm drain or contain runoff.
    - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains. Refer to fact sheet ***IC24 Wastewater Disposal*** for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
    - Dispose of parking lot sweeping debris and dirt at a landfill.
3. Consider use of source treatment BMPs to treat runoff.
    - Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
    - Utilize sand filters or oleophilic collectors for oily waste in low quantities.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices*"

4. Keep the parking and storage areas clean and orderly.
    - Clean out and cover litter receptacles frequently to prevent spillage.
    - Remove debris in a timely fashion.

    OPTIONAL:
    - Post “No Littering” signs.
5. When cleaning heavy oily deposits:
    - If possible, clean oily spots with absorbent materials.
    - Do not allow discharges to the storm drain.
    - Appropriately dispose of spilled materials and absorbents.
6. When conducting surface repair work:
    - Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
    - Conduct surface repair work during dry weather to prevent contamination from contacting stormwater runoff.
    - Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and clean any debris for proper disposal.
    - To avoid runoff, use only as much water as necessary for dust control.
    - Use drip pans or absorbent material to catch drips from paving equipment that is not in use. Dispose of collected material and absorbents properly.
7. Conduct inspections on a regular basis.
    - Designate personnel to conduct inspections of the parking facilities and stormwater conveyance systems associated with them.
    - Inspect cleaning equipment/sweepers for leaks on a regular basis.
8. Keep accurate maintenance logs to evaluate materials removed/stored and improvements made.
9. Arrange rooftop drains to prevent drainage directly onto paved surfaces.

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site’s spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
4. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
5. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read “No Dumping Drains to Ocean”.

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

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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 February 2002 by the California Coastal Commission).

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

For additional information contact:

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Main: (714) 955-0600
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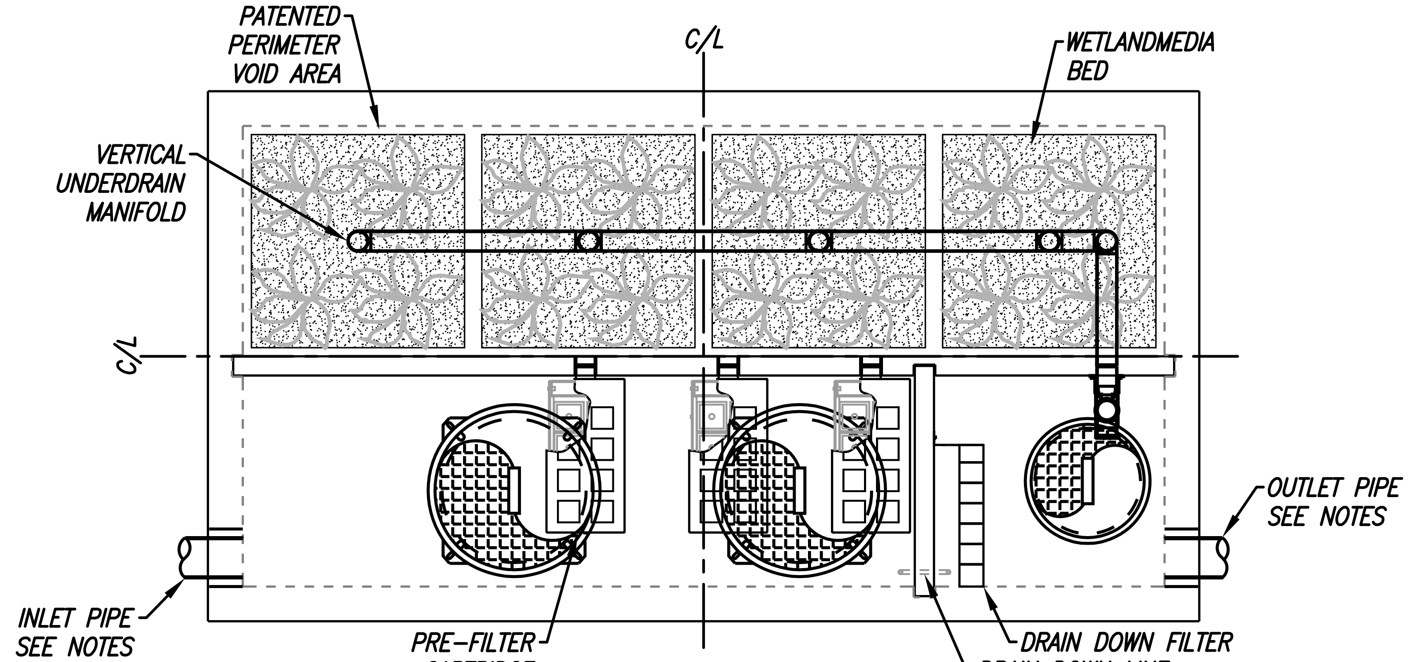
or visit our website at www.ocwatersheds.com

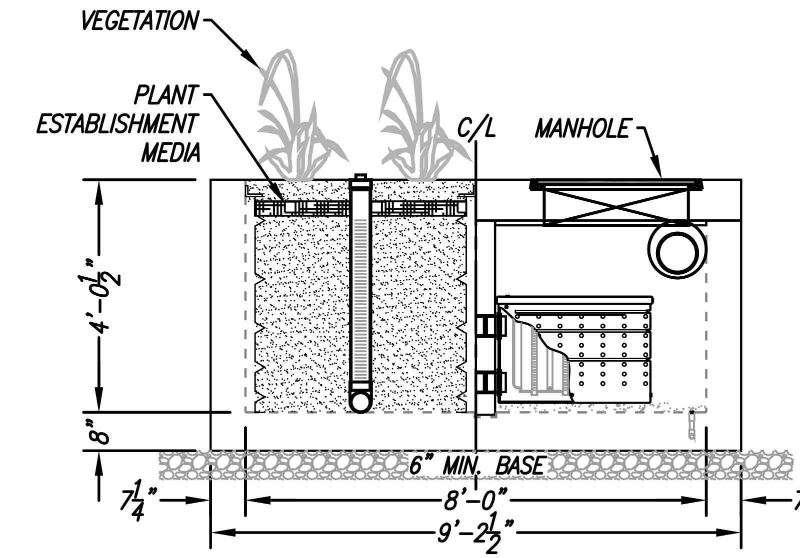
Appendix C:

BMP Details

SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			7.26
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø3.07"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			

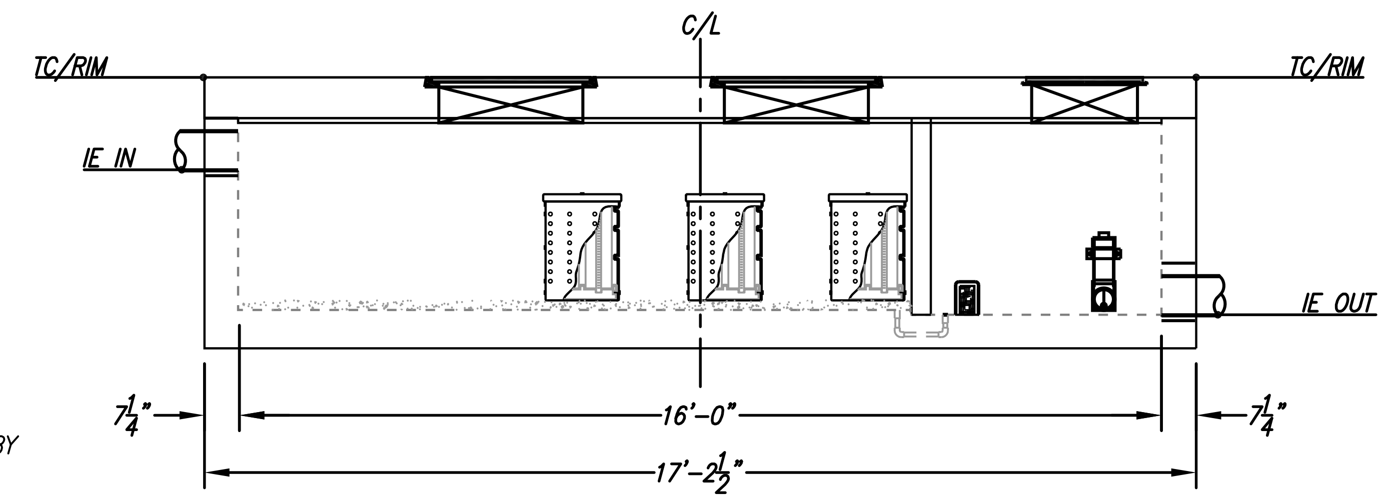


PLAN VIEW

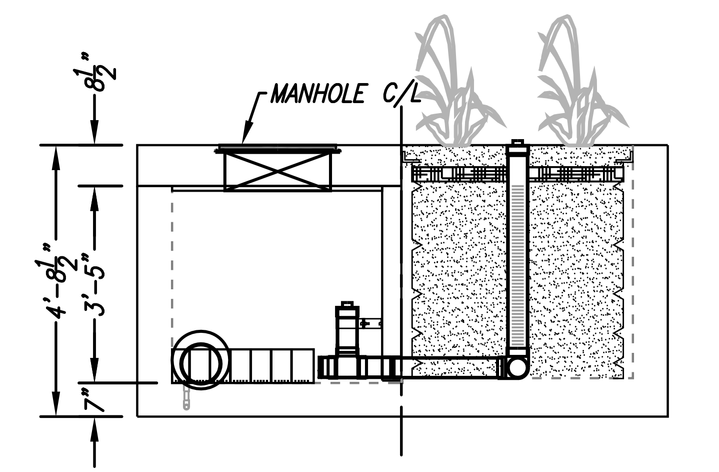


LEFT END VIEW

BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW

DISCHARGE/BIOFILTRATION

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

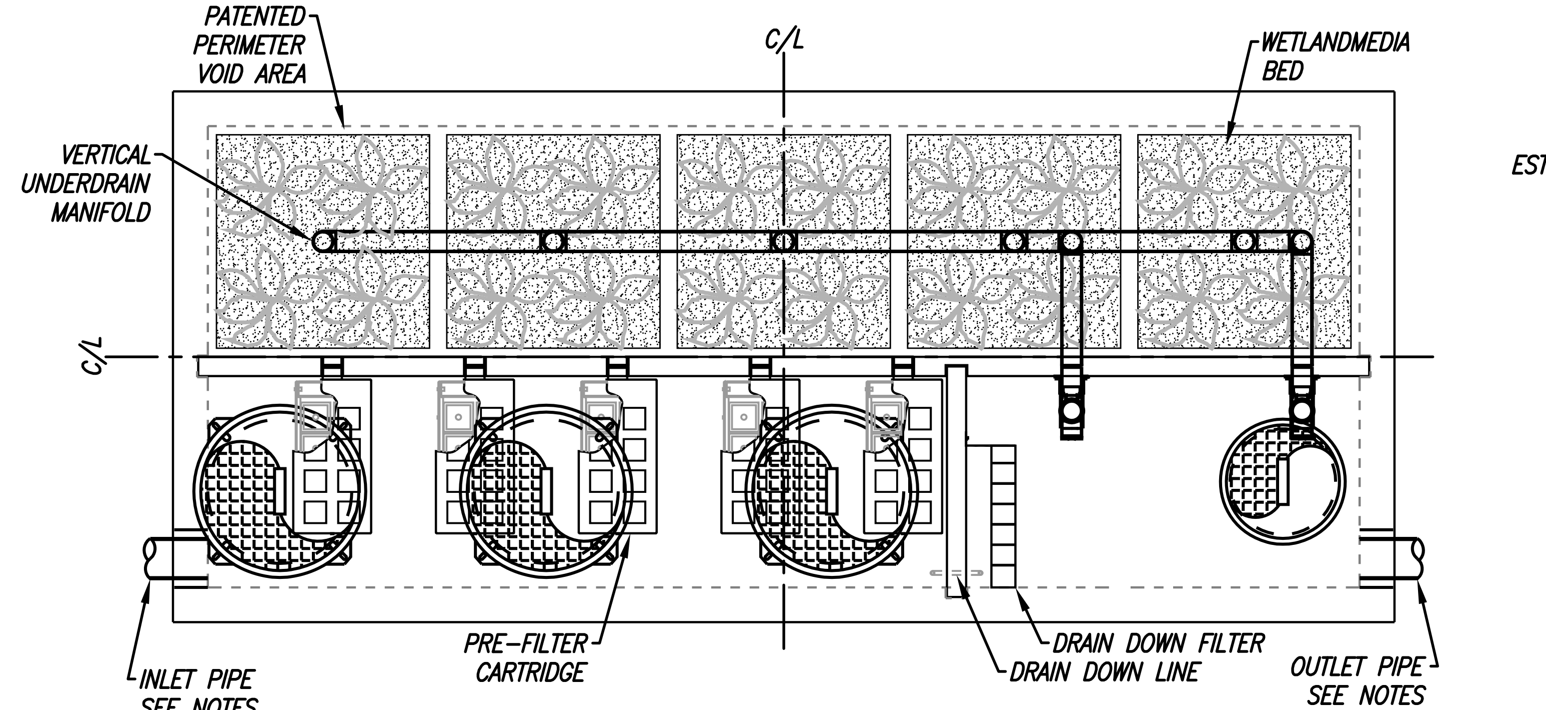
TREATMENT FLOW (CFS)	0.462
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-16-V

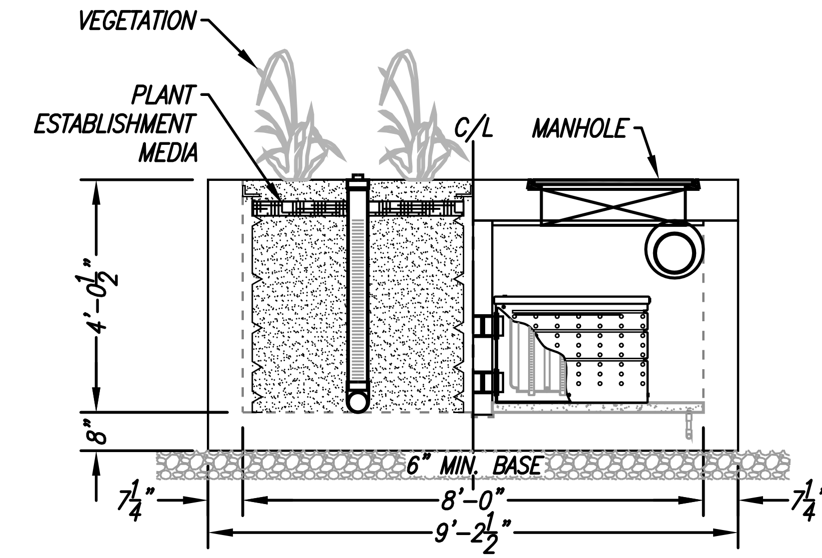
STORMWATER BIOFILTRATION SYSTEM

STANDARD DETAIL

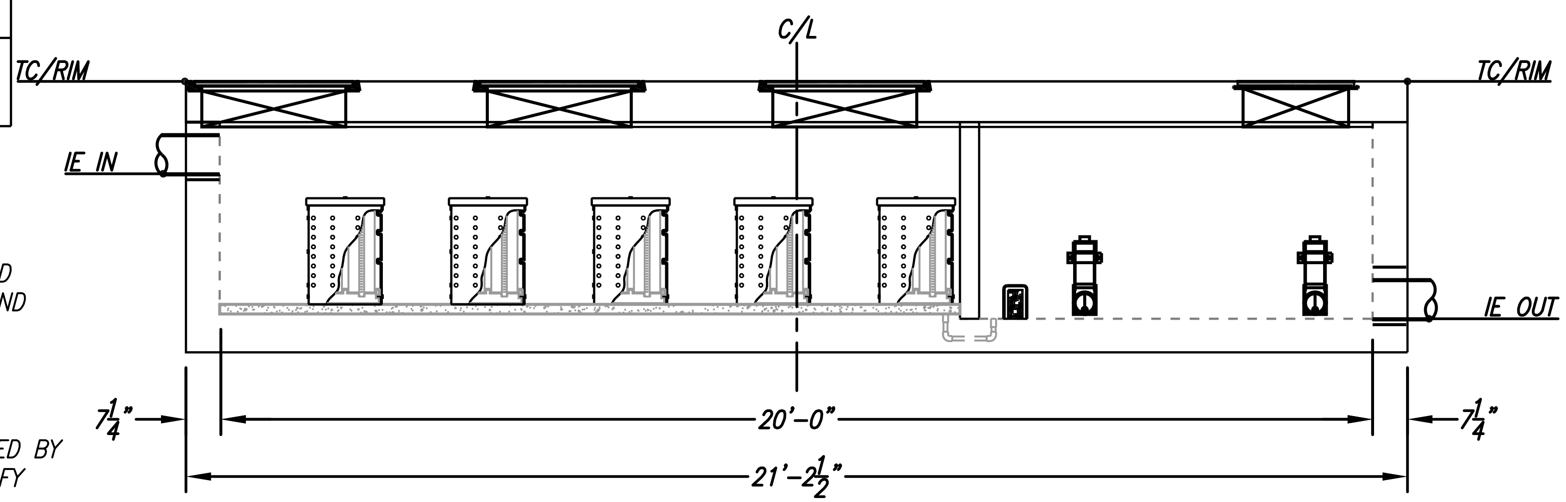
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			11.85
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.43"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



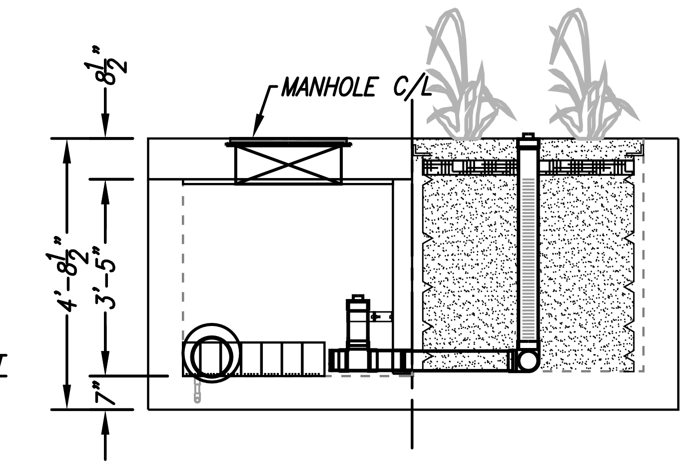
PLAN VIEW



LEFT END VIEW
BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE/BIOFILTRATION

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

6/2/15/JOHN

Section [________]
Modular Subsurface Flow Wetland System

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for Modular Subsurface Flow Wetland Systems used for biofiltration of stormwater runoff including dry weather flows and other contaminated water sources. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Modular Subsurface Flow Wetland Systems (MSFWS) are used for filtration of stormwater runoff including dry weather flows. The MSFWS is a pre-engineered biofiltration system composed of a pretreatment chamber containing filtration cartridges, a horizontal flow biofiltration chamber with a peripheral void area and a centralized and vertically extending underdrain, the biofiltration chamber containing a sorptive media mix which does not contain any organic material and a layer of plant establishment media, and a discharge chamber containing an orifice control structure . Treated water flows horizontally in series through the pretreatment chamber cartridges, biofiltration chamber and orifice control structure.

01.03.00 Manufacturer
The manufacturer of the MSFWS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the MSFWS(s) shall be a filter device Manufactured by Bio Clean or assigned distributors or licensees. Bio Clean can be reached at:

Corporate Headquarters:
Bio Clean
398 Via El Centro
Oceanside, CA 92058
Phone: (855) 566-3938
Fax: (760) 433-3176
www.biocleanenvironmental.com

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Shop drawings are to detail the MSFWS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on shop drawings

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of MSFWS.

01.05.02 Manufacturer to supply components of the MSFWS(s):

- Pretreatment chamber components (pre-assembled)
- Concrete Structure(s)
- Biofiltration chamber components (pre-assembled)
- Flow control discharge structure (pre-assembled)

01.06.00 Reference Standards

ASTM C 29	Standard Test Method for Unit Weight and Voids in Aggregate
ASTM C 88	C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C131	C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 330	C 330 Standard Specification for Lightweight Aggregate for Structural Concrete
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft.-lbf/ft3 (600 kN-m/m3)
ASTM D 1621	10 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D 1777	ASTM D1777 - 96(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 4716	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
AASHTO T 99-01	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 104	Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials.
AASHTO T 288	Standard Method of Test for Determining Minimum Laboratory Soil Resistivity
AASHTO T 289	Standard Method of Test for Determining ph of Soil for Use in Corrosion Testing
AASHTO T 291	Standard Method of Test for Determining Water Soluble Chloride Ion Content in Soil
AASHTO T 290	T 290 Standard Method of Test for Determining Water Soluble Sulfate Ion Content in Soil

PART 2 – COMPONENTS

The Modular Subsurface Flow Wetland Systems (MSFWS) and all of its components shall be self-contained within a concrete structure constructed of concrete with a minimum 28 day compressive strength of 5,000 psi, with reinforcing per ASTM A 615, Grade 60, and supports and H20 loading as indicated by AASHTO. Each Chamber shall have appropriate access hatches for easy maintenance and sized to allow removal of all internal components without disassembly. All water transfer system components shall conform with the following;

- Filter netting shall be 100% Polyester with a number 16 sieve size, and strength tested per ASTM D 3787.
- Drainage cells shall be manufactured of lightweight injection-molded plastic and have a minimum compressive strength test of 6,000 psi and a void area along the surface making contact with the filter media of 75% or greater. The cells shall be at least 2" in thickness and allow water to freely flow in all four directions.

02.01.00 Pretreatment Chamber Components

02.01.01 Filter Cartridges shall operate at a loading rate not to exceed 3 gallons per minute per square foot surface area.

02.01.02 Drain Down System shall include a pervious floor that allows water to drain into the underdrain pipe that is connected to the discharge chamber.

02.02.00 Biofiltration Chamber Components

02.02.01 Media shall consist of ceramic material produced by expanding and vitrifying select material in a rotary kiln. Media must be produced to meet the requirements of ASTM C330, ASTM C331, and AASHTO M195. Aggregates must have a minimum 24-hour water absorption of 10.5% mass. Media shall not contain any organic material. Flow through media shall be horizontal from the outer perimeter of the chamber toward the centralized and vertically extending underdrain. The retention time in the media shall be at least 3 minutes. Downward flow filters are not acceptable alternatives. The thickness of the media shall be at least 19" from influent end to effluent end. The loading rate on the media shall not exceed 1.1 gallons per minute per square foot surface area. Media must be contained within structure that spaces the surface of the media at least 2" from all vertically extending walls of the concrete structure.

02.02.02 Planting shall be native, drought tolerant species recommend by manufacturer and/or landscape architect.

02.02.03 Plant Support Media shall be made of a 3" thick moisture retention cell that is inert and contains no chemicals or fertilizers, is not made of organic material and has an internal void percentage of 80%.

02.03.00 Discharge Chamber

The discharge device shall house a flow control orifice plate that restricts flows greater than designed treatment flow rate. All piping components shall be made of a high-density polyethylene. The discharge chamber shall also contain a drain down filter if specified on the drawing.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The MSFWS has no moving internal components and functions based on gravity flow, unless otherwise specified. The MSFWS is composed of a pretreatment chamber, a biofiltration chamber and a discharge chamber. The pretreatment device houses cartridge media filters, which consist of filter media housed in a perforated enclosure. The untreated runoff flows into the system via subsurface piping and or surface inlet. Water entering the system is forced through the filter cartridge enclosures by gravity flow. Then the flow contacts the filter media. The flow through the media is horizontal toward the center of each individual media filter. In the center of the media shall be a round slotted PVC pipe of no greater than 1.5" in diameter. The slotted PVC pipe shall extend downward into the water transfer cavity of the cartridge. The slotted PVC pipe shall be threaded on the bottom to connect to the water transfer cavity. After pollutants have been removed by the filter media the water discharges the pretreatment chamber and flows into the water transfer system and is conveyed to the biofiltration chamber. Once runoff has been filtered by the biofiltration chamber it is collected by the vertical underdrain and conveyed to a discharge chamber equipped with a flow control orifice plate. Finally the treated flow exits the system.

03.01.02 Pollutants - The MSFWS will remove and retain debris, sediments, TSS, dissolved and particulate metals and nutrients including nitrogen and phosphorus species, bacteria, BOD, oxygen demanding substances, organic compounds and hydrocarbons entering the filter during frequent storm events and continuous dry weather flows.

03.01.03 Treatment Flow Rate and Bypass - The MSFWS operates in-line. The MSFWS will treat 100% of the required water quality treatment flow based on a minimum filtration capacities listed in section 03.02.00. The size of the system must match those provided on the drawing to ensure proper performance and hydraulic residence time.

Minimum Treatment Capabilities

• System must be capable of treating flows to the specified treatment flow rate on the drawings. The flow rate shall be controlled by an orifice plate.

PART 4 - EXECUTION

04.01.00 General

The installation of the MSFWS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the (MSFWS) device(s) and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies and/or DigAlert to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of MSFWS components.

04.02.03 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.

04.02.04 Concrete Structures – After backfill has been inspected by the governing agency and approved the concrete structures shall be lifted and placed in proper position per plans.

04.02.05 Subsurface Flow Wetland Media shall be carefully loaded into area so not to damage the Wetland Liner or Water Transfer Systems. The entire wetland area shall be filled to a level 9 inches below finished surface.

04.02.06 Planting layer shall be installed per manufacturer's drawings and consist of a minimum 3" grow enhancement media that ensures greater than 95% plant survival rate, and 6" of wetland media. Planting shall consist of native plants recommended by manufacturer and/or landscape architect. Planting shall be drip irrigated for at least the first 3 months to insure long term plant growth. No chemical herbicides, pesticides, or fertilizers shall be used in the planting or care and maintenance of the planted area.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – MSFWS shall be shipped to the contractor's address or job site, and is the responsibility of the contractor to offload the unit(s) and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the MSFWS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be born by the contractor. The MSFWS(s) and all components shall always be stored indoors and transported inside the original shipping container until the unit(s) are ready to be installed. The MSFWS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the MSFWS has been properly installed at the correct location(s), elevations, and with appropriate components. All components associated with the MSFWS and its installation shall be subject to inspection by the engineer at the place of installation. In addition, the contractor shall demonstrate that the MSFWS has been installed per the manufacturer's specifications and recommendations. All components shall be inspected by a qualified person once a year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of once a year and replacement of the Cartridge Filters as needed. The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the MSFWS. A Maintenance/Inspection record shall be kept by the maintenance operator. The record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured by the MSFWS shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURNACE

05.01.00 Warranty

The Manufacturer shall guarantee the MSFWS against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the ______. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The MSFWS is limited to recommended application for which it was designed.

05.02.00 Performance Certification

The MSFWS manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certificate” certifying the MSFWS is capable of achieving the specified removal efficiency for suspended solids, phosphorous and dissolved metals.

PERFORMANCE SUMMARY

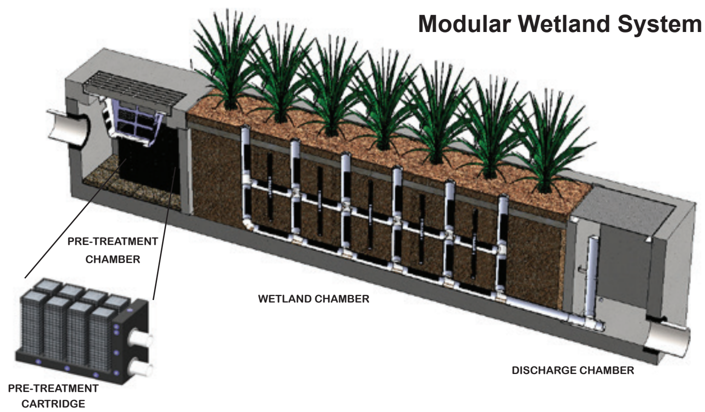
MWS-LINEAR 2.0

Application: Stand Alone Stormwater Treatment Best Management Practice
Type of Treatment: High Flow Rate Media Filtration and Biofiltration (dual-stage)

DESCRIPTION

Modular Wetland System Linear 2.0 (MWS-L 2.0) is an advanced dual-stage high flow rate media and biofiltration system for the treatment of urban stormwater runoff. Superior pollutant removal efficiencies are achieved by treating runoff through a pre-treatment chamber containing a screening device for trash and larger debris, a separation chamber for larger TSS and a series of media filter cartridges for removal of fine TSS and other particulate pollutants. Pre-treated runoff is transferred to the biofiltration chamber which contains an engineered ion exchange media designed to support an abundant plant and microbe community that captures, absorbs, transforms and uptakes pollutants through an array of physical, chemical, and biological mechanisms.

MWS-L 2.0 is a self-contained treatment train that is supplied to the job site completely assembled and ready for use. Once installed, stormwater runoff drains directly from impervious surfaces through an built-in curb inlet, drop in, or via pipe from upstream inlets or downspouts. Treated runoff is discharged from the system through an orifice control riser to assure the proper amount of flow is treated. The treated water leaving the system is connected to the storm drain system, infiltration basins, or to be re-used on site for irrigation or other uses.



Modular Wetland System Linear 2.0 (MWS-L 2.0) has been independently tested in laboratory and field conditions since 2008.

Oceanside Test Site

Portland Test Site

HEAVY METALS: Copper / Zinc

Description	Type	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Removal Efficiency	Notes
Waves Environmental - 1/4 Scale Lab Testing - 2007	Lab	.76 / .95	.06 / .19	92% / 80%	Majority Dissolved Fraction
City of Oceanside Boat Wash / Waves Environmental - 2008	Field	.04 / .24	< .02 / < .05	>50% / >79%	Effluent Concentrations Below Detectable Limits
Recycling Facility, Kileen, TX / CERL - 2011-2012	Field	.058 / .425	.032 / .061	44% / 86%	Test Unit 2
TAPE Field Testing / Portland, OR 2011/2012	Field	.017/ .120	.009 / .038	50% / 69%	Total Metals

TOTAL SUSPENDED SOLIDS:

Description	Type	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Removal Efficiency	Notes
Waves Environmental - 1/4 Scale Lab Testing - 2007	Lab	270	3	99%	Sil-co-sil 106 - 20 micron mean particle size
City of Oceanside Boat Wash / Waves Environmental - 2008	Field	45.67	8.24	82%	Mean Particle Size by Count < 8 Microns
Recycling Facility, Kileen, TX / CERL - 2011-2012	Field	676	39	94%	Test Unit 2
TAPE Field Testing / Portland, OR 2011/2012	Field	75.0	15.7	85%	Means particle size of 8 microns

Modular Wetland System, Inc.
2972 San Luis Rey Rd
Oceanside, CA 92058

MODULAR WETLANDS™

Nature & Technology Working Together In Perfect Harmony™

www.modularwetlands.com
P 760-433-7640
F 760-433-3179

PERFORMANCE SUMMARY
MWS-LINEAR 2.0

PHOSPHORUS:

Description	Type	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Removal Efficiency	Notes
TAPE Field Testing / Portland, OR 2011/2012	Field	.227	.074	64%	TOTAL P
TAPE Field Testing / Portland, OR 2011/2012	Field	.093	.031	67%	ORTHO P

NITROGEN:

Description	Type	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Removal Efficiency	Notes
City of Oceanside Boat Wash / Waves Environmental - 2008	Field	.85	.21	75%	NITRATE
TAPE Field Testing / Portland, OR 2011/2012	Field	1.40	0.77	45%	TKN

HYDROCARBONS:

Description	Type	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Removal Efficiency	Notes
Waves Environmental - 1/4 Scale Lab Testing - 2007	Lab	10	1.625	84%	Oils & Grease
City of Oceanside Boat Wash / Waves Environmental - 2008	Field	.83	0	100%	TPH Motor Oil
TAPE Field Testing / Portland, OR 2011/2012	Field	24.157	1.133	95%	Motor Oil

BACTERIA:

Description	Type	Avg. Influent (MPN)	Avg. Effluent (MPN)	Removal Efficiency	Notes
Waves Environmental - 1/4 Scale Lab Testing - 2007	Lab	1600 / 1600	535 / 637	67% / 60%	Fecal / E. Coli
City of Oceanside Boat Wash / Waves Environmental - 2008	Field	31666 / 6280	8667 / 1058	73% / 83%	Fecal / E. Coli

TURBIDITY:

Description	Type	Avg. Influent (NTU)	Avg. Effluent (NTU)	Removal Efficiency	Notes
Waves Environmental - 1/4 Scale Lab Testing - 2007	Lab	21	1.575	93%	Field Measurement
City of Oceanside Boat Wash / Waves Environmental - 2008	Field	21	6	71%	Field Measurement

LEAD:

Description	Type	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Removal Efficiency	Notes
Waves Environmental - 1/4 Scale Lab Testing - 2007	Lab	.54	.10	82%	Total
Recycling Facility, Kileen, TX / CERL - 2011-2012	Field	.01 / .043	.004 / .014	60% / 68%	Both Test Units
TAPE Field Testing / Portland, OR 2011/2012	Field	.011	.003	70%	Total

COD:

Description	Type	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Removal Efficiency	Notes
Recycling Facility, Kileen, TX / CERL - 2011-2012	Field	516 / 1450	90 / 356	83% / 75%	Both Test Units

All removal efficiencies and concentrations rounded up for easy viewing. Please call us for more information, including full copies of the reports reference above.

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2972 San Luis Rey Rd
Oceanside, CA 92058

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Modular Wetlands and Pesticides

Independent field data using the Modular Wetlands System was obtained showing the removal of Tetrachlorphenol and Pentachlorophenol (herbicides/pesticides). The following test results outline the analyte removal results in mg/Kg.

Analyte	Sample A Inlet mg/Kg	Sample B Outlet mg/Kg	Sample C Inlet mg/Kg	Sample D Outlet mg/Kg
Oil	6980	<560	5260	<530
Tetrachlorophenol 5	3.4	<2.5	4.6	<2.5
Tetrachlorophenol 6	9	4.9	9.7	5.4
Pentachlorophenol	47	16	52	22

*Data sample matrix consisted of untreated influent water and was conducted independently by SPECTRA Laboratories

Sean M. Hasan

Western Regional Director

A Forterra Company

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SPECTRA Laboratories
2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

05/12/2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411
Attn: Mike Rhubright

P.O.#: 15-04-20-024
Project: SW Substation Pole Yard
Client ID: Pole Yard Separator 2nd Ch.
Sample Matrix: Water
Date Sampled: 04/20/2015
Date Received: 04/20/2015
Spectra Project: 2015040532
Spectra Number: 1

Analyte	Result	Units	Method
Diesel	<25000	µg/L	NWTPH-D
Oil	1200000	µg/L	NWTPH-D
1,2,4-Trichlorobenzene	<250	µg/L	SW846 8270D
1,2-Dichlorobenzene	<250	µg/L	SW846 8270D
1,3-Dichlorobenzene	<250	µg/L	SW846 8270D
1,4-Dichlorobenzene	<250	µg/L	SW846 8270D
2,3,4,5-Tetrachlorophenol	<250	µg/L	SW846 8270D
2,3,4,6-Tetrachlorophenol	<250	µg/L	SW846 8270D
2,4,5-Trichlorophenol	<250	µg/L	SW846 8270D
2,4,6-Trichlorophenol	<250	µg/L	SW846 8270D
2,4-Dichlorophenol	<250	µg/L	SW846 8270D
2,4-Dimethylphenol	<250	µg/L	SW846 8270D
2,4-Dinitrophenol	<1000	µg/L	SW846 8270D
2,4-Dinitrotoluene	<250	µg/L	SW846 8270D
2,6-Dinitrotoluene	<250	µg/L	SW846 8270D
2-Chloronaphthalene	<250	µg/L	SW846 8270D
2-Chlorophenol	<250	µg/L	SW846 8270D
2-Methylnaphthalene	<100	µg/L	SW846 8270D
2-Methylphenol	<250	µg/L	SW846 8270D
2-Nitroaniline	<250	µg/L	SW846 8270D
2-Nitrophenol	<250	µg/L	SW846 8270D

Analyte	Result	Units	Method
3,3-Dichlorobenzidine	<2000	µg/L	SW846 8270D
3-Nitroaniline	<250	µg/L	SW846 8270D
4,6-Dinitro-2-Methylphenol	<1000	µg/L	SW846 8270D
4-Bromophenyl-phenylether	<250	µg/L	SW846 8270D
4-Chloro-3-Methylphenol	<250	µg/L	SW846 8270D
4-Chloroaniline	<250	µg/L	SW846 8270D
4-Chlorophenyl-phenylether	<250	µg/L	SW846 8270D
4-Methylphenol	<250	µg/L	SW846 8270D
4-Nitroaniline	<250	µg/L	SW846 8270D
4-Nitrophenol	<250	µg/L	SW846 8270D
Acenaphthene	<100	µg/L	SW846 8270D
Acenaphthylene	<100	µg/L	SW846 8270D
Aniline	<1000	µg/L	SW846 8270D
Anthracene	<100	µg/L	SW846 8270D
Azobenzene	<250	µg/L	SW846 8270D
Benzidine	<2000	µg/L	SW846 8270D
Benzo(a)Anthracene	<100	µg/L	SW846 8270D
Benzo(a)Pyrene	<100	µg/L	SW846 8270D
Benzo(b)Fluoranthene	<100	µg/L	SW846 8270D
Benzo(ghi)Perylene	<100	µg/L	SW846 8270D
Benzo(k)Fluoranthene	<100	< µg/L	SW846 8270D

Surrogate	Recovery	Method
p-Terphenyl	0	NWTPH-D
Nitrobenzene-d6	0*	SW846 8270D
p-Terphenyl-d14	0*	SW846 8270D
2-Fluorobiphenyl	0*	SW846 8270D

Surrogate	Recovery	Method
Phenol-d6	0*	SW846 8270D
2-Fluorophenol	0*	SW846 8270D
2,4,6-Tribromophenol	0*	SW846 8270D

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05/12/2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411
Attn: Mike Rhubright

P.O.#: 15-04-20-024
Project: SW Substation Pole Yard
Client ID: Pole Yard Separator 2nd Ch.
Sample Matrix: Water
Date Sampled: 04/20/2015
Date Received: 04/20/2015
Spectra Project: 2015040532
Spectra Number: 1

Analyte	Result	Units	Method
Benzoic Acid	<1000	µg/L	SW846 8270D
Benzyl Alcohol	<250	µg/L	SW846 8270D
Biphenyl	<250	µg/L	SW846 8270D
Bis(2-Chloroethyl)Ether	<250	µg/L	SW846 8270D
Butylbenzyl phthalate	<250	µg/L	SW846 8270D
Carbazole	<250	µg/L	SW846 8270D
Chrysene	<100	µg/L	SW846 8270D
Di-n-Butylphthalate	<250	µg/L	SW846 8270D
Di-n-Octyl Phthalate	<250	µg/L	SW846 8270D
Dibenzo(a,h)Anthracene	<100	µg/L	SW846 8270D
Dibenzofuran	<250	µg/L	SW846 8270D
Dibenzothiophene	<250	µg/L	SW846 8270D
Diethylphthalate	<250	µg/L	SW846 8270D
Dimethyl Phthalate	<250	µg/L	SW846 8270D
Fluoranthene	<100	µg/L	SW846 8270D
Fluorene	<100	µg/L	SW846 8270D
Hexachlorobenzene	<250	µg/L	SW846 8270D
Hexachlorobutadiene	<250	µg/L	SW846 8270D
Hexachlorocyclopentadiene	<250	µg/L	SW846 8270D
Hexachloroethane	<250	µg/L	SW846 8270D
Indeno(1,2,3-cd)Pyrene	<100	µg/L	SW846 8270D

Analyte	Result	Units	Method
Isophorone	<250	µg/L	SW846 8270D
N-Nitroso-Di-n-Propylamine	<250	µg/L	SW846 8270D
N-Nitrosodiphenylamine	<250	µg/L	SW846 8270D
N-nitrosodimethylamine	<250	µg/L	SW846 8270D
Naphthalene	<100	µg/L	SW846 8270D
Nitrobenzene	<250	µg/L	SW846 8270D
Pentachlorophenol	25700	µg/L	SW846 8270D
Phenanthrene	<100	µg/L	SW846 8270D
Phenol	<250	µg/L	SW846 8270D
Pyrene	<100	µg/L	SW846 8270D
Pyridine	<1000	µg/L	SW846 8270D
bis(2-Chloroethoxy)Methane	<250	µg/L	SW846 8270D
bis(2-Ethylhexyl)Phthalate	<250	µg/L	SW846 8270D
bis(2-chloroisopropyl)Ether	<250	µg/L	SW846 8270D

Surrogate	Recovery	Method
p-Terphenyl	0	NWTPH-D
Nitrobenzene-d6	0*	SW846 8270D
p-Terphenyl-d14	0*	SW846 8270D
2-Fluorobiphenyl	0*	SW846 8270D

Surrogate	Recovery	Method
Phenol-d6	0*	SW846 8270D
2-Fluorophenol	0*	SW846 8270D
2,4,6-Tribromophenol	0*	SW846 8270D

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05/12/2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411
Attn: Mike Rhubright

P.O.#: 15-04-20-024
Project: SW Substation Pole Yard
Client ID: Pole Yard Separator 1st Ch.
Sample Matrix: Sludge
Date Sampled: 04/20/2015
Date Received: 04/20/2015
Spectra Project: 2015040532
Spectra Number:2

Analyte	Result	Units	Method
Diesel	<9000	mg/Kg	NWTPH-D
Oil	138000	mg/Kg	NWTPH-D
1,2,4-Trichlorobenzene	<5.25	mg/Kg	SW846 8270D
1,2-Dichlorobenzene	<5.25	mg/Kg	SW846 8270D
1,3-Dichlorobenzene	<5.25	mg/Kg	SW846 8270D
1,4-Dichlorobenzene	<5.25	mg/Kg	SW846 8270D
2,4,5-Trichlorophenol	6.03	mg/Kg	SW846 8270D
2,4,6-Trichlorophenol	13.2	mg/Kg	SW846 8270D
2,4-Dichlorophenol	<5.25	mg/Kg	SW846 8270D
2,4-Dimethylphenol	<5.25	mg/Kg	SW846 8270D
2,4-Dinitrophenol	<21	mg/Kg	SW846 8270D
2,4-Dinitrotoluene	<5.25	mg/Kg	SW846 8270D
2,6-Dinitrotoluene	<5.25	mg/Kg	SW846 8270D
2-Chloronaphthalene	<5.25	mg/Kg	SW846 8270D
2-Chlorophenol	<5.25	mg/Kg	SW846 8270D
2-Methylnaphthalene	<2.20	mg/Kg	SW846 8270D
2-Methylphenol	<5.25	mg/Kg	SW846 8270D
2-Nitroaniline	<5.25	mg/Kg	SW846 8270D
2-Nitrophenol	<5.25	mg/Kg	SW846 8270D
3,3-Dichlorobenzidine	<42	mg/Kg	SW846 8270D
3-Nitroaniline	<5.25	mg/Kg	SW846 8270D
4,6-Dinitro-2-Methylphenol	<21	mg/Kg	SW846 8270D
4-Bromophenyl-phenylether	<5.25	mg/Kg	SW846 8270D
4-Chloro-3-Methylphenol	<5.25	mg/Kg	SW846 8270D
4-Chloroaniline	<5.25	mg/Kg	SW846 8270D
4-Chlorophenyl-phenylether	<5.25	mg/Kg	SW846 8270D
4-Methylphenol	19.2	mg/Kg	SW846 8270D
4-Nitroaniline	<5.25	mg/Kg	SW846 8270D
4-Nitrophenol	<5.25	mg/Kg	SW846 8270D
Acenaphthene	<2.20	mg/Kg	SW846 8270D
Acenaphthylene	<2.20	mg/Kg	SW846 8270D
Aniline	<21	mg/Kg	SW846 8270D
Anthracene	8.62	mg/Kg	SW846 8270D
Azobenzene	<5.25	mg/Kg	SW846 8270D
Benzidine	<42	mg/Kg	SW846 8270D
Benzo(a)Anthracene	<2.20	mg/Kg	SW846 8270D
Benzo(a)Pyrene	<2.20	mg/Kg	SW846 8270D
Benzo(b)Fluoranthene	<2.20	mg/Kg	SW846 8270D
Benzo(ghi)Perylene	<2.20	mg/Kg	SW846 8270D
Benzo(k)Fluoranthene	<2.20	mg/Kg	SW846 8270D
Benzoic Acid	<21	mg/Kg	SW846 8270D
Benzyl Alcohol	<5.25	mg/Kg	SW846 8270D

Results reported on a dry weight basis. Sample is 7.6% Solids.

Surrogate	Recovery	Method
2-Fluorophenol	39	SW846 8270D
Nitrobenzene-d6	63	SW846 8270D
Phenol-d6	57	SW846 8270D
2-Fluorobiphenyl	67	SW846 8270D
2,4,6-Tribromophenol	68	SW846 8270D
p-Terphenyl-d14	74	SW846 8270D
p-Terphenyl	0	NWTPH-D

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05/12/2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411
Attn: Mike Rhubright

P.O.#: 15-04-20-024
Project: SW Substation Pole Yard
Client ID: Pole Yard Separator 1st Ch.
Sample Matrix: Sludge
Date Sampled: 04/20/2015
Date Received: 04/20/2015
Spectra Project: 2015040532
Spectra Number:2

Analyte	Result	Units	Method
Biphenyl	<5.25	mg/Kg	SW846 8270D
Bis(2-Chloroethyl)Ether	<5.25	mg/Kg	SW846 8270D
Butylbenzylphthalate	<5.25	mg/Kg	SW846 8270D
Carbazole	<5.25	mg/Kg	SW846 8270D
Chrysene	2.61	mg/Kg	SW846 8270D
Di-n-Butylphthalate	<5.25	mg/Kg	SW846 8270D
Di-n-Octyl Phthalate	<5.25	mg/Kg	SW846 8270D
Dibenz(a,h)Anthracene	<2.20	mg/Kg	SW846 8270D
Dibenzofuran	<5.25	mg/Kg	SW846 8270D
Dibenzothiophene	<5.25	mg/Kg	SW846 8270D
Diethylphthalate	<5.25	mg/Kg	SW846 8270D
Dimethyl Phthalate	<5.25	mg/Kg	SW846 8270D
Fluoranthene	<2.20	mg/Kg	SW846 8270D
Fluorene	<2.20	mg/Kg	SW846 8270D
Hexachlorobenzene	<5.25	mg/Kg	SW846 8270D
Hexachlorobutadiene	<5.25	mg/Kg	SW846 8270D
Hexachlorocyclopentadiene	<5.25	mg/Kg	SW846 8270D
Hexachloroethane	<5.25	mg/Kg	SW846 8270D
Indeno(1,2,3-cd)Pyrene	<2.20	mg/Kg	SW846 8270D
Isophorone	<5.25	mg/Kg	SW846 8270D
N-Nitroso-Di-n-Propylamine	<5.25	mg/Kg	SW846 8270D

Analyte	Result	Units	Method
N-Nitrosodiphenylamine	<5.25	mg/Kg	SW846 8270D
N-nitrosodimethylamine	<5.25	mg/Kg	SW846 8270D
Naphthalene	19.0	mg/Kg	SW846 8270D
Nitrobenzene	<5.25	mg/Kg	SW846 8270D
Pentachlorophenol	487	mg/Kg	SW846 8270D
Phenanthrene	6.10	mg/Kg	SW846 8270D
Phenol	<5.25	mg/Kg	SW846 8270D
Pyrene	3.27	mg/Kg	SW846 8270D
Pyridine	<21	mg/Kg	SW846 8270D
Tetrachlorophenol	45.9	mg/Kg	SW846 8270D
bis(2-Chloroethoxy)Methane	<5.25	mg/Kg	SW846 8270D
bis(2-Ethylhexyl)Phthalate	<5.25	mg/Kg	SW846 8270D
bis(2-chloroisopropyl)Ether	<5.25	mg/Kg	SW846 8270D

Results reported on a dry weight basis. Sample is 7.6% Solids.

Surrogate	Recovery	Method
2-Fluorophenol	39	SW846 8270D
Nitrobenzene-d6	63	SW846 8270D
Phenol-d6	57	SW846 8270D
2-Fluorobiphenyl	67	SW846 8270D

Surrogate	Recovery	Method
2,4,6-Tribromophenol	68	SW846 8270D
p-Terphenyl-d14	74	SW846 8270D
p-Terphenyl	0	NWTPH-D

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May 12, 2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411

Method: NWTPH-Dx
Sample Matrix: Soil
Spectra Project: 2015040532
Applies to Spectra #: 2
Units: mg/Kg

HYDROCARBON ANALYSIS
QUALITY CONTROL RESULTS

MS/MSD

Spiked Sample: 050156-2

Date Extracted: 5/8/2015
Date Analyzed: 5/8/2015

Compound	Sample Result	Spike Amount Added	Spike Amount Found	Percent Recovery	Dup. Spike Amount Found	Percent Recovery	% RPD
Diesel	<10.0	125	85	68	86	69	1.2

BLANK SPIKE (LCS)

Date Extracted: 4/22/2015
Date Analyzed: 4/24/2015

Compound	Sample Result	Spike Amount Added	Spike Amount Found	Percent Recovery
Diesel	<10.0	125	102.3	81.84

METHOD BLANK

Date Extracted: 4/22/2015
Date Analyzed: 4/24/2015

WTPH-D <10.0

Heavy Oils <50.0

Surrogate Percent Recoveries:

p-terphenyl 82%

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May 12, 2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411

Method: NWTPH-Dx
Sample Matrix: Water
Spectra Project: 2015040532
Applies to Spectra #: 1

HYDROCARBON ANALYSIS
QUALITY CONTROL RESULTS

MS/MSD

Spiked Sample: Method Blank
Units: ug/L

Date Extracted: 4/7/2015
Date Analyzed: 4/8/2015

Compound	Sample Result	Spike Amount Added	Spike Amount Found	Percent Recovery	Dup. Spike Amount Found	Percent Recovery	% RPD
Diesel	0	2500	2165	87	2625	105	19

METHOD BLANK

Date Extracted: 4/22/2015
Units: ug/L

Date Analyzed: 5/5/2015

WTPH-D	<100
Heavy Oils	<500

Surrogate Recoveries:

p-terphenyl 98%

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May 12, 2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411

Spectra Project #	2015040532
Sample Spiked:	Method Blank
Date Extracted:	4/23/2015
Date Analyzed:	4/24/2015
Units:	ug/L
Applies to Spectra #'s:	#1

GCMS Semi-Volatile Organic Analysis Method 625/8270
Blank Spike (LCS) Results

Compound	Sample Conc.	Spike Added	MS Conc.	MS %Rec	Rec. Limits
Phenol	<2.50	75	36.7	49	32-84
2-Chlorophenol	<2.50	75	35.3	47	35-84
1,4-Dichlorobenzene	<2.50	50	17.9	36	15-90
N-Nitroso-Di-N-Propylamine	<2.50	50	32.7	65	31-104
1,2,4-Trichlorobenzene	<2.50	50	24.2	48	24-82
4-Chloro-3-Methylphenol	<2.50	75	46.8	62	34-107
Acenaphthene	<1.00	50	27.3	55	34-98
2,4-Dinitrotoluene	<2.50	50	22.8	46	32-105
4-Nitrophenol	<2.50	75	53.7	72	26-156
Pentachlorophenol	<2.50	75	27.5	37	34-101
Pyrene	<1.00	50	28.6	57	30-130

Surrogates	% Rec	Limits
2-Fluorophenol	47	33-77
Phenol-d5	64	34-122
Nitrobenzene-d5	83	32-122
2-Fluorobiphenyl	38	35-98
2,4,6-Tribromophenol	71	30-127
p-Terphenyl-d14	72	66-130

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May 12, 2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411

Sample Matrix:	Water	Date Extracted:	4/23/2015
Spectra Project:	2015040532	Date Analyzed:	4/24/2015
Applies to #1		Dilution:	1
		< = less than	

SEMIVOLATILE ORGANIC ANALYSIS METHOD BLANK RESULTS

METHOD 625/8270

Compound	ug/L	Compound	ug/L
Pyridine	< 10	2,4-Dinitrophenol	< 10
N-Nitrosodimethylamine	< 2.5	4-Nitrophenol	< 2.5
Aniline	< 10	Dibenzofuran	< 2.5
Phenol	< 2.5	2,4-Dinitrotoluene	< 2.5
bis(2-Chloroethyl)Ether	< 2.5	2,6-Dinitrotoluene	< 2.5
2-Chlorophenol	< 2.5	Diethylphthalate	< 2.5
1,3-Dichlorobenzene	< 2.5	4-Chlorophenyl-phenylether	< 2.5
1,4-Dichlorobenzene	< 2.5	Fluorene	< 1.0
Benzyl Alcohol	< 2.5	4-Nitroaniline	< 2.5
1,2-Dichlorobenzene	< 2.5	4,6-Dinitro-2-Methylphenol	< 10
2-Methylphenol	< 2.5	Ni-Nitrosodiphenylamine	< 2.5
bis(2-Chloroisopropyl)Ether	< 2.5	4-Bromophenyl-phenylether	< 2.5
4-Methylphenol	< 2.5	Hexachlorobenzene	< 2.5
N-Nitroso-di-n-Propylamine	< 2.5	Pentachlorophenol	< 2.5
Hexachloroethane	< 2.5	Phenanthrene	< 1.0
Nitrobenzene	< 2.5	Anthracene	< 1.0
Isophorone	< 2.5	Di-n-butylphthalate	< 2.5
2-Nitrophenol	< 2.5	Fluoranthene	< 1.0
2,4-Dimethylphenol	< 2.5	Benzidine	< 20
Benzoic Acid	< 10	Pyrene	< 1.0
bis(2-Chloroethoxy)methane	< 2.5	Butylbenzylphthalate	< 2.5
2,4-Dichlorophenol	< 2.5	3,3-Dichlorobenzidine	< 20
1,2,4-Trichlorobenzene	< 2.5	Benzo(a)anthracene	< 1.0
Naphthalene	< 1.0	bis(2-ethylhexyl)phthalate	< 2.5
4-Chloroaniline	< 10	Chrysene	< 1.0
Hexachlorobutadiene	< 2.5	Di-n-octyl phthalate	< 2.5
4-Chloro-3-Methylphenol	< 2.5	Benzo(b)Fluoranthene	< 1.0
2-Methylnaphthalene	< 1.0	Benzo(k)Fluoranthene	< 1.0
Hexachlorocyclopentadiene	< 2.5	Benzo(a)pyrene	< 1.0
2,4,6-Trichlorophenol	< 2.5	Indeno(1,2,3-c,d)pyrene	< 1.0
2,4,5-Trichlorophenol	< 2.5	Dibenzo(a,h)anthracene	< 1.0
2-Chloronaphthalene	< 2.5	Benzo(g,h,i)perylene	< 1.0
2-Nitroaniline	< 2.5	Carbazole	< 2.5
Dimethyl Phthalate	< 2.5	Biphenyl	< 2.5
Acenaphthylene	< 1.0	n-decane	< 2.5
3-Nitroaniline	< 2.5	n-octadecane	< 2.5
Acenaphthene	< 1.0	1-Methylnaphthalene	< 1.0
		2,3,4,5-tetrachlorophenol	< 2.5
		2,3,4,6-tetrachlorophenol	< 2.5

SURROGATE RECOVERIES

		%Rec. (Limits)			%Rec. (Limits)
Nitrobenzene-d5	76	% (32-122)	2-Fluorophenol	48	% (20-100)
2-Fluorobiphenyl	65	% (35-98)	Phenol-d5	58	% (34-122)
p-Terphenyl-d14	80	% (30-130)	2,4,6-Tribromophenol	41	% (30-127)

Steven G. Hibbs
Laboratory Manager

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May 12, 2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411

Spectra Project #	2015040532
Sample Spiked:	Method Blank
Date Extracted:	4/22/2015
Date Analyzed:	4/22/2015
Units:	mg/Kg
Applies to Spectra #'s:	#2

GCMS Semi-Volatile Organic Analysis, Method 8270D (Scan Mode)
Blank Spike (LCS) Results in Soil/ Solids

Compound	Blank Conc.	Spike Added	LCS Conc.	LCS %Rec
Phenol	<0.08	2.50	1.31	52
2-Chlorophenol	<0.08	2.50	1.22	49
1,4-Dichlorobenzene	<0.08	1.67	0.76	46
N-Nitroso-Di-N-Propylamine	<0.08	1.67	1.05	63
1,2,4-Trichlorobenzene	<0.08	1.67	0.86	51
4-Chloro-3-Methylphenol	<0.08	2.50	1.62	65
Acenaphthene	<0.03	1.67	0.88	53
2,4-Dinitrotoluene	<0.08	1.67	0.83	50
4-Nitrophenol	<0.08	2.50	2.20	88
Pentachlorophenol	<0.08	2.50	0.87	35
Pyrene	<0.03	1.67	1.21	73

Surrogates	%Rec
2-Fluorophenol	46
Phenol-d5	64
Nitrobenzene-d5	78
2-Fluorobiphenyl	67
2,4,6-Tribromophenol	65
p-Terphenyl-d14	91

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May 12, 2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411

Sample Matrix:	Soil	Date Extracted:	4/22/2015
Spectra Project:	2015040532	Date Analyzed:	4/22/2015
Applies to:	#2	Dilution:	1
		< = less than	

SEMIVOLATILE ORGANIC ANALYSIS METHOD BLANK RESULTS

METHOD 8270

Compound	mg/Kg	Compound	mg/Kg
Pyridine	< 0.33	Acenaphthene	< 0.03
N-Nitrosodimethylamine	< 0.08	2,4-Dinitrophenol	< 0.33
Aniline	< 0.33	4-Nitrophenol	< 0.08
Phenol	< 0.08	Dibenzofuran	< 0.08
bis(2-Chloroethyl)Ether	< 0.08	2,4-Dinitrotoluene	< 0.08
2-Chlorophenol	< 0.08	2,6-Dinitrotoluene	< 0.08
1,3-Dichlorobenzene	< 0.08	Diethylphthalate	< 0.08
1,4-Dichlorobenzene	< 0.08	4-Chlorophenyl-phenylether	< 0.08
Benzyl Alcohol	< 0.08	Fluorene	< 0.03
1,2-Dichlorobenzene	< 0.08	4-Nitroaniline	< 0.08
2-Methylphenol	< 0.08	4,6-Dinitro-2-Methylphenol	< 0.33
bis(2-Chloroisipropyl)Ether	< 0.08	N-Nitrosodiphenylamine	< 0.08
4-Methylphenol	< 0.08	4-Bromophenyl-phenylether	< 0.08
N-Nitroso-di-n-Propylamine	< 0.08	Hexachlorobenzene	< 0.08
Hexachloroethane	< 0.08	Pentachlorophenol	< 0.08
Nitrobenzene	< 0.08	Phenanthrene	< 0.03
Isophorone	< 0.08	Anthracene	< 0.03
2-Nitrophenol	< 0.08	Di-n-butylphthalate	< 0.08
2,4-Dimethylphenol	< 0.08	Fluoranthene	< 0.03
Benzoic Acid	< 0.33	Benzidine	< 0.67
bis(2-Chloroethoxy)methane	< 0.08	Pyrene	< 0.03
2,4-Dichlorophenol	< 0.08	Butylbenzylphthalate	< 0.08
1,2,4-Trichlorobenzene	< 0.08	3,3-Dichlorobenzidine	< 0.67
Naphthalene	< 0.03	Benzo(a)anthracene	< 0.03
4-Chloroaniline	< 0.08	bis(2-ethylhexyl)phthalate	< 0.08
Hexachlorobutadiene	< 0.08	Chrysene	< 0.03
4-Chloro-3-Methylphenol	< 0.08	Di-n-octyl phthalate	< 0.08
2-Methylnaphthalene	< 0.03	Benzo(b)Fluoranthene	< 0.03
Hexachlorocyclopentadiene	< 0.08	Benzo(k)Fluoranthene	< 0.03
2,4,6-Trichlorophenol	< 0.08	Benzo(a)pyrene	< 0.03
2,4,5-Trichlorophenol	< 0.08	Indeno(1,2,3-c,d)pyrene	< 0.03
2-Chloronaphthalene	< 0.08	Dibenzo(a,h)anthracene	< 0.03
2-Nitroaniline	< 0.08	Benzo(g,h,i)perylene	< 0.03
Dimethyl Phthalate	< 0.08	Carbazole	< 0.08
Acenaphthylene	< 0.03	Biphenyl	< 0.08
3-Nitroaniline	< 0.08	1-Methylnaphthalene	< 0.08
		Dibenzothiophene	< 0.08
		Tetrachlorophenol	< 0.08

SURROGATE RECOVERIES

Nitrobenzene-d5	77 %	2-Fluorophenol	44 %
2-Fluorobiphenyl	66 %	Phenol-d5	57 %
p-Terphenyl-d14	84 %	2,4,6-Tribromophenol	52 %

Steven G. Hibbs
Laboratory Manager

SPECTRA Laboratories

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

May 12, 2015

Tacoma Public Utilities
PO Box 11007
Tacoma, WA 98411

Spectra Project #	2015040532
Sample Spiked:	2015040143-4
Date Extracted:	4/8/2015
Date Analyzed:	4/8/2015
Units:	mg/kg wet wt.
Applies to Spectra #'s:	#2

GCMS Semi-Volatile Organic Analysis, Method 8270D (Scan Mode)
Matrix Spike/ Matrix Spike Duplicate Results in Soil

Compound	Sample Conc.	Spike Added	MS Conc.	MS %Rec	MSD Conc	MSD %Rec	RPD
Phenol	<0.08	2.50	1.47	59	1.51	60	2
2-Chlorophenol	<0.08	2.50	1.38	55	1.45	58	5
1,4-Dichlorobenzene	<0.08	1.67	0.81	49	0.86	51	6
N-Nitroso-Di-N-Propylamine	<0.08	1.67	1.09	65	1.12	67	3
1,2,4-Trichlorobenzene	<0.08	1.67	0.95	57	1.00	60	5
4-Chloro-3-Methylphenol	<0.08	2.50	1.97	79	1.96	78	1
Acenaphthene	<0.03	1.67	1.02	61	1.05	63	3
2,4-Dinitrotoluene	<0.08	1.67	0.97	58	0.92	55	4
4-Nitrophenol	<0.08	2.50	2.55	102	2.60	104	2
Pentachlorophenol	<0.08	2.50	1.56	62	1.43	57	9
Pyrene	<0.03	1.67	1.23	74	1.27	76	3

Steven G. Hibbs
Laboratory Manager

SPECTRA Laboratories
2221 Ross Way, Tacoma, WA 98421
(253) 272-4850 Fax (253) 572-9838
www.spectra-lab.com info@spectra-lab.com

SPECIAL INSTRUCTIONS/COMMENTS: ✓

CHAIN OF CUSTODY

SPECTRA PROJECT # 2015040532

Return Samples: Y (N) Page 1 of 1 STANDARD [X] RUSH [ ]

CLIENT: Tacoma Power ADDRESS: 3628 S. 35th ADDRESS CHANGE [ ]

PROJECT: SW Substation Pole Yard

CONTACT: Mike Rhubright

SAMPLED BY: Mike Rhubright

PHONE: 502 8520 FAX:

e-MAIL: mrhubrig@ci.tacoma.wa.us Prefer FAX [ ] or e-MAIL [X]

PURCHASE ORDER # 15-04-20-024

	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	NUMBER OF CONTAINERS	HYDROCARBONS: NWTPH-HCID	BTEX	BTEX/NWTPH-G	NWTPH-G	NWTPH-Dx	1664 SGT-HEM (TPH)	1664 HEM (FOG)	ORGANICS: 8260/624 VOA	8260 CHLOR SOLVENTS	8270-625 SEMI VOA	8270 PAH/PNA	8082/608 PCB	METALS: TOTAL METALS RCRA 8	TOTAL METALS (SPECIFY)	TCLP METALS RCRA 8	TCLP METALS (SPECIFY)	OTHER: PH 9040/9045	TX/TOX/EOX	TURBIDITY	FLASH POINT	BOD	SOLIDS (SPECIFY)
1	Pole Yard Separator 2nd Chamber	4/20/15	1300	Water	1					X					X												
2	Pole Yard Separator 1st Chamber Solids	↓	1310	Sludge	1					X					X												
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											

LAB USE ONLY
Shipped Via: US Mail UPS Fed Ex Courier Client
Shipping Container: Cooler Box Envelope None
Tracking # ____
Custody Seals: Y N Intact: Y N
Cooler Temp. ____ Sample Temp. ____

	SIGNATURE	PRINTED NAME	COMPANY	DATE	TIME
RELINQUISHED BY	Mike Rhubright	Mike Rhubright	TPU	4/20/15	1353
RECEIVED BY	Lori Hamilton	Lori Hamilton	Spectra	4-20-15	1:56pm
RELINQUISHED BY					
RECEIVED BY					

BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

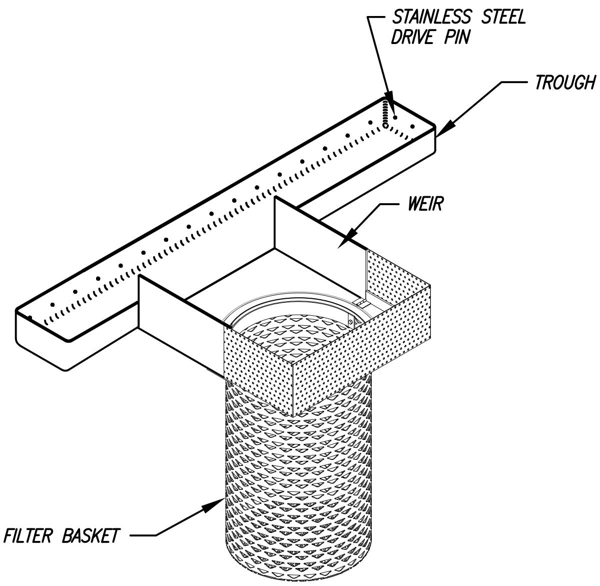


FIGURE 1:
DETAIL OF PARTS

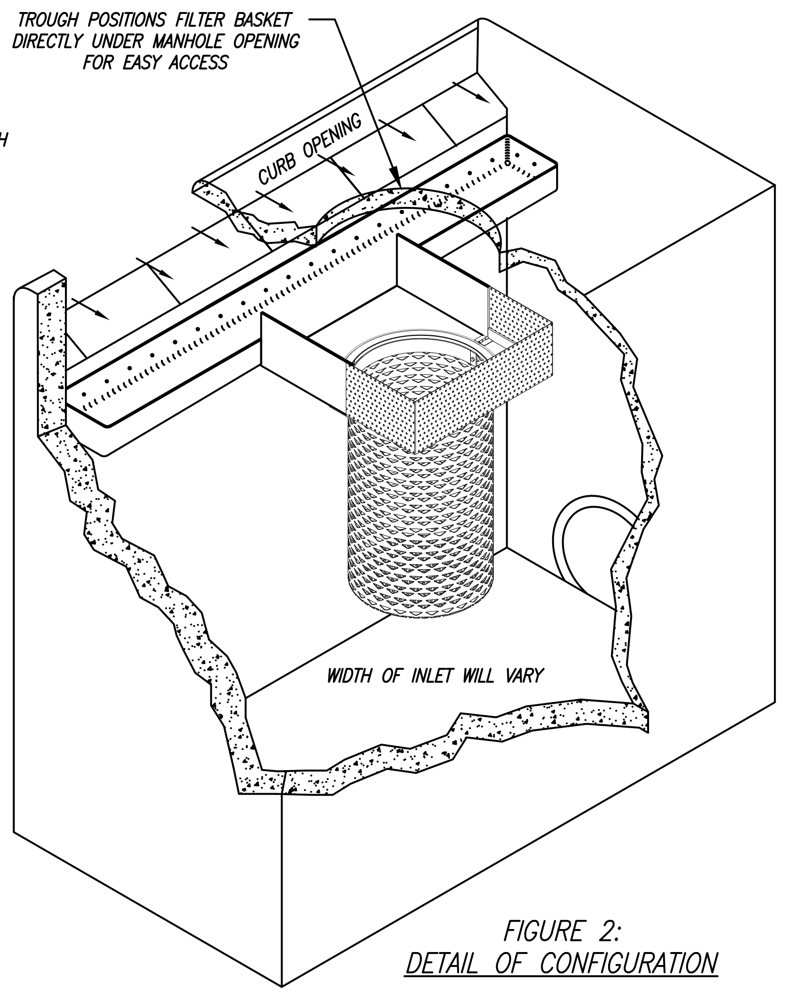


FIGURE 2:
DETAIL OF CONFIGURATION

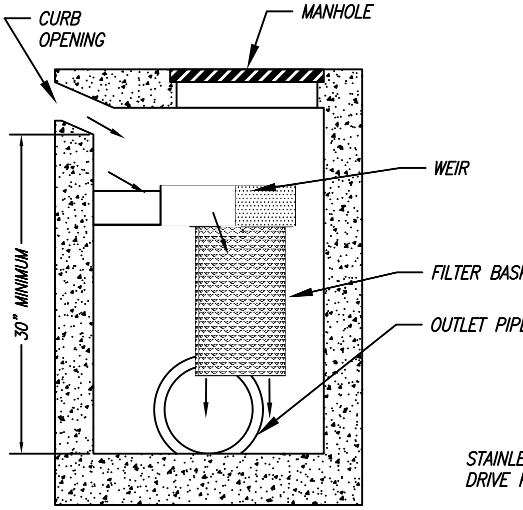


FIGURE 4:
DETAIL OF PROFILE

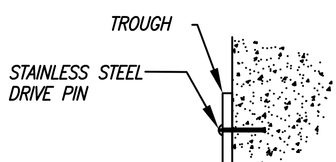


FIGURE 3:
DETAIL OF MOUNTING

NOTES:

1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 100% STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGIN SCREEN WITH 4.7 MM OPENINGS AND MEETS FULL CAPTURE REQUIREMENTS.
6. FILTER CAN BE FITTED WITH HYDROCARBON ABSORBENT BOOM
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE - CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS A SAFETY FACTOR OF 2.0
11. BYPASS IS FACILITATED VIA OVERFLOW OF THE TROUGH SYSTEM AND IS EQUAL TO THE CAPACITY OF THE CURB OPENING
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BIO-CURB-FULL-24	2.85	1.40
BIO-CURB-FULL-18	2.85	1.05
BIO-CURB-FULL-12	2.85	0.70

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS	MEETS FULL CAPTURE REQUIREMENTS
TREATMENT FLOW RATE: 2.85 cfs	MODEL #: BIO-CURB-FULL
WARRANTY: 8 YEAR MANUFACTURERS	PROJECT:
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176	REVISIONS: DATE: REVISIONS: DATE:
DATE: 10/12/2017 SCALE: NTS	REVISIONS: DATE:
DRAFTER: M.C.P. UNITS = INCHES	REVISIONS: DATE:

Bio Clean
A Forterra Company

Section [________]
Stormwater Catch Basin Filtration Device

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for devices used for filtration of stormwater runoff captured by catch basins with curb openings. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Stormwater Catch Basin Filtration Devices (SCBFD) are used to filter stormwater runoff captured by catch basins. The SCBFD is a filter system composed of a filter basket, media filtration boom and a trough system. SCBFDs are used to remove various pollutants from stormwater by means of screening, separation and media filtration.

01.03.00 Manufacturer
The manufacturer of the SCBFD shall be one that is regularly engaged in the engineering, design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the SCBFD(s) shall be a filter device manufactured/distributed by Bio Clean Environmental Services, Inc. or assigned distributors or licensees. Bio Clean Environmental Services, Inc. can be reached at:

Corporate Headquarters:
398 Via El Centro
Oceanside, CA 92058
Phone: (855) 566-3938
Fax: (760) 433-3176
www.BioCleanEnvironmental.com

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and engineer of work.

01.04.02 Shop drawings are to detail the SCBFD, its components and the sequence for installation, including:

- SCBFD configuration with primary dimensions
- Various SCBFD components
- Any accessory equipment

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of SCBFD.

01.05.02 Manufacturer to supply SCBFD(s):

- Filter Basket
- Trough System (weir and trough)
- Media Filtration Boom

01.05.03 Media Filtration Boom shall be provided with each Filter Basket housed in nylon netting and securely fastened entrance to the Filtration basket. Each media boom shall contain polymer beads to permanently absorb hydrocarbons.

01.06.00 Reference Standards

ASTM A 240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM F 716	Testing Sorbent Performance of Absorbents
ASTM F 726	Sorbent Performance of Absorbents
ASTM D3787 - 07	Standard Test Method for Bursting Strength of Textiles-Constant-Rate-of-Traverse (CRT) Ball Burst Test
ASTM D2690-98	Standard Test Method for Isophthalic Acid in Alkyd and Polyester Resins
ASTM C 582-02	Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment
ASTM D 638	Standard Test Method for Tensile Properties of Plastics
ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 648	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
ASTM D 2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 4097	Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM D3409	Standard Test Method for Adhesion of Asphalt-Roof Cement to Damp, Wet, or Underwater Surfaces
IFI 114	Break Mandrel Blind Rivets

PART 2 – COMPONENTS

02.01.00 Trough System Components

02.01.01 Trough shall be manufactured from 100% marine grade polyester resin and fiberglass strands and stainless steel.

- The entire fiberglass structure must be coated with a polyester gel coating with ultra violet inhibitors incorporated into the coating for maximum ultra violet protection.
- Fiberglass must have a minimum thickness of 3/16”.

02.01.02 Weir portion of the Trough System shall be manufactured from 100% stainless steel.

- The Weir shall fully surround the Filter Basket on all sides. On the end of the weir the sides shall be made of screen with perforated round openings less than 5 mm in size.
- Water flows in access of the capacity of the Filter Basket shall pass through the additional weir screen for added treatment and retention of trash and debris during higher bypass flows.
- The Weir shall be hinged in the middle along the centerline of the Filter Basket and hinge upward to allow for access into the catch basin.

02.01.03 Mounting Hardware shall be 100% non-corrosive metals.

- Nuts and bolts
- Rivets
- Support brackets
- Concrete anchors

02.01.04 Concrete Filler and Sealant shall be made of Acrylic Emulsion and have a minimum service temperature range of -30°F to 150°F.

02.02.00 Filter Basket Components

02.02.01 Filter Basket Housing shall be manufactured of 100% stainless steel.

02.02.02 Side Screens shall be manufactured of 100% stainless steel louver expanded metal with openings equal to or less than 4.7 mm in size.

- Screens shall be oriented with openings opposite to the flow of water into the filter and be non-clogging based on perpetual deflective shielding.

02.02.03 Bottom Screens shall be manufactured of 100% stainless steel perforated round openings less than 5 mm in size.

02.02.03 Handle shall be manufactured entirely of 100% stainless steel and be mounted to the Filter Basket Housing using mounting hardware per section 02.01.03

02.02.04 Media Filtration Boom shall be made up of granulated oil absorbing polymers that have been tested in accordance with section 11.2 of ASTM F 716.07 and held within a netting.

- Oil absorbing polymers must be proven to absorb 180% of its weight within a 300 second contact time, and at this absorption percentage the physical increase in the size of the granules is not more that 50%.
- Netting shall be 100% polyester with a number 16 sieve size, and strength tested per ASTM D 3787.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The SCBFD has no moving internal components and functions based on gravity flow, unless otherwise specified. The SCBFD is composed of a Trough System, Media Filtration Boom and a Filter Basket. Runoff enters the SCBFD from a curb opening and flows into the Trough System which is mounted under the face of the curb opening. It then flows horizontally inside the System's Trough to the Weir which holds the Filter Basket. This Trough System positions the Filter Basket directly under the catch basin access point (manhole cover, grate or hatch). The Filter Basket can be removed through the access point without disassembly. The Filter Basket can also be cleaned without entering the access point by using a vacuum truck. Within the Filter Basket is a Media Filtration Boom. Water flows through the Weir and into the Filter Basket. Stormwater enters the inside of the Filter Basket and flows downward toward the bottom portion of the Basket. The non-clogging screen has openings that are facing upward. As water flows downward the screening continuously removes debris from the screen's surface. Flowing water also makes contact with the Media Filtration Boom which absorbs free floating oils. Stormwater flow up to the peak treatment flow rate is processed through the filtration screens. During the heaviest flows the Filter Basket fills with water and spills over the top to bypass directly into the bottom of the catch basin, while previously captured debris and solids are contained by the weir screens which prevents re-suspension.

03.01.02 Pollutants - The SCBFD will remove and retain debris, sediments, metals, nutrients, oxygen demanding substances, bacteria and hydrocarbons entering the filter during frequent storm events and specified flow rates. For pollutant removal performance see section 03.02.00.

03.01.03 Treatment Flow Rate - The SCBFD operates using gravity flow. The SCBFD treatment flow rate varies by size and is provided on the drawings for each model. Flow rates must be supported by independent lab results.

03.01.04 Bypass Flow Rate – The SCBFD is designed to fit within the catch basin in a way not to affect the hydraulics. The area over the top of the Trough System is always greater than the curb opening area and/or the area of the outflow pipe. Therefore, the SCBFD does not create a critical point of restriction.

03.01.05 Pollutant Load – The SCBFD must be designed to have minimum storage capacity as documented on the drawing for each particular size and model.

03.01.06 Performance Protocol and Results – All lab testing on filtration media must be performed by an independent third party consultant and testing lab.

03.02.00 Test Performance

At a minimum, the SCBFD shall be tested, according to section 03.01.03 & 03.01.06, and meet these performance specifications:

03.02.01 Filter Pollutant Removal Table

POLLUTANT	REMOVAL EFFICIENCY
Trash and Debris - (down to 5 mm)	100%

03.02.02 Maintenance Performance – The Filter Basket must be able to be maintained and cleaned from finish surface using a vacuum hose inserted through the manhole or hatch opening and not the curb face. All cleaning shall be done without entering the catch basin. The Filter Basket shall be removable from finish surface and reinstalled from finish surface without entrance into the catch basin.

PART 4 - EXECUTION

04.01.00 General

The installation and use of the SCBFD shall conform to all applicable national, state, municipal and local specifications.

04.02.00 Installation

The contractor shall furnish all labor, equipment, materials and incidentals required to install the (SCBFD) device(s) and appurtenances in accordance with the drawings, installation manual, and these specifications, and be inspected and approved by the local governing agency. Installation contractor should possess a Confined Space Entry Certification Permit, pursuant to OSHA standards. Any damage to catch basin and surrounding infrastructure caused by the installation of the SCBFD is the responsibility of the installation contractor.

04.02.01 Trough System will be installed in accordance with manufactures' recommendations. The Trough component will be installed the complete width of the curb opening, or underneath any wings as to provide 100% coverage of incoming stormwater. The Weir component of the Trough System must be located directly under the manhole opening or other access point (not including the curb opening) regardless of its position relative of the curb opening. The Trough System must be properly mounted and assembled inside the catch basin with drive pins and pop rivets per manufacture's recommendations. Once the Trough System is secured to the walls of the catch basin all seams must be filled with sealant per section 02.01.03.

04.02.02 Filter Basket will be inserted through the manhole opening or access point of the catch basin directly without entry into the basin. The Filter Basket shall be fully visible from finish surface while looking into the access point for ease of inspection and maintenance. The curb opening itself is not a point of access as maintenance personnel cannot enter.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – SCBFD shall be shipped to the contractor's address and is the responsibility of the contractor to transport the unit(s) to the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the SCBFD(s) and its components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted, and unloading has commenced shall be born by the contractor. The SCBFD(s) and its components shall always be stored indoors and transported inside the original shipping container(s) until the SCBFD(s) are ready to be installed. The SCBFD shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the SCBFD has been properly installed at the correct location(s), elevations, and with appropriate supports and fasteners. All components associated with the SCBFD and its installation shall be subject to inspection by the engineer of work, governing agency, and the manufacture at the place of installation. In addition, the contractor shall demonstrate that the SCBFD has been installed per the manufacturer's specifications and recommendations. SCBFD(s) shall be physically inspected regularly in accordance to owner's Stormwater Pollution Prevention Plans (SWPPP) and manufacture's recommendations. An inspection record shall be kept by the inspection operator. The record shall include the condition of the SCBFD and its appurtenances. The most current copy of the inspection record shall always be copied and placed in the owner's SWPPP.

04.04.02 Maintenance – SCBFD(s) must be completely maintained from outside the catch basin. The SCBFD(s) shall be inspected, maintained and cleaned 1 to 4 times a year and/or in accordance to owner's Stormwater Pollution Prevention Plans (SWPPP). The maintenance shall be preformed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the SCBFD. A Maintenance Record shall be kept by the maintenance operator. The Maintenance Record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter. The most current copy of the Maintenance Record shall always be copied and placed in the owner's SWPPP.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured and removed from the SCBFD shall be transported and disposed of at an approved facility for disposal in accordance with local and state regulations. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURANCE

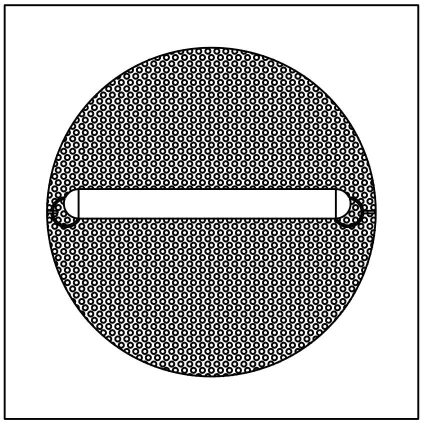
05.01.00 Warranty

The manufacturer shall guarantee the SCBFD against all manufacturing defects in materials and workmanship for a period of (8) years from the date of delivery to the contractor. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The SCBFD is limited to recommended application for which it was designed.

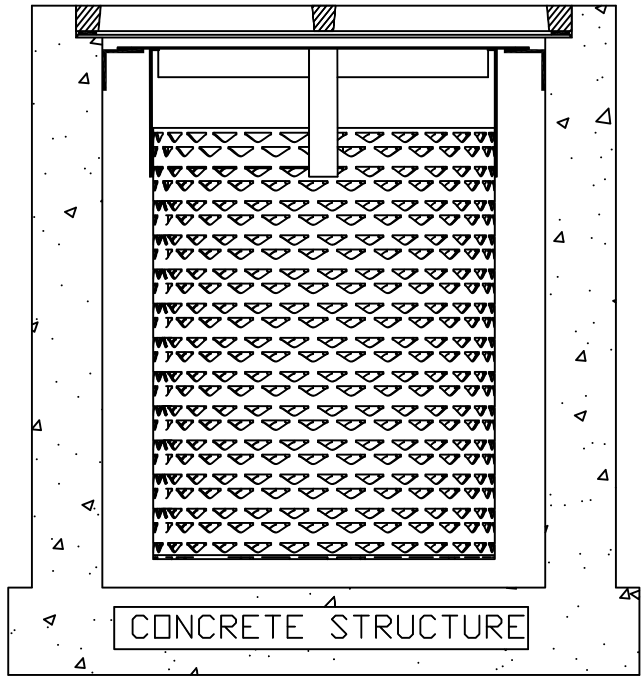
[End of This Section]

BIO CLEAN FULL CAPTURE FILTER

FOR USE IN GRATE INLETS

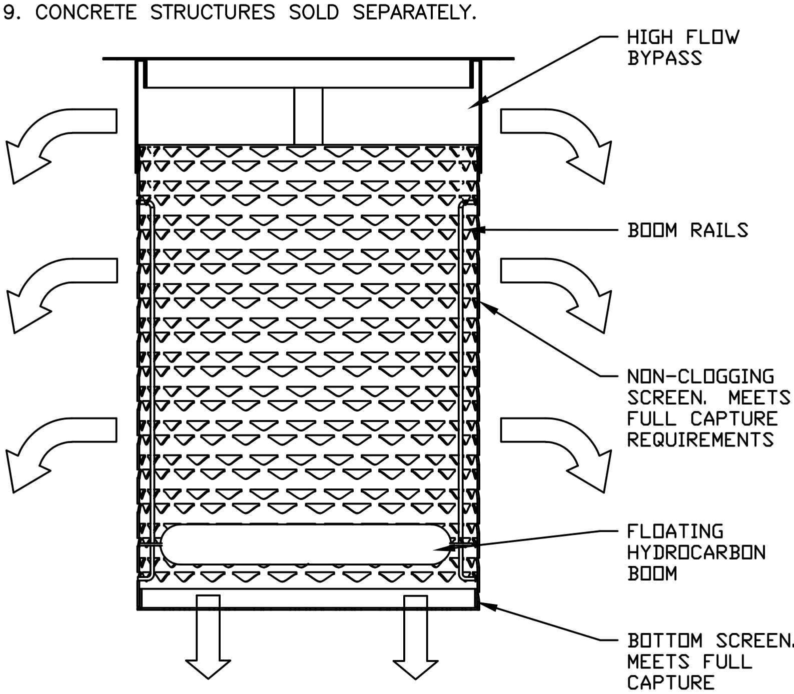


TOP VIEW



NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL
2. HYDROCARBON BOOM SHALL BE 2" DIAMETER AND CONNECTED, MECHANICALLY TO THE FILTER FRAME WITH RAILS ALLOWING IT TO FLOAT ON THE WATER SURFACE REGARDLESS OF HEIGHT
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDIING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.



FLOW SCHEMATIC

MODEL #	TREATMENT FLOW (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.55	1.55	0.27
BIO-GRATE-FULL 18-18-18	4.32	3.68	1.05
BIO-GRATE-FULL 24-24-24	7.67	4.83	2.41
BIO-GRATE-FULL 30-30-24	12.97	6.21	3.98
BIO-GRATE-FULL 25-38-24	13.53	6.59	4.16
BIO-GRATE-FULL 36-36-24	19.64	7.60	5.94
BIO-GRATE-FULL 48-48-18	25.59	10.13	7.92

DRAWING: BIO CLEAN GRATE INLET FILTER DETAILS		MEETS FULL CAPTURE REQUIREMENTS	
TYPICAL MODEL DETAIL			
WARRANTY: 8 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 10/12/17	SCALE: SF = 15	REVISIONS:	DATE:
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

Section [________]
Stormwater Catch Basin Filtration Device

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for devices used for filtration of stormwater runoff captured by catch basins with grates. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Stormwater Catch Basin Filtration Devices (SCBFD) are used to filter stormwater runoff captured by catch basins. The SCBFD is a filter system composed of a SCBFD with a media filtration storm boom. SCBFDs are used to remove various pollutants from stormwater by means of screening, separation and media filtration.

01.03.00 Manufacturer
The manufacturer of the SCBFD shall be one that is regularly engaged in the engineering, design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the SCBFD(s) shall be a filter device manufactured/distributed by Bio Clean Environmental Services, Inc., or assigned distributors or licensees. Bio Clean Environmental Services, Inc. can be reached at:

Corporate Headquarters:
398 Via El Centro
Oceanside, CA 92058
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

01.04.00 Submittals

01.04.01 Submittal drawings will be provided with each order to the contractor and engineer of work.

01.04.02 Submittal drawings are to detail the SCBFD, its components and the sequence for installation, including:
- SCBFD configuration with primary dimensions
- Various SCBFD components
- Any accessory equipment

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of SCBFD.

01.05.02 Manufacturer to supply SCBFD(s):
- Filter Basket
- Media Filtration Storm Boom

01.05.03 Media Filtration Boom shall be provided with each Filter Basket housed in nylon netting and securely fastened entrance to the Filtration basket. Each media boom shall contain polymer beads to permanently absorb hydrocarbons.

01.06.00 Reference Standards

ASTM A 240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM F 716	Testing Sorbent Performance of Absorbents
ASTM F 726	Sorbent Performance of Absorbents
ASTM D3787 - 07	Standard Test Method for Bursting Strength of Textiles-Constant-Rate-of-Traverse (CRT) Ball Burst Test
ASTM D2690-98	Standard Test Method for Isophthalic Acid in Alkyd and Polyester Resins
ASTM C 582-02	Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment
ASTM D 638	Standard Test Method for Tensile Properties of Plastics
ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 648	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
ASTM D 2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 4097	Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM D3409	Standard Test Method for Adhesion of Asphalt-Roof Cement to Damp, Wet, or Underwater Surfaces
IFI 114	Break Mandrel Blind Rivets

PART 2 – COMPONENTS

02.01.00 Filter Basket Components

All SCBFD components must be made of stainless steel, per these specifications. SCBFD's containing any fabrics or plastics will not be accepted.

02.01.01 Filter Housing shall be manufactured of 100% stainless steel.

02.02.02 Side Screens shall be manufactured of 100% stainless steel louver expanded metal with openings equal to or less than 4.7 mm in size.

- Screens shall be oriented with openings opposite to the flow of water into the filter and be non-clogging based on perpetual deflective shielding.

02.02.03 Bottom Screens shall be manufactured of 100% stainless steel perforated round openings less than 5 mm in size.

02.02.04 Media Filtration Boom shall be made up of granulated oil absorbing polymers that have been tested in accordance with section 11.2 of ASTM F 716.07 and held within a netting.

- Oil absorbing polymers must be proven to absorb 180% of its weight within a 300 second contact time, and at this absorption percentage the physical increase in the size of the granules is not more that 50%.

- Netting shall be 100% polyester with a number 16 sieve size, and strength tested per ASTM D 3787.
- Filter netting shall be 100% polyester with a number 16 sieve size, and strength tested per ASTM D 3787.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The SCBFD has no moving internal components and functions based on gravity flow, unless otherwise specified. Runoff enters the SCBFD from a catch basin with a grate opening and flows downward into the SCBFD. This SCBFD shall be positioned directly under the catch basin grate. After removal of the grate the SCBFD must be able to be removed through the catch basin opening without any further disassembly Stormwater enters the inside of the Filter Basket and flows downward toward the bottom portion of the Basket. The non-clogging screen has openings that are facing upward. As water flows downward the screening continuously removes debris from the screen's surface. Flowing water also makes contact with the Media Filtration Boom which absorbs free floating oils. Stormwater flow up to the peak treatment flow rate is processed through the filtration screens. During the heaviest flows the Basket fills with water and spills out the internal bypass and into the bottom of the catch basin.

03.01.02 Pollutants - The SCBFD will remove and retain debris, sediments, metals, nutrients, oxygen demanding substances and hydrocarbons entering the catch basin during frequent storm events and specified flow rates. For pollutant removal performance see section 03.02.00.

03.01.03 Treatment Flow Rate - The SCBFD operates using gravity flow. The SCBFD treatment flow rate varies by size and is provided on the drawings for each model. Flow rates must be supported by independent lab results.

03.01.04 Bypass Flow Rate – The SCBFD is designed to fit within the catch basin in a way not to affect the existing hydraulics and treat or bypass all flows. The bypass must be sized with a surface area greater then the outlet pipe size, thus the SCBFD shall not be a critical point of flow restriction. Bypass flow rate must be based on the SCBFD's inlet throat or bypass orifice capacity, which ever is less.

03.01.05 Pollutant Load – The SCBFD must be designed to have minimum storage

03.01.06 capacity as documented on the drawing for each particular size and model.

03.01.07 Performance Protocol and Results – All lab testing on filtration media must be performed by an independent third party consultant and testing lab.

03.02.00 Test Performance

At a minimum, the SCBFD shall be tested, according to section 03.01.06, and meet these performance specifications:

03.02.01 Filter Pollutant Removal Table

POLLUTANT	REMOVAL EFFICIENCY
Trash and Debris - (down to 5 mm)	100%

PART 4 - EXECUTION

04.01.00 General

The installation and use of the SCBFD shall conform to all applicable national, state, municipal and local specifications.

04.02.00 Installation

The contractor shall furnish all labor, equipment, materials and incidentals required to install the (SCBFD) device(s) and appurtenances in accordance with the drawings, installation manual, and these specifications, and be inspected and approved by the local governing agency. Installation contractor should possess a Confined Space Entry Certification Permit, pursuant to OSHA standards. Any damage to catch basin and surrounding infrastructure caused by the installation of the SCBFD is the responsibility of the installation contractor.

04.02.01 Filter Basket and all components or accessories shall be inserted through the catch basin and properly secured per manufactures installation manual and these specifications.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – SCBFD shall be shipped to the contractor's address and is the responsibility of the contractor to transport the unit(s) to the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the SCBFD(s) and its components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted, and unloading has commenced shall be born by the contractor. The SCBFD(s) and its components shall always be stored indoors and transported inside the original shipping container(s) until the SCBFD(s) are ready to be installed. The SCBFD shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the SCBFD has been properly installed at the correct location(s), elevations, and with appropriate supports and fasteners. All components associated with the SCBFD and its installation shall be subject to inspection by the engineer of work, governing agency, and the manufacture at the place of installation. In addition, the contractor shall demonstrate that the SCBFD has been installed per the manufacturer's specifications and recommendations. SCBFD(s) shall be physically inspected regularly in accordance to owner's Stormwater Pollution Prevention Plans (SWPPP) and manufacture's recommendations. An inspection record shall be kept by the inspection operator. The record shall include the condition of the SCBFD and its appurtenances. The most current copy of the inspection record shall always be copied and placed in the owner's SWPPP.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal and replacement of the Media Filtration Boom as needed. The maintenance shall be preformed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the SCBFD(s). A detailed Maintenance Record shall be kept by the maintenance operator. The Maintenance Record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter. The most current copy of the Maintenance Record shall always be copied and placed in the owner's Stormwater Pollution Prevention Plan (SWPPP) per governing agency.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured and removed from the SCBFD shall be transported and disposed of at an approved facility for disposal in accordance with local and state regulations. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURANCE

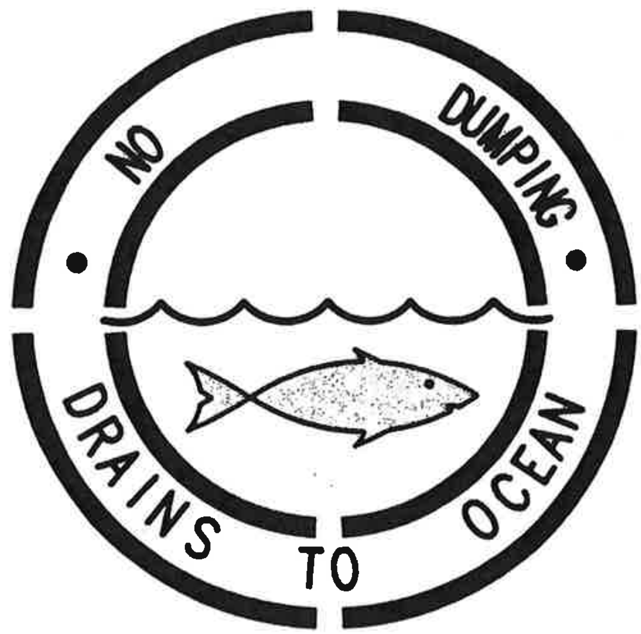
05.01.00 Warranty

The manufacturer shall guarantee the SCBFD against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the contractor. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The SCBFD is limited to recommended application for which it was designed.

[End of This Section]

Appendix D:

BMP Maintenance Information



SAMPLE STENCIL TO BE USED NEAR
GRATE AND CURB OPENING INLETS

SYMBOL TO BE 24" IN DIAMETER

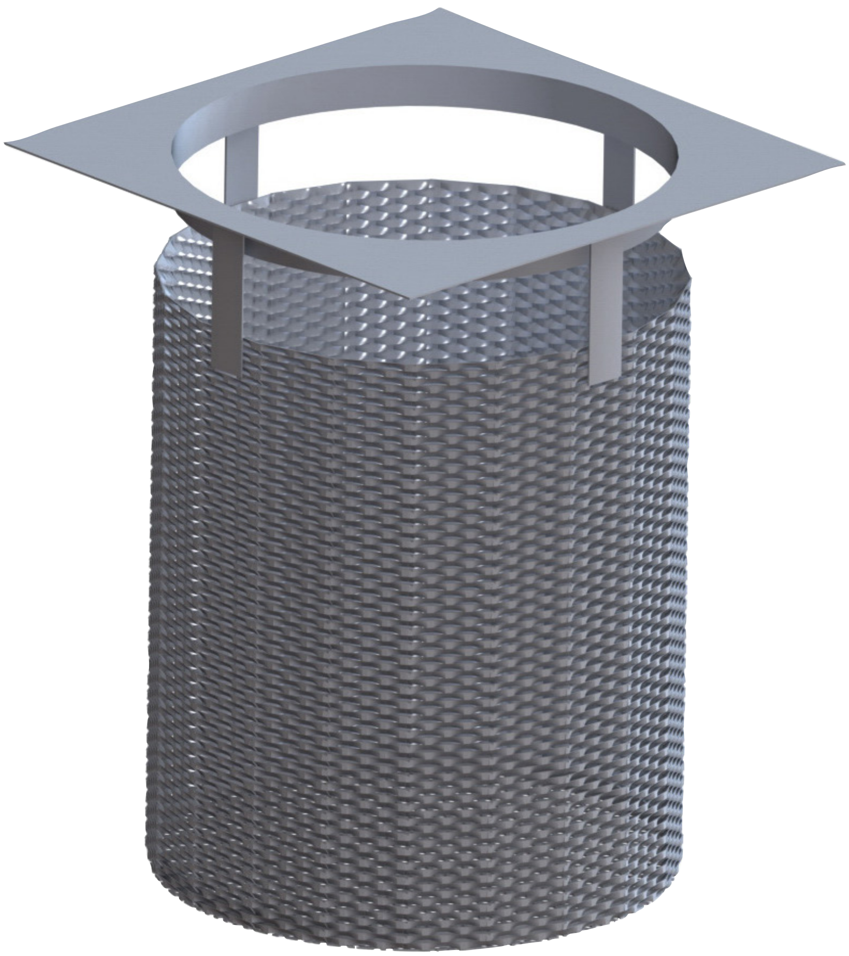
Thienes Engineering
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

SAMPLE CATCH BASIN STENCIL
PER BMP SD-13

Grate Inlet Filter

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE



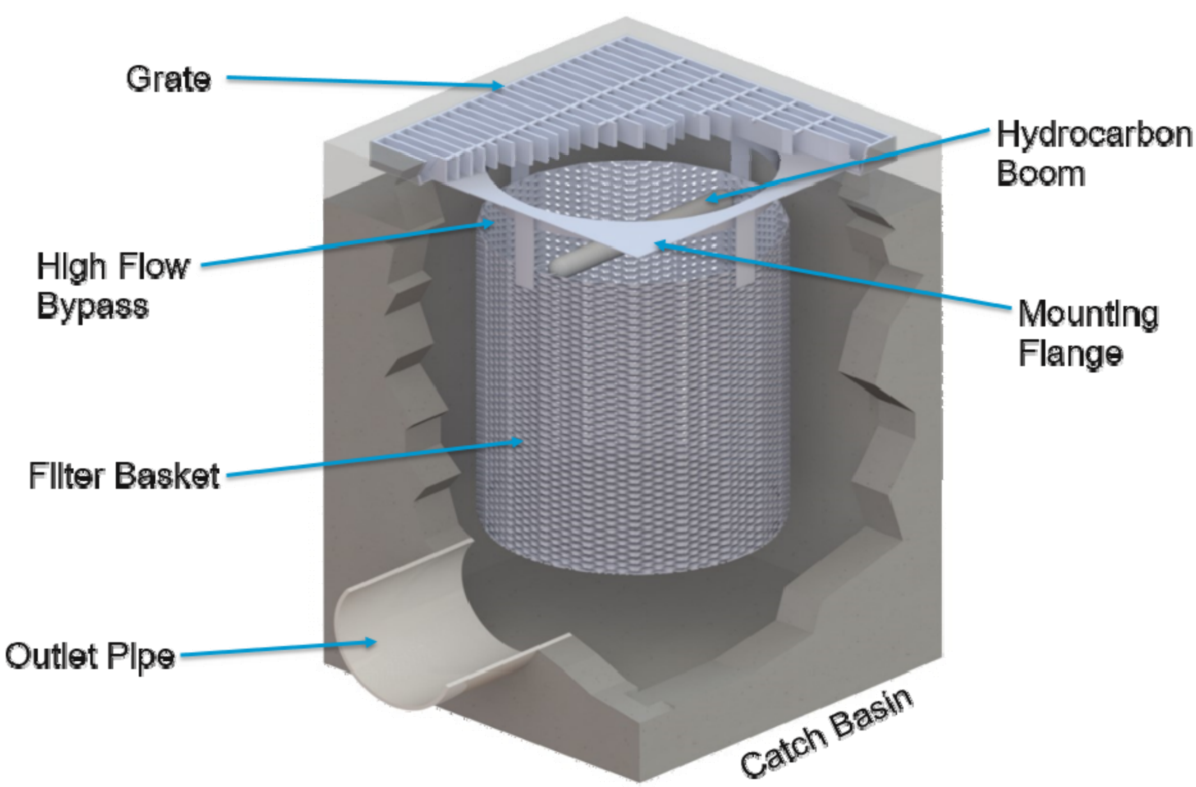
Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

www.BioCleanEnvironmental.com
p: 760.433.7640
f: 760.433.3176

OPERATION & MAINTENANCE

The Bio Clean Grate Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the trash full capture and multi-level screening configurations. A supplemental manual is available for the Kraken and media filter variations. This filter is made of 100% stainless steel and is available and various sizes and depths allowing it to fit in any grated catch basin inlet. The filters heavy duty construction allows for cleaning with any vacuum truck. The filet can also easily be cleaned by hand.

As with all stormwater BMPs, inspection and maintenance on the Grate Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

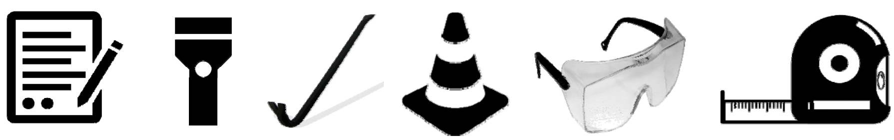


System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Grate Inlet Filter:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Grate Inlet Filter are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Grate Inlet Filter can be inspected though visual observation. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open grated inlet. Once the grate has been safely removed the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the filter with the grate removed.
- Look for any out of the ordinary obstructions on the grate or in the filter and its bypass. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the filter basket and its bypass.
- Excessive accumulation of trash, foliage and sediment in the filter basket. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-GRATE-12-12-12	10.00	12.00	0.27	0.55
BC-GRATE-18-18-18	16.00	18.00	1.05	2.09
BC-GRATE-24-24-24	21.00	24.00	2.41	4.81
BC-GRATE-30-30-24	27.00	24.00	3.98	7.95
BC-GRATE-36-36-24	33.00	24.00	5.94	11.88
BC-GRATE-48-48-18	44.00	18.00	7.92	15.84

Maintenance Equipment

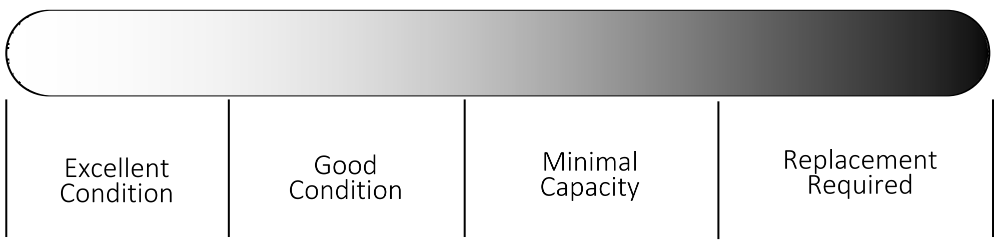
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter, though it can easily cleaned by hand:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to remove the grate.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Grate Inlet Filter can be performed utilizing a vacuum truck. Once all safety measures have been set up cleaning of the Grate Inlet Filter can proceed as followed:

- Remove grate (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened catch basin. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying of any debris stuck on the side or bottom of the filter basket. Power wash off the filter basket sides and bottom.
- Next remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- Follow is a replacement indication color chart for the hydrocarbon booms:



- The last step is to replace the grate and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

Maintenance Sequence

Remove grate and set up vacuum truck to clean the filter basket.

Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off screens.

Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom.

Close up and replace the grate and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

Bio Clean
A Forterra Company

Inspection and Maintenance Report
Catch Basin Only

Project Name ______________________________

Project Address ______________________________
(city) (Zip Code)

Owner / Management Company ______________________________

Contact ______________________________ Phone ( ) –

Inspector Name ______________________________ Date ____/____/______ Time ______________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm

Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ______________________________ Additional Notes ______________________________

For Office Use Only
(Reviewed By)
(Date) Office personnel to complete section to the left.

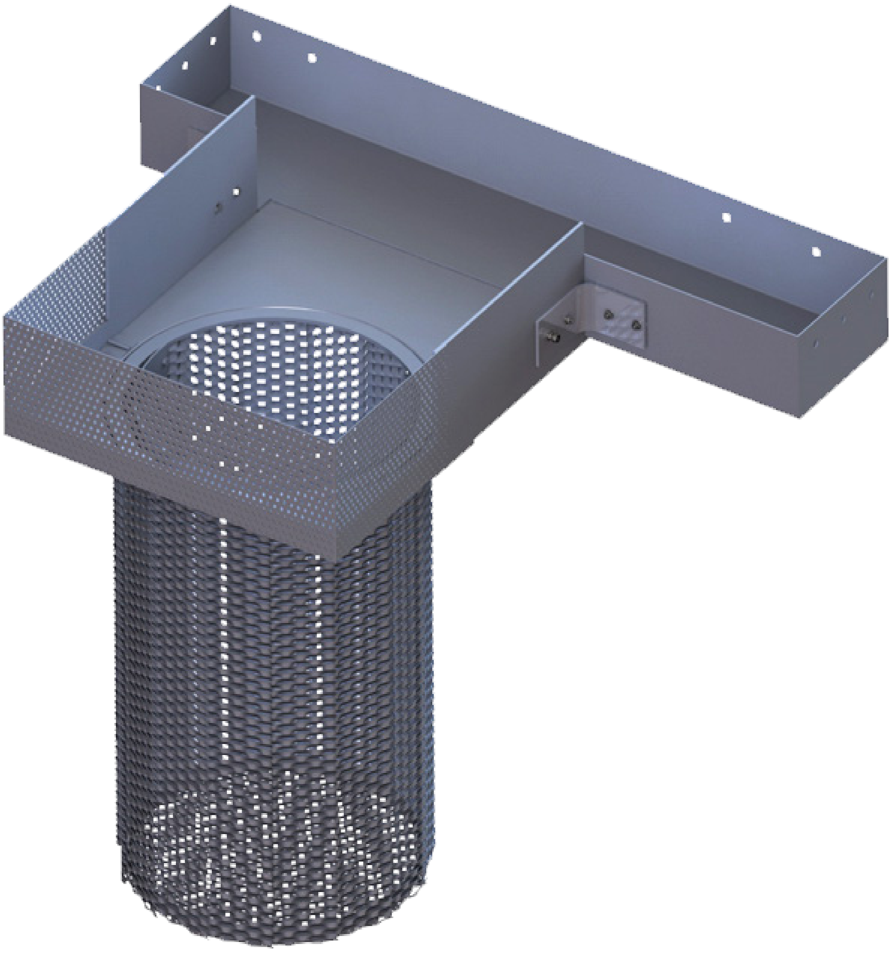
Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
2	Lat: Long:							
3	Lat: Long:							
4	Lat: Long:							
5	Lat: Long:							
6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							

Comments:

Curb Inlet Filter

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE



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Oceanside, CA 92058

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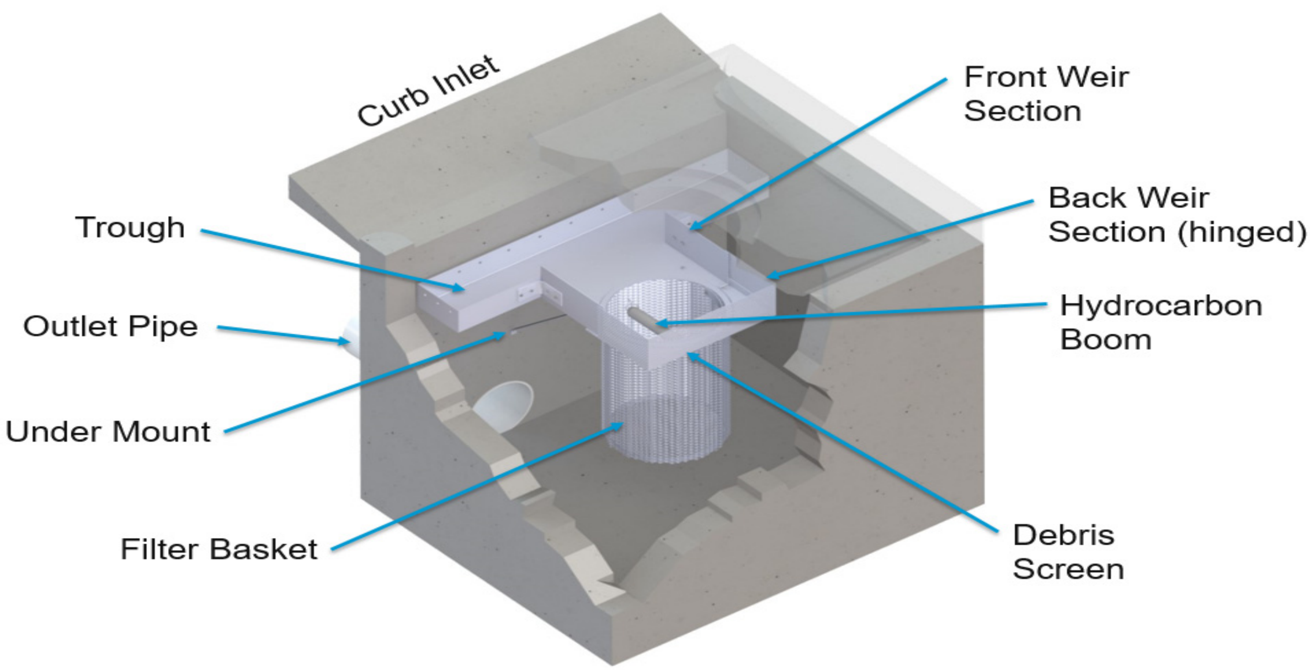
OPERATION & MAINTENANCE

The Bio Clean Curb Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the trash full capture and multi-level screening configurations. A supplemental manual is available for the Kraken and media filter variations. The innovative trough & weir system is mounted along the curb face and directs incoming stormwater toward the filter basket which is positioned "directly" under the manhole access opening regardless of its location in the catch basin. This innovative design allows the filter to be cleaned from finish surface without access into the catch basin, therefore drastically reducing maintenance time and eliminating confined space entry. The filter has a lifting handle allowing for the filter to be removed easily through the manhole. The weir also folds up to allow for unimpeded access into the basin for routine maintenance or pipe jetting.

As with all stormwater BMPs, inspection and maintenance on the Curb Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

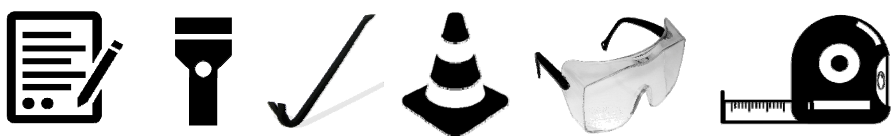


System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Curb Inlet Filter:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Curb Inlet Fitler are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Curb Inlet Filter can be inspected though visual observation without entry into the catch basin. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once the manhole has been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the catch basin through the manhole. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the catch basin.
- Look for any out of the ordinary obstructions in the catch basin, trough, weir, filter basket, basin floor our outlet pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.

- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the trough, weir, filter basket or catch basin.
- Excessive accumulation of trash, foliage and sediment in the filter basket and/or trough and weir sections. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-CURB-30	18	30	2.21	4.42
BC-CURB-24	18	24	1.77	3.53
BC-CURB-18	18	18	1.33	2.65
BC-CURB-12	18	12	0.88	1.77

Maintenance Equipment

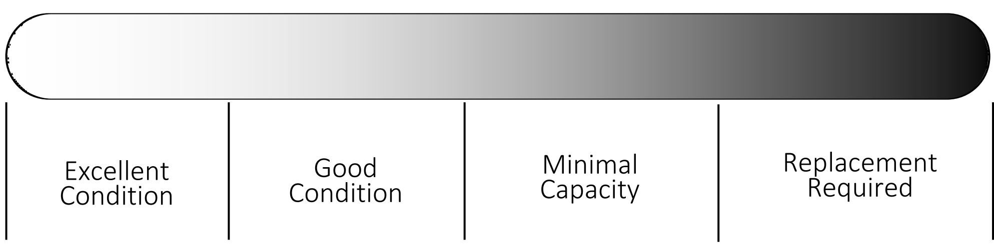
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter though it can easily cleaned by hand:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

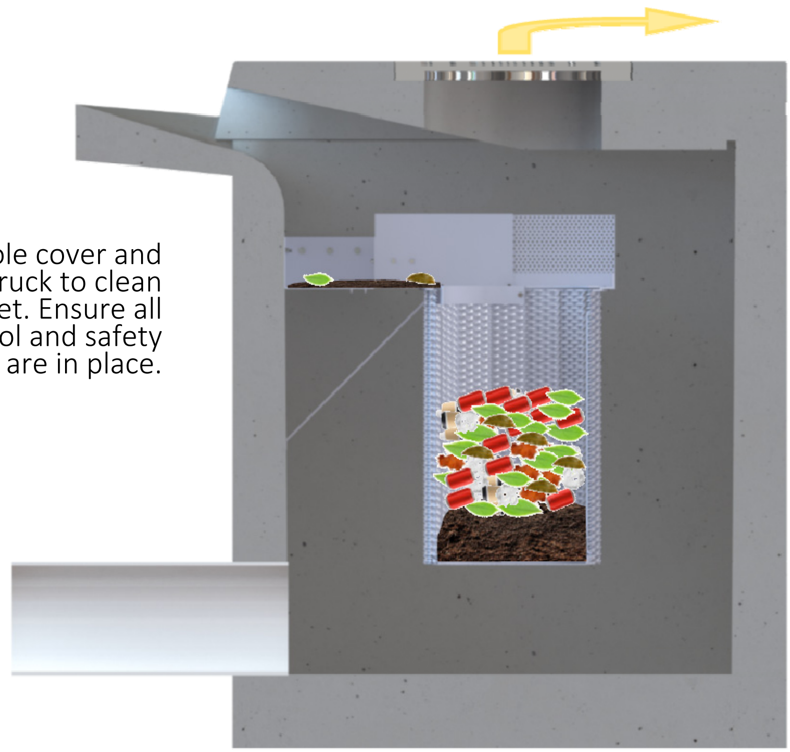
It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Curb Inlet Filter can be performed from finish surface without entry into catch basin utilizing a vacuum truck. Some unique and custom configurations may create conditions which would require entry for some or all of the maintenance procedures. Once all safety measures have been set up cleaning of the Curb Inlet Filter can proceed as followed:

- Remove all manhole cover or access hatches (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened manhole or hatch opening. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying of any debris stuck on the side or bottom of the filter basket. If the filter basket is full, trash, sediment, and debris will accumulate inside the trough and weir sections of the system. Once the filter basket is clean power wash the weir and trough pushing these debris into the filter basket (leave the hose in the filter basket during this process so entering debris will be sucked out). Power wash off the trough, weir, debris screen, and filter basket sides and bottom.
- Next remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- Follow is a replacement indication color chart for the hydrocarbon booms:

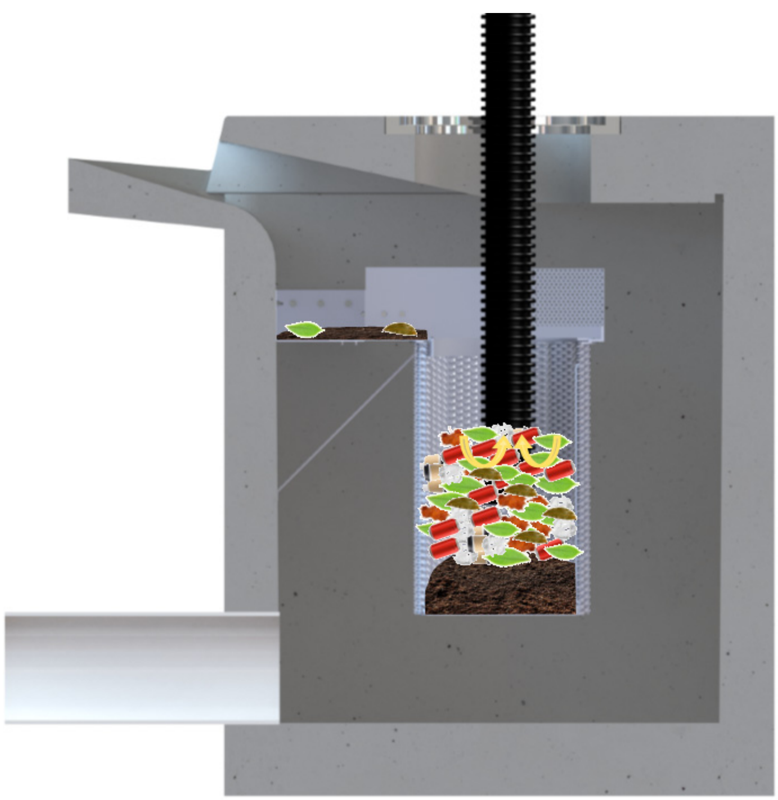


- The last step is to close up and replace the manhole or hatch and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

Maintenance Sequence



Remove manhole cover and set up vacuum truck to clean the filter basket. Ensure all traffic control and safety measures are in place.



Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off the weir and trough and vacuum out any remaining debris.

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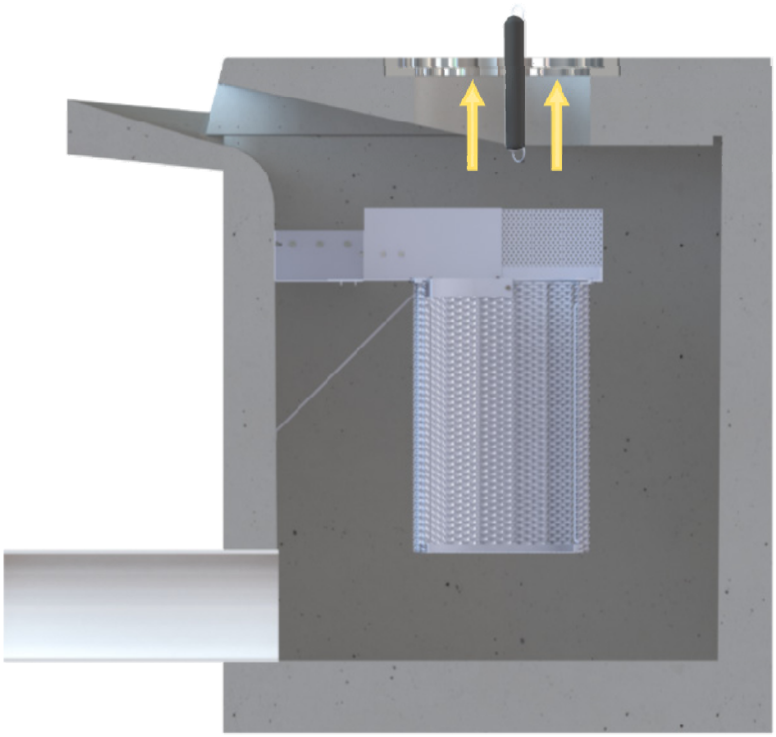
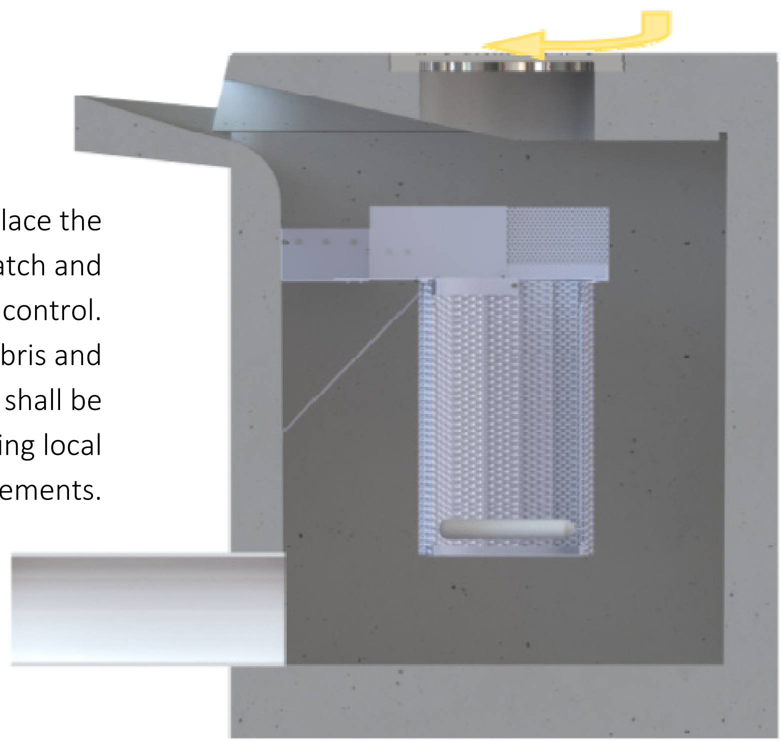


Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom.

Close up and replace the manhole or hatch and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.



For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email: info@biocleanenvironmental.com

Inspection and Maintenance Report
Catch Basin Only

Bio Clean
A Forterra Company

Project Name ______________________

Project Address ______________________ (city) (Zip Code)

Owner / Management Company ______________________

Contact ______________________ Phone ( ) –

Inspector Name ______________________ Date ____ / ____ / ______ Time __________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ______________________ Additional Notes ______________________

For Office Use Only

(Reviewed By)

(Date)

Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
2	Lat: Long:							
3	Lat: Long:							
4	Lat: Long:							
5	Lat: Long:							
6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							

Comments:

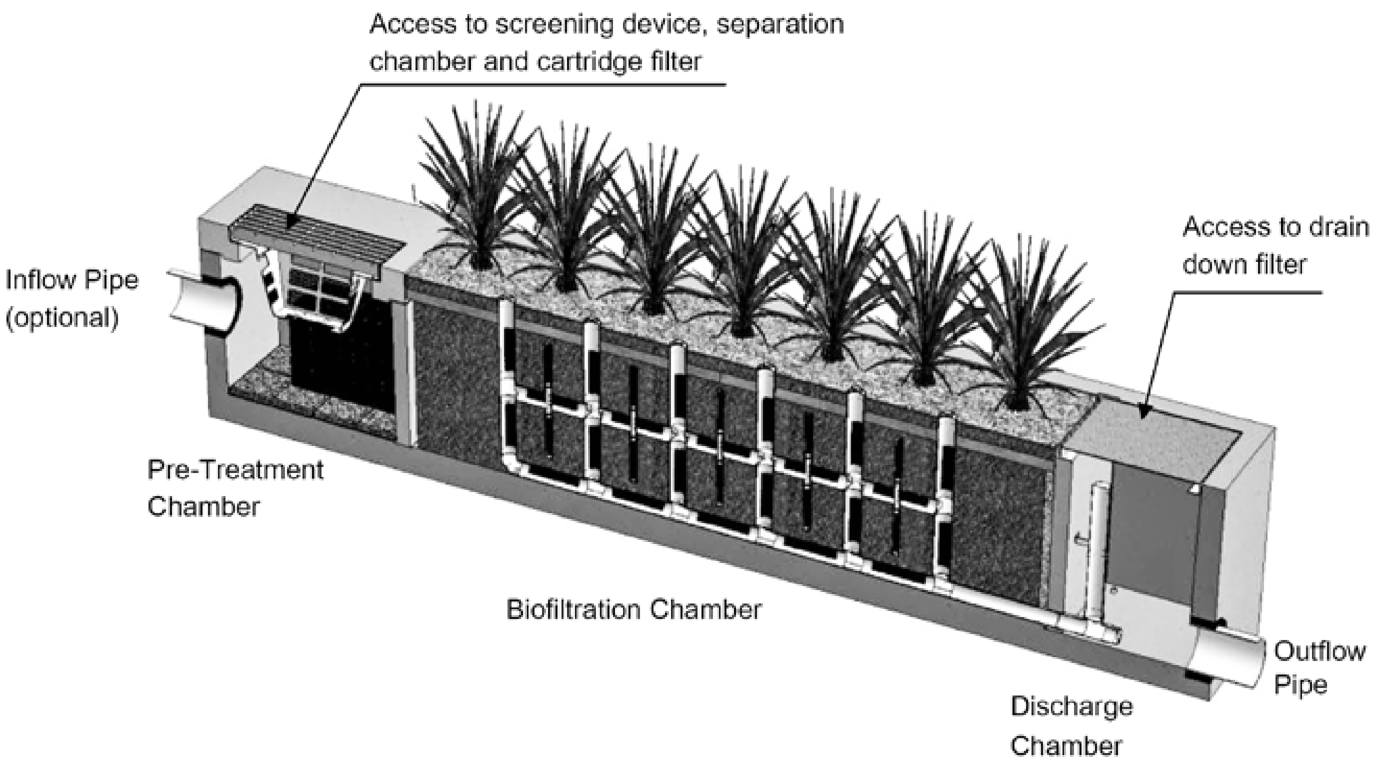
CONTECH®
ENGINEERED SOLUTIONS

Modular Wetlands® Linear Operation & Maintenance Manual

MODULAR WETLANDS®

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - *(5 minute average service time).*
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - *(10 minute average service time).*
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - *(10- 15 minute per cartridge average service time).*
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - *(5 minute average service time).*
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - *(Service time varies).*



System Diagram

Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre- Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer, spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber. Entry into chambers may require confined space training based on state and local regulations.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

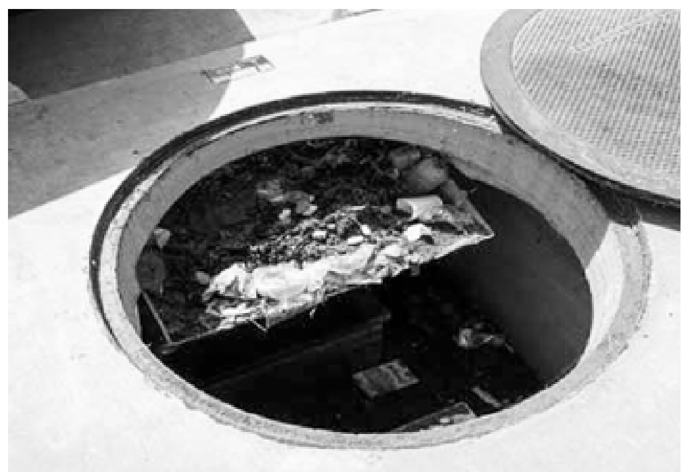
Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/ inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the Biofiltration Chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

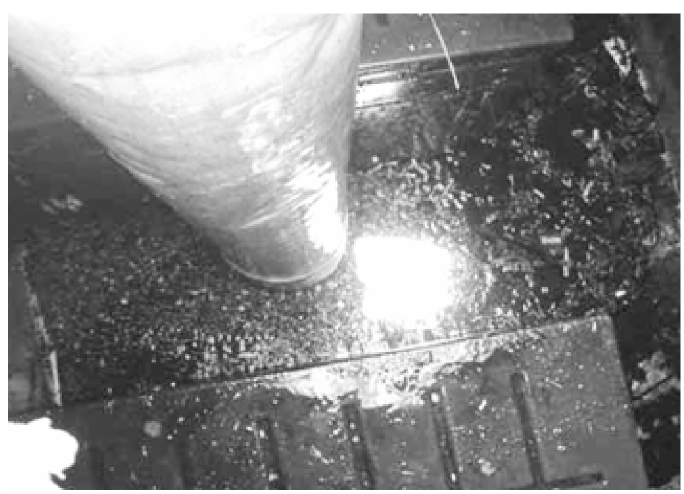
Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.



Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Report
Modular Wetlands Linear

Project Name ______________________________

Project Address ______________________________
(city) (Zip Code)

Owner / Management Company ______________________________

Contact ______________________ Phone ( ) –

Inspector Name ______________________ Date ___/___/_____ Time ________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ______________________ Additional Notes ______________________

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): ____________ Size (22', 14' or etc.): ____________

Structural Integrity:	Yes	No	Comments	
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?				
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?				
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?				
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?				
Working Condition:				
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?				
Is there standing water in inappropriate areas after a dry period?				
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?				
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.				Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:	
Any signs of improper functioning in the discharge chamber? Note issues in comments section.				
Other Inspection Items:				
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?				
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.				
Is there a septic or foul odor coming from inside the system?				

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: ______________________________

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Cleaning and Maintenance Report
Modular Wetlands Linear

Project Name ______________________ | For Office Use Only

Project Address ______________________ (city) (Zip Code) | (Reviewed By)

Owner / Management Company ______________________ | (Date)

Office personnel to complete section to the left.

Contact ______________________ Phone ( ) –

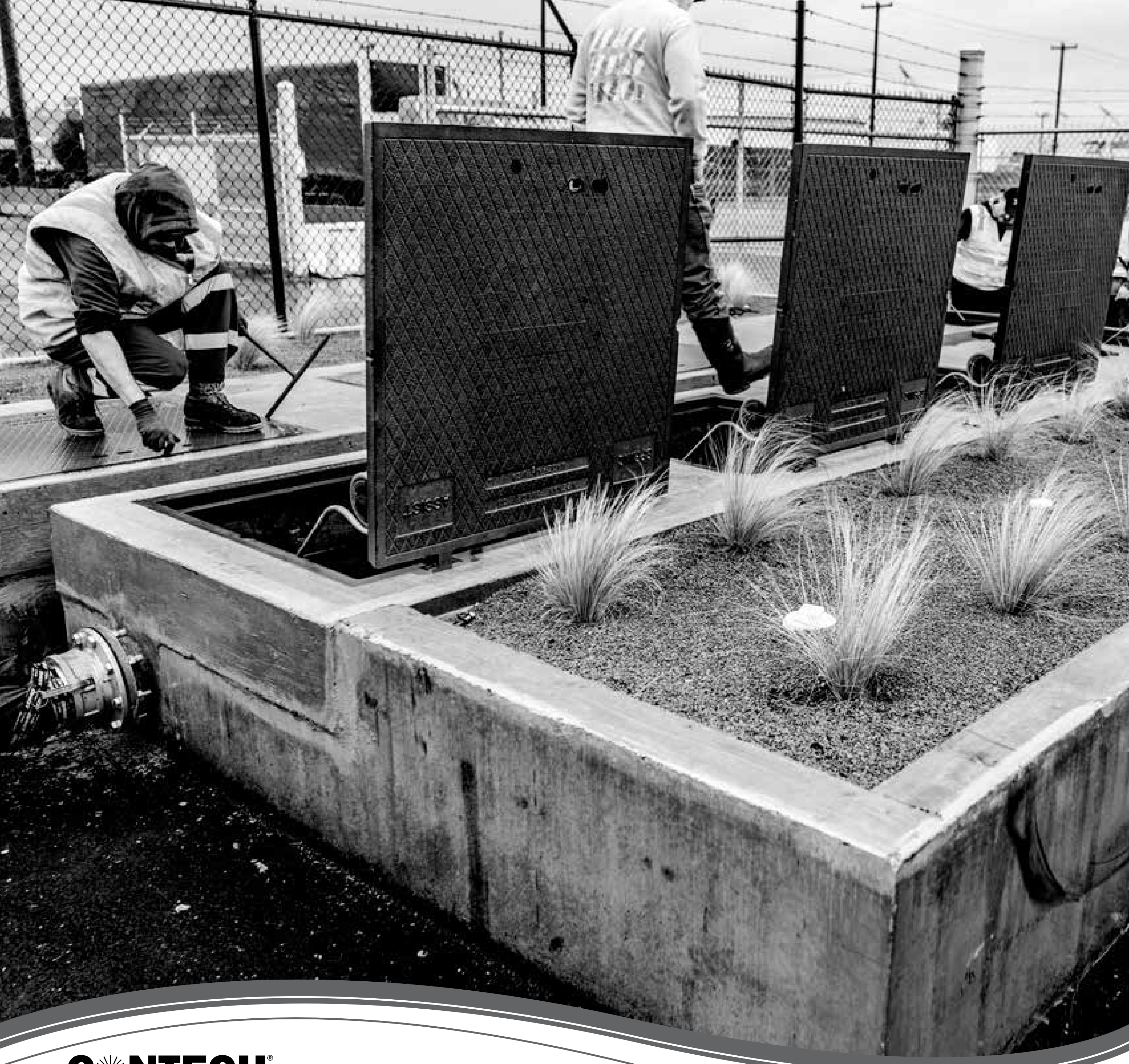
Inspector Name ______________________ Date / / Time AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ______________________ Additional Notes ______________________

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:



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LIFT STATION REQUIRED MAINTENANCE

The lift station should be inspected twice a year for proper operation, and should be checked for overabundance of solid matter such as grease and soap buildup.

Proper operation and inspection would include the following:

1) Automatic operation of the system by float activation. One pump starting at lead on levels, second pump starting at high level conditions; manual operation by use of the selector switches.

2) Inspect floats for proper elevation and for proper movement. Correct any obstructions.

3) Check incoming power for proper voltage. Check voltage at motor connections.

4) Check amperage of each motor.

5) Hose down lift station to clean the walls of the wet well, pumps and floats.

MECHANICAL SEAL INSPECTION OF PUMPS

Inspection of the mechanical seals should be done every two years.

The inspection will include the following:

Pull pump out of wet well. Remove oil seal plug and inspect the oil for clarity. Clear oil indicates no water intrusion and chamber is to be topped off with 30 weight turbine oil. If oil is cloudy the mechanical seal and oil needs to be replaced.

PSI recommends that preventive maintenance and service be performed by a qualified technician.

Any question regarding your lift station should be directed to Scott Richardson at 800-358-9095.

Appendix E:
Infiltration Feasibility

(For Reference Purposes Only)

From: Tawnie Schraan <tschraan@cityoforange.org>
Sent: Tuesday, March 22, 2022 8:29 AM
To: Nicole Morse <NMorse@tbplanning.com>
Subject: RE: 759 Eckhoff

Hi Nicole,

During the final step of our review, we are required to submit the WQMP to OCWD. During their review, there was a concern about using infiltration. Although there is no direct evidence of contamination of the soils at either the deep or shallow ground water level at the proposed site; Orange County Water District does not recommend introducing (infiltrating) storm water into the larger ground water table near the site, without any further comprehensive analysis. OCWD has made this finding based on concerns from historical uses on sites that are in the vicinity and up-gradient of the proposed project.

In light of this concern raised by the OCWD, we are not recommending the use of infiltration at the site and new BMPs must be presented capable of treating the DCV. Please feel free to contact me or the Program Manager – Mike Carney, with any further questions.

Thank you,

Tawnie Schraan, P.E.
Associate Civil Engineer
City of Orange
Public Works – Development Services
300 E. Chapman Ave | Orange, CA 92866
Direct: (714) 744-5528 | www.cityoforange.org

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

October 4, 2021

IDI Logistics
840 Apollo Street
Suite 343
El Segundo, CA 90245

Attention: Mr. Brandon Dickens
Vice President of Capital Deployment

Project No.: **20G199-3**

Subject: **Results of Updated Infiltration Testing**
Two Proposed Industrial Buildings
759 North Eckhoff Street
Orange, California

Reference: Geotechnical Investigation, Two Proposed Industrial Buildings, 759 North Echoff Street, Orange. California, prepared by Southern California Geotechnical, Inc. (SCG), prepared for IDI Logistics, LLC, SCG Project No. 20G199-1, dated October 30, 2020.

Mr. Dickens:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 20P342R and Change Order No. 20G199-CO, dated September 15, 2020 and June 17, 2021, respectively. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with the guidelines published by Orange County: Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs), Appendix VII. These guidelines are dated December 20, 2013.

Site and Project Description

The subject site is located on the east side of Eckhoff Street, 500± feet north of the intersection with Sequoia Avenue in Orange, California. The site is also referenced by the street address of 759 North Eckhoff Street. The site is bounded to the west by Eckhoff Street, to the north by the BNSF railroad and to the south and east by existing commercial/industrial developments. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The subject site is an irregularly-shaped area, 12.57± acres in size. The site is presently developed with several commercial/industrial facilities, including Oilwell Varco. These buildings are of tilt-up concrete and/or steel frame construction, and are assumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. The buildings are surrounded by Portland cement concrete pavements within the fenced areas. Heavy machinery, scaffolds, and stored products surround the buildings. A steel tower, approximately 150 feet in height, apparently used for testing drilling equipment, is located in the north-central area of the site. Several gates and chain-link fences are located on the property. The buildings are surrounded by Portland cement concrete pavements within the fenced areas. The remaining areas of the site are paved with asphaltic concrete pavements for automobile and truck parking. Several landscaped planters are present along Eckhoff Avenue.

Preliminary topographic information was obtained from an ALTA survey provided by the client. Based on this survey, the site is relatively level, sloping slightly downward to the west/Southwest. There appears to be less than 3 to 4± feet of elevation differential across the site.

Proposed Development

Based on the site plan (Scheme 1) provided to our office, the proposed development will consist of two (2) new industrial buildings, 187,710± and 102,270± ft^2 in size. Loading docks will be constructed along a portion of one building wall for each new building. We expect that the buildings will be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck court areas, with isolated areas of concrete flatwork and landscape planters.

We understand that the proposed development will include on-site stormwater infiltration. The infiltration system will consist of a below-grade chamber systems located in the northern, southern, and southeastern regions of the site. Based on conversations with the project civil engineer, the bottom of the infiltration systems will range from 10 to 12± feet below the existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, also referenced above. As part of this study seven (7) borings were advanced to depths of 15 to 50± feet below existing site grades. Portland cement concrete (PCC) was encountered at the ground surface of Boring Nos. B-1 and B-3 through B-6. The pavement sections consist of 8 to 10½± inches of reinforced PCC. Boring Nos. B-2 and B-7 encountered asphaltic concrete (AC) pavements at the ground surface. These pavement sections consist of 3½ to 4± inches of AC underlain by 6± inches of aggregate base. With the exception of Boring No. B-3, all the borings encountered fill soils immediately beneath the pavement surface. These fill soils extend to depths of 2½ to 5½± feet. The fill soils generally consist of loose to dense silty fine sands and silty fine to coarse sands with occasional clay content. Isolated samples of the fill contain trace amounts of fine to coarse gravel. Additional soils classified as possible fill were also encountered, extending to depths of up to 6½± feet. The possible fill soils generally consist of loose to medium dense silty fine sands and fine to coarse sands with occasional gravel content, extending to depths of up to 6½ ± feet. Native alluvium was encountered beneath the fill/possible fill soils and beneath the pavement surface at Boring No. B-3. Within the upper 25± feet the alluvium generally consists of loose to medium dense sands, silty sands and sandy silt as well as soft to medium stiff silty clays and clayey silts. At greater depths, the alluvium consists of dense to very dense silty fine to coarse sands with occasional fine to coarse gravel and cobbles, extending to depths of at least 50± feet. Boring No. B-7 was terminated within the dense native alluvium at a depth of 36± feet after encountering refusal within dense gravel and cobbles.

Groundwater

Groundwater was not encountered at any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 50± feet below existing site grades, at the time of the subsurface investigation.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in area of the subject site is CGS Seismic Hazard Zone Report (SHZR) 011 for the Orange 7.5 Minute Quadrangle, which indicates that the historic high groundwater level for the site was 20± feet below the ground surface in the western area of the site, and slightly over 30± feet in the eastern area.

Recent water level data was obtained from the California Department of Water Resources, Water Data Library Station Map, website, https://wdl.water.ca.gov/waterdatalibrary/Home.aspx. The nearest monitoring well on record is located 0.91 miles south-southwest of the site. Water level readings within this monitoring well indicate a groundwater level of 60± feet below the ground surface in June 2008.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of eight (8) infiltration test borings, advanced to depths of 10 to 12± feet below the existing site grades. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch diameter hollow stem augers and were logged during drilling by a member of our staff. The approximate locations of the infiltration test borings (identified as I-1 through I-8) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Pavement

AC or PCC pavements were encountered at all eight (8) boring locations. The encountered pavements consisted of 2 to 6± inches AC with 3 to 6± inches AB. Infiltration Test Nos. I-1, I-2, I-7 and I-8 encountered 8½ to 10± inches of PCC with no discernable aggregate base at the ground surface.

Artificial Fill

Artificial fill and possible fill soils were encountered beneath the pavements at all eight (8) boring locations, extending to depths of 3 to 5½± feet below existing site grades. The artificial fill soils consisted of medium dense silty fine sands, fine sandy silts, and fine sands. Dense fine sands were also encountered within the fill strata. Trace quantities of medium to coarse sand and clay nodules were also encountered within the artificial fill.

Alluvium

Native alluvial soils were encountered beneath the artificial fill soils at all eight (8) boring locations, extending to at least the maximum explored depth of 12± feet below existing site grades. The alluvium generally consisted of very loose to medium dense fine sands, loose silty fine sands and silts, medium dense fine to medium sands, and stiff silty clays and clayey silts. Variable trace quantities of medium to coarse sand, silt, and clay were encountered within the alluvial strata. The Boring Logs, which illustrate the conditions encountered at the boring locations, are included with this report.

Infiltration Testing

As previously mentioned, the infiltration testing was performed in general accordance with the Orange County guidelines: Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs), Appendix VII.

Pre-soaking

In accordance with the county infiltration standards, all eight (8) of the infiltration test borings were pre-soaked prior to the infiltration testing. The pre-soaking process consisted of filling the test borings by inverting a full 5-gallon bottle of clear water supported over each hole so that the water level reaches a level of at least 5 times the hole's radius above the gravel at the bottom of each hole. The pre-soaking was completed after all of the water had percolated through each test hole or after 15 hours since initiating the pre-soak. Based on the results of the pre-soaking process, different infiltration procedures were used during the infiltration testing at the infiltration boring locations.

Infiltration Testing

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of each test hole, and less than or equal to the water level used during the pre-soaking process. In accordance with the Orange County guidelines, since "sandy soils" were encountered at the bottom of Infiltration Boring Nos. I-1, I-4, I-6, and I-7 (when two-consecutive measurements show that 6 inches of water seep away in less than 25 minutes), these tests were run for an additional hour with measurements taken at 10-minute and 1-minute intervals. Since "non-sandy soils" were encountered at the bottom of Infiltration Boring Nos. I-2, I-3, I-5, and I-8, readings were taken at 30-minute intervals for a total of 6 hours at the test locations. After each reading, the borings were refilled to the correct water level above the gravel at the bottom of each test hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the test are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used as the design infiltration rate. The rates are summarized below:

Infiltration Test No.	**Surface Elevation (feet)**	**Depth to Bottom of Test (feet)**	**Bottom of Infiltration system (msl feet)**	**Soil Description**	**Infiltration Rate (inches/hour)**
I-1	158.3	10	158.0	Light Gray Brown fine to medium Sand, trace coarse Sand, trace Silt	21.1
I-2	158.2	10	158.0	Gray Brown fine Sandy Silt, trace medium Sand	1.0
I-3	157.7	12	158.0	Light Gray Brown fine Sandy Silt, trace medium Sand	0.5
I-4	158.1	12	158.0	Light Brown fine to medium Sand, trace coarse Sand, little Silt	4.4
I-5	158.3	12	158.0	Brown Silty Clay, little fine Sand	0.3
I-6	156.4	12	158.0	Gray Brown Gravelly Silt, some fine to coarse Sand	4.3
I-7	158.3	10	158.0	Brown fine to coarse Sand, trace Silt	22.1
I-8	158.5	12	158.0	Gray Brown Clayey Silt, little fine Sand	0.8

Note: Infiltration Test Nos. I-1, I-2, and I-7 are located approximately 30 feet away from the B.N.S.F. Railroad tracks.

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the bottom of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-8 of this report.

Design Recommendations

Eight (8) infiltration tests were performed at the subject site. As noted above, the infiltration rates at these locations range from 0.3 to 22.1 inches per hour. **Based on the results of the infiltration testing, we recommend the following design infiltration rates for the proposed below-grade chamber systems:**

Infiltration Test No.	Infiltration System	Measured Infiltration Rate (Inches per Hour)*	Design Infiltration Rate (Inches per Hour)**
I-1, I-2, I-7	"A"	21.6	9.8
I-3, I-4	"B"	2.5	0.8
I-5, I-6, I-8	"C"	1.8	0.5

*** Measured infiltration rate based on average rate between each group of tests. Infiltration Test No. I-2 was not included in the average, since it is not located within the proposed system.**
****Design infiltration rate based on Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet in the Orange County Technical Guidance Document Appendix VII.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration system to identify the soil classification at the base of the chamber system. It should be confirmed that the soils at the base of the proposed infiltration system corresponds with those presented in this report to ensure that the performance of the system will be consistent with the rates reported herein.

The design of the proposed storm water infiltration system should be performed by the project civil engineer, in accordance with the City of Orange and/or County of Orange guidelines. However, it is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rate recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rates are based on infiltration testing at eight (8) discrete locations and the overall infiltration rate of the storm water infiltration system could vary considerably.

Infiltration Rate Considerations

The infiltration rates presented herein was determined in accordance with the City of Orange and/or County of Orange guidelines and are considered valid only for the time and place of the actual test. Varying subsurface conditions will exist in other areas of the site, which could alter the recommended infiltration rates presented above. The infiltration rates will decline over time between maintenance cycles as silt or clay particles accumulate on the BMP surface. The infiltration rate is highly dependent upon a number of factors, including density, silt and clay content, grainsize distribution throughout the range of particle sizes, and particle shape. Small changes in these factors can cause large changes in the infiltration rates.

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration system can significantly reduce the infiltration ability of the basins. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. It should be confirmed that the soils at the base of the proposed infiltration systems correspond with those presented in this report to ensure that the performance of the systems will be consistent with the rates reported herein.

We recommend that scrapers and other rubber-tired heavy equipment not be operated on the basin bottom, or at levels lower than 2 feet above the bottom of the system, particularly within basins. As such, the bottom 24 inches of the infiltration systems should be excavated with non-rubber-tired equipment, such as excavators.

Basin Maintenance

The proposed project may include infiltration basins. Water flowing into these basins will carry some level of sediment. Wind-blown sediments and erosion of the basin side walls will also contribute to sediment deposition at the bottom of the basin. This layer has the potential to significantly reduce the infiltration rate of the basin subgrade soils. Therefore, a formal basin maintenance program should be established to ensure that these silt and clay deposits are removed from the basin on a regular basis. Appropriate vegetation on the basin sidewalls and bottom may reduce erosion and sediment deposition.

Basin maintenance should also include measures to prevent animal burrows, and to repair any burrows or damage caused by such. Animal burrows in the basin sidewalls can significantly increase the risk of erosion and piping failures.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls and railroad tracks.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rates contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between trench locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Daryl Kas, CEG 2467
Senior Geologist

PROFESSIONAL GEOLOGIST
DARYL R. KAS
No. 2467
CERTIFIED
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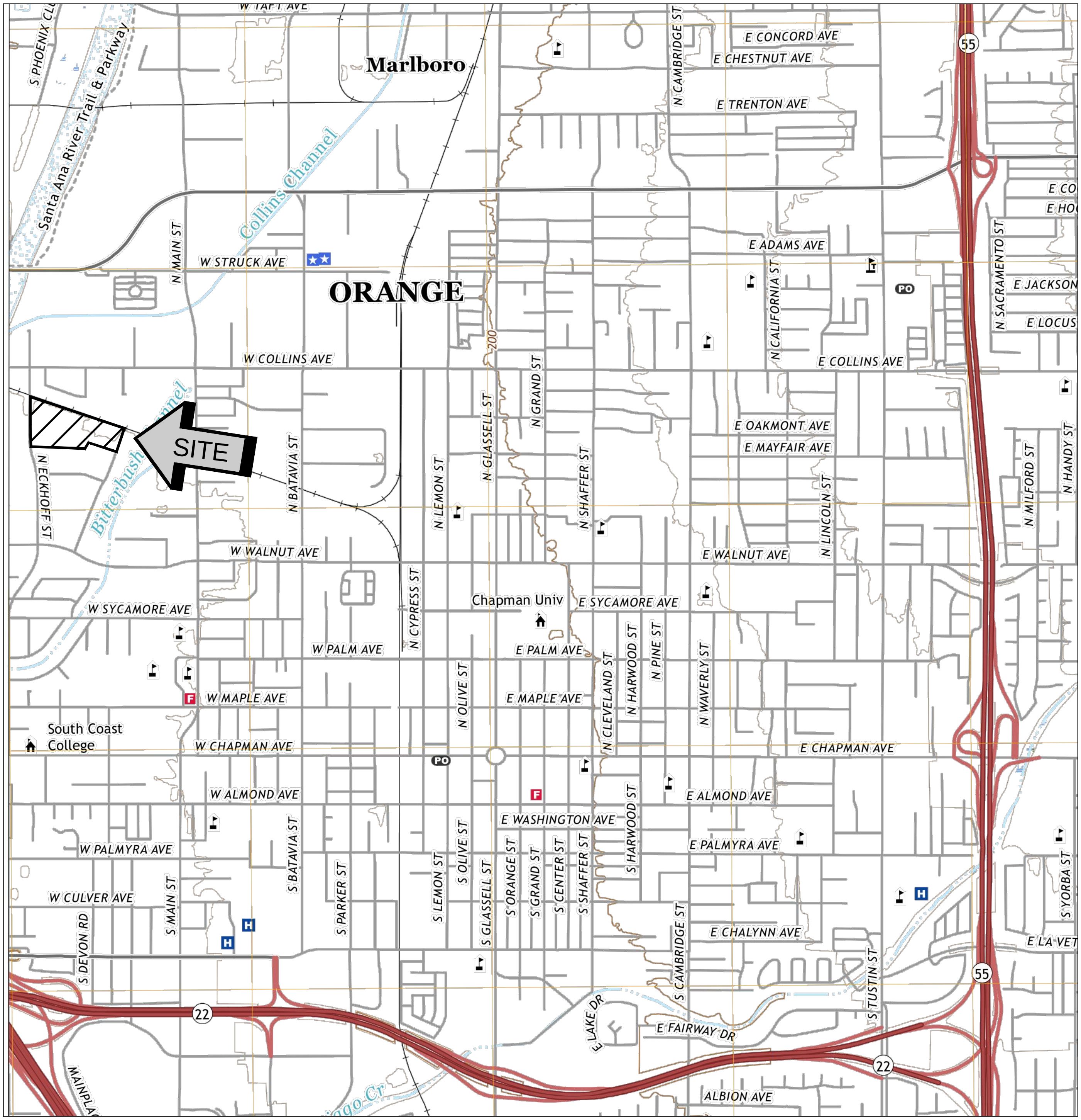
REGISTERED PROFESSIONAL ENGINEER
GREGORY K. MITCHELL
No. 2364
Exp. 09/30/22
GEOTECHNICAL
STATE OF CALIFORNIA

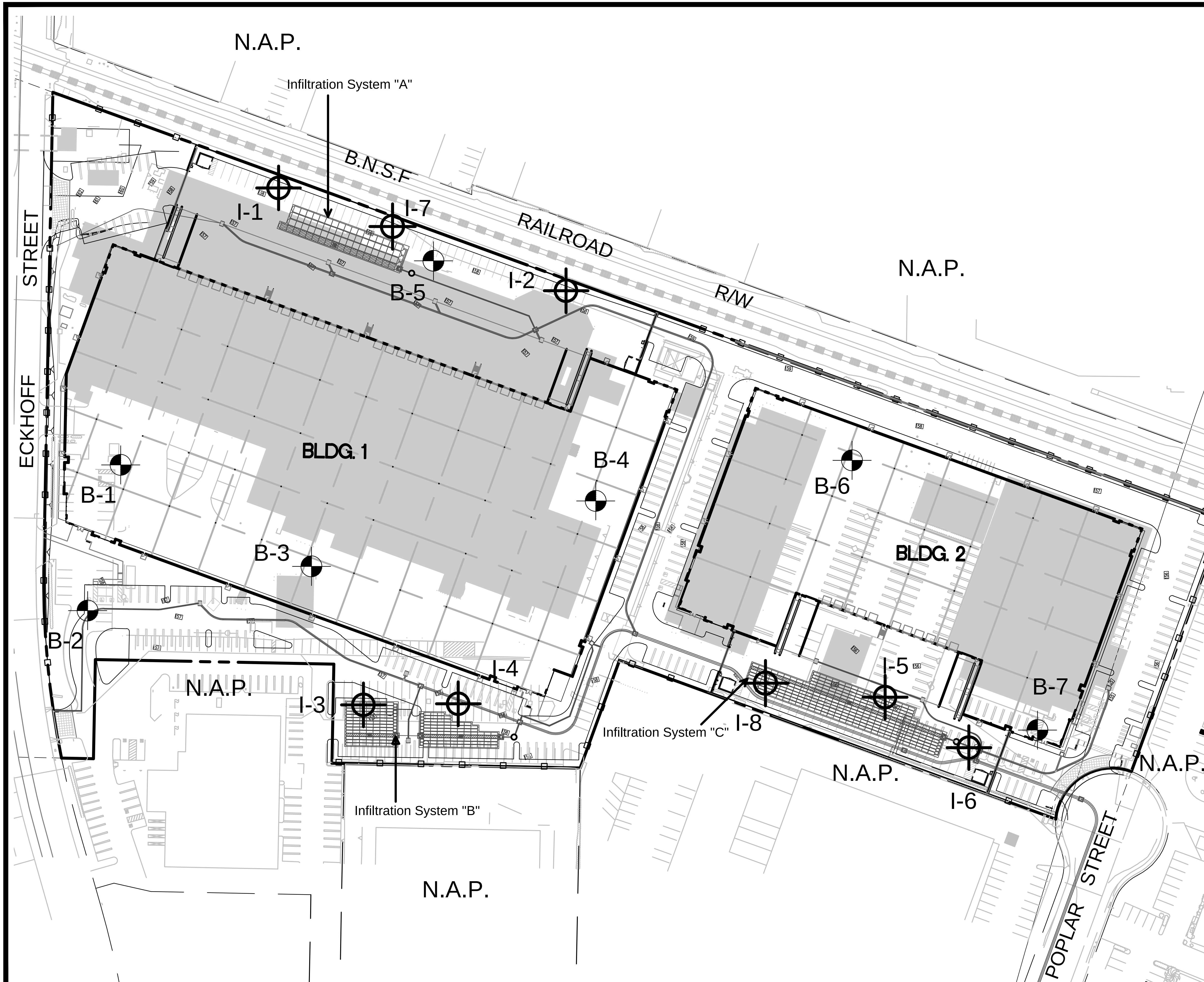
Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (10 pages)
Infiltration Test Results Spreadsheets (10 pages)
Grain Size Distribution Graphs (8 pages)



SOURCE: USGS TOPOGRAPHIC MAP OF THE
ORANGE QUADRANGLE, ORANGE COUNTY, CALIFORNIA, 2018

SITE LOCATION MAP	
TWO PROPOSED INDUSTRIAL BUILDINGS	
ORANGE, CALIFORNIA	
SCALE: 1" = 2000'	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAH CHKD: GKM	
SCG PROJECT 20G199-3	
PLATE 1	



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION (SCG PROJECT NO. 20G199-1)
- EXISTING BUILDING TO BE DEMOLISHED
- PROPOSED INFILTRATION SYSTEM

NOTE: CONCEPTUAL SITE PLAN PROVIDED BY THIENES ENGINEERING, INC.

INFILTRATION TEST LOCATION PLAN

TWO PROPOSED INDUSTRIAL BUILDINGS

ORANGE, CALIFORNIA

SCALE: 1" = 100'

DRAWN: MD
CHKD: GKM

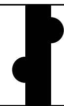
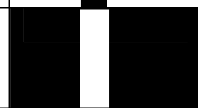
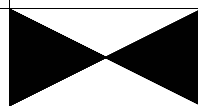
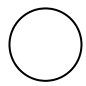
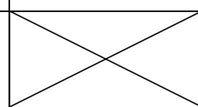
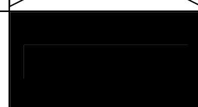
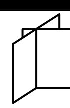
SCG PROJECT
20G199-3

PLATE 2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3” indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT 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 SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING NO. I-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 10/3/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

SURFACE ELEVATION: 158.3 feet MSL

FIELD RESULTS: DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS: DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 10± inches PCC with no discernible Aggregate Base							
		10			FILL: Brown Silty fine Sand, trace medium to coarse Sand, trace Clay nodules, loose to medium dense-damp to moist		8					
		9					9					
5												
		3			ALLUVIUM: Gray Brown fine Sand, trace to little Silt, trace medium to coarse Sand, very loose-moist		10					
		13			Light Gray Brown fine to medium Sand, trace coarse Sand, trace Silt, medium dense-damp		5			5		
10												

Boring Terminated at 10'

TBL 20G199-3.GPJ SOCALGEO.GDT 8/10/21

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-2

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 10/3/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

SURFACE ELEVATION: 158.2 feet MSL

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 10± inches PCC with no discernible Aggregate Base							
	X	12			FILL: Gray Brown intermixed layers of Silty fine Sand, fine Sand, and fine Sandy Silt, medium dense-damp		7					
	X	7			ALLUVIUM: Gray Brown fine Sand, trace medium Sand, loose-dry		2					
5												
	X	4			Gray Brown fine Sandy Silt, trace medium Sand, trace Iron Oxide staining, loose-very moist to wet		24					
	X	5					17			58		
10												

Boring Terminated at 10'

TBL 20G199-3.GPJ SOCALGEO.GDT 8/10/21

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-3

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 10/3/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

SURFACE ELEVATION: 157.7 feet MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
				PAVEMENT: 2± inches Asphaltic Concrete with 3± inches Aggregate Base							
	X	30		FILL: Yellow Brown fine Sand, trace Clay nodules, medium dense to dense-moist to very moist		12					
				POSSIBLE FILL: Dark Brown Silty fine Sand, little Iron Oxide staining, medium dense to dense-moist							
	X	19		ALLUVIUM: Light Gray Brown fine Sand, medium dense-dry to damp		9					
5											
	X	6		Light Gray Brown fine Sandy Silt, trace medium Sand, trace Iron Oxide staining, trace Calcareous nodules, loose-dry to wet		3					
	X	8				25					
10											
	X	12				20			52		

Boring Terminated at 12'

TBL 20G199-3.GPJ SOCALGEO.GDT 8/10/21

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-4

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 10/3/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 158.1 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 2± inches Asphaltic Concrete, 3± inches Aggregate Base							
	X	22			FILL: Yellow Brown fine Sand, trace Clay nodules, medium dense-damp to moist		9 7					
					POSSIBLE FILL: Dark Brown Silty fine Sand, trace Iron Oxide staining, medium dense-damp							
	X	14			ALLUVIUM: Light Gray Brown fine Sand, medium dense-damp		5					
5												
	X	8			Interbedded layers of Gray Brown fine Sandy Silt to Silty fine Sand, loose-moist		11					
	X	8			Light Brown fine to medium Sand, little Silt, medium dense-very moist		14					
10												
	X	12					15			12		

Boring Terminated at 12'

TBL 20G199-3.GPJ SOCALGEO.GDT 8/10/21

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-5

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 10/3/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

SURFACE ELEVATION: 158.3 feet MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 6± inches Asphaltic Concrete, 6± inches Aggregate Base							
	X	20	3.0		FILL: Dark Brown Silty fine Sand, trace fine Gravel, medium dense-moist		10					
	X	22					9					
					POSSIBLE FILL: Light Gray Brown fine Sand, medium dense-damp to moist							
5												
	X	7	1.5		ALLUVIUM: Brown fine Sandy Silt, little Iron Oxide staining, loose-wet		23					
	X	5			Brown Silt, trace to little Clay, little Iron Oxide staining, loose-very moist		23					
10												
	X	9	2.0		Brown Silty Clay, little Iron Oxide staining, little fine Sand, stiff-very moist		24			83		

Boring Terminated at 12'

TBL 20G199-3.GPJ SOCALGEO.GDT 8/10/21

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 10/3/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 156.4 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 4± inches Asphaltic Concrete, 6± inches Aggregate Base							
	X	28			FILL: Gray Brown fine Sand, trace Silt, trace fine Gravel, trace AC fragments, medium dense-damp		6					
	X	9			ALLUVIUM: Gray Brown fine Sandy Silt, trace fine root fibers, trace Iron Oxide staining, trace Calcareous veining, loose-damp to very moist		11					
5												
	X	14					8					
	X	12					15					
10												
	X	19					10			39		

Boring Terminated at 12'

TBL 20G199-3.GPJ SOCALGEO.GDT 8/10/21

BORING NO. I-7

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 6/29/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS | LABORATORY RESULTS

SURFACE ELEVATION: 158.3 feet MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 8½± inches PCC with no discernible Aggregate Base							
	X	20			FILL: Brown Silty fine Sand, trace medium to coarse Sand, medium dense-moist		10					
	X	14			POSSIBLE FILL: Gray Brown Silty fine to medium Sand, medium dense-damp		4					
5												
	X	6			ALLUVIUM: Brown fine to coarse Sand, trace Silt, loose-damp		5					
	X	11					3			3		
10												

Boring Terminated at 10'

TEST BORING LOG

BORING NO. I-8

JOB NO.: 20G199-3
PROJECT: Two Proposed Industrial Buildings
LOCATION: Orange, California

DRILLING DATE: 6/29/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 158.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 9± inches PCC with no discernible Aggregate Base							
	X	20			FILL: Brown Silty fine Sand, trace to little medium to coarse Sand, medium dense-moist		8					
	X	16					9					
5	X	4			ALLUVIUM: Gray Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, very loose to loose-very moist		23					
	X	7					18					
10	X	6	1.5		Gray Brown Clayey Silt, little fine Sand, little Iron oxide staining, micaceous, medium stiff-very moist		24			85		

Boring Terminated at 12'

TBL 20G199-3.GPJ SOCALGEO.GDT 8/10/21

TEST BORING LOG

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	10.2	(ft)

Infiltration Test Hole	I-1

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	8:00 AM	1.0	8.70	0.42	1.29	34.60
	Final	8:01 AM		9.12			
PS2	Initial	8:02 AM	1.0	8.70	0.40	1.30	32.73
	Final	8:03 AM		9.10			
1	Initial	8:04 AM	1.0	8.70	0.38	1.31	30.88
	Final	8:05 AM		9.08			
2	Initial	8:07 AM	1.0	8.70	0.38	1.31	30.88
	Final	8:08 AM		9.08			
3	Initial	8:09 AM	1.0	8.70	0.37	1.32	29.97
	Final	8:10 AM		9.07			
4	Initial	8:12 AM	1.0	8.70	0.36	1.32	29.06
	Final	8:13 AM		9.06			
5	Initial	8:15 AM	1.0	8.70	0.35	1.33	28.16
	Final	8:16 AM		9.05			
6	Initial	8:17 AM	1.0	8.70	0.33	1.34	26.37
	Final	8:18 AM		9.03			
7	Initial	8:20 AM	1.0	8.70	0.33	1.34	26.37
	Final	8:21 AM		9.03			
8	Initial	8:22 AM	1.0	8.70	0.33	1.34	26.37
	Final	8:23 AM		9.03			
9	Initial	8:24 AM	1.0	8.70	0.34	1.33	27.26
	Final	8:25 AM		9.04			
10	Initial	8:27 AM	1.0	8.70	0.32	1.34	25.49
	Final	8:28 AM		9.02			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)

ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	10.2	(ft)

Infiltration Test Hole	I-1

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
11	Initial	8:29 AM	1.0	8.70	0.31	1.35	24.61
	Final	8:30 AM		9.01			
12	Initial	8:32 AM	1.0	8.70	0.31	1.35	24.61
	Final	8:33 AM		9.01			
13	Initial	8:34 AM	1.0	8.70	0.30	1.35	23.74
	Final	8:35 AM		9.00			
14	Initial	8:37 AM	1.0	8.70	0.30	1.35	23.74
	Final	8:38 AM		9.00			
15	Initial	8:39 AM	1.0	8.70	0.31	1.35	24.61
	Final	8:40 AM		9.01			
16	Initial	8:42 AM	1.0	8.70	0.29	1.36	22.87
	Final	8:43 AM		8.99			
17	Initial	8:45 AM	1.0	8.70	0.29	1.36	22.87
	Final	8:46 AM		8.99			
18	Initial	8:47 AM	1.0	8.70	0.28	1.36	22.01
	Final	8:48 AM		8.98			
19	Initial	8:50 AM	1.0	8.70	0.27	1.37	21.15
	Final	8:51 AM		8.97			
20	Initial	8:53 AM	1.0	8.70	0.27	1.37	21.15
	Final	8:54 AM		8.97			
21	Initial	8:55 AM	1.0	8.70	0.27	1.37	21.15
	Final	8:56 AM		8.97			
22	Initial	8:58 AM	1.0	8.70	0.27	1.37	21.15
	Final	8:59 AM		8.97			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	10.2	(ft)

Infiltration Test Hole	I-1

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
23	Initial	9:01 AM	1.0	8.70	0.27	1.37	21.15
	Final	9:02 AM		8.97			
24	Initial	9:03 AM	1.0	8.70	0.27	1.37	21.15
	Final	9:04 AM		8.97			
25	Initial	9:05 AM	1.0	8.70	0.27	1.37	21.15
	Final	9:06 AM		8.97			
26	Initial	9:08 AM	1.0	8.70	0.27	1.37	21.15
	Final	9:09 AM		8.97			
27	Initial	9:10 AM	1.0	8.70	0.27	1.37	21.15
	Final	9:11 AM		8.97			
28	Initial	9:13 AM	1.0	8.70	0.28	1.36	22.01
	Final	9:14 AM		8.98			
29	Initial	9:15 AM	1.0	8.70	0.27	1.37	21.15
	Final	9:16 AM		8.97			
30	Initial	9:18 AM	1.0	8.70	0.27	1.37	21.15
	Final	9:19 AM		8.97			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	10.1	(ft)

Infiltration Test Hole	I-2

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	9:25 AM	30.0	7.49	0.71	2.26	1.17
	Final	9:55 AM		8.20			
PS2	Initial	9:55 AM	30.0	7.49	0.71	2.26	1.17
	Final	10:25 AM		8.20			
1	Initial	10:26 AM	30.0	7.49	0.71	2.26	1.17
	Final	10:56 AM		8.20			
2	Initial	10:57 AM	30.0	7.49	0.73	2.25	1.21
	Final	11:27 AM		8.22			
3	Initial	11:28 AM	30.0	7.49	0.74	2.24	1.23
	Final	11:58 AM		8.23			
4	Initial	12:00 PM	30.0	7.49	0.72	2.25	1.19
	Final	12:30 PM		8.21			
5	Initial	12:31 PM	30.0	7.49	0.71	2.26	1.17
	Final	1:01 PM		8.20			
6	Initial	1:02 PM	30.0	7.49	0.70	2.26	1.15
	Final	1:32 PM		8.19			
7	Initial	1:33 PM	30.0	7.49	0.66	2.28	1.08
	Final	2:03 PM		8.15			
8	Initial	2:04 PM	30.0	7.49	0.66	2.28	1.08
	Final	2:34 PM		8.15			
9	Initial	2:37 PM	30.0	7.49	0.65	2.29	1.06
	Final	3:07 PM		8.14			
10	Initial	3:08 PM	30.0	7.49	0.64	2.29	1.04
	Final	3:38 PM		8.13			
11	Initial	3:40 PM	30.0	7.49	0.64	2.29	1.04
	Final	4:10 PM		8.13			
12	Initial	4:11 PM	30.0	7.49	0.64	2.29	1.04
	Final	4:41 PM		8.13			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	12.2	(ft)

Infiltration Test Hole	I-3

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	9:30 AM	30.0	10.20	0.21	1.90	0.41
	Final	10:00 AM		10.41			
PS2	Initial	10:01 AM	30.0	10.20	0.23	1.89	0.45
	Final	10:31 AM		10.43			
1	Initial	10:33 AM	30.0	10.20	0.24	1.88	0.47
	Final	11:03 AM		10.44			
2	Initial	11:04 AM	30.0	10.20	0.25	1.88	0.49
	Final	11:34 AM		10.45			
3	Initial	11:34 AM	30.0	10.20	0.26	1.87	0.51
	Final	12:04 PM		10.46			
4	Initial	12:04 PM	30.0	10.20	0.25	1.88	0.49
	Final	12:34 PM		10.45			
5	Initial	12:35 PM	30.0	10.20	0.25	1.88	0.49
	Final	1:05 PM		10.45			
6	Initial	1:06 PM	30.0	10.20	0.26	1.87	0.51
	Final	1:36 PM		10.46			
7	Initial	1:37 PM	30.0	10.20	0.25	1.88	0.49
	Final	2:07 PM		10.45			
8	Initial	2:07 PM	30.0	10.20	0.25	1.88	0.49
	Final	2:37 PM		10.45			
9	Initial	2:38 PM	30.0	10.20	0.25	1.88	0.49
	Final	3:08 PM		10.45			
10	Initial	3:12 PM	30.0	10.20	0.25	1.88	0.49
	Final	3:42 PM		10.45			
11	Initial	3:43 PM	30.0	10.20	0.26	1.87	0.50
	Final	4:13 PM		10.46			
12	Initial	4:13 PM	30.0	10.20	0.25	1.88	0.49
	Final	4:43 PM		10.45			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	12.0	(ft)

Infiltration Test Hole	I-4

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	7:30 AM	5.0	9.90	0.40	1.85	4.76
	Final	7:35 AM		10.30			
PS2	Initial	7:40 AM	5.0	9.90	0.42	1.84	5.02
	Final	7:45 AM		10.32			
1	Initial	7:47 AM	10.0	9.90	0.70	1.70	4.50
	Final	7:57 AM		10.60			
2	Initial	7:58 AM	10.0	9.90	0.69	1.71	4.42
	Final	8:08 AM		10.59			
3	Initial	8:09 AM	10.0	9.90	0.70	1.70	4.50
	Final	8:19 AM		10.60			
4	Initial	8:20 AM	10.0	9.90	0.70	1.70	4.50
	Final	8:30 AM		10.60			
5	Initial	8:31 AM	10.0	9.90	0.68	1.71	4.35
	Final	8:41 AM		10.58			
6	Initial	8:42 AM	10.0	9.90	0.69	1.71	4.42
	Final	8:52 AM		10.59			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	12.1	(ft)

Infiltration Test Hole	I-5

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	8:55 AM	30.0	10.00	0.13	2.04	0.24
	Final	9:25 AM		10.13			
PS2	Initial	9:26 AM	30.0	10.00	0.14	2.03	0.25
	Final	9:56 AM		10.14			
1	Initial	9:57 AM	30.0	10.00	0.15	2.03	0.27
	Final	10:27 AM		10.15			
2	Initial	10:29 AM	30.0	10.00	0.15	2.03	0.27
	Final	10:59 AM		10.15			
3	Initial	11:00 AM	30.0	10.00	0.15	2.03	0.27
	Final	11:30 AM		10.15			
4	Initial	11:31 AM	30.0	10.00	0.16	2.02	0.29
	Final	12:01 PM		10.16			
5	Initial	12:02 PM	30.0	10.00	0.15	2.03	0.27
	Final	12:32 PM		10.15			
6	Initial	12:35 PM	30.0	10.00	0.15	2.03	0.27
	Final	1:05 PM		10.15			
7	Initial	1:06 PM	30.0	10.00	0.15	2.03	0.27
	Final	1:36 PM		10.15			
8	Initial	1:37 PM	30.0	10.00	0.16	2.02	0.29
	Final	2:07 PM		10.16			
9	Initial	2:08 PM	30.0	10.00	0.16	2.02	0.29
	Final	2:38 PM		10.16			
10	Initial	2:40 PM	30.0	10.00	0.16	2.02	0.29
	Final	3:10 PM		10.16			
11	Initial	3:10 PM	30.0	10.00	0.16	2.02	0.29
	Final	3:40 PM		10.16			
12	Initial	3:41 PM	30.0	10.00	0.16	2.02	0.29
	Final	4:11 PM		10.16			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Luis Arriaga

Test Hole Radius	4	(in)
Test Depth	12.2	(ft)

Infiltration Test Hole	I-6

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	9:01 AM	1.0	8.70	0.27	3.37	9.17
	Final	9:02 AM		8.97			
PS2	Initial	9:03 AM	1.0	8.70	0.27	3.37	9.17
	Final	9:04 AM		8.97			
1	Initial	10:02 AM	10.0	10.10	0.55	1.83	3.31
	Final	10:12 AM		10.65			
2	Initial	10:13 AM	10.0	10.10	0.59	1.81	3.59
	Final	10:23 AM		10.69			
3	Initial	10:24 AM	10.0	10.10	0.60	1.80	3.66
	Final	10:34 AM		10.70			
4	Initial	10:35 AM	10.0	10.10	0.65	1.78	4.02
	Final	10:45 AM		10.75			
5	Initial	10:46 AM	10.0	10.10	0.68	1.76	4.24
	Final	10:56 AM		10.78			
6	Initial	10:58 AM	10.0	10.10	0.69	1.76	4.31
	Final	11:08 AM		10.79			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)

ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Ryan Bremer

Test Hole Radius	4	(in)
Test Depth	10.0	(ft)

Infiltration Test Hole	I-7

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	7:00 AM	9.0	6.00	4.00	2.00	24.62
	Final	7:09 AM		10.00			
PS2	Initial	7:10 AM	9.0	6.00	4.00	2.00	24.62
	Final	7:19 AM		10.00			
1	Initial	7:20 AM	10.0	6.00	4.00	2.00	22.15
	Final	7:30 AM		10.00			
2	Initial	7:31 AM	10.0	6.00	4.00	2.00	22.15
	Final	7:41 AM		10.00			
3	Initial	7:42 AM	10.0	6.00	4.00	2.00	22.15
	Final	7:52 AM		10.00			
4	Initial	7:53 AM	10.0	6.00	4.00	2.00	22.15
	Final	8:03 AM		10.00			
5	Initial	8:04 AM	10.0	6.00	4.00	2.00	22.15
	Final	8:14 AM		10.00			
6	Initial	8:15 AM	10.0	6.00	4.00	2.00	22.15
	Final	8:25 AM		10.00			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Orange, CA
Project Number	20G199-3
Engineer	Ryan Bremer

Test Hole Radius	4	(in)
Test Depth	11.5	(ft)

Infiltration Test Hole	I-8

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
PS1	Initial	8:59 AM	25.0	9.19	0.43	2.10	0.91
	Final	9:24 AM		9.62			
PS2	Initial	9:25 AM	25.0	9.39	0.39	1.92	0.90
	Final	9:50 AM		9.78			
1	Initial	9:50 AM	30.0	9.19	0.49	2.07	0.88
	Final	10:20 AM		9.68			
2	Initial	10:20 AM	30.0	9.45	0.42	1.84	0.84
	Final	10:50 AM		9.87			
3	Initial	10:50 AM	30.0	9.56	0.39	1.75	0.82
	Final	11:20 AM		9.95			
4	Initial	11:20 AM	30.0	9.57	0.39	1.74	0.82
	Final	11:50 AM		9.96			
5	Initial	11:50 AM	30.0	9.56	0.39	1.75	0.82
	Final	12:20 PM		9.95			
6	Initial	12:20 PM	30.0	9.55	0.39	1.76	0.81
	Final	12:50 PM		9.94			

Per County Standards, Infiltration Rate calculated as follows:

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

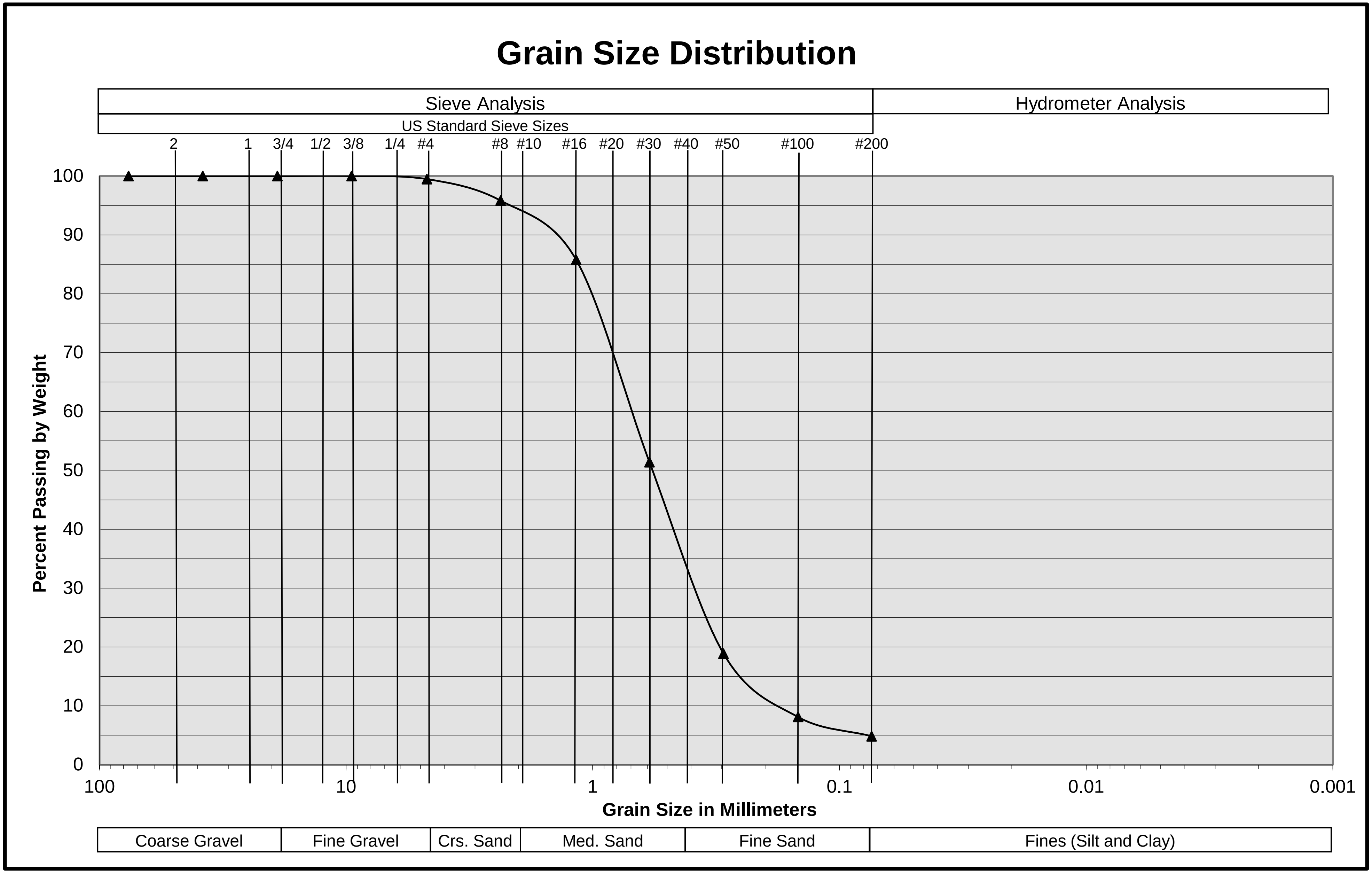
Where: Q = Infiltration Rate (in inches per hour)

ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

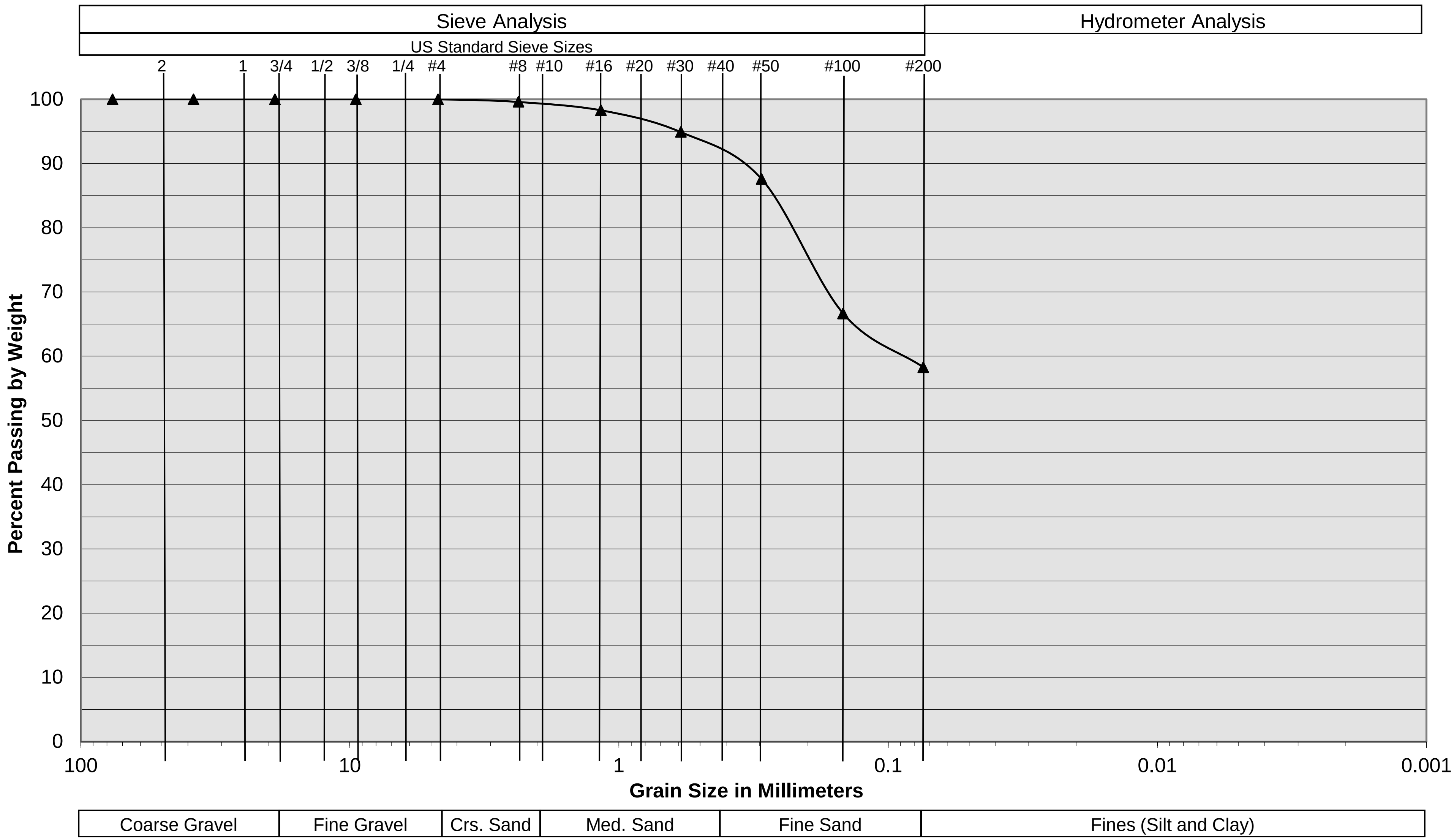


Sample Description	I-1 @ 8.5'
Soil Classification	Light Gray Brown fine to medium Sand, trace coarse Sand, trace Silt

Two Proposed Industrial Buildings
Orange, California
Project No. 20G199-3
PLATE C-1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL A California Corporation

Grain Size Distribution

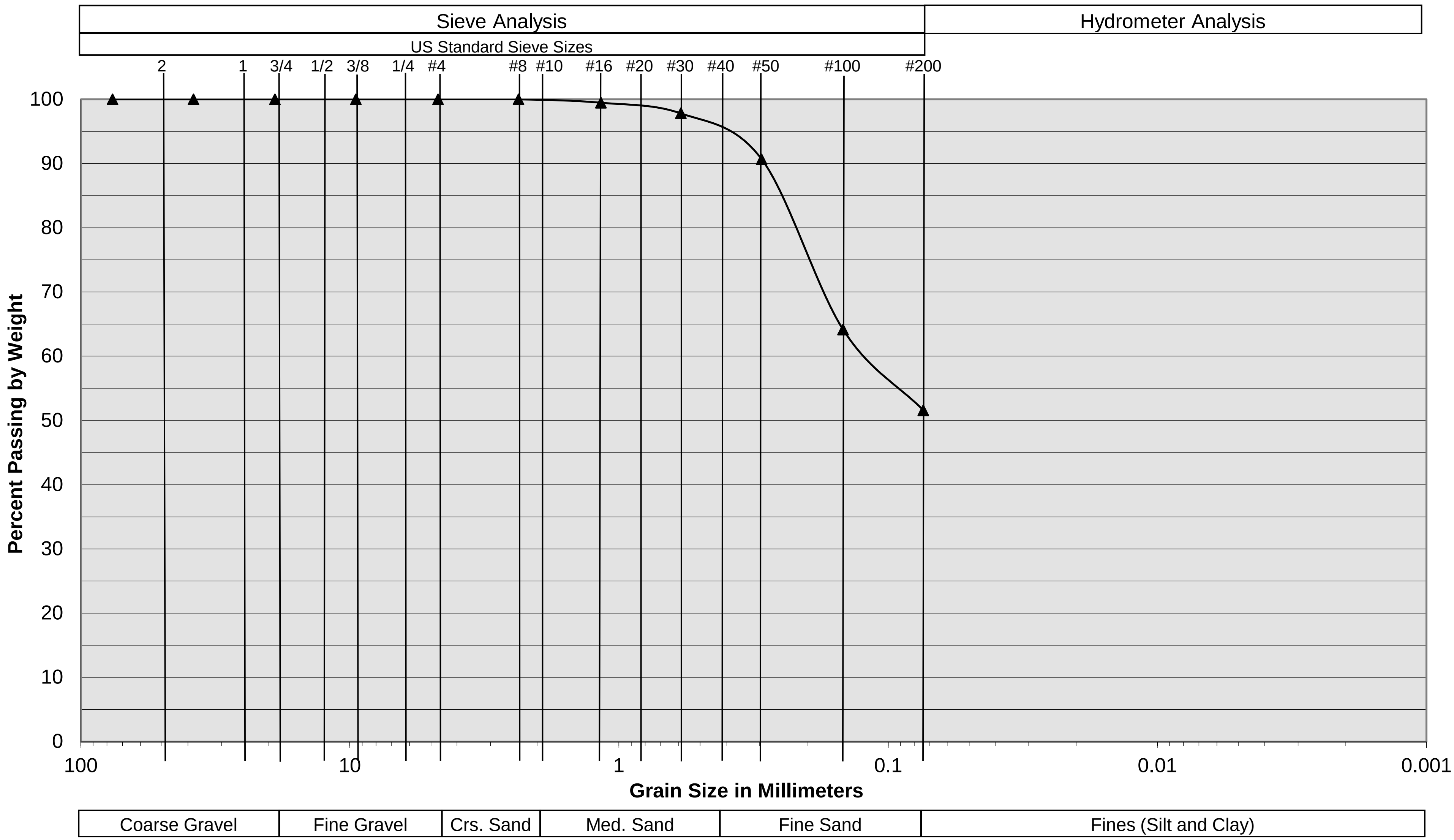


Sample Description	I-2 @ 8.5'
Soil Classification	Gray Brown fine Sandy Silt, trace medium Sand

Two Proposed Industrial Buildings
Orange, California
Project No. 20G199-3
PLATE C-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

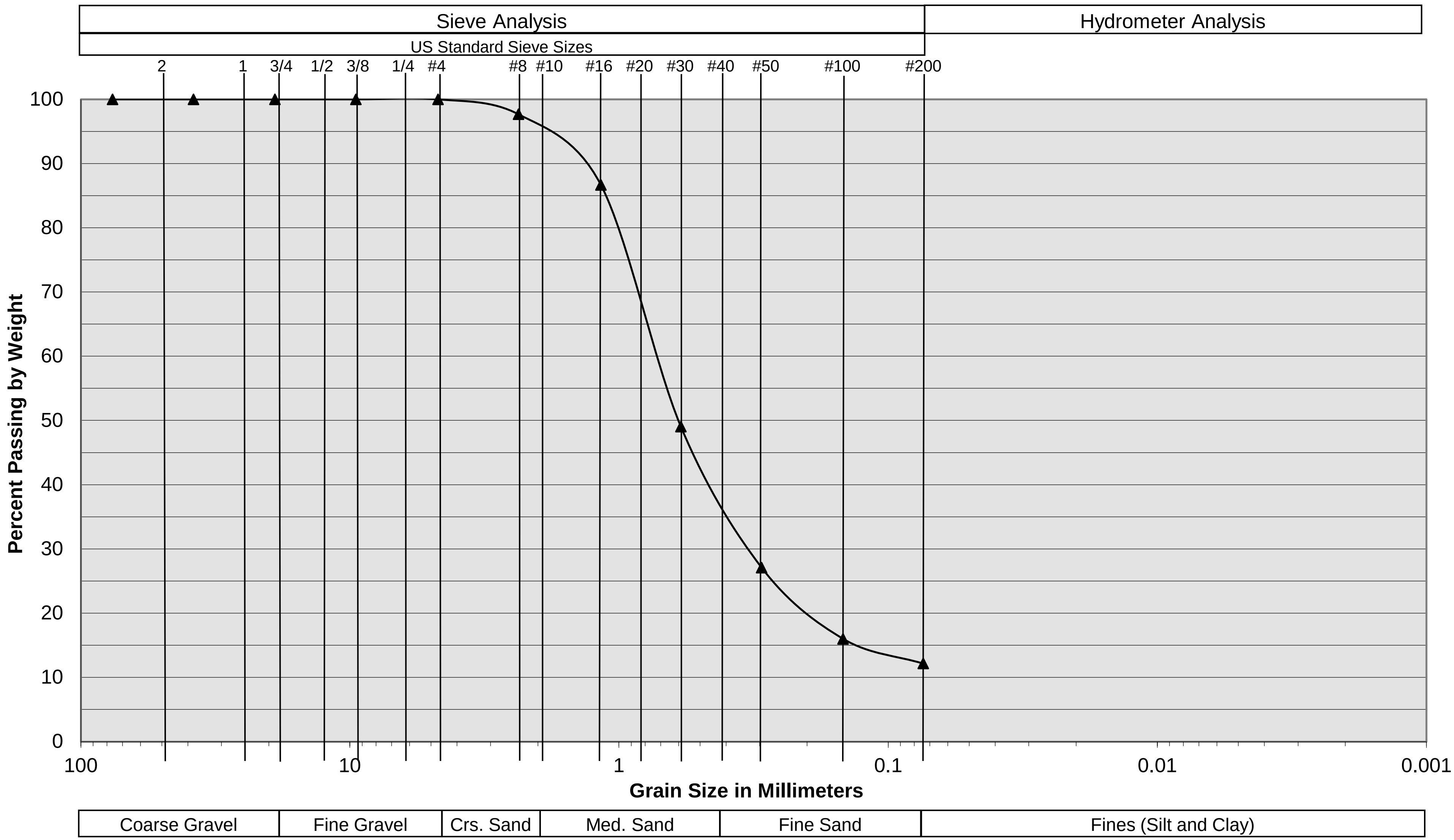


Sample Description	I-3 @ 10.5'
Soil Classification	Light Gray Brown fine Sandy Silt, trace medium Sand

Two Proposed Industrial Buildings
Orange, California
Project No. 20G199-3
PLATE C-3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

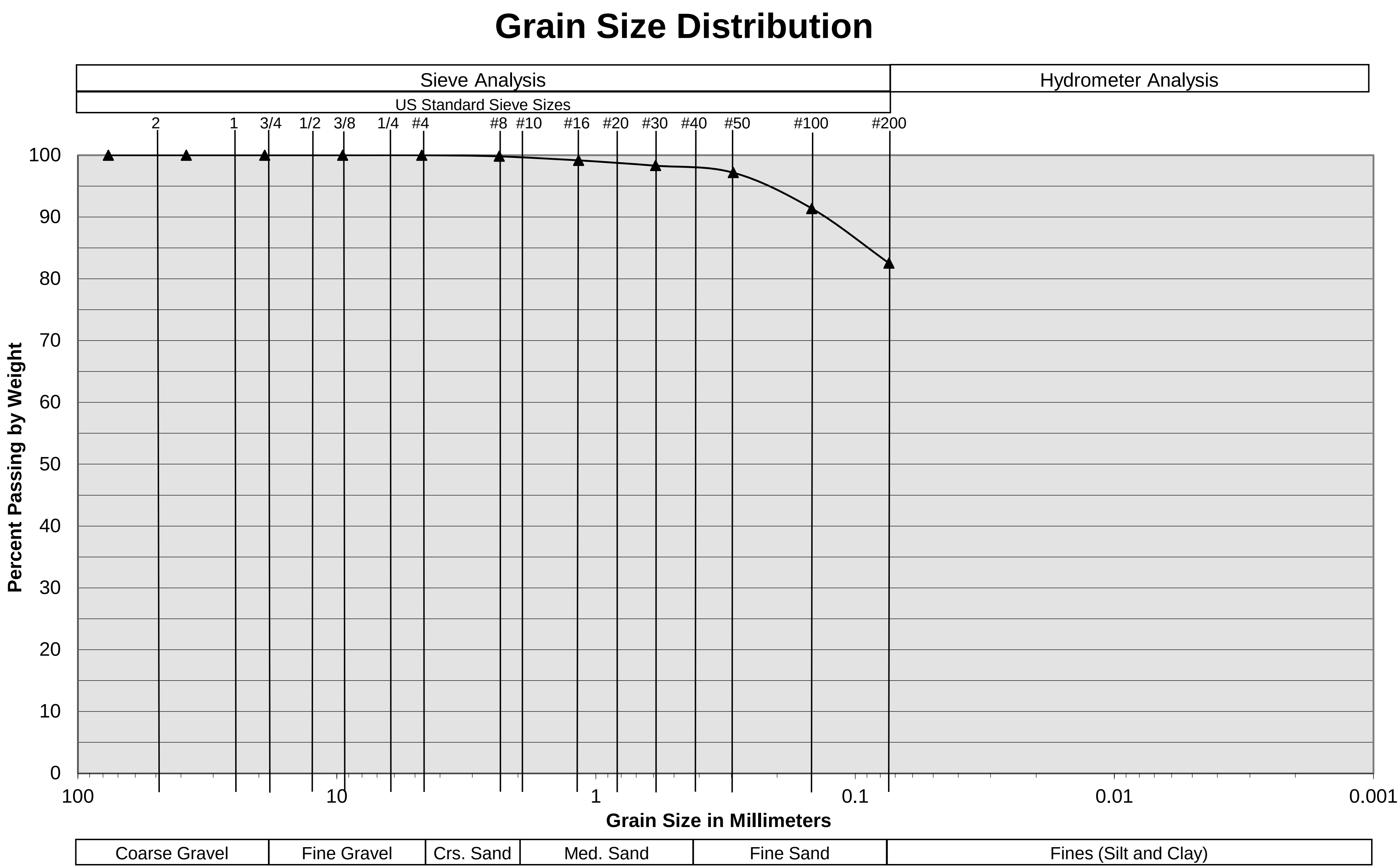
Grain Size Distribution



Sample Description	I-4 @ 10.5'
Soil Classification	Light Brown fine to medium Sand, trace coarse Sand, little Silt

Two Proposed Industrial Buildings
Orange, California
Project No. 20G199-3
PLATE C-4

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

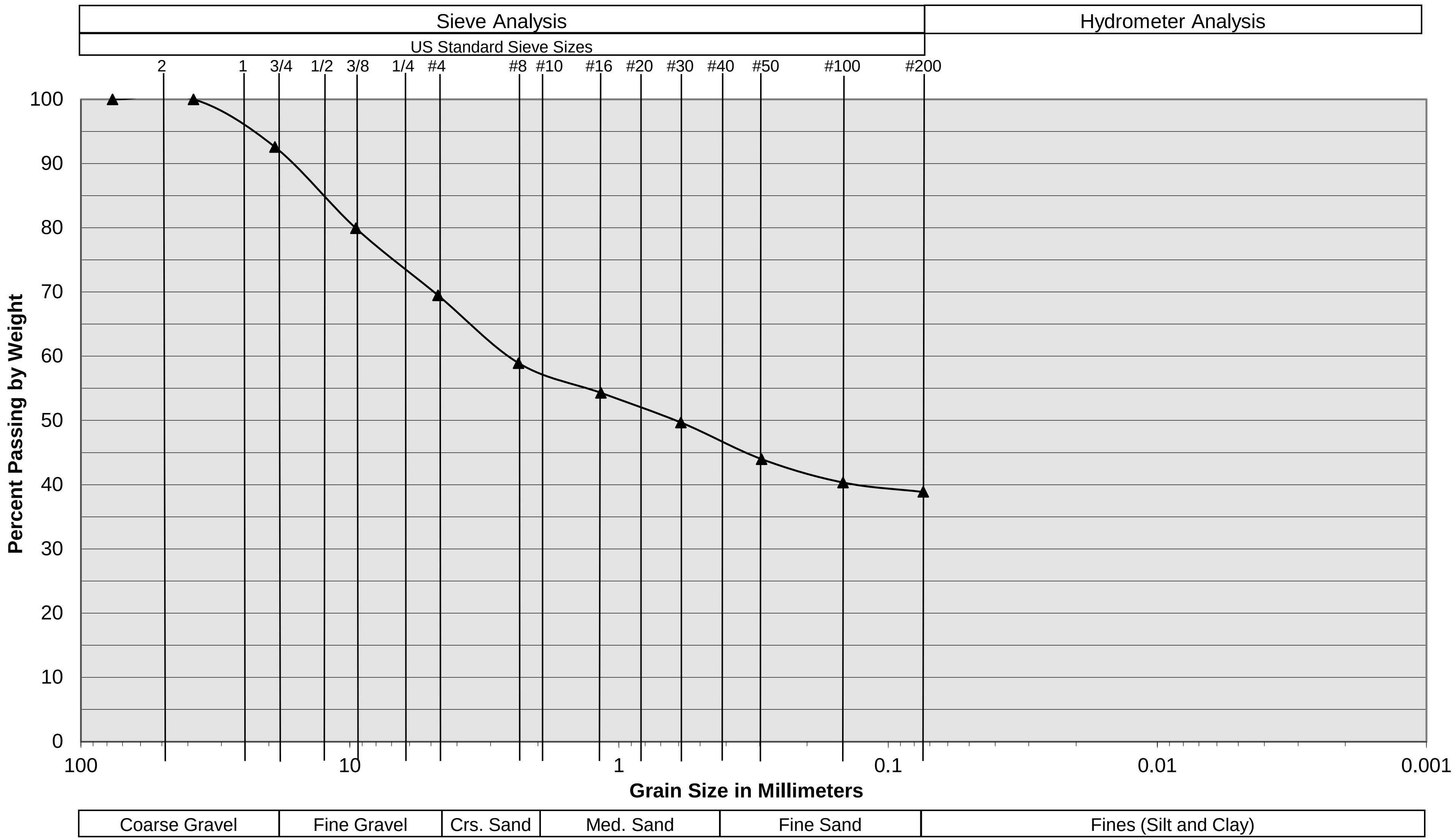


Sample Description	I-5 @ 10.5'
Soil Classification	Brown Silty Clay, little fine Sand

Two Proposed Industrial Buildings
Orange, California
Project No. 20G199-3
PLATE C-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

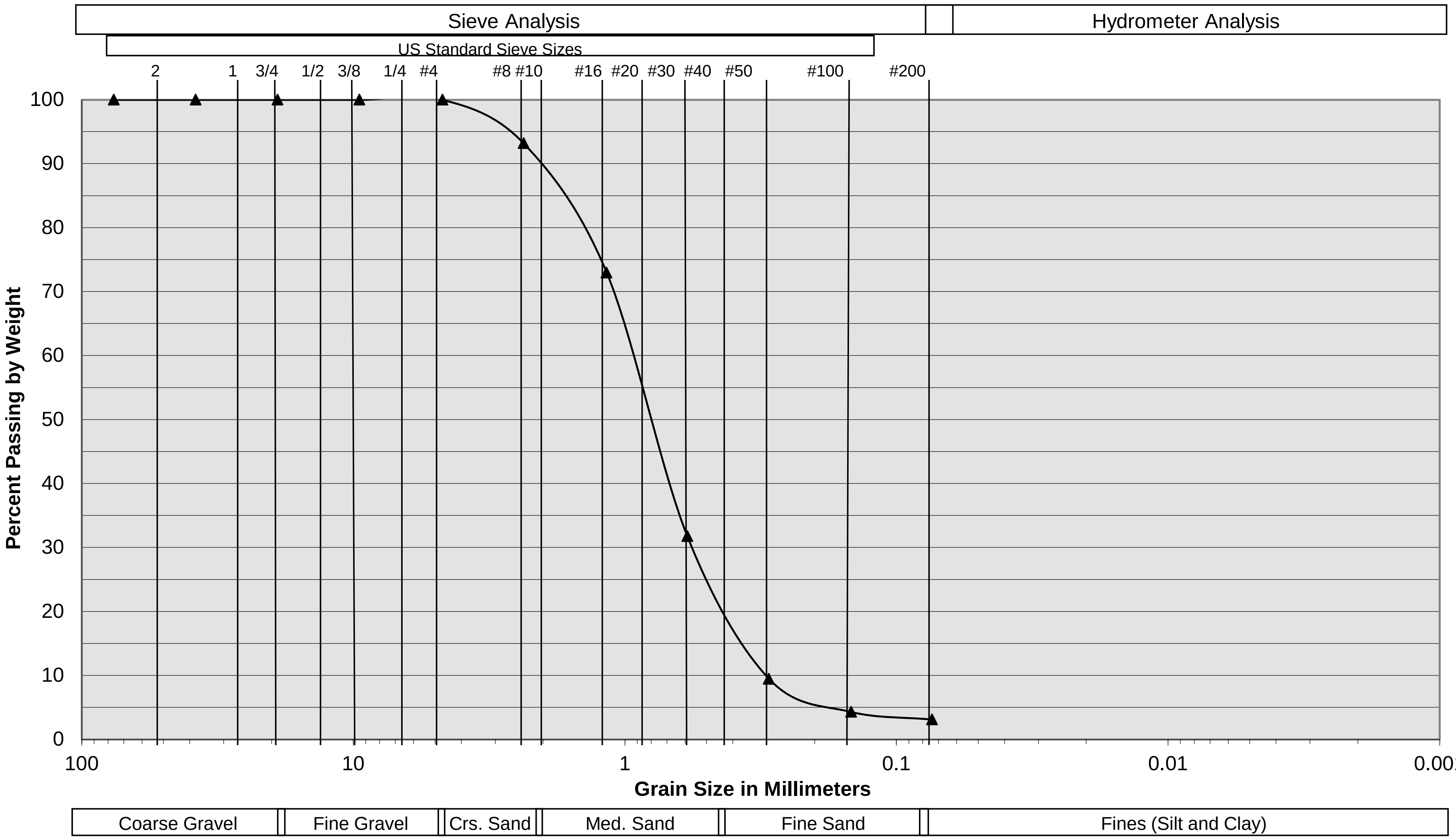


Sample Description	I-6 @ 10.5'
Soil Classification	Gray Brown Gravelly Silt, some fine to coarse Sand

Two Proposed Industrial Buildings
Orange, California
Project No. 20G199-3
PLATE C-6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

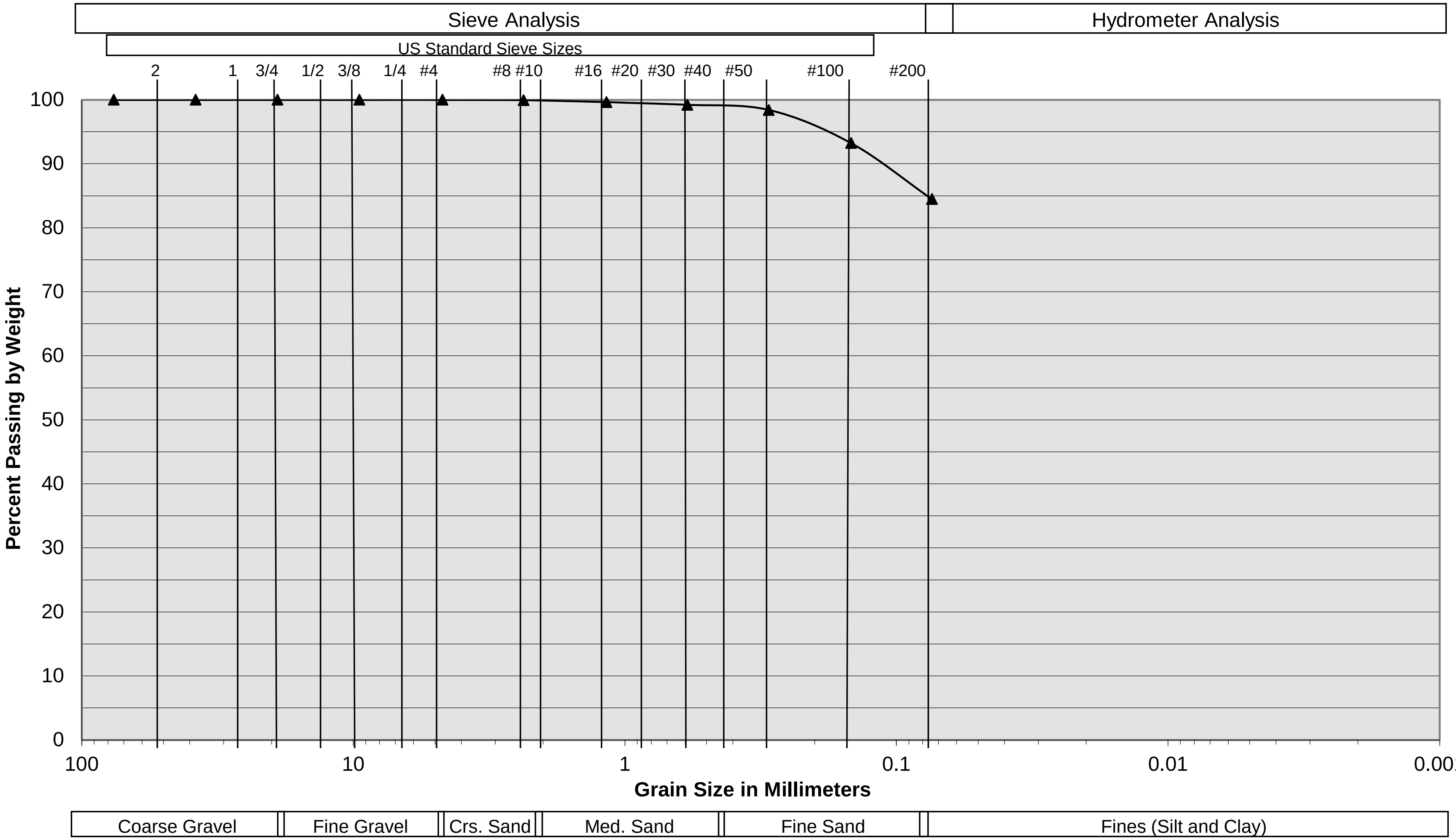


Sample Description	I-7 @ 8½ feet
Soil Classification	Brown fine to coarse Sand, trace Silt

Two Proposed Industrial Buildings
Orange, CA
Project No. 20G199-3
PLATE C- 7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-8 @ 10½ feet
Soil Classification	Gray Brown Clayey Silt, little fine Sand

Two Proposed Industrial Buildings
Orange, CA
Project No. 20G199-3
PLATE C- 8

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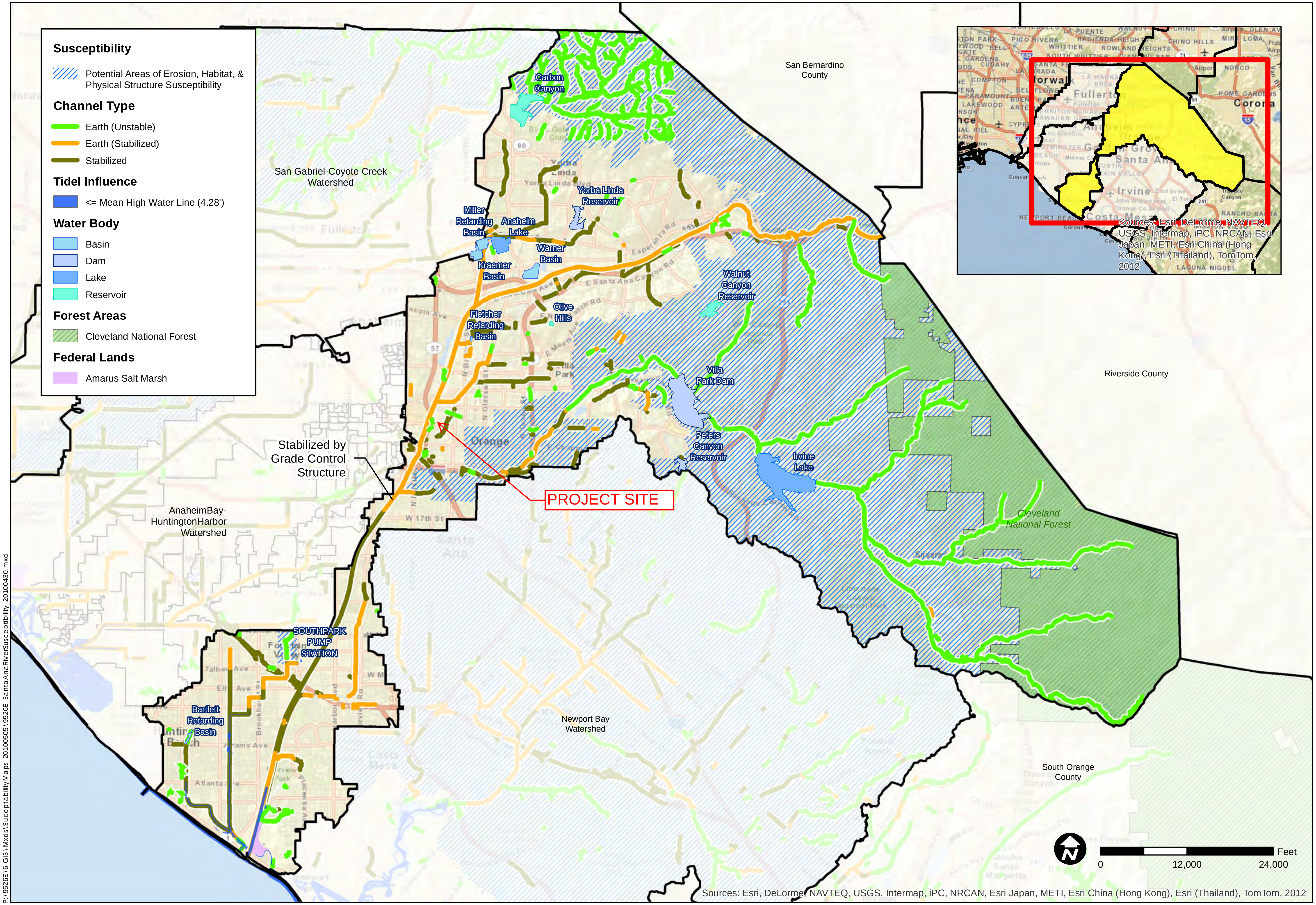
Appendix F:

Hydrology Information

SUSCEPTIBILITY MAP UPATE (FEB 2013)



TITLE: SUSCEPTIBILITY ANALYIS SANTA ANA RIVER

JOB: ORANGE COUNTY WATERSHED MASTER PLANNING

ORANGE CO. CA

SCALE	1" = 12000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE 3

```
****************************************************************************
           NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                    AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3910
  2-YEAR LOSS RATES
  EXISTING CONDITION
============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
         1        12.70       10.00       32.(AMC II)     0.400      0.801

    TOTAL AREA (Acres) =     12.70
                               _
    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.040
                                   _
    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.199
============================================================================
```

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****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

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----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3910
  2-YEAR HYDROGRAPH
  EXISTING CONDITION TO CONCRETE CHANNEL
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    5.00
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.040
    LOW LOSS FRACTION = 0.199
    TIME OF CONCENTRATION(MIN.) =  9.00
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.64
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.22

****************************************************************************
  TIME     VOLUME      Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)     (CFS)
----------------------------------------------------------------------------
  0.10      0.0000      0.00  Q         .         .         .         .
  0.25      0.0007      0.12  Q         .         .         .         .
  0.40      0.0022      0.12  Q         .         .         .         .
  0.55      0.0036      0.12  Q         .         .         .         .
  0.70      0.0051      0.12  Q         .         .         .         .
  0.85      0.0065      0.12  Q         .         .         .         .
  1.00      0.0080      0.12  Q         .         .         .         .
  1.15      0.0095      0.12  Q         .         .         .         .
  1.30      0.0110      0.12  Q         .         .         .         .
  1.45      0.0125      0.12  Q         .         .         .         .
  1.60      0.0140      0.12  Q         .         .         .         .
  1.75      0.0155      0.12  Q         .         .         .         .
  1.90      0.0171      0.12  Q         .         .         .         .
  2.05      0.0186      0.13  Q         .         .         .         .
  2.20      0.0202      0.13  Q         .         .         .         .
  2.35      0.0217      0.13  Q         .         .         .         .
  2.50      0.0233      0.13  Q         .         .         .         .
  2.65      0.0249      0.13  Q         .         .         .         .
  2.80      0.0265      0.13  Q         .         .         .         .
  2.95      0.0281      0.13  Q         .         .         .         .
  3.10      0.0297      0.13  Q         .         .         .         .
  3.25      0.0313      0.13  Q         .         .         .         .
  3.40      0.0330      0.13  Q         .         .         .         .
  3.55      0.0346      0.13  Q         .         .         .         .
  3.70      0.0363      0.13  Q         .         .         .         .
  3.85      0.0380      0.14  Q         .         .         .         .
  4.00      0.0397      0.14  Q         .         .         .         .
  4.15      0.0414      0.14  Q         .         .         .         .
  4.30      0.0431      0.14  Q         .         .         .         .
  4.45      0.0448      0.14  Q         .         .         .         .
  4.60      0.0466      0.14  Q         .         .         .         .
  4.75      0.0483      0.14  Q         .         .         .         .
  4.90      0.0501      0.14  Q         .         .         .         .
  5.05      0.0519      0.15  Q         .         .         .         .
  5.20      0.0537      0.15  Q         .         .         .         .
  5.35      0.0555      0.15  Q         .         .         .         .
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  5.50     0.0574      0.15  Q         .         .         .         .
  5.65     0.0592      0.15  Q         .         .         .         .
  5.80     0.0611      0.15  Q         .         .         .         .
  5.95     0.0630      0.15  Q         .         .         .         .
  6.10     0.0649      0.15  Q         .         .         .         .
  6.25     0.0668      0.16  Q         .         .         .         .
  6.40     0.0688      0.16  Q         .         .         .         .
  6.55     0.0707      0.16  Q         .         .         .         .
  6.70     0.0727      0.16  Q         .         .         .         .
  6.85     0.0747      0.16  Q         .         .         .         .
  7.00     0.0767      0.16  Q         .         .         .         .
  7.15     0.0788      0.17  Q         .         .         .         .
  7.30     0.0808      0.17  Q         .         .         .         .
  7.45     0.0829      0.17  Q         .         .         .         .
  7.60     0.0850      0.17  Q         .         .         .         .
  7.75     0.0871      0.17  Q         .         .         .         .
  7.90     0.0893      0.17  Q         .         .         .         .
  8.05     0.0915      0.18  Q         .         .         .         .
  8.20     0.0937      0.18  Q         .         .         .         .
  8.35     0.0959      0.18  Q         .         .         .         .
  8.50     0.0982      0.18  Q         .         .         .         .
  8.65     0.1005      0.19  Q         .         .         .         .
  8.80     0.1028      0.19  Q         .         .         .         .
  8.95     0.1051      0.19  Q         .         .         .         .
  9.10     0.1075      0.19  Q         .         .         .         .
  9.25     0.1099      0.20  Q         .         .         .         .
  9.40     0.1123      0.20  Q         .         .         .         .
  9.55     0.1148      0.20  Q         .         .         .         .
  9.70     0.1173      0.20  Q         .         .         .         .
  9.85     0.1199      0.21  Q         .         .         .         .
 10.00     0.1225      0.21  Q         .         .         .         .
 10.15     0.1251      0.21  Q         .         .         .         .
 10.30     0.1278      0.22  Q         .         .         .         .
 10.45     0.1305      0.22  Q         .         .         .         .
 10.60     0.1332      0.22  Q         .         .         .         .
 10.75     0.1360      0.23  Q         .         .         .         .
 10.90     0.1389      0.23  Q         .         .         .         .
 11.05     0.1418      0.24  Q         .         .         .         .
 11.20     0.1447      0.24  Q         .         .         .         .
 11.35     0.1478      0.25  Q         .         .         .         .
 11.50     0.1508      0.25  Q         .         .         .         .
 11.65     0.1540      0.26  .Q        .         .         .         .
 11.80     0.1572      0.26  .Q        .         .         .         .
 11.95     0.1605      0.27  .Q        .         .         .         .
 12.10     0.1638      0.27  .Q        .         .         .         .
 12.25     0.1676      0.34  .Q        .         .         .         .
 12.40     0.1719      0.35  .Q        .         .         .         .
 12.55     0.1762      0.36  .Q        .         .         .         .
 12.70     0.1806      0.36  .Q        .         .         .         .
 12.85     0.1852      0.37  .Q        .         .         .         .
 13.00     0.1899      0.38  .Q        .         .         .         .
 13.15     0.1947      0.39  .Q        .         .         .         .
 13.30     0.1996      0.40  .Q        .         .         .         .
 13.45     0.2047      0.42  .Q        .         .         .         .
 13.60     0.2099      0.43  .Q        .         .         .         .
 13.75     0.2153      0.45  .Q        .         .         .         .
 13.90     0.2209      0.46  .Q        .         .         .         .
 14.05     0.2267      0.48  .Q        .         .         .         .
 14.20     0.2328      0.51  . Q       .         .         .         .
 14.35     0.2394      0.54  . Q       .         .         .         .
 14.50     0.2462      0.56  . Q       .         .         .         .
 14.65     0.2534      0.60  . Q       .         .         .         .
 14.80     0.2609      0.62  . Q       .         .         .         .
 14.95     0.2689      0.68  . Q       .         .         .         .
 15.10     0.2775      0.71  . Q       .         .         .         .
 15.25     0.2870      0.81  .  Q      .         .         .         .
 15.40     0.2974      0.88  .  Q      .         .         .         .
 15.55     0.3085      0.91  .  Q      .         .         .         .
 15.70     0.3206      1.05  .   Q     .         .         .         .
 15.85     0.3370      1.60  .     Q   .         .         .         .
 16.00     0.3608      2.25  .       Q .         .         .         .
 16.15     0.4188      7.10  .         .         .       Q .         .
 16.30     0.4705      1.26  .    Q    .         .         .         .
 16.45     0.4836      0.86  .  Q      .         .         .         .
 16.60     0.4936      0.75  .  Q      .         .         .         .
 16.75     0.5023      0.65  . Q       .         .         .         .
 16.90     0.5099      0.58  . Q       .         .         .         .
 17.05     0.5167      0.53  . Q       .         .         .         .
 17.20     0.5229      0.47  .Q        .         .         .         .
 17.35     0.5285      0.44  .Q        .         .         .         .
 17.50     0.5337      0.41  .Q        .         .         .         .
 17.65     0.5386      0.39  .Q        .         .         .         .
 17.80     0.5433      0.37  .Q        .         .         .         .
 17.95     0.5478      0.35  .Q        .         .         .         .
```

18.10	0.5520	0.34	.Q	.	.	.	.
18.25	0.5557	0.26	.Q	.	.	.	.
18.40	0.5589	0.25	.Q	.	.	.	.
18.55	0.5620	0.24	Q	.	.	.	.
18.70	0.5650	0.23	Q	.	.	.	.
18.85	0.5678	0.23	Q	.	.	.	.
19.00	0.5706	0.22	Q	.	.	.	.
19.15	0.5733	0.21	Q	.	.	.	.
19.30	0.5758	0.21	Q	.	.	.	.
19.45	0.5784	0.20	Q	.	.	.	.
19.60	0.5808	0.19	Q	.	.	.	.
19.75	0.5832	0.19	Q	.	.	.	.
19.90	0.5855	0.18	Q	.	.	.	.
20.05	0.5877	0.18	Q	.	.	.	.
20.20	0.5900	0.18	Q	.	.	.	.
20.35	0.5921	0.17	Q	.	.	.	.
20.50	0.5942	0.17	Q	.	.	.	.
20.65	0.5963	0.16	Q	.	.	.	.
20.80	0.5983	0.16	Q	.	.	.	.
20.95	0.6003	0.16	Q	.	.	.	.
21.10	0.6022	0.16	Q	.	.	.	.
21.25	0.6041	0.15	Q	.	.	.	.
21.40	0.6060	0.15	Q	.	.	.	.
21.55	0.6078	0.15	Q	.	.	.	.
21.70	0.6096	0.14	Q	.	.	.	.
21.85	0.6114	0.14	Q	.	.	.	.
22.00	0.6132	0.14	Q	.	.	.	.
22.15	0.6149	0.14	Q	.	.	.	.
22.30	0.6166	0.14	Q	.	.	.	.
22.45	0.6182	0.13	Q	.	.	.	.
22.60	0.6199	0.13	Q	.	.	.	.
22.75	0.6215	0.13	Q	.	.	.	.
22.90	0.6231	0.13	Q	.	.	.	.
23.05	0.6247	0.13	Q	.	.	.	.
23.20	0.6262	0.12	Q	.	.	.	.
23.35	0.6278	0.12	Q	.	.	.	.
23.50	0.6293	0.12	Q	.	.	.	.
23.65	0.6308	0.12	Q	.	.	.	.
23.80	0.6322	0.12	Q	.	.	.	.
23.95	0.6337	0.12	Q	.	.	.	.
24.10	0.6351	0.12	Q	.	.	.	.
24.25	0.6359	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1440.0
10%	90.0
20%	27.0
30%	18.0
40%	9.0
50%	9.0
60%	9.0
70%	9.0
80%	9.0
90%	9.0

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                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

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----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3910
  2-YEAR HYDROGRAPH
  EXISTING CONDITION TO ECKHOFF STREET
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    6.00
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.040
    LOW LOSS FRACTION = 0.199
    TIME OF CONCENTRATION(MIN.) =  7.10
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.76
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.26

****************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.03      0.0000      0.00  Q         .         .         .         .
  0.14      0.0007      0.14  Q         .         .         .         .
  0.26      0.0020      0.14  Q         .         .         .         .
  0.38      0.0034      0.14  Q         .         .         .         .
  0.50      0.0048      0.14  Q         .         .         .         .
  0.62      0.0061      0.14  Q         .         .         .         .
  0.74      0.0075      0.14  Q         .         .         .         .
  0.85      0.0089      0.14  Q         .         .         .         .
  0.97      0.0103      0.14  Q         .         .         .         .
  1.09      0.0117      0.14  Q         .         .         .         .
  1.21      0.0131      0.14  Q         .         .         .         .
  1.33      0.0146      0.15  Q         .         .         .         .
  1.45      0.0160      0.15  Q         .         .         .         .
  1.56      0.0174      0.15  Q         .         .         .         .
  1.68      0.0189      0.15  Q         .         .         .         .
  1.80      0.0203      0.15  Q         .         .         .         .
  1.92      0.0218      0.15  Q         .         .         .         .
  2.04      0.0232      0.15  Q         .         .         .         .
  2.16      0.0247      0.15  Q         .         .         .         .
  2.27      0.0262      0.15  Q         .         .         .         .
  2.39      0.0277      0.15  Q         .         .         .         .
  2.51      0.0291      0.15  Q         .         .         .         .
  2.63      0.0307      0.15  Q         .         .         .         .
  2.75      0.0322      0.15  Q         .         .         .         .
  2.87      0.0337      0.16  Q         .         .         .         .
  2.98      0.0352      0.16  Q         .         .         .         .
  3.10      0.0367      0.16  Q         .         .         .         .
  3.22      0.0383      0.16  Q         .         .         .         .
  3.34      0.0398      0.16  Q         .         .         .         .
  3.46      0.0414      0.16  Q         .         .         .         .
  3.58      0.0430      0.16  Q         .         .         .         .
  3.69      0.0446      0.16  Q         .         .         .         .
  3.81      0.0462      0.16  Q         .         .         .         .
  3.93      0.0478      0.16  Q         .         .         .         .
  4.05      0.0494      0.17  Q         .         .         .         .
  4.17      0.0510      0.17  Q         .         .         .         .
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4.29	0.0526	0.17	Q	.	.	.	.
4.40	0.0543	0.17	Q	.	.	.	.
4.52	0.0559	0.17	Q	.	.	.	.
4.64	0.0576	0.17	Q	.	.	.	.
4.76	0.0592	0.17	Q	.	.	.	.
4.88	0.0609	0.17	Q	.	.	.	.
5.00	0.0626	0.17	Q	.	.	.	.
5.11	0.0643	0.17	Q	.	.	.	.
5.23	0.0660	0.18	Q	.	.	.	.
5.35	0.0678	0.18	Q	.	.	.	.
5.47	0.0695	0.18	Q	.	.	.	.
5.59	0.0713	0.18	Q	.	.	.	.
5.71	0.0730	0.18	Q	.	.	.	.
5.82	0.0748	0.18	Q	.	.	.	.
5.94	0.0766	0.18	Q	.	.	.	.
6.06	0.0784	0.18	Q	.	.	.	.
6.18	0.0802	0.19	Q	.	.	.	.
6.30	0.0820	0.19	Q	.	.	.	.
6.41	0.0839	0.19	Q	.	.	.	.
6.53	0.0858	0.19	Q	.	.	.	.
6.65	0.0876	0.19	Q	.	.	.	.
6.77	0.0895	0.19	Q	.	.	.	.
6.89	0.0914	0.20	Q	.	.	.	.
7.01	0.0933	0.20	Q	.	.	.	.
7.12	0.0953	0.20	Q	.	.	.	.
7.24	0.0972	0.20	Q	.	.	.	.
7.36	0.0992	0.20	Q	.	.	.	.
7.48	0.1012	0.20	Q	.	.	.	.
7.60	0.1032	0.21	Q	.	.	.	.
7.72	0.1052	0.21	Q	.	.	.	.
7.84	0.1072	0.21	Q	.	.	.	.
7.95	0.1093	0.21	Q	.	.	.	.
8.07	0.1114	0.21	Q	.	.	.	.
8.19	0.1134	0.21	Q	.	.	.	.
8.31	0.1156	0.22	Q	.	.	.	.
8.43	0.1177	0.22	Q	.	.	.	.
8.55	0.1198	0.22	Q	.	.	.	.
8.66	0.1220	0.22	Q	.	.	.	.
8.78	0.1242	0.23	Q	.	.	.	.
8.90	0.1264	0.23	Q	.	.	.	.
9.02	0.1287	0.23	Q	.	.	.	.
9.14	0.1309	0.23	Q	.	.	.	.
9.26	0.1332	0.24	Q	.	.	.	.
9.37	0.1355	0.24	Q	.	.	.	.
9.49	0.1379	0.24	Q	.	.	.	.
9.61	0.1402	0.24	Q	.	.	.	.
9.73	0.1426	0.25	Q	.	.	.	.
9.85	0.1451	0.25	Q	.	.	.	.
9.97	0.1475	0.25	.Q	.	.	.	.
10.08	0.1500	0.25	.Q	.	.	.	.
10.20	0.1525	0.26	.Q	.	.	.	.
10.32	0.1550	0.26	.Q	.	.	.	.
10.44	0.1576	0.27	.Q	.	.	.	.
10.56	0.1602	0.27	.Q	.	.	.	.
10.68	0.1629	0.27	.Q	.	.	.	.
10.79	0.1655	0.28	.Q	.	.	.	.
10.91	0.1683	0.28	.Q	.	.	.	.
11.03	0.1710	0.28	.Q	.	.	.	.
11.15	0.1738	0.29	.Q	.	.	.	.
11.27	0.1767	0.29	.Q	.	.	.	.
11.38	0.1795	0.30	.Q	.	.	.	.
11.50	0.1825	0.30	.Q	.	.	.	.
11.62	0.1854	0.31	.Q	.	.	.	.
11.74	0.1885	0.31	.Q	.	.	.	.
11.86	0.1916	0.32	.Q	.	.	.	.
11.98	0.1947	0.32	.Q	.	.	.	.
12.10	0.1981	0.38	.Q	.	.	.	.
12.21	0.2020	0.41	.Q	.	.	.	.
12.33	0.2060	0.41	.Q	.	.	.	.
12.45	0.2100	0.42	.Q	.	.	.	.
12.57	0.2142	0.43	.Q	.	.	.	.
12.69	0.2184	0.44	.Q	.	.	.	.
12.80	0.2227	0.45	.Q	.	.	.	.
12.92	0.2271	0.45	.Q	.	.	.	.
13.04	0.2316	0.46	.Q	.	.	.	.
13.16	0.2362	0.47	.Q	.	.	.	.
13.28	0.2409	0.49	.Q	.	.	.	.
13.40	0.2457	0.49	.Q	.	.	.	.
13.52	0.2506	0.51	. Q	.	.	.	.
13.63	0.2556	0.52	. Q	.	.	.	.
13.75	0.2608	0.54	. Q	.	.	.	.
13.87	0.2661	0.55	. Q	.	.	.	.
13.99	0.2715	0.57	. Q	.	.	.	.
14.11	0.2772	0.59	. Q	.	.	.	.

```
14.23      0.2832      0.63  . Q       .         .         .         .
14.34      0.2894      0.64  . Q       .         .         .         .
14.46      0.2959      0.68  . Q       .         .         .         .
14.58      0.3026      0.70  . Q       .         .         .         .
14.70      0.3096      0.74  . Q       .         .         .         .
14.82      0.3169      0.76  .  Q      .         .         .         .
14.93      0.3246      0.81  .  Q      .         .         .         .
15.05      0.3327      0.84  .  Q      .         .         .         .
15.17      0.3414      0.93  .  Q      .         .         .         .
15.29      0.3508      0.99  .  Q      .         .         .         .
15.41      0.3607      1.05  .   Q     .         .         .         .
15.53      0.3709      1.03  .   Q     .         .         .         .
15.65      0.3822      1.29  .    Q    .         .         .         .
15.76      0.3958      1.49  .    Q    .         .         .         .
15.88      0.4140      2.24  .       Q .         .         .         .
16.00      0.4403      3.13  .         . Q       .         .         .
16.12      0.5036      9.81  .         .         .         .        Q.
16.24      0.5603      1.79  .      Q  .         .         .         .
16.35      0.5747      1.14  .   Q     .         .         .         .
16.47      0.5854      1.05  .   Q     .         .         .         .
16.59      0.5949      0.88  .  Q      .         .         .         .
16.71      0.6031      0.79  .  Q      .         .         .         .
16.83      0.6104      0.72  . Q       .         .         .         .
16.95      0.6171      0.66  . Q       .         .         .         .
17.07      0.6234      0.62  . Q       .         .         .         .
17.18      0.6291      0.56  . Q       .         .         .         .
17.30      0.6344      0.53  . Q       .         .         .         .
17.42      0.6395      0.50  . Q       .         .         .         .
17.54      0.6442      0.48  .Q        .         .         .         .
17.66      0.6488      0.46  .Q        .         .         .         .
17.77      0.6532      0.44  .Q        .         .         .         .
17.89      0.6575      0.42  .Q        .         .         .         .
18.01      0.6615      0.41  .Q        .         .         .         .
18.13      0.6651      0.33  .Q        .         .         .         .
18.25      0.6683      0.31  .Q        .         .         .         .
18.37      0.6713      0.30  .Q        .         .         .         .
18.48      0.6742      0.29  .Q        .         .         .         .
18.60      0.6771      0.29  .Q        .         .         .         .
18.72      0.6798      0.28  .Q        .         .         .         .
18.84      0.6825      0.27  .Q        .         .         .         .
18.96      0.6851      0.26  .Q        .         .         .         .
19.08      0.6877      0.26  .Q        .         .         .         .
19.19      0.6901      0.25  .Q        .         .         .         .
19.31      0.6926      0.24  Q         .         .         .         .
19.43      0.6949      0.24  Q         .         .         .         .
19.55      0.6972      0.23  Q         .         .         .         .
19.67      0.6995      0.23  Q         .         .         .         .
19.79      0.7017      0.22  Q         .         .         .         .
19.91      0.7039      0.22  Q         .         .         .         .
20.02      0.7060      0.22  Q         .         .         .         .
20.14      0.7081      0.21  Q         .         .         .         .
20.26      0.7102      0.21  Q         .         .         .         .
20.38      0.7122      0.20  Q         .         .         .         .
20.50      0.7142      0.20  Q         .         .         .         .
20.61      0.7161      0.20  Q         .         .         .         .
20.73      0.7180      0.19  Q         .         .         .         .
20.85      0.7199      0.19  Q         .         .         .         .
20.97      0.7218      0.19  Q         .         .         .         .
21.09      0.7236      0.19  Q         .         .         .         .
21.21      0.7254      0.18  Q         .         .         .         .
21.33      0.7272      0.18  Q         .         .         .         .
21.44      0.7290      0.18  Q         .         .         .         .
21.56      0.7307      0.18  Q         .         .         .         .
21.68      0.7324      0.17  Q         .         .         .         .
21.80      0.7341      0.17  Q         .         .         .         .
21.92      0.7357      0.17  Q         .         .         .         .
22.03      0.7374      0.17  Q         .         .         .         .
22.15      0.7390      0.16  Q         .         .         .         .
22.27      0.7406      0.16  Q         .         .         .         .
22.39      0.7422      0.16  Q         .         .         .         .
22.51      0.7437      0.16  Q         .         .         .         .
22.63      0.7453      0.16  Q         .         .         .         .
22.74      0.7468      0.16  Q         .         .         .         .
22.86      0.7483      0.15  Q         .         .         .         .
22.98      0.7498      0.15  Q         .         .         .         .
23.10      0.7513      0.15  Q         .         .         .         .
23.22      0.7528      0.15  Q         .         .         .         .
23.34      0.7542      0.15  Q         .         .         .         .
23.45      0.7556      0.15  Q         .         .         .         .
23.57      0.7571      0.14  Q         .         .         .         .
23.69      0.7585      0.14  Q         .         .         .         .
23.81      0.7599      0.14  Q         .         .         .         .
23.93      0.7612      0.14  Q         .         .         .         .
24.05      0.7626      0.14  Q         .         .         .         .
```

```
 24.17      0.7633      0.00  Q         .         .         .         .
 ---------------------------------------------------------------------------
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                Duration
        Peak Flow Rate                     (minutes)
    =======================                =========
              0%                             1441.3
             10%                               78.1
             20%                               21.3
             30%                               14.2
             40%                                7.1
             50%                                7.1
             60%                                7.1
             70%                                7.1
             80%                                7.1
             90%                                7.1
```

```
****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                          Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRADA, CA 90638
                               714-521-4811

****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3910
  2-YEAR HYDROGRAPH
  EXISTING CONDITION TO POPLAR STREET
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    2.40
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.040
    LOW LOSS FRACTION = 0.199
    TIME OF CONCENTRATION(MIN.) =  7.90
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.31
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.10

****************************************************************************
  TIME     VOLUME      Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.07      0.0002      0.06  Q         .         .         .         .
  0.20      0.0008      0.06  Q         .         .         .         .
  0.33      0.0014      0.06  Q         .         .         .         .
  0.46      0.0020      0.06  Q         .         .         .         .
  0.59      0.0026      0.06  Q         .         .         .         .
  0.73      0.0032      0.06  Q         .         .         .         .
  0.86      0.0038      0.06  Q         .         .         .         .
  0.99      0.0044      0.06  Q         .         .         .         .
  1.12      0.0051      0.06  Q         .         .         .         .
  1.25      0.0057      0.06  Q         .         .         .         .
  1.38      0.0063      0.06  Q         .         .         .         .
  1.52      0.0070      0.06  Q         .         .         .         .
  1.65      0.0076      0.06  Q         .         .         .         .
  1.78      0.0082      0.06  Q         .         .         .         .
  1.91      0.0089      0.06  Q         .         .         .         .
  2.04      0.0095      0.06  Q         .         .         .         .
  2.17      0.0102      0.06  Q         .         .         .         .
  2.31      0.0109      0.06  Q         .         .         .         .
  2.44      0.0115      0.06  Q         .         .         .         .
  2.57      0.0122      0.06  Q         .         .         .         .
  2.70      0.0129      0.06  Q         .         .         .         .
  2.83      0.0135      0.06  Q         .         .         .         .
  2.96      0.0142      0.06  Q         .         .         .         .
  3.10      0.0149      0.06  Q         .         .         .         .
  3.23      0.0156      0.06  Q         .         .         .         .
  3.36      0.0163      0.06  Q         .         .         .         .
  3.49      0.0170      0.06  Q         .         .         .         .
  3.62      0.0177      0.06  Q         .         .         .         .
  3.75      0.0184      0.07  Q         .         .         .         .
  3.89      0.0191      0.07  Q         .         .         .         .
  4.02      0.0198      0.07  Q         .         .         .         .
  4.15      0.0205      0.07  Q         .         .         .         .
  4.28      0.0212      0.07  Q         .         .         .         .
  4.41      0.0220      0.07  Q         .         .         .         .
  4.54      0.0227      0.07  Q         .         .         .         .
  4.68      0.0234      0.07  Q         .         .         .         .
```

4.81	0.0242	0.07	Q	.	.	.	.
4.94	0.0249	0.07	Q	.	.	.	.
5.07	0.0257	0.07	Q	.	.	.	.
5.20	0.0265	0.07	Q	.	.	.	.
5.34	0.0272	0.07	Q	.	.	.	.
5.47	0.0280	0.07	Q	.	.	.	.
5.60	0.0288	0.07	Q	.	.	.	.
5.73	0.0296	0.07	Q	.	.	.	.
5.86	0.0304	0.07	Q	.	.	.	.
5.99	0.0312	0.07	Q	.	.	.	.
6.12	0.0320	0.07	Q	.	.	.	.
6.26	0.0328	0.07	Q	.	.	.	.
6.39	0.0336	0.08	Q	.	.	.	.
6.52	0.0344	0.08	Q	.	.	.	.
6.65	0.0353	0.08	Q	.	.	.	.
6.78	0.0361	0.08	Q	.	.	.	.
6.91	0.0369	0.08	Q	.	.	.	.
7.05	0.0378	0.08	Q	.	.	.	.
7.18	0.0387	0.08	Q	.	.	.	.
7.31	0.0395	0.08	Q	.	.	.	.
7.44	0.0404	0.08	Q	.	.	.	.
7.57	0.0413	0.08	Q	.	.	.	.
7.70	0.0422	0.08	Q	.	.	.	.
7.84	0.0431	0.08	Q	.	.	.	.
7.97	0.0440	0.08	Q	.	.	.	.
8.10	0.0449	0.09	Q	.	.	.	.
8.23	0.0459	0.09	Q	.	.	.	.
8.36	0.0468	0.09	Q	.	.	.	.
8.49	0.0478	0.09	Q	.	.	.	.
8.63	0.0487	0.09	Q	.	.	.	.
8.76	0.0497	0.09	Q	.	.	.	.
8.89	0.0507	0.09	Q	.	.	.	.
9.02	0.0517	0.09	Q	.	.	.	.
9.15	0.0527	0.09	Q	.	.	.	.
9.28	0.0537	0.09	Q	.	.	.	.
9.42	0.0547	0.10	Q	.	.	.	.
9.55	0.0558	0.10	Q	.	.	.	.
9.68	0.0569	0.10	Q	.	.	.	.
9.81	0.0579	0.10	Q	.	.	.	.
9.94	0.0590	0.10	Q	.	.	.	.
10.07	0.0601	0.10	Q	.	.	.	.
10.21	0.0612	0.10	Q	.	.	.	.
10.34	0.0624	0.10	Q	.	.	.	.
10.47	0.0635	0.11	Q	.	.	.	.
10.60	0.0647	0.11	Q	.	.	.	.
10.73	0.0659	0.11	Q	.	.	.	.
10.87	0.0671	0.11	Q	.	.	.	.
11.00	0.0683	0.11	Q	.	.	.	.
11.13	0.0695	0.12	Q	.	.	.	.
11.26	0.0708	0.12	Q	.	.	.	.
11.39	0.0721	0.12	Q	.	.	.	.
11.52	0.0734	0.12	Q	.	.	.	.
11.65	0.0747	0.12	Q	.	.	.	.
11.79	0.0760	0.13	Q	.	.	.	.
11.92	0.0774	0.13	Q	.	.	.	.
12.05	0.0788	0.13	Q	.	.	.	.
12.18	0.0804	0.16	Q	.	.	.	.
12.31	0.0822	0.16	Q	.	.	.	.
12.45	0.0840	0.17	Q	.	.	.	.
12.58	0.0858	0.17	Q	.	.	.	.
12.71	0.0877	0.18	Q	.	.	.	.
12.84	0.0896	0.18	Q	.	.	.	.
12.97	0.0916	0.18	Q	.	.	.	.
13.10	0.0936	0.19	Q	.	.	.	.
13.23	0.0957	0.19	Q	.	.	.	.
13.37	0.0978	0.20	Q	.	.	.	.
13.50	0.1000	0.20	Q	.	.	.	.
13.63	0.1022	0.21	Q	.	.	.	.
13.76	0.1045	0.22	Q	.	.	.	.
13.89	0.1069	0.22	Q	.	.	.	.
14.02	0.1093	0.23	Q	.	.	.	.
14.16	0.1119	0.24	Q	.	.	.	.
14.29	0.1146	0.26	.Q	.	.	.	.
14.42	0.1174	0.26	.Q	.	.	.	.
14.55	0.1203	0.28	.Q	.	.	.	.
14.68	0.1234	0.29	.Q	.	.	.	.
14.82	0.1267	0.31	.Q	.	.	.	.
14.95	0.1301	0.32	.Q	.	.	.	.
15.08	0.1337	0.35	.Q	.	.	.	.
15.21	0.1376	0.37	.Q	.	.	.	.
15.34	0.1419	0.42	.Q	.	.	.	.
15.47	0.1465	0.41	.Q	.	.	.	.
15.60	0.1513	0.48	.Q	.	.	.	.
15.74	0.1569	0.55	. Q	.	.	.	.

```
 15.87      0.1644     0.84  .  Q      .         .         .         .
 16.00      0.1753     1.17  .   Q     .         .         .         .
 16.13      0.2018     3.68  .         .   Q     .         .         .
 16.26      0.2254     0.67  . Q       .         .         .         .
 16.40      0.2313     0.42  .Q        .         .         .         .
 16.53      0.2358     0.39  .Q        .         .         .         .
 16.66      0.2397     0.33  .Q        .         .         .         .
 16.79      0.2432     0.30  .Q        .         .         .         .
 16.92      0.2463     0.27  .Q        .         .         .         .
 17.05      0.2491     0.25  Q         .         .         .         .
 17.18      0.2517     0.22  Q         .         .         .         .
 17.32      0.2540     0.21  Q         .         .         .         .
 17.45      0.2563     0.20  Q         .         .         .         .
 17.58      0.2584     0.19  Q         .         .         .         .
 17.71      0.2604     0.18  Q         .         .         .         .
 17.84      0.2623     0.17  Q         .         .         .         .
 17.98      0.2642     0.17  Q         .         .         .         .
 18.11      0.2659     0.15  Q         .         .         .         .
 18.24      0.2674     0.13  Q         .         .         .         .
 18.37      0.2687     0.12  Q         .         .         .         .
 18.50      0.2700     0.12  Q         .         .         .         .
 18.63      0.2713     0.11  Q         .         .         .         .
 18.77      0.2725     0.11  Q         .         .         .         .
 18.90      0.2737     0.11  Q         .         .         .         .
 19.03      0.2748     0.10  Q         .         .         .         .
 19.16      0.2759     0.10  Q         .         .         .         .
 19.29      0.2770     0.10  Q         .         .         .         .
 19.42      0.2781     0.10  Q         .         .         .         .
 19.56      0.2791     0.09  Q         .         .         .         .
 19.69      0.2801     0.09  Q         .         .         .         .
 19.82      0.2811     0.09  Q         .         .         .         .
 19.95      0.2821     0.09  Q         .         .         .         .
 20.08      0.2830     0.09  Q         .         .         .         .
 20.21      0.2839     0.08  Q         .         .         .         .
 20.34      0.2848     0.08  Q         .         .         .         .
 20.48      0.2857     0.08  Q         .         .         .         .
 20.61      0.2866     0.08  Q         .         .         .         .
 20.74      0.2875     0.08  Q         .         .         .         .
 20.87      0.2883     0.08  Q         .         .         .         .
 21.00      0.2891     0.08  Q         .         .         .         .
 21.14      0.2899     0.07  Q         .         .         .         .
 21.27      0.2907     0.07  Q         .         .         .         .
 21.40      0.2915     0.07  Q         .         .         .         .
 21.53      0.2923     0.07  Q         .         .         .         .
 21.66      0.2931     0.07  Q         .         .         .         .
 21.79      0.2938     0.07  Q         .         .         .         .
 21.92      0.2946     0.07  Q         .         .         .         .
 22.06      0.2953     0.07  Q         .         .         .         .
 22.19      0.2960     0.07  Q         .         .         .         .
 22.32      0.2967     0.06  Q         .         .         .         .
 22.45      0.2974     0.06  Q         .         .         .         .
 22.58      0.2981     0.06  Q         .         .         .         .
 22.72      0.2988     0.06  Q         .         .         .         .
 22.85      0.2995     0.06  Q         .         .         .         .
 22.98      0.3001     0.06  Q         .         .         .         .
 23.11      0.3008     0.06  Q         .         .         .         .
 23.24      0.3014     0.06  Q         .         .         .         .
 23.37      0.3021     0.06  Q         .         .         .         .
 23.51      0.3027     0.06  Q         .         .         .         .
 23.64      0.3033     0.06  Q         .         .         .         .
 23.77      0.3040     0.06  Q         .         .         .         .
 23.90      0.3046     0.06  Q         .         .         .         .
 24.03      0.3052     0.06  Q         .         .         .         .
 24.16      0.3055     0.00  Q         .         .         .         .
----------------------------------------------------------------------------
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                Duration
        Peak Flow Rate                     (minutes)
    =======================                =========
              0%                            1445.7
             10%                              86.9
             20%                              23.7
             30%                              15.8
             40%                               7.9
             50%                               7.9
             60%                               7.9
             70%                               7.9
             80%                               7.9
             90%                               7.9
```

```
****************************************************************************
           NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                     AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3910
  2-YEAR LOSS RATES
  PROPOSED CONDITION
============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
        1         12.70       10.00       32.(AMC II)     0.400      0.801

    TOTAL AREA (Acres) =     12.70

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.040

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.199
============================================================================
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****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                          Analysis prepared by:

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                           LA MIRADA, CA 90638
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 Problem Descriptions:
  TEI JOB 3910
  2-YEAR HYDROGRAPH
  PROPOSED CONDITION
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   13.40
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.040
    LOW LOSS FRACTION = 0.199
    TIME OF CONCENTRATION(MIN.) =  9.50
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

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    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.71
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.58

****************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.01      0.0000      0.00  Q         .         .         .         .
  0.17      0.0020      0.31  Q         .         .         .         .
  0.32      0.0061      0.31  Q         .         .         .         .
  0.48      0.0102      0.31  Q         .         .         .         .
  0.64      0.0143      0.32  Q         .         .         .         .
  0.80      0.0184      0.32  Q         .         .         .         .
  0.96      0.0226      0.32  Q         .         .         .         .
  1.12      0.0268      0.32  Q         .         .         .         .
  1.27      0.0310      0.32  Q         .         .         .         .
  1.43      0.0352      0.33  Q         .         .         .         .
  1.59      0.0395      0.33  Q         .         .         .         .
  1.75      0.0438      0.33  Q         .         .         .         .
  1.91      0.0482      0.33  Q         .         .         .         .
  2.07      0.0525      0.33  Q         .         .         .         .
  2.22      0.0569      0.34  Q         .         .         .         .
  2.38      0.0614      0.34  Q         .         .         .         .
  2.54      0.0658      0.34  Q         .         .         .         .
  2.70      0.0703      0.34  Q         .         .         .         .
  2.86      0.0748      0.35  Q         .         .         .         .
  3.02      0.0794      0.35  Q         .         .         .         .
  3.17      0.0840      0.35  Q         .         .         .         .
  3.33      0.0886      0.35  Q         .         .         .         .
  3.49      0.0933      0.36  Q         .         .         .         .
  3.65      0.0980      0.36  Q         .         .         .         .
  3.81      0.1027      0.36  Q         .         .         .         .
  3.97      0.1075      0.37  Q         .         .         .         .
  4.12      0.1123      0.37  Q         .         .         .         .
  4.28      0.1172      0.37  Q         .         .         .         .
  4.44      0.1221      0.38  Q         .         .         .         .
  4.60      0.1270      0.38  Q         .         .         .         .
  4.76      0.1320      0.38  Q         .         .         .         .
  4.92      0.1370      0.39  Q         .         .         .         .
  5.07      0.1421      0.39  Q         .         .         .         .
  5.23      0.1472      0.39  Q         .         .         .         .
  5.39      0.1524      0.40  Q         .         .         .         .
  5.55      0.1576      0.40  Q         .         .         .         .
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```
 5.71      0.1629      0.40  Q         .         .         .         .
 5.87      0.1682      0.41  Q         .         .         .         .
 6.03      0.1735      0.41  Q         .         .         .         .
 6.18      0.1789      0.42  Q         .         .         .         .
 6.34      0.1844      0.42  Q         .         .         .         .
 6.50      0.1899      0.42  Q         .         .         .         .
 6.66      0.1955      0.43  Q         .         .         .         .
 6.82      0.2012      0.43  Q         .         .         .         .
 6.97      0.2069      0.44  Q         .         .         .         .
 7.13      0.2126      0.44  Q         .         .         .         .
 7.29      0.2185      0.45  Q         .         .         .         .
 7.45      0.2243      0.45  Q         .         .         .         .
 7.61      0.2303      0.46  Q         .         .         .         .
 7.77      0.2363      0.46  Q         .         .         .         .
 7.93      0.2424      0.47  Q         .         .         .         .
 8.08      0.2486      0.47  Q         .         .         .         .
 8.24      0.2549      0.48  Q         .         .         .         .
 8.40      0.2612      0.49  Q         .         .         .         .
 8.56      0.2676      0.49  Q         .         .         .         .
 8.72      0.2741      0.50  Q         .         .         .         .
 8.88      0.2807      0.51  .Q        .         .         .         .
 9.03      0.2874      0.51  .Q        .         .         .         .
 9.19      0.2941      0.52  .Q        .         .         .         .
 9.35      0.3010      0.53  .Q        .         .         .         .
 9.51      0.3080      0.54  .Q        .         .         .         .
 9.67      0.3150      0.54  .Q        .         .         .         .
 9.82      0.3222      0.55  .Q        .         .         .         .
 9.98      0.3295      0.56  .Q        .         .         .         .
10.14      0.3369      0.57  .Q        .         .         .         .
10.30      0.3445      0.58  .Q        .         .         .         .
10.46      0.3521      0.59  .Q        .         .         .         .
10.62      0.3599      0.60  .Q        .         .         .         .
10.77      0.3679      0.61  .Q        .         .         .         .
10.93      0.3760      0.62  .Q        .         .         .         .
11.09      0.3842      0.64  .Q        .         .         .         .
11.25      0.3926      0.65  .Q        .         .         .         .
11.41      0.4012      0.67  .Q        .         .         .         .
11.57      0.4100      0.67  .Q        .         .         .         .
11.73      0.4189      0.69  .Q        .         .         .         .
11.88      0.4281      0.71  .Q        .         .         .         .
12.04      0.4375      0.73  .Q        .         .         .         .
12.20      0.4480      0.88  .Q        .         .         .         .
12.36      0.4598      0.93  .Q        .         .         .         .
12.52      0.4720      0.94  .Q        .         .         .         .
12.68      0.4846      0.97  .Q        .         .         .         .
12.83      0.4974      0.99  .Q        .         .         .         .
12.99      0.5106      1.02  . Q       .         .         .         .
13.15      0.5241      1.04  . Q       .         .         .         .
13.31      0.5380      1.09  . Q       .         .         .         .
13.47      0.5524      1.11  . Q       .         .         .         .
13.62      0.5672      1.16  . Q       .         .         .         .
13.78      0.5826      1.19  . Q       .         .         .         .
13.94      0.5985      1.25  . Q       .         .         .         .
14.10      0.6151      1.28  . Q       .         .         .         .
14.26      0.6327      1.41  . Q       .         .         .         .
14.42      0.6515      1.45  . Q       .         .         .         .
14.57      0.6712      1.56  .  Q      .         .         .         .
14.73      0.6920      1.62  .  Q      .         .         .         .
14.89      0.7141      1.76  .  Q      .         .         .         .
15.05      0.7377      1.85  .  Q      .         .         .         .
15.21      0.7635      2.10  .   Q     .         .         .         .
15.37      0.7921      2.27  .   Q     .         .         .         .
15.52      0.8222      2.34  .   Q     .         .         .         .
15.68      0.8552      2.70  .    Q    .         .         .         .
15.84      0.8999      4.14  .       Q .         .         .         .
16.00      0.9651      5.82  .         .Q        .         .         .
16.16      1.1237     18.41  .         .         .         .     Q   .
16.32      1.2653      3.23  .     Q   .         .         .         .
16.48      1.3018      2.36  .   Q     .         .         .         .
16.63      1.3300      1.95  .  Q      .         .         .         .
16.79      1.3538      1.68  .  Q      .         .         .         .
16.95      1.3747      1.50  .  Q      .         .         .         .
17.11      1.3934      1.37  . Q       .         .         .         .
17.27      1.4103      1.22  . Q       .         .         .         .
17.42      1.4257      1.13  . Q       .         .         .         .
17.58      1.4401      1.06  . Q       .         .         .         .
17.74      1.4537      1.01  . Q       .         .         .         .
17.90      1.4665      0.96  .Q        .         .         .         .
18.06      1.4787      0.91  .Q        .         .         .         .
18.22      1.4894      0.72  .Q        .         .         .         .
18.38      1.4985      0.68  .Q        .         .         .         .
18.53      1.5073      0.66  .Q        .         .         .         .
18.69      1.5157      0.63  .Q        .         .         .         .
18.85      1.5238      0.61  .Q        .         .         .         .
```

19.01	1.5316	0.59	.Q	.	.	.	.
19.17	1.5392	0.57	.Q	.	.	.	.
19.33	1.5465	0.55	.Q	.	.	.	.
19.48	1.5535	0.53	.Q	.	.	.	.
19.64	1.5604	0.52	.Q	.	.	.	.
19.80	1.5671	0.50	.Q	.	.	.	.
19.96	1.5736	0.49	Q	.	.	.	.
20.12	1.5799	0.48	Q	.	.	.	.
20.27	1.5861	0.47	Q	.	.	.	.
20.43	1.5921	0.46	Q	.	.	.	.
20.59	1.5980	0.45	Q	.	.	.	.
20.75	1.6038	0.44	Q	.	.	.	.
20.91	1.6094	0.43	Q	.	.	.	.
21.07	1.6149	0.42	Q	.	.	.	.
21.23	1.6203	0.41	Q	.	.	.	.
21.38	1.6257	0.40	Q	.	.	.	.
21.54	1.6309	0.39	Q	.	.	.	.
21.70	1.6360	0.39	Q	.	.	.	.
21.86	1.6410	0.38	Q	.	.	.	.
22.02	1.6460	0.37	Q	.	.	.	.
22.17	1.6508	0.37	Q	.	.	.	.
22.33	1.6556	0.36	Q	.	.	.	.
22.49	1.6603	0.36	Q	.	.	.	.
22.65	1.6649	0.35	Q	.	.	.	.
22.81	1.6695	0.35	Q	.	.	.	.
22.97	1.6740	0.34	Q	.	.	.	.
23.12	1.6784	0.34	Q	.	.	.	.
23.28	1.6828	0.33	Q	.	.	.	.
23.44	1.6871	0.33	Q	.	.	.	.
23.60	1.6913	0.32	Q	.	.	.	.
23.76	1.6955	0.32	Q	.	.	.	.
23.92	1.6997	0.31	Q	.	.	.	.
24.08	1.7037	0.31	Q	.	.	.	.
24.23	1.7058	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.0
10%	104.5
20%	28.5
30%	19.0
40%	9.5
50%	9.5
60%	9.5
70%	9.5
80%	9.5
90%	9.5