Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING

Preliminary Water Quality Management Plan (P-WQMP)

Project Name:
Centurion Plaza
15661 Red Hill Avenue
Tustin, CA 92780

Prepared for:
Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657
Phone: (949) XXX-XXXX

Prepared by:
Thienes Engineering Inc.
14349 Firestone Boulevard
La Mirada, CA 90638
(714) 521-4811
Contact: Luis Prado (luisp@thieneseng.com)
JN: 4136
Engineer Reinhard Stenzel, PE Registration No. C56155

Prepared on:
February 22, 2023

Template Prepared:
July 15, 2011

Project Owner's Certification			
Permit/Application No.	DR 2023-XXXX	Grading Permit No.	
Tract/Parcel Map No.		Building Permit No.	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			APN: 430-233-19

This Water Quality Management Plan (WQMP) has been prepared for **Centurion Plaza LLC** by **Thienes Engineering, Inc**. The WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the 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 current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner: Centurion Plaza LLC		
Name/Title	Mike Moshayedi, [TITLE HERE]	
Company	Centurion Plaza LLC	
Address	36 Deep Sea, Newport Coast, CA 92657	
Email	mike.moshayedi@gmail.com	
Telephone #	(949) XXX-XXXX	
Signature	Date	

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Attachments

Section I Discretionary Permit(s) and Water Quality Conditions

Provide discretionary permit and water quality information. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available from the Orange County Stormwater Program (ocwatersheds.com).*

Project Infomation			
Permit/Application No.	DR-2023-XXXX	Tract/Parcel Map No.	
Additional Information/ Comments:	This preliminary WQMP is intended to serve as a support instrument for the environmental assessment of the project and its impacts.		
Water Quality Conditions			
Water Quality Conditions (list verbatim)	Pending		
Watershed-Based Plan Conditions			
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	No WHIMPS. TMDLS: Metals, Nutrients, Pathogens, Pesticides/PCBs/Priority Organics, Siltation, Selenium		

Section II Project Description

II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;
- A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. *Refer to Section 2.2 in the TGD for information that must be included in the project description.*

Description of Proposed Project		
Development Category (Verbatim from WQMP):	Priority Project Category 8 – All significant redevelopment projects, where significant redevelopment is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety.	
Project Area (ft^2): 268,329 (6.16 acres)	Number of Dwelling Units: _____	SIC Code: 4225
Narrative Project Description:	The project site is located at 15661 Red Hill Avenue in the City of Tustin, Orange County. The project site encompasses approximately 6.16 acres. Proposed improvements to the site include the construction of two commercial/ industrial buildings with approximately 49,577 and 93,158 square feet. There is a truck yard located on the northwesterly side of the proposed buildings. Vehicle parking is located on the northwesterly side of Building 1 and along the entire perimeter of Building 2 (excluding Red Hill Avenue). There will be drought tolerant landscaping adjacent to Bell Avenue and Red Hill Avenue and smaller areas throughout the site.	

Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	0.62 acres	10%	5.54 acres	90%
Post-Project Conditions	0.31 acres	5%	5.85 acres	95%
Drainage Patterns/Connections	**Existing drainage patterns:** Under existing conditions, the majority of the site drains southerly toward the intersection of Bell Avenue and Red Hill Avenue. Here, on the project site there is a pair of catch basins that collect the runoff and convey it to the existing 54" storm drain in Bell Avenue. A small portion of the site in the northwest side drains out to Bell Avenue via a v-gutter system on site. The northeast of the project drains out a shared v-gutter (with adjacent property) and discharges into an existing catch basin which connects to the existing storm drain in Red Hill Avenue. **Proposed drainage patterns:** Drainage from building 1 and the associate vehicle parking will all be directed to a low spot in the truck yard. Here a proposed catch basin will be installed. The private storm drain will convey the runoff southeasterly towards the existing 54" storm drain in Bell Avenue. A new connection will be proposed to allow for this discharge. Drainage from Building 2 and the vehicle parking along the north side will be directed to a pair of catch basins in the truck yard. The proposed storm drain will continue westerly collecting runoff from the west vehicle parking and drive aisle. The storm drain will continue to the southern corner of the site. The existing public catch basin on Bell Avenue will be reconstructed to allow for this proposed connection. The northern drive aisle will continue to drain as in the existing condition, along an existing v-gutter which is utilized by the neighboring property. The existing catch basin at the downstream end of this gutter will be reconstructed in a slightly new location to allow for the parking improvements. The existing storm drain lateral will continue to be utilized. Full capture devices (connector pipe screens of 5mm or smaller) are proposed to comply with the new Trash Amendment. These will also serve as pretreatment to the MWS units. Before the onsite flows discharge offsite, manhole structures will divert low flows to a sump pump that will transport flows to the proposed			

	proprietary biofiltration systems for treatment. There will be one MWS system serving Building 1 (DMA A – 2.06 acres) and another MWS system (comprised of 2 units) serving Building 2 (DMA B – 3.83 acres). Additionally, permeable pavement is provided along the existing northern drive aisle of Building 2 (see WQMP site map in Section VI.1; depicted as DMA C – 0.27 acres) as a site design BMP. This area drains a shared driveway with the existing neighboring property to a shared curb-side catch basin. To prevent the need to treat comingling flows from offsite run-on, the project proposes permeable pavement in this area to mimic landscape/pervious areas. This area will not drain to structural LID BMP for treatment.

II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. *Refer to Section 2.2.2 and Table 2.1 in the TGD for guidance.*

Pollutants of Concern			
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 (copper and zinc)
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

II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are determined to be potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the TGD for* NOC *or Section 2.2.3.2 for* <SOC>.

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the TGD.*

The project site is located in an area of potential susceptibility. The table below compares the flow rate, volume, and time of concentration between existing and proposed conditions.

2 year, 24-hr Storm Event			
	Flow Rate (cfs)	Volume (ac-ft)	Time of Concentration (min)
Pre-Development	8.89	0.8011	10.38
Post-Development	9.76	0.7998	7.47
Difference	0.87	-0.0013	-2.91
Difference (as % of pre-developed)	9.79%	-0.16%	-28.07%

Priority projects where there is an HCOC shall, as the first priority, implement on-site or regional hydromodification controls such that:

- Post-development runoff volume for the 2-yr, 24-hr storm even is no greater than 105 percent of that for the pre-development condition.

AND

- Time of concentration of post-development runoff for the 2-yr, 24-hr storm event is no greater than 105 percent of that for the pre-development condition.

Where the Project WQMP documents that the excess runoff volume from the 2-yr runoff event cannot feasibly be retained, the project must implement on-site or regional hydromodification controls to:

- Retain the excess volume from the 2-yr runoff event to the MEP (maximum extent practicable).
- Reduce post-development runoff 2-yr peak flow rate to no greater than 110% of the pre-development runoff 2-yr peak flow rate.

Due to the presence of shallow groundwater (<= 5') and the South Basin Groundwater Plume, infiltration of stormwater is not considered feasible for the site; therefore, retaining any volume is not feasible. Compared to existing conditions, the post-development runoff flow rate will increase by 9.79%; the HCOC mitigation conditions are met. Refer to Attachment H for detailed HCOC calculations and Section VI for the existing hydrology map and the proposed hydrology map.

II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the TGD.*

Proposed drainage patterns: Drainage from building 1 and the associate vehicle parking will all be directed to a low spot in the truck yard. Here a proposed catch basin will be installed. The private storm drain will convey the runoff southeasterly towards the existing 54" storm drain in Bell Avenue. A new connection will be proposed to allow for this discharge.

Drainage from Building 2 and the vehicle parking along the north side will be directed to a pair of catch basins in the truck yard. The proposed storm drain will continue westerly collecting runoff from the west vehicle parking and drive aisle. The storm drain will continue to the southern corner of the site. The existing public catch basin on Bell Avenue will be reconstructed to allow for this proposed connection.

The northern drive aisle will continue to drain as in the existing condition, along an existing v-gutter which is utilized by the neighboring property. The existing catch basin at the downstream end of this gutter will be reconstructed in a slightly new location to allow for the parking improvements. The existing storm drain lateral will continue to be utilized.

Full capture devices (connector pipe screens of 5mm or smaller) are proposed to comply with the new Trash Amendment. These will also serve as pretreatment to the MWS units.

Before the onsite flows discharge offsite, manhole structures will divert low flows to a sump pump that will transport flows to the proposed proprietary biofiltration systems for treatment. There will be one MWS system serving Building 1 (DMA A – 2.06 acres) and another MWS system (comprised of 2 units) serving Building 2 (DMA B – 3.83 acres).

Additionally, permeable pavement is provided along the existing northern drive aisle of Building 2 (see WQMP site map in Section VI.1; depicted as DMA C – 0.27 acres) as a site design BMP. This area drains a shared driveway with the existing neighboring property to a shared curb-side catch basin. To prevent the need to treat comingling flows from offsite run-on, the project proposes permeable pavement in this area to mimic landscape/pervious areas. This area will not drain to structural LID BMP for treatment.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the TGD.*

Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657
Contact: Mike Moshayedi
(949) XXX-XXXX
Email: mike.moshayedi@gmail.com

No infrastructure will be transferred to public agencies. A Property Owner Association (POA) is needed to for the long-term maintenance of the project's stormwater facilities. The owner is ultimately responsible for funding and maintenance of BMPs until the site is sold or transferred.

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the TGD.*

Planning Area/ Community Name	Centurion Plaza
Location/Address	15661 Red Hill Avenue Tustin, CA 92780
Project Area Description	The project is located in International Rectifier Planned Community.
Land Use	PCCB – Planned Community Commercial/Business
Zoning	PC IND/BUS – Planned Community Industrial/Business
Acreage	6.16 acres
Predominant Soil Type	Soil Type B

III.2 Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. Refer to Section 2.3.2 in the TGD.

Precipitation Zone	*0.70 inches per TGD XVI-1 – Rainfall Zones*
Topography	*The project site's topography is relatively level descending slightly from a north to south direction on the order of a few feet. The site is currently occupied by four buildings, parking lots and drive aisles.*
Drainage Patterns/Connections	*See Section II.1, above.*
Soil Type, Geology, and Infiltration Properties	*The site consists of soil type B per TGD XVI-2a. The site sits over shallow groundwater per TGD XVI-2e. The site also sits over the South Basin Groundwater Protection Plume per TGD XVI-2f.* *Due to the presence of shallow groundwater (<= 5') and the South Basin Groundwater Plume, infiltration of stormwater is not considered feasible for the site.* *See Attachment C of this WQMP report for more details.*

Site Characteristics (continued)	
Hydrogeologic (Groundwater) Conditions	*Due to the presence of shallow groundwater (<= 5') and the South Basin Groundwater Plume, infiltration of stormwater is not considered feasible for the site.* *See Attachment C of this WQMP report for more details.*
Geotechnical Conditions (relevant to infiltration)	*The site consists of soil type B per TGD XVI-2a. The site sits over shallow groundwater per TGD XVI-2e. The site also sits over the South Basin Groundwater Protection Plume per TGD XVI-2f.* *Due to the presence of shallow groundwater (<= 5') and the South Basin Groundwater Plume, infiltration of stormwater is not considered feasible for the site.* *See Attachment C of this WQMP report for more details.*
Off-Site Drainage	*Building 2's northern drive aisle will continue to drain as in the existing condition, along an existing v-gutter which is utilized by the neighboring property. This shared drive aisle accepts offsite run-on, however, the v-gutter will direct it southerly to the existing private catch basin as it did in existing condition.*
Utility and Infrastructure Information	*Runoff is tabled to the existing 54" storm drain system within Bell Avenue.*

III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.3 in the TGD.*

Receiving Waters	Peters Canyon Channel San Diego Creek Reach 1 Newport Bay, Upper Newport Bay, Lower
303(d) Listed Impairments	Peters Canyon Channel: Benthic Community Effects, DDT, Indicator Bacteria, Malathion, Selenium, Toxaphene and Toxicity San Diego Creek Reach 1: Benthic Community Effects, DDT, Indicator Bacteria, Sedimentation/Siltation, Selenium, Toxaphene and Toxicity Newport Bay, Upper: Chlordane, Copper, DDT, Indicator Bacteria, Malathion, Nutrients, PCBs, Sedimentation/Siltation and Toxicity Newport Bay, Lower: Chlordane, Copper, DDT, Indicator Bacteria, Nutrients, PCBs and Toxicity
Applicable TMDLs	San Diego Creek Reach 1: Metals, Selenium, Nutrients, Pesticides and Siltation Newport Bay, Upper: Metals, Nutrients, Pathogens, Pesticides/PCBs and Siltation Newport Bay, Lower: Metals, Nutrients, Pathogens, Pesticides/Priority Organics and Siltation
Pollutants of Concern for the Project	Nutrients, Heavy Metals, Pathogens and Pesticides
Environmentally Sensitive and Special Biological Significant Areas	None

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

Describe project performance criteria. Several steps must be followed in order to determine what performance criteria will apply to a project. These steps include:

- If the project has an approved WIHMP or equivalent, then any watershed specific criteria must be used and the project can evaluate participation in the approved regional or sub-regional opportunities. The local Permittee planning or NPDES staff should be consulted regarding the existence of an approved WIHMP or equivalent.
- Determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 of the Model WQMP.*
- Determine applicable LID performance criteria. *Refer to Section 7.II-2.4.3 of the Model WQMP.*
- Determine applicable treatment control BMP performance criteria. *Refer to Section 7.II-*3.2.2 *of the Model WQMP.*
- Calculate the LID design storm capture volume for the project. *Refer to Section 7.II-2.4.3 of the Model WQMP.*

(NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?	YES ☐	NO ☒
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.		

Project Performance Criteria (continued)	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	The project was evaluated to determine if there were potential HCOC impacts on the downstream receiving water bodies. The evaluation concluded that while portions of the San Diego Creek are not hard-lined, the creek was designed to convey the developed condition stormwater runoff from the project site as well as the rest of its watershed (86,881 acres total). Therefore, hydromodification of the creek is not expected.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	The following performance criteria for LID implementation are required: • Priority Projects must infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hourstorm event (Design Capture Volume). • A properly designed biotreatment system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full design capture volume. In this case, infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biotreatment may be provided for the remaining design capture volume. The project site will utilize two sets of proprietary biofiltration facilities for treatment.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	No applicable treatment control BMP performance criteria necessary. The LID performance criterion is satisfied.

Calculate LID design storm capture volume for Project.

Area (acres)	Area (acres)	Design Capture Storm Depth d (inches)	imp	C	DCV (cu-ft)
DMA A	2.06	0.70	0.95	0.863	4,515
DMA B	3.83	0.70	0.95	0.863	8,394
DMA C	0.27	0.70	0.95	0.863	592
TOTAL	**6.16**				**13,500**

MWS #	Area (ac)	Tc (mins)	i (in/hr)	imp	C	SQDF (cfs)	Modular Wetlands			
							Treatment Per Unit (cfs)	QTY	Model	Total Treatment (cfs)
1	2.06	5.0	0.2625	0.95	0.863	0.466	0.476	1	MWS-L-8-16-V @3.5'	0.476
2	3.83	5.0	0.2625	0.95	0.863	0.867	0.476	2	MWS-L-8-16-V @3.4'	0.952

Refer to Attachment D for BMP Calculations.

IV.2. SITE DESIGN AND DRAINAGE PLAN

Describe site design and drainage plan including

- A narrative of site design practices utilized or rationale for not using practices;
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP plot plan.
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs (unless not required by local jurisdiction).

Refer to Section 2.4.2 in the TGD.

The site was designed to include the LID design principles and techniques described in the Orange County T.G.D. to the maximum extent feasible. They include:

Minimize Impervious Area – Impervious areas were minimized to the maximum extent practicable. Landscaped areas will be provided along the public street frontages and throughout the site. Additionally, the proprietary biofiltration units and permeable pavement help minimize the impervious area of the overall site.

Preserve Existing Drainage Patterns and Time of Concentration – Post-development drainage patterns will mimic existing conditions. Stormwater will be detained by the proprietary biofiltration units which will assist in increasing the time of concentration.

Disconnect Impervious Areas – Impervious surfaces such as rooftops, driveways and parking lots are directed to the proprietary biofiltration units for disconnection/treatment. In addition, Connector Pipe Screens (CPS) will be installed at every inlet location to capture trash.

Other measures - Full capture devices (connector pipe screens of 5mm or smaller) are proposed to comply with the new Trash Amendment. These will also serve as pretreatment to the MWS units.

Refer to the WQMP Site Map for proposed BMP locations, drainage areas, pervious areas and connection points with the existing storm drain system.

IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

Each sub-section below documents that the proposed design features conform to the applicable project performance criteria via check boxes, tables, calculations, narratives, and/or references to worksheets. *Refer to Section 2.4.2.3 in the TGD for selecting LID BMPs and Section 2.4.3 in the TGD for conducting conformance analysis with project performance criteria.*

IV.3.1 Hydrologic Source Controls

Name	Included?
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	☐
Impervious area reduction (e.g. permeable pavers, site design)	☒
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐

Permeable pavement is provided along the northern drive aisle of Building 2 (see WQMP site map in Section VI.1; depicted as DMA C – 0.27 acres) as a site design BMP. This area drains a shared driveway with the existing neighboring property to a shared curb-side catch basin. To prevent the need to treat comingling flows from offsite run-on, the project proposes permeable pavement in this area to mimic landscape/pervious areas. This area will not drain to structural LID BMP for treatment.

IV.3.2 Infiltration BMPs

Identify infiltration BMPs to be used in project. If design volume cannot be met state why BMPs cannot be met

Name	Included?
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trenches	☐
Infiltration basins	☐
Drywells	☐
Subsurface infiltration galleries	☐
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐
Other:	☐

The site sits over shallow groundwater per TGD XVI-2e. The site also sits over the South Basin Groundwater Protection Plume per TGD XVI-2f.

Due to the presence of shallow groundwater (<= 5') and the South Basin Groundwater Plume, infiltration of stormwater is not considered feasible for the site.

See Attachment C of this WQMP report for more details.

Infiltration dependent BMPs have been deemed infeasible due to the above.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

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

Evapotranspiration and rainwater harvesting BMPs are not feasible due to the limited amount of landscaping proposed/used at an industrial site.

IV.3.4 Biotreatment BMPs

Name	Included?
Bioretention with underdrains	☐
Stormwater 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			
							Treatment Per Unit (cfs)	QTY	Model	Total Treatment (cfs)
1	2.06	5.0	0.2625	0.95	0.863	0.466	0.476	1	MWS-L-8-16-V @3.5'	0.476
2	3.83	5.0	0.2625	0.95	0.863	0.867	0.476	2	MWS-L-8-16-V @3.4'	0.952

DMA A: Drainage from building 1 and the associate vehicle parking will all be directed to a low spot in the truck yard. Here a proposed catch basin will be installed. The private storm drain will convey the runoff southeasterly towards the existing 54" storm drain in Bell Avenue. A new connection will be proposed to allow for this discharge.

Before the onsite flows discharge offsite, manhole structures will divert low flows to a sump pump that will transport flows to the proposed proprietary biofiltration system for treatment. There will be one MWS system serving Building 1 (DMA A – 2.06 acres).

DMA B: Drainage from Building 2 and the vehicle parking along the north side will be directed to a pair of catch basins in the truck yard. The proposed storm drain will continue westerly collecting runoff from the west vehicle parking and drive aisle. The storm drain will continue to the southern corner of the site. The existing public catch basin on Bell Avenue will be reconstructed to allow for this proposed connection.

Before the onsite flows discharge offsite, manhole structures will divert low flows to a sump pump that will transport flows to the proposed proprietary biofiltration system for treatment. There will be one MWS system (comprised of 2 units) serving Building 2 (DMA B – 3.83 acres).

Full capture devices (connector pipe screens of 5mm or smaller) are proposed to comply with the new Trash Amendment. These will also serve as pretreatment to the MWS units.

IV.3.5 Hydromodification Control BMPs

Hydromodification Control BMPs	
BMP Name	**BMP Description**

IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub-Regional LID BMPs
Not applicable.

IV.3.7 Treatment Control BMPs

Treatment Control BMPs	
BMP Name	**BMP Description**

IV.3.8 Non-structural Source Control BMPs

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	If future occupants store hazardous materials, they must comply with all Title 22 CCR regulations.
N6	Local Industrial Permit Compliance	☐	☒	Statewide IGP (only applicable if not exempt through NEC).
N7	Spill Contingency Plan	☒	☐	
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tank onsite.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous material onsite.
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☒	☐	
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Not a retail gasoline outlet

IV.3.9 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if Structural source controls were not used.

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor storage areas onsite.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	Slopes and channels do not exist onsite.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	The site is not within the SDRWQCB NPDES Permit area.
S6	Dock areas	☒	☐	
S7	Maintenance bays	☐	☒	No maintenance bay proposed.
S8	Vehicle wash areas	☐	☒	No vehicle wash areas proposed.
S9	Outdoor processing areas	☐	☒	No outdoor processing areas proposed.
S10	Equipment wash areas	☐	☒	No equipment washing onsite.
S11	Fueling areas	☐	☒	No fueling areas proposed.
S12	Hillside landscaping	☐	☒	No hillsides.
S13	Wash water control for food preparation areas	☐	☒	No food preparation onsite.
S14	Community car wash racks	☐	☒	No community car wash.

IV.4 ALTERNATIVE COMPLIANCE PLAN (IF APPLICABLE)

IV.4.1 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 3.1 of the Model WQMP for description of credits and Appendix VI of the TGD for calculation methods for applying water quality credits.*

<table>
<tr><th colspan="5">Description of Proposed Project</th></tr>
<tr><td colspan="5">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td>☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="2">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td colspan="2">☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).</td></tr>
<tr><td colspan="2">☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).</td><td colspan="2">☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned</td><td>☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td>☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
<tr><td>Calculation of Water Quality Credits
(if applicable)</td><td colspan="4">Not applicable.</td></tr>
</table>

IV.4.2 Alternative Compliance Plan Information

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the WQMP.*

Not applicable.

Section V Inspection/Maintenance Responsibility for BMPs

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. *Refer to Section 7.II 4.0 in the Model WQMP.*

ADDITIONAL INSPECTION AND MAINTENANCE INFORMATION FOR VARIOUS BMPs ARE AVAILABLE IN ATTACHMENT B OF THIS PWQMP REPORT. PLEASE REFER TO IT FOR MORE DETAILS.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
TC-32: Bioretention Modular Wetlands	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Description of BMP: The Modular Wetlands will be utilized as bioretention treatment of storm water runoff from the project site. Runoff passes through the system horizontally, with planted material at the surface. Start up date: When storm drain system is complete.	Maintenance Schedule: Pollutant loading varies greatly from site to site and no two sites are the same. Therefore, the first year requires inspection monthly during the wet-season and every other month during the dry season in order to observe and record the amount of pollutant loading the system is receiving. Then a site-specific inspection and maintenance frequency can be established.
Sump Pumps	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	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.	Maintenance Schedule: Semi-annually (October 1st and February 1st) through maintenance service contract with the vendor or equally qualified contractor.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Connector Pipe Screen (CPS)	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Description of BMP: CPS devices will need to be inspected. Inspect the inflow of the catch basin where the CPS is located. Check for any obstructions to inflow of the CB and remove if any. Remove the manhole cover to estimate the amount and types of debris found in the CB. Look for any visual signs of damage that may compromise the CB to function properly. Inspect for any standing water as well as for large amounts of sediment and debris surrounding the CPS device. If standing water and high sediment volume is found, remove water, sediment and debris by vacuum truck or by other debris removal methods. Start-up date: When storm drain system is complete.	Maintenance Schedule: Routine inspection and maintenance intervals for all CPS devices are twice per year for inspections and once per year for maintenance service. CPS devices may require more frequent maintenance service if the device is located in a high debris loading drainage area. In such cases, the CPS device may require more frequent inspection and maintenance service, which could range from twice per year to monthly inspection and maintenance service depending on pollutant load conditions. CPS devices shall be maintained late summer/early fall prior to the start of the rainy season.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
S1. Storm Drain System Stencilling and Signage	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	If signage is missing or broken or stencilling is illegible, repairs are to be made immediately.	Stencilling and signage at catch basins to be inspected quarterly.
S3. Trash and waste storage areas	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Sweep, clean trash enclosure of trash and other debris. The trash enclosures may not be pressure washed or rinsed out unless wastewater is contained and disposed to sewer.	Weekly inspection of trash area. Remove trash as needed.
S4. Efficient irrigation systems and landscape design, water conservation, smart controllers, and source control	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Inspection and maintenance of landscape and irrigation at the site as well as water conservation and source control practices. If leakage, broken irrigation or controllers are broken, shut off water and repair immediately. Practice regular source control and water conservation.	Landscaping, irrigation system and controllers inspected at every routine maintenance on company's landscape maintenance schedule.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
S7. Dock Areas **N13.** Housekeeping of Loading Docks	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Loading/unloading docks will be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate clean-up of spills and broken containers.	Weekly inspections and continuous monitoring during loading and unloading of materials.
N1. Education for Property Owners, Tenants, And Occupants **N12.** Employee Training	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Provide the tenants with information concerning good housekeeping practices that contribute to protection of storm water quality. Employees shall be trained to clean up spills and participate in ongoing maintenance.	Check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants. The project site will have annual employee training and new hires within 1 month.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
N2. Activity Restrictions. Conditions, Covenants and Restrictions (CC&R's)	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Prohibit discharges of fertilizer, pesticides, or animal wastes to streets or storm drains. Prohibit blowing or sweeping of debris (leaf litter, grass clippings, litter, etc.) into streets or storm drains. Requirement to keep trash receptacles covered or sheltered by a roof overhang or canopy. Prohibit vehicle washing, maintenance, or repair on the premises.	Daily
N3. Common Area Landscaping Management	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Maintenance of the landscaping shall be done weekly. Irrigation must be consistent with City's Water Conservation Ordinance. Fertilizer and pesticide usage will be consistent with County Management Guidelines for Use of Fertilizers and Pesticides.	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.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
N7. Spill Contingency Plan	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Spill contingency plans apply to those facilities having bulk liquid storage in tanks or drums. A spillage control plan will be established following the guidelines and to handle smaller potential spills. Each user may need to update or revise spillage control plan to reflect onsite use of liquids, if any.	Daily inspections and maintenance and immediate dry clean up of any spills.
N11. Common Area Litter Control	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	Future employees, gardeners, and the property manager will help keep the site free of trash and other debris. The trash enclosure is located on the west side of the service building.	Weekly inspections and maintenance and immediate dry clean up of any trash or debris.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
N14. Common Area Catch Basin Inspection	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	The owner/maintenance contractor will be responsible for cleaning the catch basins on-site on a regular basis prior to the storm season, no later than October 1st of each year.	Catch basins and storm drain system will be cleaned at least twice a year and prior to October 1. Catch basin filters will be inspected four times a year and prior, during and following a rain event, and serviced by a qualified technician. Service contractor will properly dispose of all wastes.
N15. Parking Lot Sweeping	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX	The owner/maintenance contractor will have the private drive swept. Hosing or watering of the site will not be permitted as a method of cleaning	Parking lots and drive isles will be swept or vacuumed at least quarterly, October 1, January 1, April 1 and July 1 and as necessary. If there is any trash or debris in between the routine sweeping it will be swept or vacuumed immediately.

Section VI Site Plan and Drainage Plan

VI.1 SITE PLAN AND DRAINAGE PLAN

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

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

VI.2 ELECTRONIC DATA SUBMITTAL

The minimum requirement is to provide submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open.

If the local jurisdiction requires specialized electronic document formats (CAD, GIS) to be submitted, this section will be used to describe the contents (e.g., layering, nomenclature, georeferencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

Last Update: 2/22/23
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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

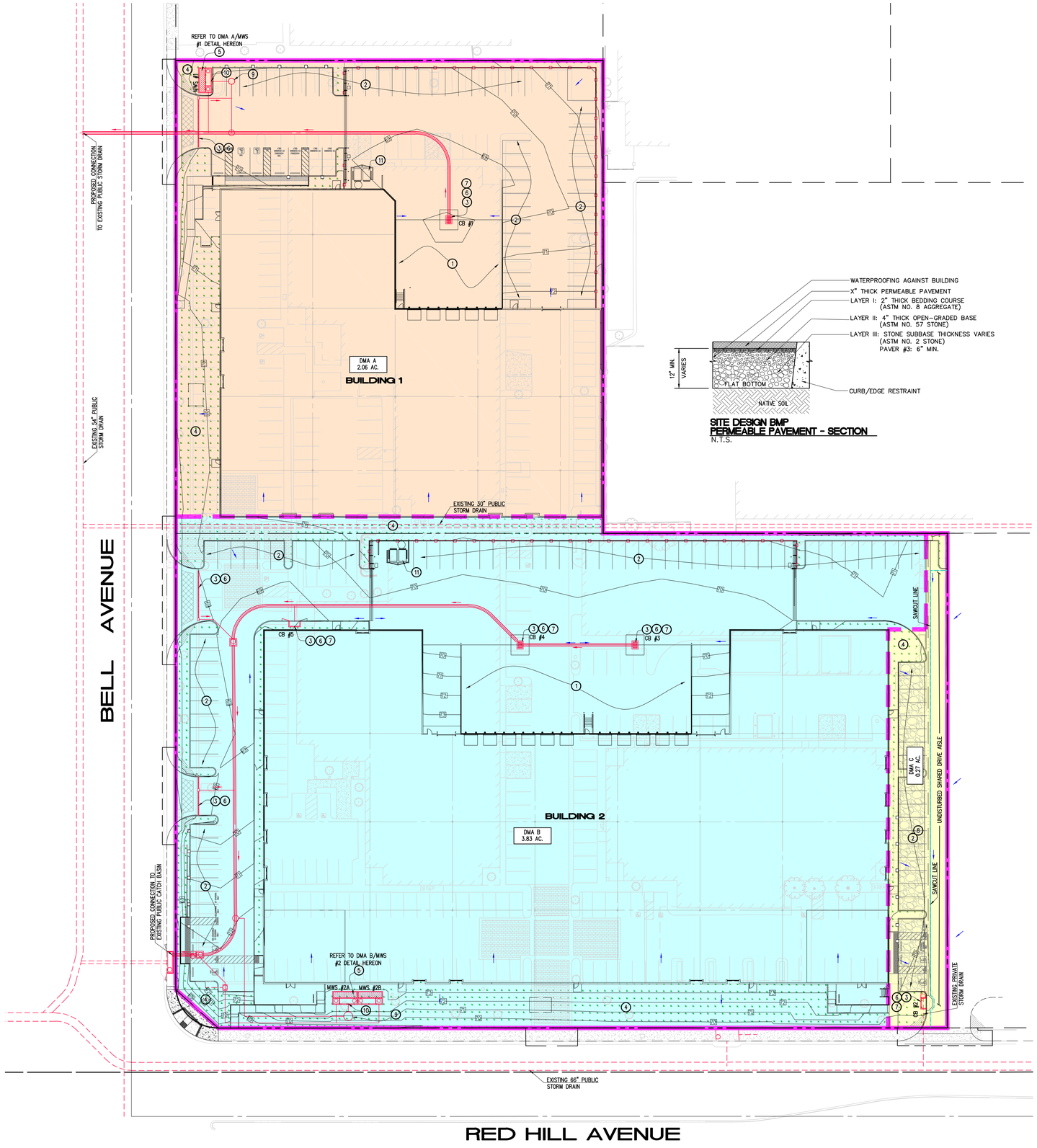
VICINITY MAP

FOR

15661 RED HILL AVENUE
TUSTIN, CA 92780

N

NTS

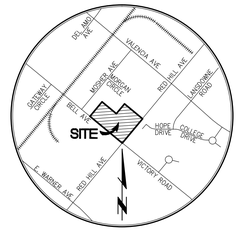


SITE DESIGN BMP
PERMEABLE PAVEMENT - SECTION
N.T.S.

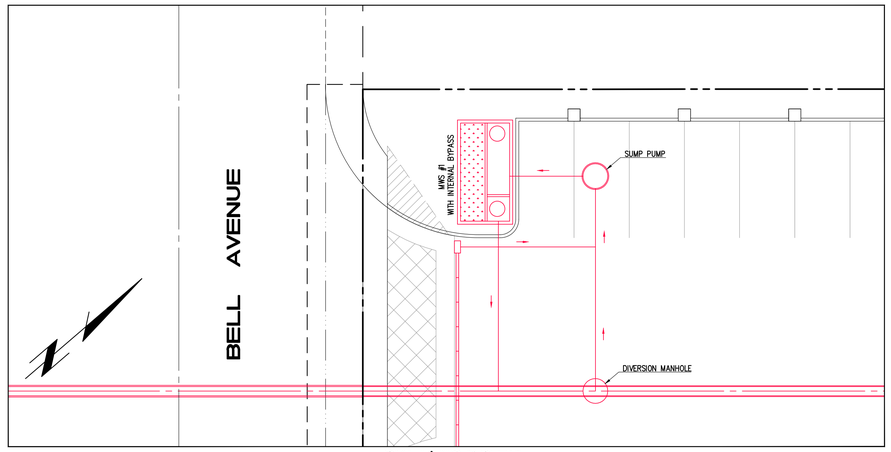
LEGEND

1. S7 & N13: LOADING DOCKS
2. N15: PARKING AREA MAINTENANCE
3. N14: CATCH BASIN INSPECTION
4. N3: LANDSCAPE MAINTENANCE
   S4: EFFICIENT IRRIGATION
5. PROPRIETARY BIOFILTRATION SYSTEM
6. S1: STORM DRAIN SYSTEM STENCILING AND SIGNAGE "NO DUMPING-DRAINS TO RIVER"
7. CONNECTOR PIPE SCREEN (CPS)
8. PERMEABLE PAVEMENT – SITE DESIGN BMP
9. SUMP PUMP
10. SUMP PUMP DISCHARGE LOCATION
11. TRASH ENCLOSURE

RD — ROOF DRAIN
LANDSCAPE
PERMEABLE PAVEMENT
PROPERTY BOUNDARY
DRAINAGE AREAS
SURFACE FLOW LINE
SD FLOW LINE



VICINITY MAP
N.T.S.



DMA A/MWS #1 DETAIL
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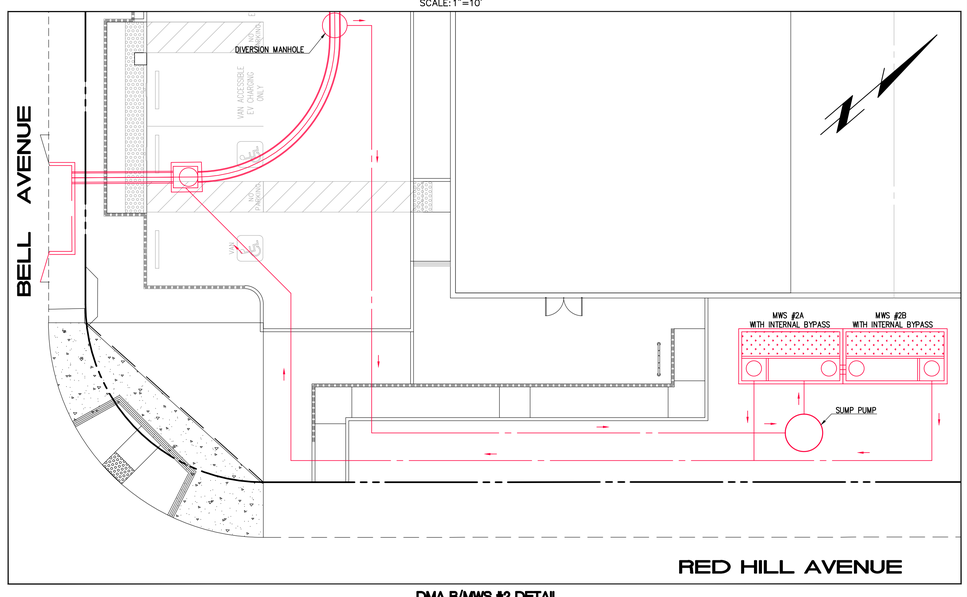

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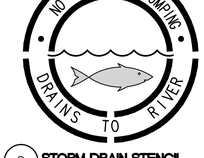
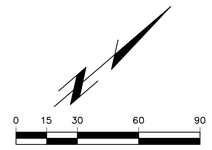


6 **STORM DRAIN STENCIL**
N.T.S.



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Last Update: 2/22/23
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CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

PWQMP SITE MAP
CENTURION PLAZA
15661 RED HILL AVENUE

4136/ 1 OF 4 SHEETS

PREPARED FOR:
CENTURION PLAZA LLC
36 DEEP SEA
NEWPORT COAST, CA 92657
PHONE: (XXX) XXX-XXXX

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

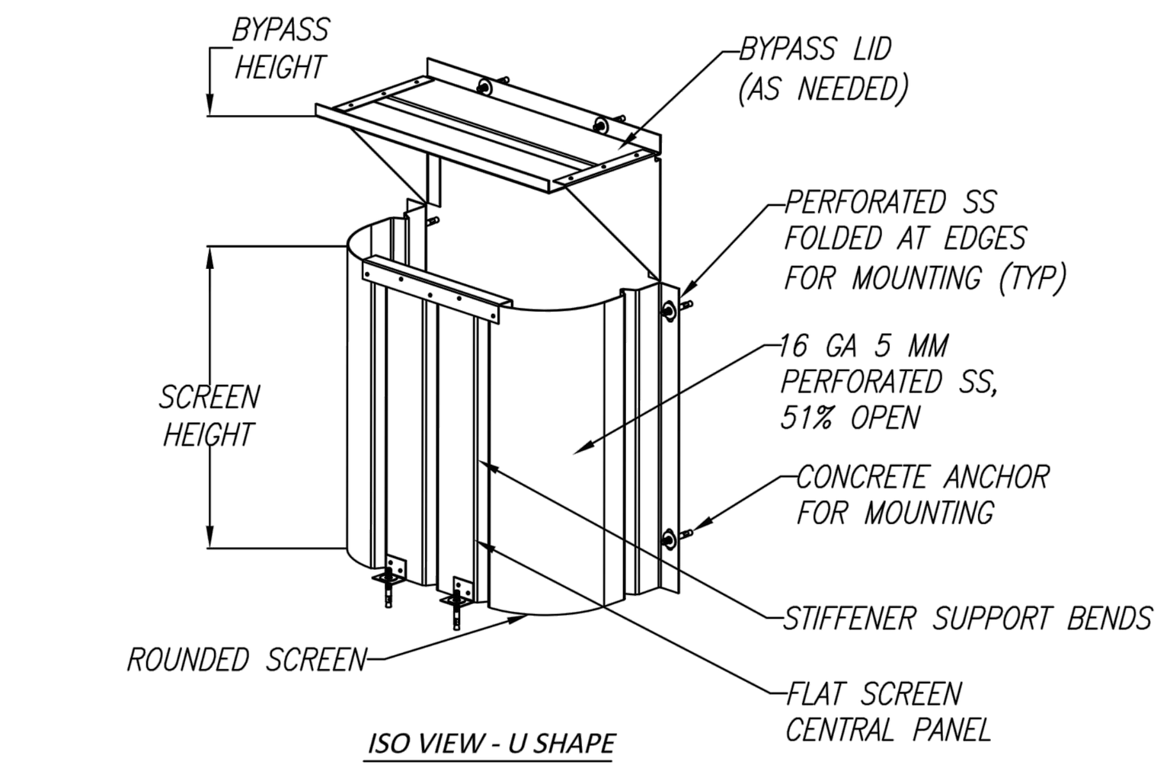
Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director _____ R.C.E. _____

Sheet 1 of 4 Sheets

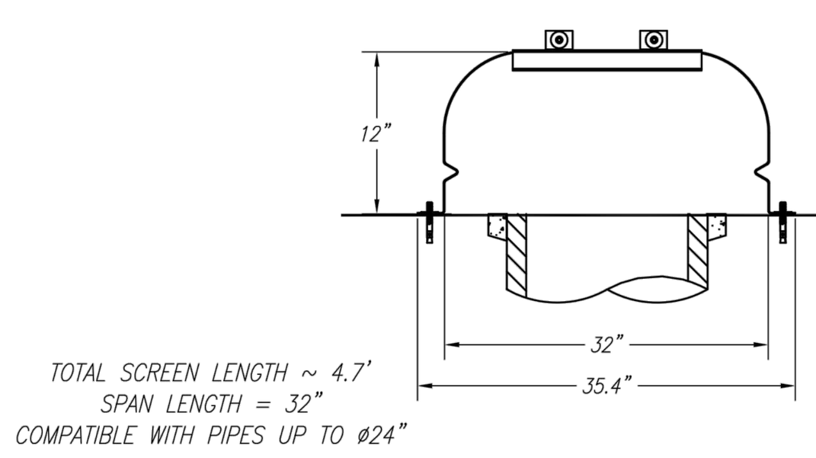
HYDRA CONNECTOR PIPE SCREEN (CPS)

U 4.7



ISO VIEW - U SHAPE

CPS U WITH 4.7 FT SCREEN LENGTH	
CPS HEIGHT (IN)	SCREEN FLOW (CFS)
12	6.67
18	12.26
24	18.88
30	26.40
36	34.71
NOTE: BYPASS FLOW RATES VARY WITH VAULT DEPTH AND BYPASS HEIGHT. CONTACT BIO CLEAN FOR ADDITIONAL INFORMATION.	



TOTAL SCREEN LENGTH ~ 4.7'
SPAN LENGTH = 32"
COMPATIBLE WITH PIPES UP TO ø24"

TOP SECTION VIEW - U SHAPE

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE.
3. THIS CPS UNIT IS DESIGNED FOR TREATMENT FLOWS THROUGH THE SCREEN. FLOWS GREATER THAN THE TREATMENT FLOW RATE WILL BYPASS OVER THE SCREEN.
4. A BYPASS LID IS REQUIRED WHEN THE OUTLET PIPE IS DIRECTLY BELOW THE CURB OPENING.
5. CPS IS COMPRISED OF 304 STAINLESS STEEL. THICKNESS IS 16 GAUGE. SCREEN PERFORATIONS ARE 5 MILLIMETERS IN DIAMETER. THE SCREEN AREA IS 51% OPEN SPACE.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO INSTALL THE CPS UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. POSITION THE CPS SO IT IS EVENLY SPACED AROUND THE CONNECTOR PIPE, ENSURING A MIN. OF 4" SPACING AWAY FROM ANY CORNERS. SCREEN BOTTOM SHALL BE FLUSH WITH THE CATCH BASIN FLOOR, OR WITH GAPS NO GREATER THAN 5 MM.
3. IF A BYPASS LID IS REQUIRED, VERIFY THE BYPASS HEIGHT NEEDED AND MARK THAT LOCATION ON THE WALL DIRECTLY ABOVE THE BASE UPRIGHTS. LIFT THE LID IN PLACE AND MARK THE HOLE LOCATIONS FOR THE LID MOUNTING BRACKETS. SECURE THE LID WITH STAINLESS STEEL NUTS.

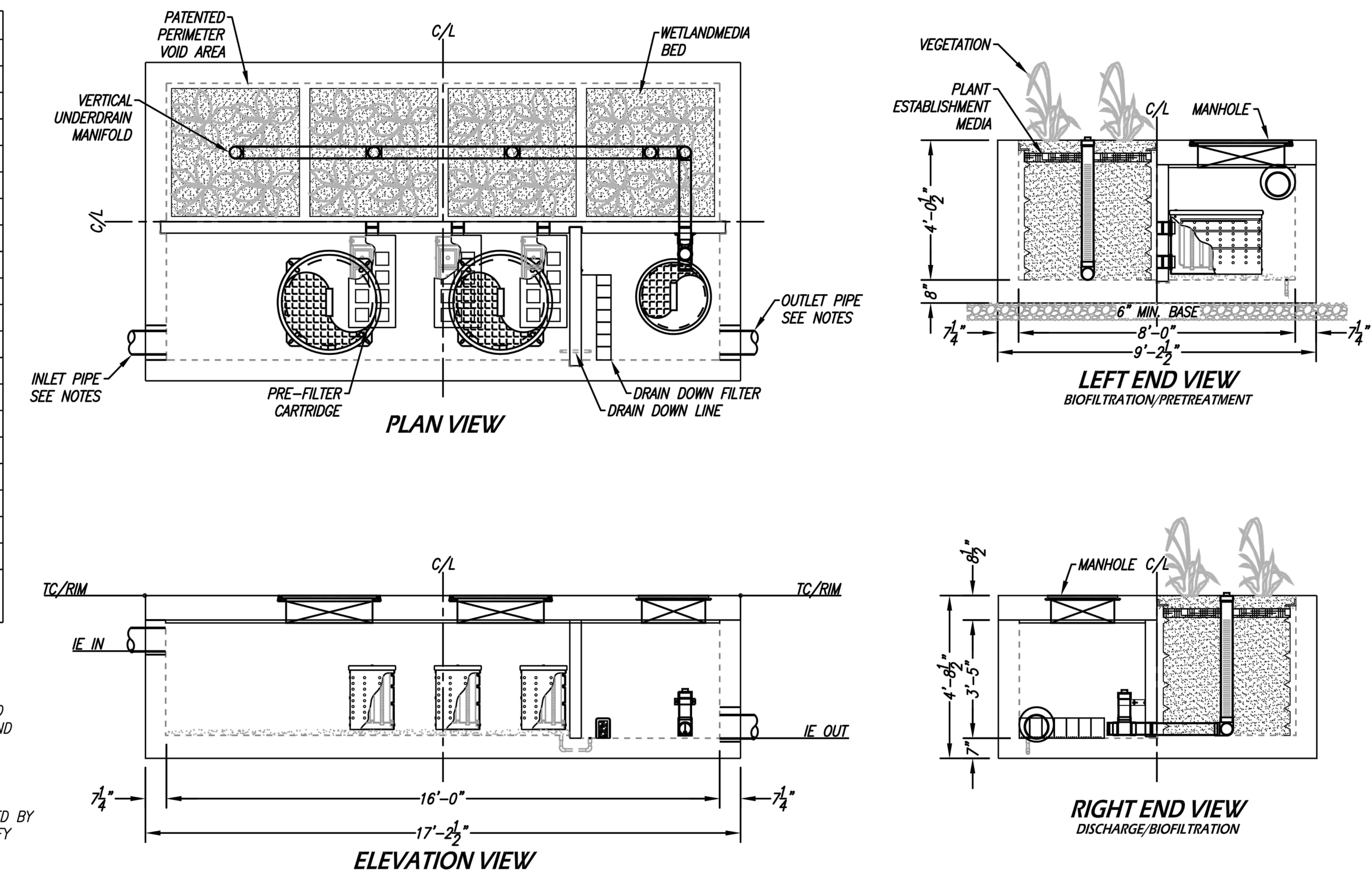
WARRANTY: 3 YEAR MANUFACTURER'S		MEETS FULL CAPTURE REQUIREMENTS		Bio Clean A Forterra Company
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640		REVISIONS:	DATE:	
		REVISIONS:	DATE:	
DATE: 1/17/2020	SCALE: NTS	REVISIONS:	DATE:	
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:	

CONNECTOR PIPE SCREEN (CPS) SUMMARY TABLE			
CB/MH ID	OUTLET PIPE SIZE (IN)	CPS MODEL #	CPS HEIGHT (IN)
CB #1	18	HYDRA CPS U 4.7	18
CB #2	18	HYDRA CPS U 4.7	18
CB #3	18	HYDRA CPS U 4.7	18
CB #5	18	HYDRA CPS U 4.7	18
CB #6	18	HYDRA CPS U 4.7	18

7 CONNECTOR PIPE SCREEN

SCALE: NTS

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.

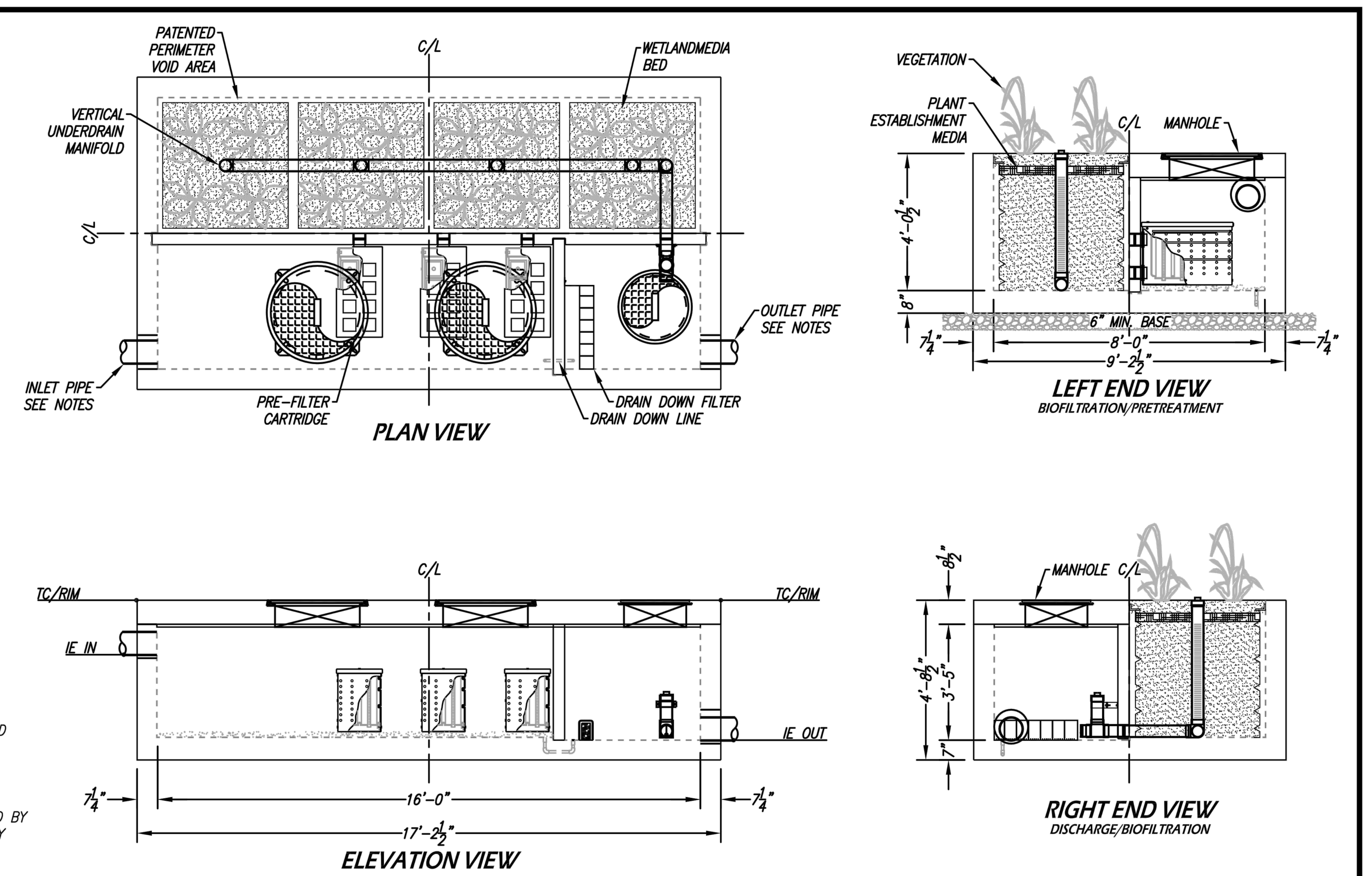
TREATMENT FLOW (CFS)	0.462
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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

MODULAR WETLANDS
www.ModularWetlands.com | (855) 5MOD-WET

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)			7.26
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø3.07"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



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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

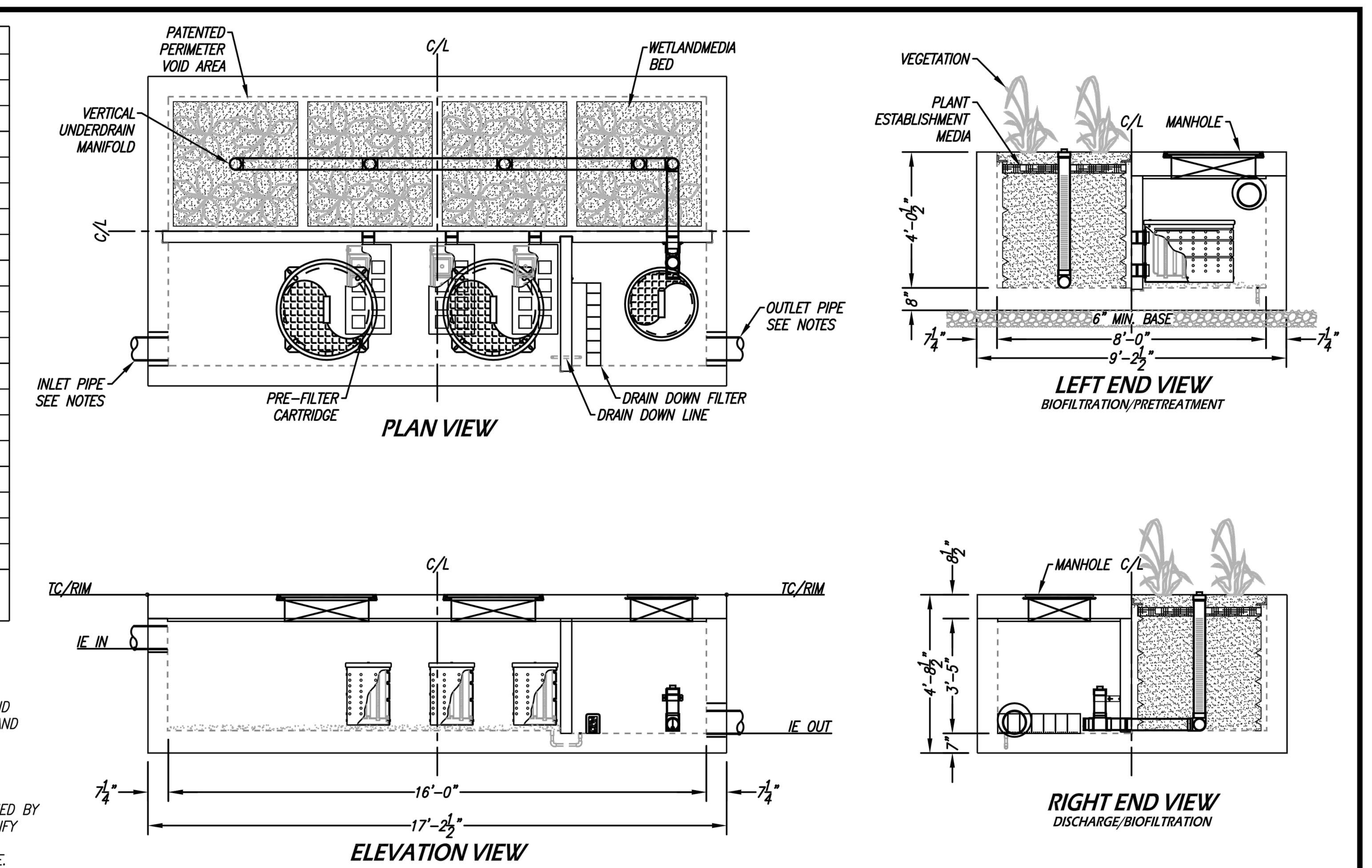
THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

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
www.ModularWetlands.com | (855) 5MOD-WET

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)			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

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

Last Update: 2/21/23
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CITY OF TUSTIN

PUBLIC WORKS DEPARTMENT

PWQMP SITE MAP

CENTURION PLAZA

15661 RED HILL AVENUE

PREPARED FOR:

CENTURION PLAZA LLC
36 DEEP SEA
NEWPORT COAST, CA 92657
PHONE: (XXX) XXX-XXXX

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 **4** Sheets

4136/ 2 OF 4 SHEETS

PACKAGE DUPLEX PUMP LIFT STATION - MANUFACTURED BY PACIFIC SOUTHWEST INDUSTRIES
RUSTIN LOGISTICS CENTER RIVERSIDE, CA.

Furnish and install complete pre-packaged duplex Lift Station model #PSI-THI101822 as manufactured by Pacific Southwest Industries (national phone # 800-358-9095)

This pre-packaged Lift Station shall incorporate a quick removal system manufactured by the pump manufacturer. The pump(s) shall be guided to the discharge base elbow by a single or double guide rail and shall be stainless steel and shall extend from the discharge base elbow to the upper guide bracket mounted on 1-5/8" x 1-5/8" channel strut just below the basin cover. Stainless steel lifting chain or cable shall be supplied and properly installed to remove the pump from the wet well. The internal discharge piping shall be completely pre-plumbed with pressure rated schedule 40 or 80 PVC pipe as indicated and extend 12" beyond the wet well and valve vault side wall for contractor connection to the force main piping. The pump(s) discharge piping shall have a check and ball valve installed on each pump discharge. The Lift Station shall include control panel and level control floats. The control panel shall be suitable for surface mounting or free standing on a leg kit if the site conditions require it.

PUMPS:
Each Tsurumi non-clog B series pump(s) shall be designed to pump wastewater, sewage or effluent containing solids without damage during operation. The pump(s) shall be designed so that the shaft power required (BHP)/(kW) shall not exceed the motor rated output throughout the entire operating range of the pump performance curve.

MATERIALS OF CONSTRUCTION:
Construction of major parts of the pumping unit(s) including casing, impeller, and discharge elbow shall be manufactured from gray cast iron, ASTM A48 CLASS 35. Unit(s) shall have a field adjustable and/or replaceable, cast-iron shield type wear plate or wear rings. Internal and external surfaces coming into contact with the pumpage shall be protected by a fused polymer coating. All exposed fasteners shall be stainless steel. All units shall be furnished with a discharge elbow with 150 lb. (10 Kg. /Cm2) flat face flange and NPT companion flange. Impellers shall be of the solids handling design equipped with back pump out vanes and shall be slip fit to the shaft and key driven. The pump casing shall incorporate an air relief valve.

MECHANICAL SEAL:
All units shall be furnished with a dual inside mechanical shaft seal located completely out of the pumpage, running in a separate oil filled chamber and further protected by an exclusionary oil seal located between the bottom seal faces and the fluid being pumped. The oil chamber shall be fitted with a device that shall provide positive lubrication of the top mechanical seal, (down to one third of the standard oil level). The device shall not consume any additional electrical power. Mechanical seals shall be rated to preclude the incursion of water up to 42.6 PSI (98.4 Ft.). Units shall have silicon carbide mechanical seal faces.

MOTOR:
Motor(s) shall be air filled, copper wound, class F insulated with built in thermal protection for each winding. Motor shaft shall be 420 or 403 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. On units up to 10 Hp (75 kW), the bottom bearing shall be a single row, double shielded, C3, deep groove type ball bearing. On units 15 Hp. (11 kW), the bottom bearing shall be two row, double shielded, C3 deep groove type ball bearings. The top bearing on all units shall be single row, double shielded, C3, deep groove type ball bearings. Motor housing and bearing housing shall be gray cast iron, ASTM A48 CLASS 30. Motors shall be D.O.L. or Star-delta start (15 Hp.), shall be suitable for across the line start or variable speed applications, utilizing a properly sized variable frequency drive.

POWER CABLE AND CABLE ENTRANCE:
The pump power cable shall be suitable for submersible pump applications. Units up to 5 Hp. shall be supplied with a cable entrance that incorporates built in strain relief, a one-piece, three-way mechanical compression seal with a fatigue reducing cable boot. On units 7.5 Hp. and above, the cable entrance shall incorporate built in strain relief, and combination three-way mechanical compression sealing with a fatigue reducing/thermal expansion rubber boot. The power cable shall be field replaceable utilizing standard submersible pump cable. The cable entrance assembly on all units shall contain an anti-wicking block to eliminate water incursion into the motor due to capillary wicking should the power cable be accidentally damaged.

QUICK REMOVAL SYSTEM:
The pumping unit(s) shall be equipped with quick removal system (QRS). The construction shall be such that the pump(s) will automatically connect to the discharge piping when lowered into place on the discharge connector. There shall be no need for personnel to enter the wet well to accomplish installation or removal of the pump(s). The pumping unit(s) shall be fitted with stainless steel lifting chain(s) of sufficient length and strength to permit the raising and lowering of the unit(s). The chain(s) shall be fastened at the top of the structure near the access opening. The need for a protective coating shall not be required. A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connection with a bracket to connect with the discharge connection. Sealing of the pumping unit to the discharge connection shall be accomplished by a single linear downward motion of the pump with the entire weight of the pumping unit guided by a pawl, thereby wedging the pumping unit tightly against the discharge connector. No portion of the pump shall bear directly on the floor of the sump nor shall a rotary motion of the pump be required for sealing. All fasteners coming into contact with the pumpage shall be stainless steel. Two corrosion resistant guide pipes shall be furnished and installed for each pump to permit raising and lowering of the pump.

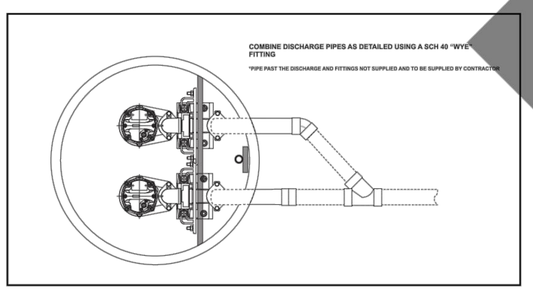
FIBERGLASS WET WELL:
The fiberglass wet well with an anti-flotation flange shall have the proper diameter and depth below the lowest inlet to promote proper cycling while maintaining the rim at grade. The fiberglass wet well shall be manufactured using a process that is filament wound and or chopped spray. The wet well shall be constructed with a anti flotation flange. Lifting lugs shall be required for those wet wells 48 inches in diameter and larger for setting of the wet well. The laminate shall have a Barco hardness of at least 90% of the resin manufactures minimum specified hardness for cured resin on both the interior and exterior surfaces. The minimum wall thickness of the wet well shall not be less than 1/4". Stainless steel studs will be encapsulated in the bottom of the wet well to allow the mounting of the quick removal system. The top rim flange will be a minimum of 2" wide to allow for the installation of the pedestrian rated aluminum cover to the rim flange or shall be rimless if the cover is specified for H20 off street locations. The wet well shall be provided with "unseal" fittings that can be installed in the field to insure proper elevation of the inlet, vent, and electrical on the side of the wet well. The wet well will house 2 - swing check valves, and 2 – shut off valves.

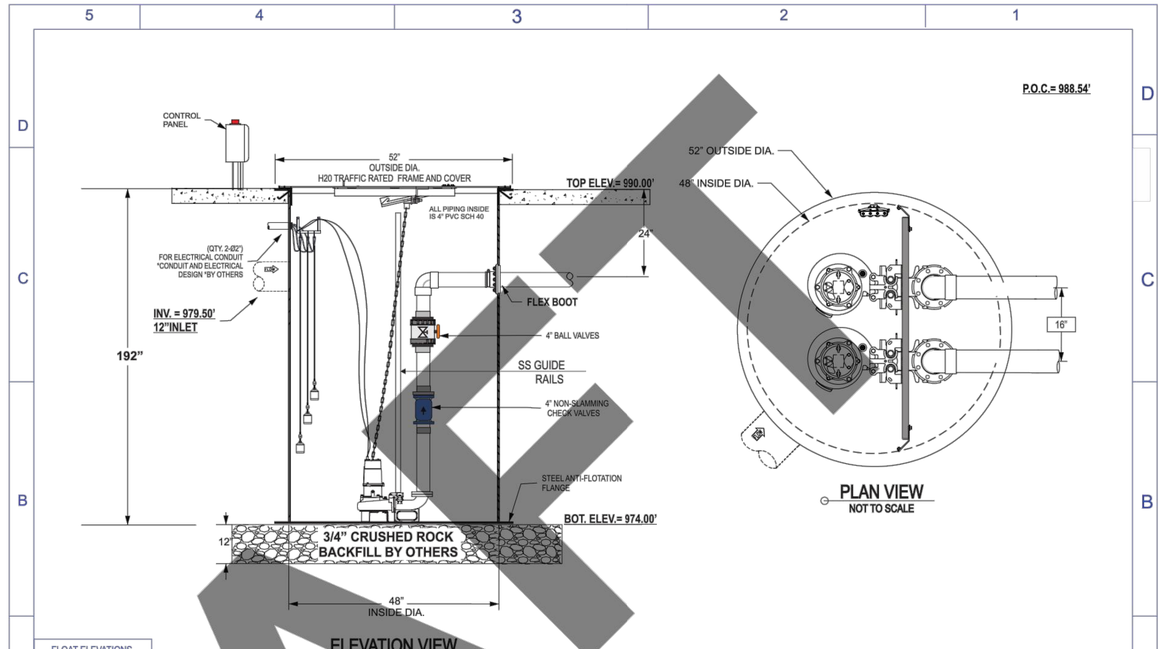
COVER(s)
The wet well cover shall always be gasketed and bolted to the rim flange of the fiber glass tank using 7/16" stainless steel hex head bolts unless the cover is to be in a H20 off street location. The type of material to be used for the cover shall be as indicated on this plan sheet.

DUPLEX ALTERNATING CONTROL PANEL:
The duplex control panel, as a minimum, shall include the appropriate enclosure type for the environment it is to be installed in and should include the following:
Motor starters, motor circuit protectors or variable frequency drives (VFD), pump run indicator(s),
operation selector switch(es), high water alarm and light, silence switch, dry contact for alarm, numbered terminals for all incoming power, pump motor(s) and level controls. The control panel shall be UL listed 508 or 913.

The following options marked "x" shall be included and specific for this site.

NEMA 4X _x_ NEMA 3R ___ LEG KIT ___ ETM's ___ SEAL FAIL ___ THERMAL CUTOUTS ___ PHASE LOSS MONITOR ___ SOFT START ___ GENSET HOOKUP ___ DOOR IN DOOR DEAD FRONT ___ THROUGH DOOR MAIN DISCONNECT ___ TRANSDUCER OPERATED ___ FLOAT BACKUP ___ CURRENT CENSOR ___ AUTO DIALER ___ REDUNDANT OFF ___ INTRINSICALLY SAFE ___ SMART RELAY WHICH INCLUDES EXERCISER, RUN COUNT, ALARM COUNT AND FLOAT POSITION _x_

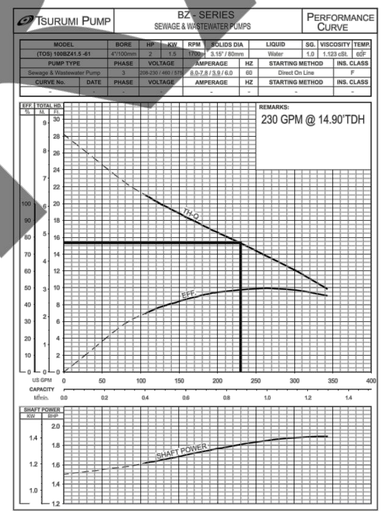




FLOAT ELEVATIONS	
LAG/ALARM	979.50'
ON	978.50'
OFF	975.00'

PUMP MODEL: 100BZ41.5
2 HP 460V 3 PH FLA 3.9 AMP
PERFORMANCE:
230 GPM AT 14.90 FT TDH

PSI Pacific Southwest Industries
PACKAGED LIFT STATION
(800)-358-9095



LIFT STATION PROFILE & CALCULATIONS					
6" SCH 40 = 6.06 SCH 80 = 5.76					
6" PVC PIPE	(QTY)	20.14	x	1 FT	20.14 FT
6" PVC 90 ELBOW	(QTY)	1	x	16 FT	16 FT
6" PVC 45 BEND	(QTY)	1	x	7.7 FT	7.7 FT
6" PVC TEE	(QTY)	0	x	33 FT	0 FT
6" BALL VALVE	(QTY)	1	x	3.5 FT	3.5 FT
6" CHECK VALVE	(QTY)	1	x	39 FT	39 FT
TOTAL EQUIVALENT LENGTH					86.34 FT
FRICTION LOSS PER 100 FT 6" PVC		230 GPM	0.4 FT		PER 100 FT
FRICTION LOSS 6"	86.34	/	100	x 0.4 FT	0.36 FT
TOTAL DYNAMIC HEAD					
6" FRICTION LOSS					0.36 FT
STATIC HEAD				+	14.54 FT
PERFORMANCE	230 GPM	@	14.90	FT TDH THROUGH 6" PVC LINE	

HAZEN-WILLIAMS EQUATION/HEAD LOSS IN WATER PIPE	
$(f) = 0.2083\ (100 / c)^{1.852}\ q^{1.852} / dh^{4.8655}$	
c=	140 HDPE / PVC
q=	230 GPM
dh=	6" SCH 40 = 6.06
FRICTION LOSS PER 100 FT f=	0.41
Velocity (ft/s) =	2.56

LIFT STATION DETAILS

NOTE: VERIFY ALL ELEVATIONS PRIOR TO FABRICATION. OTHERS TO VERIFY ALL ELEVATIONS AND DIMENSIONS PRIOR TO FABRICATION AND INSTALLATION.
*ALL PIPE OPENINGS AND SEALING SHALL BE COMPLETED IN FIELD BY OTHERS.

PSI Pacific Southwest Industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
18541 COLLIER, , LAKE ELSINORE, CA 92530 PH: 800 358-9095

No.	Description	Date

LIFT STATION DETAILS
RUSTIN LOGISTICS CENTER
RIVERSIDE CA

Scale: NTS
Sheet No. 1 OF 1
Date: 10/18/2022
Drawn by: EM
Checked by:

LSD-1

Last Update:2/21/23
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CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

PWQMP SITE MAP
CENTURION PLAZA
15661 RED HILL AVENUE

PREPARED FOR:
CENTURION PLAZA LLC
36 DEEP SEA
NEWPORT COAST, CA 92657
PHONE: (XXX) XXX-XXXX

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 3 of 4 Sheets

4136/ 3 OF 4 SHEETS

14451 MYFORD ROAD TUSTIN, CA PUMP #61
PACKAGE STORM WATER LIFT STATION

SCOPE OF SUPPLY:

Furnish and install complete pre-packaged storm water pump lift station model **#PSI-THI010621-P61** as manufactured by Pacific Southwest Industries, (national phone# 800-358-9095), No exceptions shall be taken to this specification without engineers approval.
NOTE: Due to the specific nature of this pump station/ equipment and its operational sequence, any contractor not intending to purchase and supply as specified, by model number, must provide full submittals for review and approval prior to ordering, no exceptions. send full submittals to, www.submittalapproval.com, allow one week for a response.

The pre-packaged Lift Station shall incorporate a quick removal system manufactured by the pump manufacturer. The pump(s) shall be guided to the discharge base elbow by stainless steel guide rails. The rails shall extend from the discharge base elbow to the upper guide bracket mounted on fiberglass channel just below the basin cover. Stainless steel lifting chain or cable shall be supplied and properly installed to remove the pump from the wet well. The internal discharge piping shall be completely pre-plumbed in PVC pipe and extend 12" beyond the wet well side wall for contractor connection to the force main piping. The pump(s) discharge pipe shall have a check and ball valve installed on each discharge line. The Lift Station shall include three liquid level controls on a removable float tree and a control panel suitable for surface mounting. The pump(s), quick removal system and the level sensors shall be housed in a fiberglass wet well (basin) and shall be of sufficient length to maintain the rim of the wet well at grade.

PUMPS:
Each Tsurumi non clog model #100BZ42.2 shall be capable of delivering 440 G.P.M. at 13.68 Feet TDH. The pump(s) shall be designed to pump wastewater, sewage or effluent containing solids without damage during operation. The pump(s) shall be designed so that the shaft power required (BHP)/(kW) shall not exceed the motor rated output throughout the entire operating range of the pump performance curve.

MATERIALS OF CONSTRUCTION:
Construction of major parts of the pumping unit(s) including casing, impeller, and discharge elbow shall be manufactured from gray cast iron, ASTM A48 CLASS 35. Unit(s) shall have a field adjustable and/or replaceable, cast iron shield type wear plate or wear rings. Internal and external surfaces coming into contact with the pumpage shall be protected by a fused polymer coating. All exposed fasteners shall be stainless steel. All units shall be furnished with a discharge elbow with 150 lb. (10 Kg./Cm2) flat face flange and NPT companion flange. impellers shall be of the solids handling design equipped with back pump out vanes and shall be slip fit to the shaft and key driven. The pump casing shall incorporate an air relief valve.

MECHANICAL SEAL:
All units shall be furnished with a dual inside mechanical shaft seal located completely out of the pumpage, running in a separate oil filled chamber and further protected by an exclusionary oil seal located between the bottom seal faces and the fluid being pumped. The oil chamber shall be fitted with a device that shall provide positive lubrication of the top mechanical seal, (down to one third of the standard oil level). The device shall not consume any additional electrical power. Mechanical seals shall be rated to preclude the incursion of water up to 42.6 PSI (98.4 Ft.). Units shall have silicon carbide mechanical seal faces.

MOTOR:
The pump motor(s) shall be 3 HP, 2.2 kW, 460V, 60 Hz. 3 Phase and shall be NEMA MG-1, Design Type B equivalent. Motor(s) shall be rated at 4.6 full load amps. Motors shall have a 1.15 service factor and shall be rated for 20 starts per hour. Motor(s) shall be air filled, copper wound, class F insulated with built in thermal protection for each winding. Motor shaft shall be 420 or 403 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. On units up to 10 Hp (75 kW), the bottom bearing shall be a single row, double shielded, C3, deep groove type ball bearing. On units 15 Hp. (11 kW), the bottom bearing shall be two row, double shielded, C3 deep groove type ball bearings. The top bearing on all units shall be single row, double shielded, C3, deep groove type ball bearings. Motor housing and bearing housing shall be gray cast iron, ASTM A48 CLASS 30. Motors shall be D.O.L. or Star-delta start (15 Hp.), shall be suitable for across the line start or variable speed applications, utilizing a properly sized variable frequency drive.

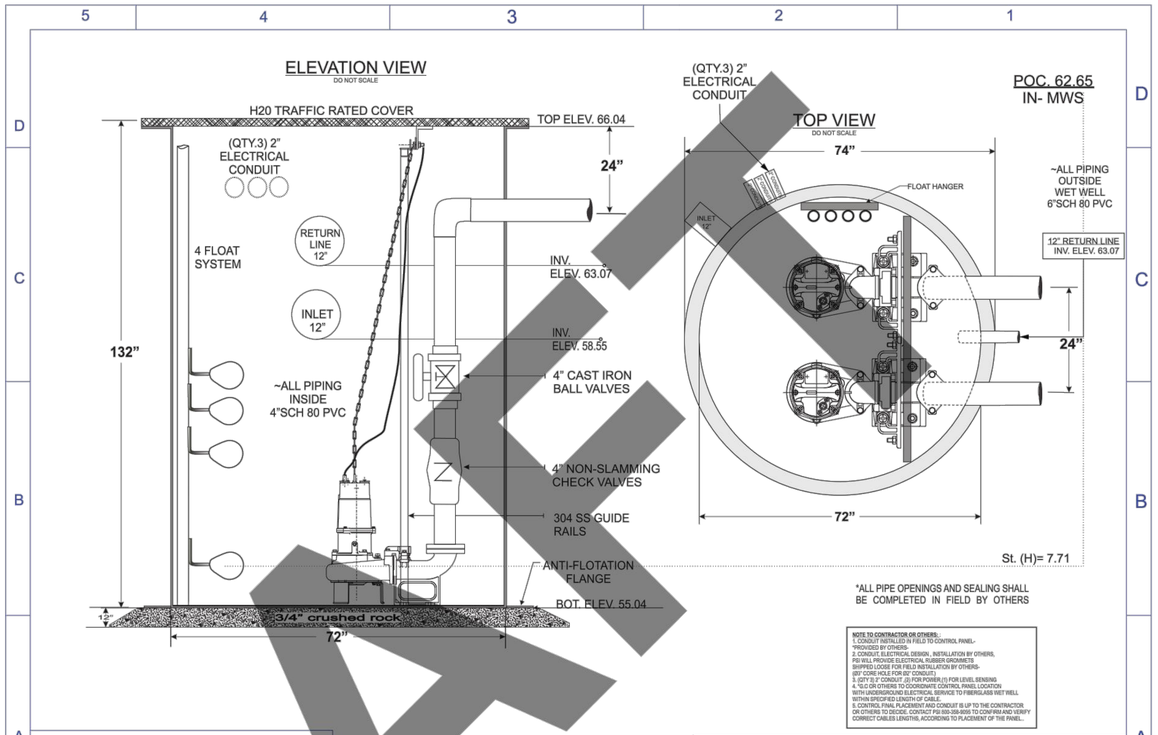
POWER CABLE AND CABLE ENTRANCE:
The pump power cable shall be suitable for submersible pump applications. Units up to 5 Hp. shall be supplied with a cable entrance that incorporates built in strain relief, a one piece, three way mechanical compression seal with a fatigue reducing cable boot. On units 7.5 Hp. and above, the cable entrance shall incorporate built in strain relief, and combination three way mechanical compression sealing with a fatigue reducing/thermal expansion rubber boot. The power cable shall be field replaceable utilizing standard submersible pump cable. The cable entrance assembly on all units shall contain an anti-wicking block to eliminate water incursion into the motor due to capillary wicking should the power cable be accidentally damaged.

DUPLEX ALTERNATING CONTROL PANEL:
The control panel shall have a NEMA 4X door -in -door dead front lockable fiberglass enclosure suitable for wall mounting. A motor circuit protector shall be provided for each pump and magnetic starter with three leg overload protection for each pump. A Smart relay shall be provided with automatic load selector to alternate pumps on each successive cycle of operation, exercise timers, elapsed time meters, and cycle counter. The starter shall have auxiliary contacts to operate both pumps in an override condition. The control circuit shall not be affected in the event that either pump trips the pump circuit breaker. H.O.A. switches and run lights shall be supplied for each pump. A terminal strip shall be provided to terminate all incoming power, pumps, level sensors and remote alarm wiring. A 100VA control transformer shall be provided to supply reduced voltage to the control circuit. The control panel shall offer a high water alarm light, top mounted for 360 degree visibility. An external push button shall be provided to silence the audible alarm. U.L. 508 listed shop.

A dry, non-powered contact shall be supplied in the main control panel to interface with the owners computerized security system. This contact is to normally open. The contact will close when the high level alarm float is activated or upon power loss.

FIBERGLASS WET WELL:
The fiberglass wet well shall be suitable direct burial installation. The wet well shall be no less than 72 inches in diameter and will be 132 inches in length. The laminate shall have a barcol hardness of a least 90% of the resin manufactures minimum specified hardness for cured resin on both the interior and exterior surfaces. The minimum wall thickness of the wet well shall not be less than 3/16". The wet well manufacturer shall encapsulate a steel base plate with stainless steel studs for the mounting of the quick removal system. The wet well will be provided with 2-12" inlet fitting for field installation by the contractor at the elevation and location as indicated on the plans. All other penetrations shall be sealed by using "Uniseal" fitting or "Flex boot" fittings.

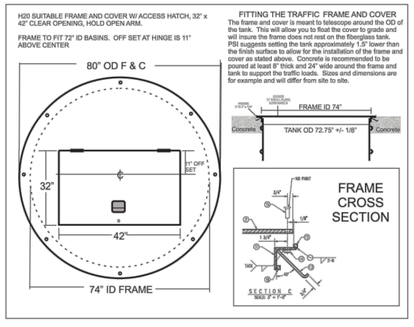
STEEL H20 SUITABLE FRAME AND COVER:
The cover of the wet well shall be no less than ¼" thick and shall be suitable for H-20 traffic loads. The cover shall be solid with no penetrations through the top and shall be secured to the rim of the wet well with steel hardware. The cover is to be suspended in a Class A bed of concrete a minimum of 6" thick and to extended a minimum of 18" past the frame. The covers will be supplied with enamel primer paint.

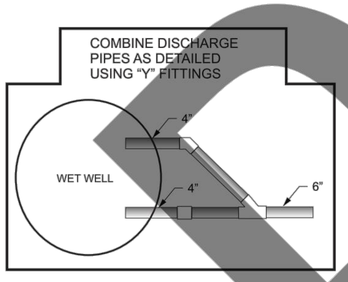


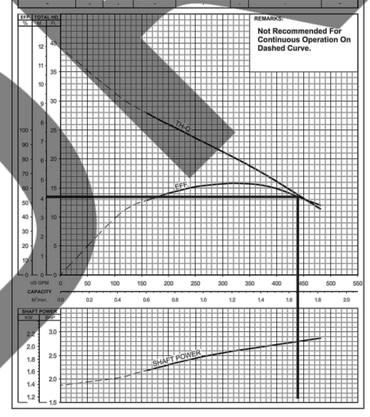
NOTE TO CONTRACTOR OR OTHERS:
1. CONDUIT INSTALLED IN FIELD TO CONTROL PANEL- *PROVIDED BY OTHERS*
2. CONDUIT, ELECTRICAL DESIGN , INSTALLATION BY OTHERS, PSI WILL PROVIDE ELECTRICAL RUBBER GROMMETS SHIPPED LOOSE FOR FIELD INSTALLATION BY OTHERS- (69" CORE HOLE FOR (6)" CONDUIT.)
3. (QTY 3) 2" CONDUIT ,(3) FOR POWER,(1) FOR LEVEL SENSING
4. *E.C.I OR OTHERS TO COORDINATE CONTROL PANEL LOCATION WITH UNDERGROUND ELECTRICAL SERVICE TO FIBERGLASS WET WELL WITHIN SPECIFIED LENGTH OF CABLE.
5. CONTROL PANEL PLACEMENT AND CONDUIT IS UP TO THE CONTRACTOR OR OTHERS TO DECIDE. CONTACT PSI 800-358-9095 TO CONFIRM AND VERIFY CORRECT CABLES LENGTHS, ACCORDING TO PLACEMENT OF THE PANEL.

PUMP MODEL: 100BZ42.2
HP 460V 3 PH FLA 4.6AMP
PERFORMANCE:
440 GPM AT 13.68 TDH

PSI pacific southwest industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
(800) 358 9095
PACKAGED LIFT STATION







Hazen-Williams Equation
Head Loss in Water Pipe

$f = 0.2083\ (100 / c)^{1.852}\ q^{1.852} / d_h^{4.8655}$

c = 150 HDPE/PVC

q = 440 GPM

dh = 3.83 for 4" SCH80

FRICTION LOSS PER 100 FT

11.24 FT

c = 150 HDPE/PVC

q = 440 GPM

dh = 5.76 for 6" SCH80

FRICTION LOSS PER 100 FT

1.54 FT

STORM LIFT STATION PROFILE & CALCULATIONS

EQUIVALENT PIPE RUN CALCULATION

6" SCH 80 PVC PIPE		20.0 FT
6" PVC SCH 80 90 ELBOW (0)	X 16 FT	0.0 FT
6" PVC SCH 80 45 BEND (1)	X 7.7 FT	7.7 FT
TOTAL EQUIVALENT LENGTH		27.7 FT
FRICTION LOSS PER 100 FT 6" PVC @ 440 GPM		1.54 FT PER 100 FT
FRICTION LOSS 6"	27.7/100 X 1.54 FT =	.93 FT
4" PVC SCH 80 PIPE		11.0 FT
4" PVC SCH 80 90 ELBOW (1)	X 10 FT	10.0 FT
4" CHECK VALVE (1)	X 26 FT	26.0 FT
4" BALL VALVE (1)	X 2.3 FT	2.3 FT
TOTAL EQUIVALENT LENGTH		49.3 FT
FRICTION LOSS PER 100 FT 4" PVC @ 440 GPM		11.24 FT PER 100 FT
FRICTION LOSS 4"	49.3/100X 11.24 FT =	5.54 FT
FRICTION LOSS .43 + 5.54		5.97 FT
STATIC HEAD		7.71 FT
TOTAL DEVELOPED HEAD		13.68 FT
PERFORMANCE 440 GPM @ 13.68 FT TDH THRU 6" PVC LINE		

MWS- STORM WATER LIFT STATION DETAILS

PSI pacific southwest industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
18541 COLLIER AVE . LAKE ELSINORE, CA 92530 PH: 800 358-9095

NOTE: VERIFY ALL ELEVATIONS PRIOR TO FABRICATION, OTHERS TO VERIFY
ALL INLET/OUTLET ORIENTATIONS PRIOR TO FABRICATION AND INSTALLATION.
*ALL PIPE OPENINGS AND SEALING SHALL BE COMPLETED IN FIELD BY OTHERS.

No.	Description	Date

LIFT STATION DETAILS
14451 MYFORD ROAD
TUSTIN, CA

Date: 01/06/21
Drawn by: CB
Checked by: OR
Scale: NTS
Sheet No. 1 OF 1

LSD-1

Last Update:2/21/23
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CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

PWQMP SITE MAP
CENTURION PLAZA
15661 RED HILL AVENUE

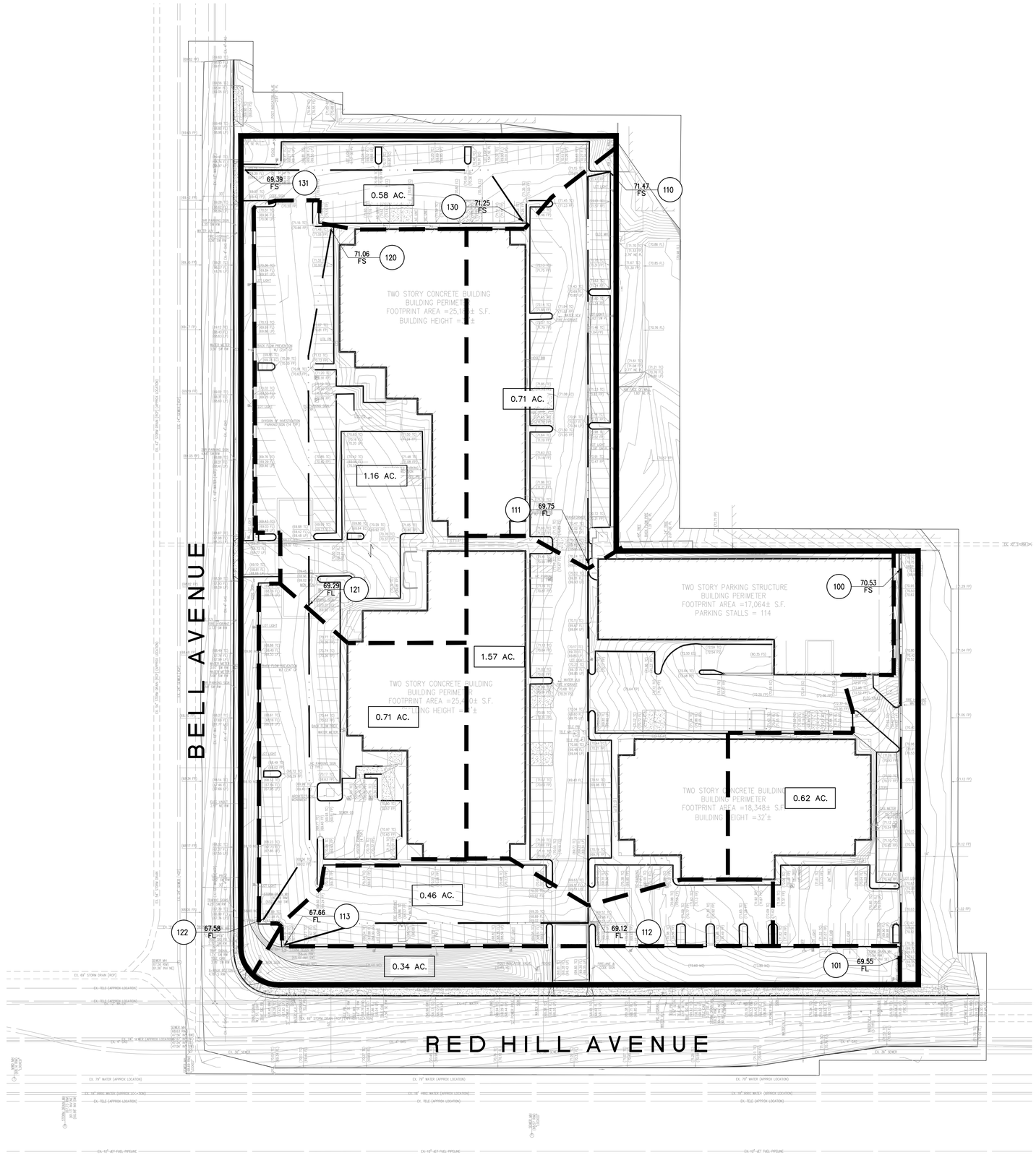
4136/ 4 OF 4 SHEETS

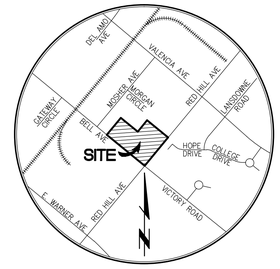
PREPARED FOR:
CENTURION PLAZA LLC
36 DEEP SEA
NEWPORT COAST, CA 92657
PHONE: (XXX) XXX-XXXX

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 4 of 4 Sheets





VICINITY MAP

N.T.S.

LEGEND	
———	PROJECT BOUNDARY
– – –	SUBAREA BOUNDARY
———	FLOW PATH
4.10 AC.	SUBAREA AREA
(100)	NODE NUMBER
———	FLOW DIRECTION

0 20 40 80 120

SCALE 1"=40'

PREPARED FOR:

Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657

CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

EXISTING HYDROLOGY MAP

CENTURION PLAZA
15661 RED HILL AVENUE, TUSTIN, CA

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. XXXXX

Sheet 1 of 1 Sheets

JN: 4136

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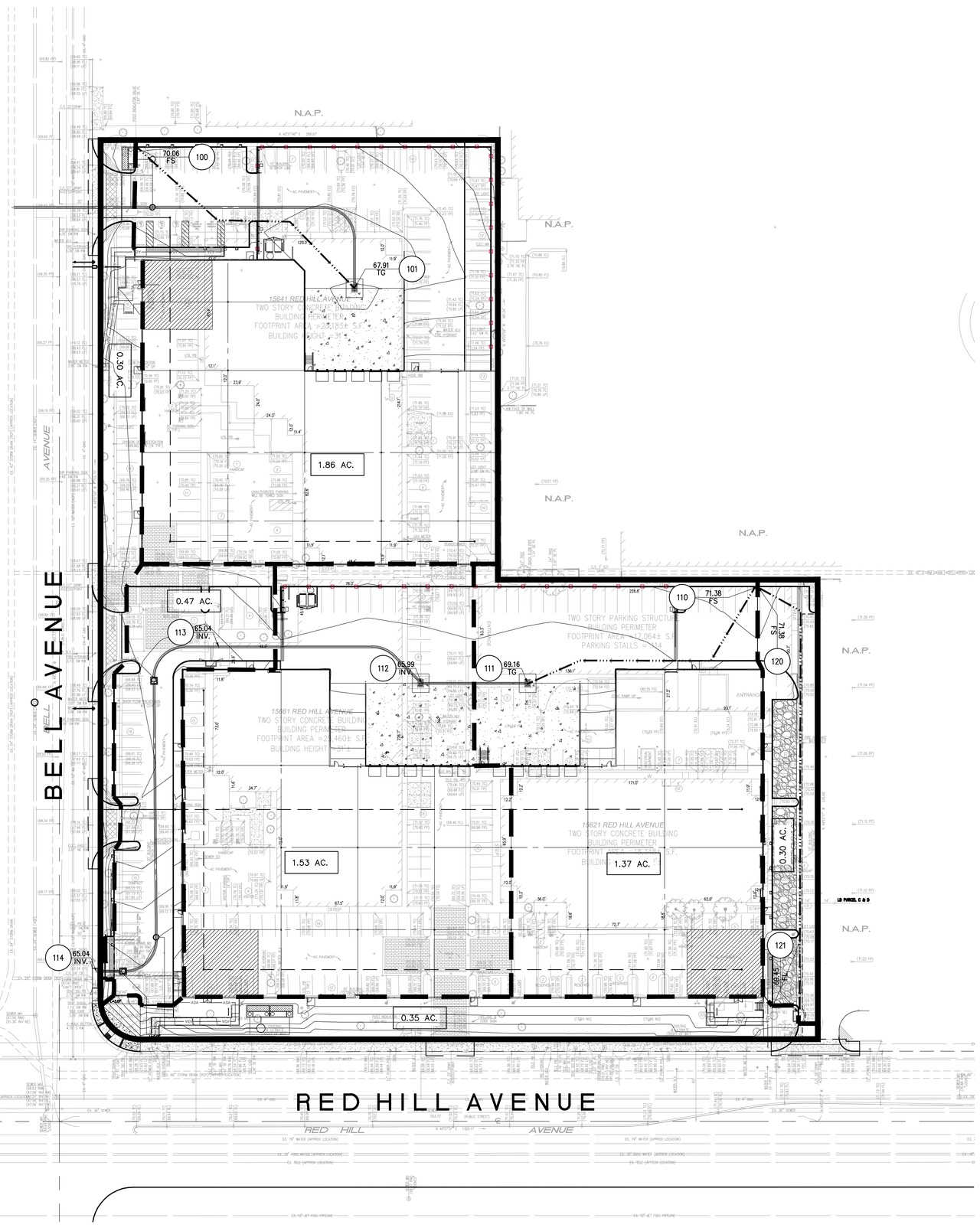

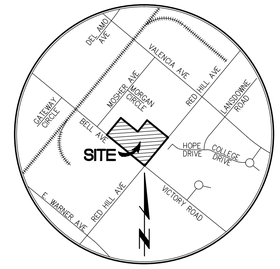

VICINITY MAP

N.T.S.

LEGEND

- PROJECT BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- 4.10 AC. — SUBAREA AREA
- 100 — NODE NUMBER
- FLOW DIRECTION

0 20 40 80 120

SCALE 1"=40'

PREPARED FOR:

Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657

CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

PRELIMINARY HYDROLOGY MAP
CENTURION PLAZA
15661 RED HILL AVENUE, TUSTIN, CA

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

Last Update: 2/7/23
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Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____

Public Works Director _____ R.C.E. _____

Sheet 1 of 1 Sheets

JN: 4136

Section VII Educational Materials

Refer to the Orange County Stormwater Program (ocwatersheds.com) for a library of materials available. For the copy submitted to the Permittee, only attach the educational materials specifically applicable to the project. Other materials specific to the project may be included as well and must be attached.

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)	☐	CASQA New and Redevelopment BMP Fact Sheets (see Attachment A).	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☐		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill	☒		☐
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	☐		☐

ATTACHMENT A
EDUCATIONAL MATERIALS

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

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

Orange County Stormwater Program

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).

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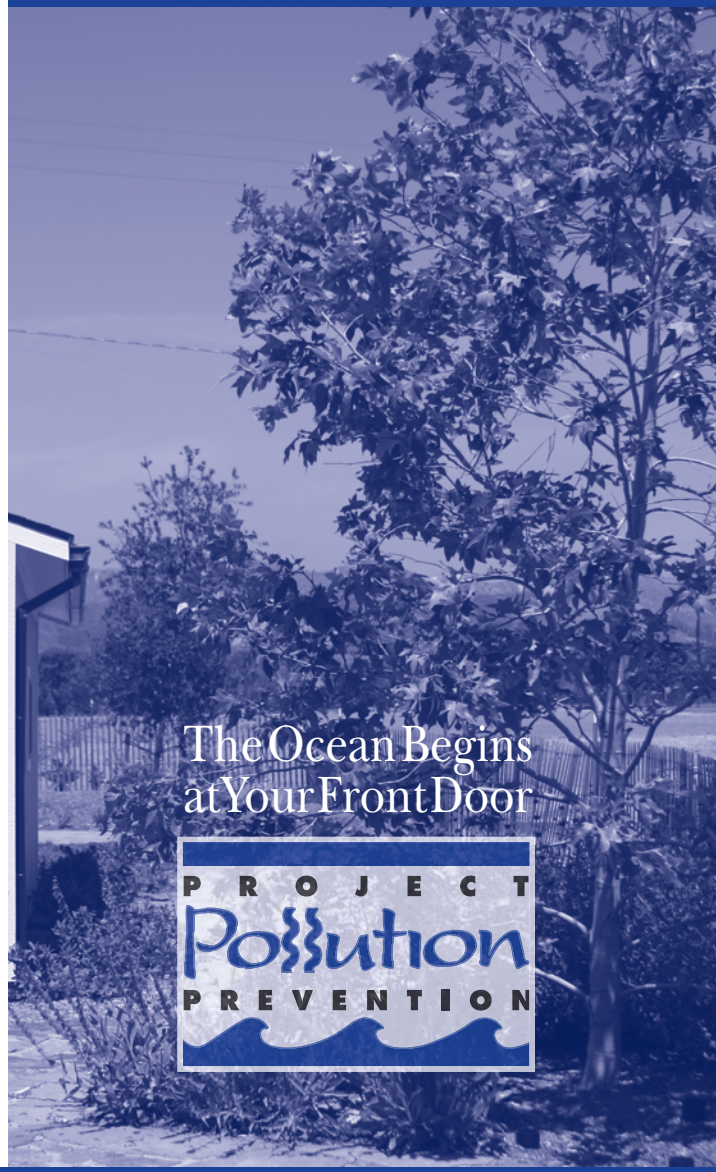
Help Prevent Ocean Pollution:

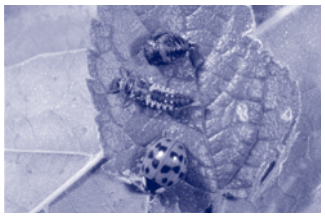
Responsible Pest Control



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.

UC CE 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.

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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

PROJECT Pollution PREVENTION
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!

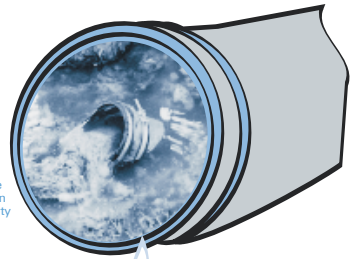
Time is of the essence in dealing with sewage spills. You are required to **immediately**:

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

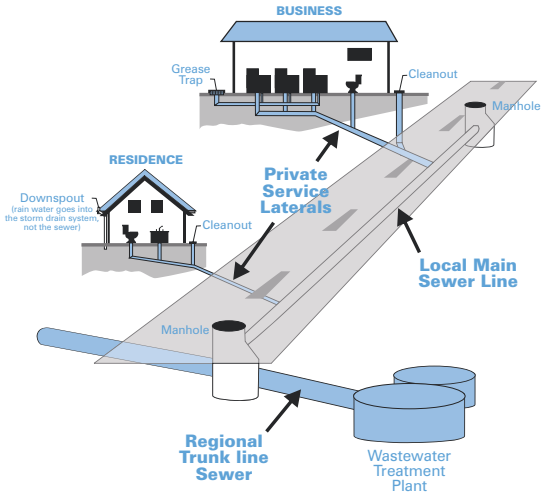
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

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

How a Sewer System Works

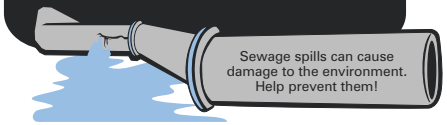
A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the 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

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

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

UCCE Master Gardener Hotline:
(714) 708-1646

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

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oclandfills.com

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Materials and excess concrete or mortar can be blown or washed into the 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 throw building materials into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

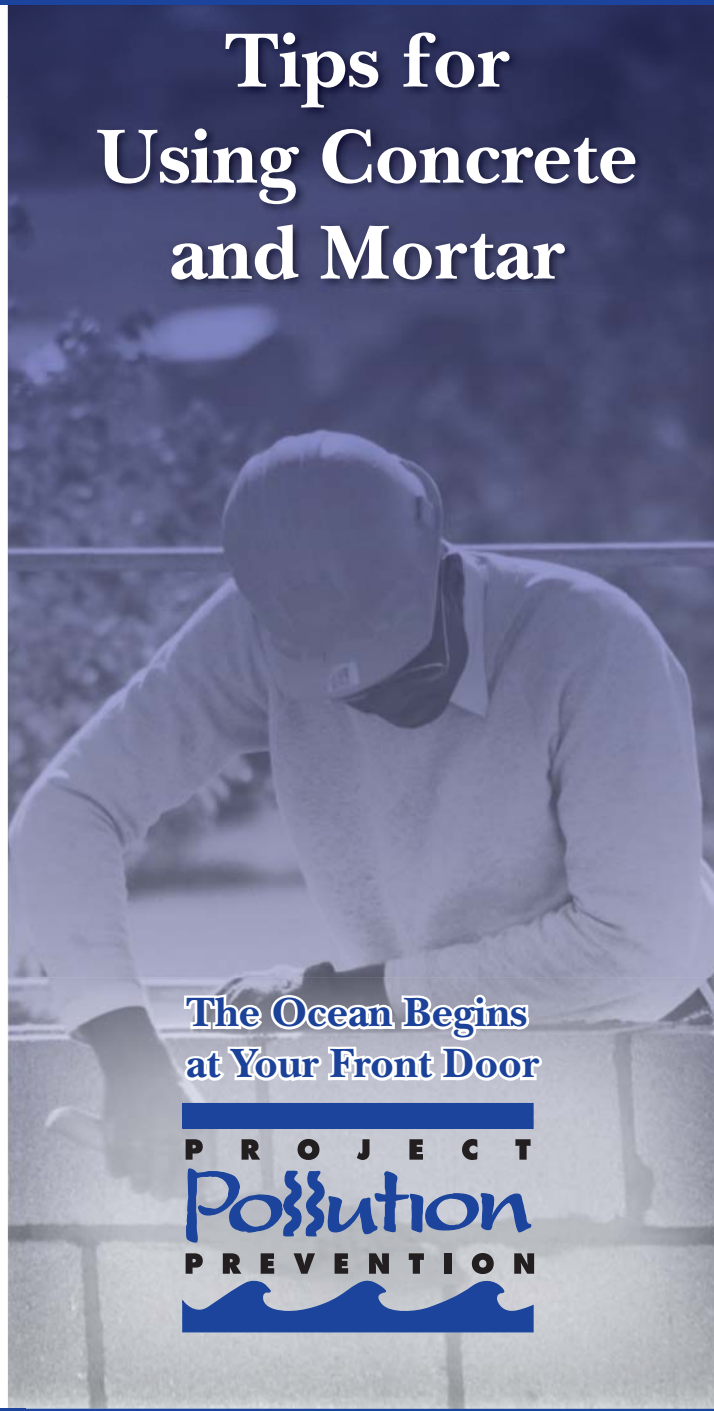
For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com.**

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

For emergencies, dial 911.

The Tips contained in this brochure provide useful information about how you can keep materials and washwater from entering the storm drain system. If you have other suggestions for how water and materials may be contained, please contact your city's stormwater representative or call the Orange County Stormwater Program.

Tips for Using Concrete and Mortar



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Using Concrete and Mortar

Never allow materials or washwater to enter the street or storm drain.

Before the Project

- Schedule projects for dry weather.
- Store materials under cover, with temporary roofs or plastic sheets, to eliminate or reduce the possibility that the materials can be carried from the project site to streets, storm drains or adjacent properties via rainfall, runoff or wind.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Take measures to block nearby storm drain inlets.

During the Project

- Set up and operate small mixers on tarps or heavy drop cloths.
- Do not mix more fresh concrete or cement than is needed for the job.

- When breaking up pavement, pick up all chunks and pieces and recycle them at a local construction and demolition recycling company. (See information to the right)
- When making saw cuts in pavement, protect nearby storm drain inlets during the saw-cutting operation and contain the slurry. Collect the slurry residue from the pavement or gutter and remove from the site.

Clean-Up

- Dispose of small amounts of dry concrete, grout or mortar in the trash.
- Never hose materials from exposed aggregate concrete, asphalt or similar treatments into a street, gutter, parking lot, or storm drain.
- Wash concrete mixers and equipment in designated washout areas where the water can flow into a containment area or onto dirt. Small amounts of dried material can be disposed of in the trash. Large amounts should be recycled at a local construction and demolition recycling company. (See information below)

- Recycle cement wash water by pumping it back into cement mixers for reuse.

Spills

- Never hose down pavement or impermeable surfaces where fluids have spilled. Use an absorbent material such as cat litter to soak up a spill, then sweep and dispose in the trash.
- Clean spills on dirt areas by digging up and properly disposing of contaminated dry soil in trash.
- Immediately report significant spills to the County's 24-Hour Water Pollution Problem Reporting Hotline at 714-567-6363 or log onto the County's website at www.ocwatersheds.com and fill out an incident reporting form.

For a list of construction and demolition recycling locations in your area visit www.ciwmb.ca.gov/Recycle/.

For additional information on how to control, prevent, remove, and reduce pollution refer to the Stormwater Best Management Practice Handbook, available on-line at www.cabmphandbooks.com.

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

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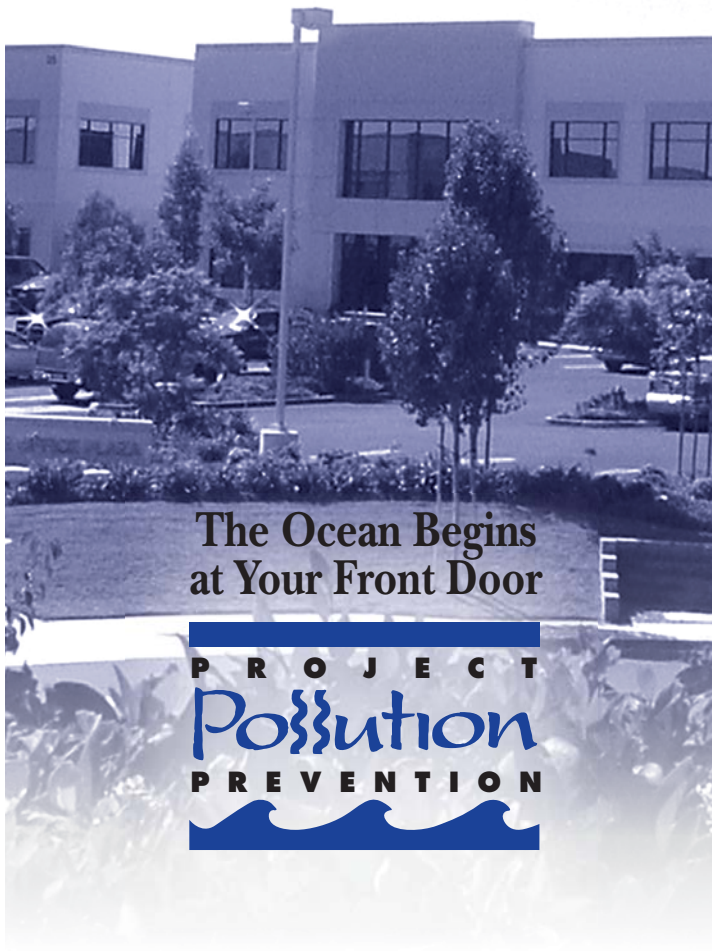
Help Prevent Ocean Pollution:

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.

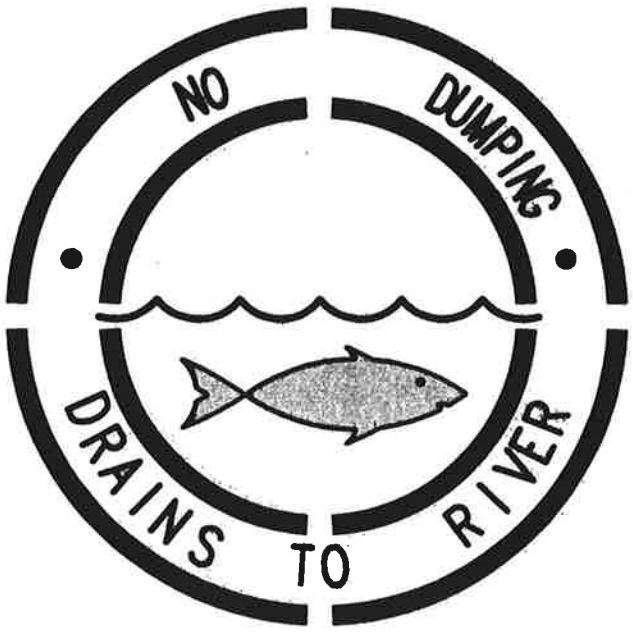
Building Maintenance

- 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



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

Non-Stormwater Discharges SC-10

Description

Non-stormwater discharges (NSWDs) are flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain if local regulations allow. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include: potable water sources, fire hydrant flushing, air conditioner condensate, landscape irrigation drainage and landscape watering, emergency firefighting, etc. as discussed in Section 2.

However there are certain non-stormwater discharges that pose an environmental concern. These discharges may originate from illegal dumping of industrial material or wastes and illegal connections such as internal floor drains, appliances, industrial processes, sinks, and toilets that are illegally connected to the nearby storm drainage system through on-site drainage and piping. These unauthorized discharges (examples of which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains.

Non-stormwater discharges will need to be addressed through a combination of detection and elimination. The ultimate goal is to effectively eliminate unauthorized non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

pollutants on streets and into the storm drain system and downstream water bodies.

Approach

Initially the Discharger must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is the elimination of unauthorized non-stormwater discharges. See other BMP Fact Sheets for activity-specific pollution prevention procedures.

General Pollution Prevention Protocols

- Implement waste management controls described in SC-34 Waste Handling and Disposal.

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled or demarcated next to them to warn against ignorant or unintentional dumping of pollutants into the storm drainage system.

- Manage and control sources of water such as hose bibs, faucets, wash racks, irrigation heads, etc. Identify hoses and faucets in the SWPPP, and post signage for appropriate use.

Non-Stormwater Discharge Investigation Protocols

Identifying the sources of non-stormwater discharges requires the Discharger to conduct an investigation of the facility at regular intervals. There are several categories of non-stormwater discharges:

- Visible, easily identifiable discharges, typically generated as surface runoff, such as uncontained surface runoff from vehicle or equipment washing; and

- Non-visible, (e.g., subsurface) discharges into the site drainage system through a variety of pathways that are not obvious.

The approach to detecting and eliminating non-stormwater discharges will vary considerably, as discussed below:

Visible and identifiable discharges

- Conduct routine inspections of the facilities and of each major activity area and identify visible evidence of unauthorized non-stormwater discharges. This may include:

  - ✓ Visual observations of actual discharges occurring;

- ✓ Evidence of surface staining, discoloring etc. that indicates that discharges have occurred;
- ✓ Pools of water in low lying areas when a rain event has not occurred; and
- ✓ Discussions with operations personnel to understand practices that may lead to unauthorized discharges.

- ☐ If evidence of non-stormwater discharges is discovered:
  - ✓ Document the location and circumstances using Worksheets 5 and 6 (Section 2 of the manual), including digital photos;
  - ✓ Identify and implement any quick remedy or corrective action (e.g., moving uncovered containers inside or to a proper location); and
  - ✓ Develop a plan to eliminate the discharge. Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge.

- ☐ Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge. Make sure the facility SWPPP is up-to-date and includes applicable BMPs to address the non-stormwater discharge.

Other Illegal Discharges (Non visible)

Illicit Connections

- ☐ Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- ☐ Isolate problem areas and plug illicit discharge points.
- ☐ Locate and evaluate discharges to the storm drain system.
- ☐ Visual Inspection and Inventory:
  - ✓ Inventory and inspect each discharge point during dry weather.
  - ✓ Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system.
  - ✓ Non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- ☐ A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.

- Inspect the path of loading/unloading area drain inlets and floor drains in older buildings.

- Never assume storm drains are connected to the sanitary sewer system.

Monitoring for investigation/detection of illegal discharges

- If a suspected illegal or unknown discharge is detected, monitoring of the discharge may help identify the content and/or suggest the source. This may be done with a field screening analysis, flow meter measurements, or by collecting a sample for laboratory analysis. Section 5 and Appendix D describe the necessary field equipment and procedures for field investigations.

- Investigative monitoring may be conducted over time. For example if, a discharge is intermittent, then monitoring might be conducted to determine the timing of the discharge to determine the source.

- Investigative monitoring may be conducted over a spatial area. For example, if a discharge is observed in a pipe, then monitoring might be conducted at accessible upstream locations in order to pinpoint the source of the discharge.

- Generally, investigative monitoring requiring collection of samples and submittal for lab analysis requires proper planning and specially trained staff.

Smoke Testing

Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two piping systems. Smoke testing is generally performed at a downstream location and the smoke is forced upstream using blowers to create positive pressure. The advantage to smoke testing is that it can potentially identify multiple potential discharge sources at once.

- Smoke testing uses a harmless, non-toxic smoke cartridges developed specifically for this purpose.

- Smoke testing requires specialized equipment (e.g., cartridges, blowers) and is generally only appropriate for specially trained staff.

- A Standard Operating Procedure (SOP) for smoke testing is highly desirable. The SOP should address the following elements:

  - ✓ Proper planning and notification of nearby residents and emergency services is necessary since introducing smoke into the system may result in false alarms;

  - ✓ During dry weather, the stormwater collection system is filled with smoke and then traced back to sources;

- ✓ Temporary isolation of segments of pipe using sand bags is often needed to force the smoke into leaking pipes; and
- ✓ The appearance of smoke in a waste vent pipe, at a sewer manhole, or even the base of a toilet indicates that there may be a connection between the sanitary and storm water systems.

- Most municipal wastewater agencies will have necessary staff and equipment to conduct smoke testing and they should be contacted if cross connections with the sanitary sewer are suspected. See SC-44 Drainage System Maintenance for more information.

Dye Testing

- Dye testing is typically performed when there is a suspected specific pollutant source and location (i.e., leaking sanitary sewer) and there is evidence of dry weather flows in the stormwater collection system.
- Dye is released at a probable upstream source location, either the facility's sanitary or process wastewater system. The dye must be released with a sufficient volume of water to flush the system.
- Operators then visually examine the downstream discharge points from the stormwater collection system for the presence of the dye.
- Dye testing can be performed informally using commercially available products in order to conduct an initial investigation for fairly obvious cross-connections.
- More detailed dye testing should be performed by properly trained staff and follow SOPs. Specialized equipment such as fluorometers may be necessary to detect low concentrations of dye.
- Most municipal wastewater agencies will have necessary staff and equipment to conduct dye testing and they should be contacted if cross connections with the sanitary sewer are suspected.

TV Inspection of Drainage System

- Closed Circuit Television (CCTV) can be employed to visually identify illicit connections to the industrial storm drainage system. Two types of CCTV systems are available: (1) a small specially designed camera that can be manually pushed on a stiff cable through storm drains to observe the interior of the piping, or (2) a larger remote operated video camera on treads or wheels that can be guided through storm drains to view the interior of the pipe.
- CCTV systems often include a high-pressure water jet and camera on a flexible cable. The water jet cleans debris and biofilm off the inside of pipes so the camera can take video images of the pipe condition.

- CCTV units can detect large cracks and other defects such as offsets in pipe ends caused by root intrusions or shifting substrate.
- CCTV can also be used to detect dye introduced into the sanitary sewer.
- CCTV inspections require specialized equipment and properly trained staff and are generally best left to specialized contractors or municipal public works staff.

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks may include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. These wastes can cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ An anonymous tip/reporting mechanism; and
  - ✓ Evidence of responsible parties (e.g., tagging, encampments, etc.).
- One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Spill and Leak Prevention and Response

- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See SC-11 Spill Prevention Control and Cleanup.

Employee Training Program

- Training of technical staff in identifying and documenting illegal dumping incidents is required. The frequency of training must be presented in the SWPPP, and depends on site-specific industrial materials and activities.
- Consider posting a quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.
- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan. Employees should be able to identify work/jobs with high potential for spills and suggest methods to reduce possibility.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- Conduct spill response drills annually (if no events occurred) in order to evaluate the effectiveness of the plan.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Quality Assurance and Record Keeping

Performance Evaluation

- Annually review internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.
- Develop document and data management procedures.
- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Annually document and report the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.
- Document training activities.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Many facilities do not have accurate, up-to-date 'as-built' plans or drawings which may be necessary in order to conduct non-stormwater discharge assessments.
  - ✓ Online tools such as Google Earth™ can provide an aerial view of the facility and may be useful in understanding drainage patterns and potential sources of non-stormwater discharges
  - ✓ Local municipal jurisdictions may have useful drainage systems maps.

- Video surveillance cameras are commonly used to secure the perimeter of industrial facilities against break-ins and theft. These surveillance systems may also be useful for capturing illegal dumping activities. Minor, temporary adjustments to the field of view of existing surveillance camera systems to target known or suspected problem areas may be a cost-effective way of capturing illegal dumping activities and identifying the perpetrators.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital facility cost requirements may be minimal unless cross-connections to storm drains are detected.
- Indoor floor drains may require re-plumbing if cross-connections are detected.
- Leaky sanitary sewers will require repair or replacement which can have significant costs depending on the size and industrial activity at the facility.

Maintenance (including administrative and staffing)

- The primary effort is for staff time and depends on how aggressively a program is implemented.
- Costs for containment, and disposal of any leak or discharge is borne by the Discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Permit Requirements

The IGP authorizes certain Non-Storm Water Discharges (NSWDs) provided BMPs are included in the SWPPP and implemented to:

- Reduce or prevent the contact of authorized NSWDs with materials or equipment that are potential sources of pollutants;
- Reduce, to the extent practicable, the flow or volume of authorized NSWDs;
- Ensure that authorized NSWDs do not contain quantities of pollutants that cause or contribute to an exceedance of a water quality standards (WQS); and,

- Reduce or prevent discharges of pollutants in authorized NSWDs in a manner that reflects best industry practice considering technological availability and economic practicability and achievability."

References and Resources

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Spill Prevention, Control & Cleanup SC-11

Description

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

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

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

Approach

General Pollution Prevention Protocols

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.
- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

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- ✓ Facility map of the locations of industrial materials;
- ✓ Notification and evacuation procedures;
- ✓ Cleanup instructions;
- ✓ Identification of responsible departments; and
- ✓ Identify key spill response personnel.

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

Spill and Leak Prevention and Response

Spill Prevention

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

- ☐ If illegal dumping is observed at the facility:

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

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

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

Preventative Maintenance

- ☐ Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.

- ☐ Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

- Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

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

- Label all containers according to their contents (e.g., solvent, gasoline).

- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).

- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

- Identify key spill response personnel.

Spill Response

- Clean up leaks and spills immediately.

- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).

- On paved surfaces, clean up spills with as little water as possible.

  - ✓ Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills.

  - ✓ If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

  - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.

- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.

- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board or local authority as location regulations dictate.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ Clean-up procedures; and
  - ✓ Responsible parties.

Employee Training Program

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and
  - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.
- Extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

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

- Date and time of the incident;
- Weather conditions;
- Duration of the spill/leak/discharge;

- Cause of the spill/leak/discharge;
- Response procedures implemented;
- Persons notified; and
- Environmental problems associated with the spill/leak/discharge.

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

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

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

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

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

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

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

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

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanges, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.

- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

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

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

Vehicle and Equipment Maintenance

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

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:

  Cover fueling area if possible.

  Use a perimeter drain or slope pavement inward with drainage to a sump.

  Pave fueling area with concrete rather than asphalt.

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

Industrial Spill Prevention Response

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

The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department).
- Develop procedures to prevent/mitigate spills to storm drain systems.
- Identify responsible departments.

- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- Address spills at municipal facilities, as well as public areas.
- Provide training concerning spill prevention, response and cleanup to all appropriate personnel.

References and Resources

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

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

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Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities

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

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

Outdoor Loading/Unloading SC-30

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by wind, stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

Good Housekeeping

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains inlets in the area.
- Grade and/or berm the loading/unloading area with drainage to sump; regularly remove materials accumulated in sump.

Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date or have an emergency spill cleanup plan readily available, as applicable.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all employees.
- Ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Material Handling and Waste Management

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

- Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the storm drain or sanitary sewer.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- Post "no littering" signs.
- Perform work area clean-up and dry sweep after daily operations.

Employee Training Program

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document activities performed, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.
- Keep accurate logs of daily clean-up operations.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
  - ✓ Designate specific areas for outdoor loading and unloading.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.
- It may not be possible to conduct transfers only during dry weather.
  - ✓ Limit materials and equipment rainfall exposure to all extents practicable.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

Many facilities will already have indoor or covered areas where loading/unloading takes place and will require no additional capital expenditures.

If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.

Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.

- Conduct regular inspections and make repairs and improvements as necessary.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area. Do not wash with water.

Supplemental Information

Loading and Unloading of Liquids

- Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer,

treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - ✓ The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - ✓ The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.
  - ✓ The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
  - ✓ Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
  - ✓ Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

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Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Outdoor Equipment Operations SC-32

Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, and solid waste treatment and disposal are examples of process operations that can lead to contamination of stormwater runoff. The targeted constituents will vary for each site depending on the operation being performed.

Approach

Implement source control BMPs to limit exposure of outdoor equipment to direct precipitation and stormwater run-on. Refer to SC-22 Vehicle and Equipment Repair for additional information.

General Pollution Prevention Protocols

- ☐ Perform the activity during dry periods whenever possible.
- ☐ Install secondary containment measures where leaks and spills may occur.
- ☐ Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.
- ☐ Connect process equipment area to public sanitary sewer or facility wastewater treatment system when possible. Some jurisdictions require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Good Housekeeping

- ☐ Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.

Objectives
■ Cover
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Cover the work area with a permanent roof if possible.
- Use drop cloths for sanding and painting operations.
- Use a vacuum for fine particle clean-up in pavement cracks and crevices.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (run-on prevention).
- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Use roll down or permanent walls when windy/breezy to prevent wind transport of particulates/pollutants.

Preventative Maintenance

- Design outdoor equipment areas to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump.
- Dry clean the work area regularly. Do not wash outdoor equipment with water if there is a direct connection to the storm drain.
- Pave area with concrete rather than asphalt.
- Inspect outdoor equipment regularly for leaks or spills. Also check for structural failure, spills and overfills due to operator error, and/or failure of piping system.
- Inspect and clean, if necessary, storm drain inlets and catch basins within the outdoor equipment area before October 1 each year.

Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Prevent operator errors by using engineering safe guards and thus reducing accidental releases of pollutant.

Material Handling and Waste Management

- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drain or sewer connections.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees on proper equipment operation and maintenance procedures.
- Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Ensure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for outdoor equipment, types and quantities of materials removed and disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Providing cover over outdoor equipment may be impractical or cost-prohibitive.
  - ✓ Operate outdoor equipment only during periods of dry weather.
- Regular operations and time limitations may require outdoor activities during wet weather.
  - ✓ Designate specific areas for outdoor activities.
  - ✓ Allow time for work area clean-up after each shift.
  - ✓ Require employees to understand and follow preventive maintenance and spill and leak prevention BMPs.
  - ✓ Design and install secondary containment and good housekeeping BMPs for outdoor equipment area.
- Storage sheds often must meet building and fire code requirements.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Many facilities will already have indoor covered areas where vehicle and equipment repairs take place and will require no additional capital expenditures.
- If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- Routine cleanout of oil and grease is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.

References and Resources

Minnesota Pollution Control Agency. *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315*. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Oregon Department of Environmental Quality, *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*, February 2013. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: Best Management Practices. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Waste Handling & Disposal SC-34

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Accomplish reduction in the amount of waste generated using the following source controls:
  - ✓ Production planning and sequencing;
  - ✓ Process or equipment modification;
  - ✓ Raw material substitution or elimination;
  - ✓ Loss prevention and housekeeping;
  - ✓ Waste segregation and separation; and
  - ✓ Close loop recycling.
- ☐ Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- ☐ Recycle materials whenever possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Use the entire product before disposing of the container.
- To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.
- Provide containers for each waste stream at each work station. Allow time after shift to clean area.

Good Housekeeping

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain. Clean in a designated wash area that drains to a clarifier.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Preventative Maintenance

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.

- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, vacuuming, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Spill Response and Prevention Procedures

- Keep your spill prevention and plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - ✓ Vehicles equipped with baffles for liquid waste; and
  - ✓ Trucks with sealed gates and spill guards for solid waste.

Material Handling and Waste Management

Litter Control

- Post “No Littering” signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.

- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.
- Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.
- If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315,* Revised. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

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Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: Best Management Practices. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL and 303(d) list pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests

Objectives
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	

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by methods that pose a lower risk to employees, the public, and the environment.

- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies
- Procedures
  - ✓ Standard operating procedures (SOPs);
  - ✓ Purchasing guidelines and procedures; and
  - ✓ Bid packages (services and supplies).
- Materials
  - ✓ Preferred or approved product and supplier lists;
  - ✓ Product and supplier evaluation criteria;
  - ✓ Training sessions and manuals; and
  - ✓ Fact sheets for employees.

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC-20 – SC-22) and SC-41 Building and Grounds Maintenance.

Employee Training Program

- Employees who handle potentially harmful materials should be trained in the use of safer alternatives.
- Purchasing departments should be trained on safer alternative products and encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.
- Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources provided in this fact sheet.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds"

- Alternative products may not be available, suitable, or effective in every case.

- ✓ Minimize use of hazardous/harmful products if no alternative product is available.

Regulatory Considerations

This BMP has no regulatory requirements unless local/municipal ordinance applies. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements;
- Storm water runoff sampling requirements;
- Training and licensing requirements; and
- Record keeping and reporting requirements.

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.
- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Refined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes with low VOC content are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps.

All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.

- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting. Use paper products with post-consumer recycled content and implement electric had dryers.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control, http://www.dtsc.ca.gov/PollutionPrevention/GreenTechnology/Index.cfm.

CalRecycle, http://www.calrecycle.ca.gov/Business/Regulated.htm.

City of Santa Monica Office of Sustainability and Environment, http://www.smgov.net/departments/ose/.

City of Palo Alto, http:// www.city.palo-alto.ca.us/cleanbay.

City and County of San Francisco, Department of the Environment, http://www.sfenvironment.org/toxics-health/greener-business-practices.

Green Business Program, http://www.greenbiz.ca.gov/GRlocal.html .

Product Stewardship Institute, http://www.productstewardship.us/index.cfm.

Sacramento Clean Water Business Partners. http://www.sacstormwater.org/CleanWaterBusinessPartners/CleanWaterBusinessPartners.html.

USEPA. National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges From Industrial Facilities, http://cfpub.epa.gov/npdes/stormwater/indust.cfm.

USEPA Region IX Pollution Prevention Program, http://www.epa.gov/region9/waste/p2/business.html.

Western Sustainability and Pollution Prevention Network, http://wsppn.org/.

Metals (mercury, copper)

National Electrical Manufacturers Association – Environmental Stewardship, http://www.nema.org/Policy/Environmental-Stewardship/pages/default.aspx.

Sustainable Conservation, http://www.suscon.org.

Auto Recycling Project

Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center, http://www.birc.org.

California Department of Pesticide Regulation, http://www.cdpr.ca.gov/dprprograms.htm.

University of California Statewide IPM Program, http://www.ipm.ucdavis.edu/default.html.

Dioxins

Bay Area Dioxins Project, http://www.abag.ca.gov/bayarea/dioxin/project_materials.htm.

Building & Grounds Maintenance SC-41

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Switch to non-toxic chemicals for maintenance to the maximum extent possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Encourage proper lawn management and landscaping, including use of native vegetation.
- ☐ Encourage use of Integrated Pest Management techniques for pest control.
- ☐ Encourage proper onsite recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.

Good Housekeeping

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.

- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.

- If you are pressure washing on a grassed 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 grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures on exposed soils. See also SC-40, Contaminated and Erodible Areas, for more information.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

- 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.

- Clean paintbrushes 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.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and

solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Building & Grounds Maintenance SC-41

Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Material Handling and Waste Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Dispose of empty pesticide containers according to the instructions on the container label.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Employee Training Program

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the needs of individual staff.

Quality Assurance and Record Keeping

- Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

Site fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

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US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: http://www.epa.gov/region6/6en/h/handbk4.pdf.

Ventura Countywide Stormwater Management Program Clean Business Fact Sheets. Available online at: http://www.vcstormwater.org/documents/programs_business/building.pdf.

Building Repair and Construction SC-42

Description

Site modifications are common, particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and minor construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

This fact sheet is intended to be used for minor repairs and construction. If major construction is required, the guidelines in the Construction BMP Handbook should be followed.

Approach

The BMP approach is to reduce potential for pollutant discharges through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.
- ☐ Avoid outdoor repairs and construction during periods of wet weather.
- ☐ Use safer alternative products to the maximum extent practicable. See also SC-35 Safer Alternative Products for more information.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	✓
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Buy recycled products to the maximum extent practicable.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.
- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Good Housekeeping

Repair & Remodeling

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep and vacuum the area regularly to remove sediments and small debris.
- Cover raw materials of particular concern that must be left outside, particularly during the rainy season. See also SC-33 Outdoor Storage of Raw Materials for more information.
- Use equipment and tools such as bag sanders to reduce accumulation of debris.
- Limit/prohibit work on windy days; implement roll-down walls or other measures to reduce wind transport of pollutants.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store liquid materials properly that are normally used in repair and remodeling such as paints and solvents. See also SC-31 Outdoor Liquid Container Storage for more information.
- Sweep out rain gutters or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed. See also SC-44 Drainage System Maintenance for more information.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100 percent effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose of the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Material Handling and Waste Management

- Post “No Littering” signs and enforce anti-litter laws.

- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.
- Make sure that hazardous waste is collected, removed, and disposed of properly. See also SC-34, Waste Handling and Disposal for more information.

Sediment and Erosion Controls

- Limit disturbance to bare soils and preserve natural vegetation whenever possible. See also EC-2, Preservation of Existing Vegetation, in the Construction BMP Handbook.
- Stabilize loose soils by re-vegetating whenever possible. See also EC-4 Hydroseeding, in the Construction BMP Handbook.
- Utilize non-vegetative stabilization methods for areas prone to erosion where vegetative options are not feasible. Examples include:
  - ✓ Areas of vehicular or pedestrian traffic such as roads or paths;
  - ✓ Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
  - ✓ Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
  - ✓ Areas where vegetation will not grow adequately within the construction time frame.

  There are several non-vegetative stabilization methods and selection should be based on site-specific conditions. See also EC-16 Non-Vegetative Stabilization, in the Construction BMP Handbook.

- Utilize chemical stabilization when needed. See also EC-5 Soil Binders, in the Construction BMP Handbook.
- Use geosynthetic membranes to control erosion if feasible. See also EC-7 Geotextiles and Mats, in the Construction BMP Handbook.
- Stabilize all roadways, entrances, and exits to sufficiently control discharges of erodible materials from discharging or being tracked off the site. See also TC 1-3 Tracking Control, in the Construction BMP Handbook.
- Refer to the supplemental information provided below for projects that involve more extensive soil disturbance activities.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly implement the source control BMPs described above. Detailed information for Sediment and Erosion Control BMPs is provided in the Construction BMP Handbook.
- Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about pollutant source control responsibilities.
- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for building repair and construction, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more extensive requirements for larger projects that would disturb one or more acres of surface.
  - ✓ Refer to the companion "Construction Best Management Practice Handbook" which contains specific guidance and best management practices for larger-scale projects.

- Time constraints may require some outdoor repairs and construction during wet weather.
  - ✓ Require employees to understand and follow good housekeeping and spill and leak prevention BMPs.
  - ✓ Inspect sediment and erosion control BMPs daily during periods of wet weather and repair or improve BMP implementation as necessary.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
  - ✓ Minimize use of hazardous materials to the maximum extent practicable.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.
- Prices for recycled/safer alternative materials and fluids may be higher than those of conventional materials.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Limited capital investments may be required at some sites if adequate cover and containment facilities do not exist for construction materials and wastes.
- Purchase and installation of erosion and sediment controls, if needed will require additional capital investments, and this amount will vary depending on site characteristics and the types of BMPs being implemented.
- Minimize costs by maintaining existing vegetation and limiting construction operations on bare soils.

Maintenance

- The erosion and sediment control BMPs described above require periodic inspection and maintenance to remain effective. The cost of these actions will vary depending on site characteristics and the types of BMPs being implemented.
- Irrigation costs may be required to establish and maintain vegetation.

Supplemental Information

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

Building Repair and Construction SC-42

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

California Stormwater Quality Association, 2012. *Construction Stormwater Best Management Practice Handbook*. Available at http://www.casqa.org.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

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US EPA. *Construction Site Stormwater Runoff Control*. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4.

Parking Area Maintenance SC-43

Description

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

BMPs for other outdoor areas on site (loading/unloading, material storage, and equipment operations) are described in SC-30 through SC-33.

Approach

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

General Pollution Prevention Protocols

- Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.
- Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.
- Post "No Littering" signs and enforce anti-litter laws.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ☐ Provide an adequate number of litter receptacles.
- ☐ Clean out and cover litter receptacles frequently to prevent spillage.

Preventative Maintenance

Inspection

Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.

- ☐ Inspect cleaning equipment/sweepers for leaks on a regular basis.

Surface Cleaning

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

Surface Repair

- ☐ Check local ordinance for SUSMP/LID ordinance.
- ☐ Preheat, transfer or load hot bituminous material away from storm drain inlets.
- ☐ Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- ☐ Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in

place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control during sweeping to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Spill Response and Prevention Procedures

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

Employee Training Program

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

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the amount of BMPs required.

Maintenance

- Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the Treatment Control Fact Sheets and the New Development and Redevelopment Manual for more information.

- When possible, direct sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

California Stormwater Quality Association, 2003. *New Development and Redevelopment Stormwater Best Management Practice Handbook*. Available online at: https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook.

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Drainage System Maintenance SC-44

Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the offsite conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

Approach

Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.
- ☐ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

Good Housekeeping

Illicit Connections and Discharges

- ☐ Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ✓ Identify evidence of spills such as paints, discoloring, odors, etc.
- ✓ Record locations of apparent illegal discharges/illicit connections.
- ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- ✓ Eliminate the discharge once the origin of flow is established.

- ☐ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- ☐ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

Illegal Dumping

- ☐ Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- ☐ Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills); and
  - ✓ Responsible parties.
- ☐ Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- ☐ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

Preventative Maintenance

Catch Basins/Inlet Structures

- ☐ Staff should regularly inspect facilities to ensure compliance with the following:
  - ✓ Immediate repair of any deterioration threatening structural integrity.
  - ✓ Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Prioritize storm drain inlets; clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Wildlife. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Army Corps of Engineers and USFWS.

Spill Response and Prevention Procedures

- Keep your spill prevention control plan up-to-date.

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - ✓ OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - ✓ OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
  - ✓ Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system including how wastes were cleaned up and disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Provided below are typical limitations and recommended "work-arounds" for drainage system maintenance:

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

  - ✓ Perform all maintenance onsite and do not flush accumulated material downstream to private property or riparian habitats.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, and liquid/sediment disposal.

  - ✓ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

  - ✓ Do not dump illegal materials anywhere onsite.

  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.

  - ✓ Cleanup spills immediately and properly dispose of wastes.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.

  - ✓ Collect all materials and pollutants accumulated in drainage system and dispose of according to local regulations.

  - ✓ Install debris excluders in areas with a trash TMDL.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential .

- Developing and implementing a site specific drainage system maintenance plan will require additional capital if a similar program is not already in place.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Supplemental Information

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used if allowed or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

Knox County Tennessee *Stormwater Management Manual* Chapter 5 Drainage System Maintenance, 2008. Available online at: http://www.knoxcounty.org/stormwater/manual/Volume%201/knoxco_swmm_v1_chap5_jan2008.pdf.

US EPA. Storm Drain System Cleaning, 2012. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=102.

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

- Signage on top of curbs tends to weather and fade.

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

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

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be comparable and equally effective.

Redeveloping Existing Installations

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

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

ATTACHMENT B
O&M PLAN

Operations and Maintenance (O&M) Plan

Water Quality Management Plan
for

“Centurion Plaza”

Location: Bell Ave and Red Hill Avenue

APN: 430-233-19

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
	Non-Structural Source Control BMPs		
Yes	**N1. Education for Property Owners, Tenants and Occupants** The owners will provide the first tenants with information concerning good housekeeping practices that contribute to protection of storm water quality. Please see Section VII for educational materials.	Start up to begin immediately after construction is completed. Maintenance Schedule: The owner will check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants. Employees shall be trained to clean up spills and participate in ongoing maintenance. The project site will have annual employee training and new hires within 1 month.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Yes	**N2. Activity Restrictions** Conditions, Covenants and Restrictions (CC&R's) will identify restricting or prohibiting activities once the project is operational. These activities include, but will not be limited to: •Prohibit discharges of fertilizer, pesticides, or animal wastes to streets or storm drains. •Prohibit blowing or sweeping of debris (leaf litter, grass clippings, litter, etc.) into streets or storm drains. •Requirement to keep trash receptacles covered or sheltered by a roof overhang or canopy. •Prohibit vehicle washing, maintenance, or repair on the premises.	Start up to begin immediately after construction is completed. Activity restriction will be enforced daily.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Yes	**N3. Common Area Landscape Management** Maintenance of the landscaping shall be done weekly. Irrigation must be consistent with City's Water Conservation Ordinance. Fertilizer and pesticide usage will be consistent with County Management Guidelines for Use of Fertilizers and Pesticides.	Start up upon completion of landscaping. 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.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**N4. BMP Maintenance** BMP maintenance, implementation schedules, and responsible parties are included with each specific BMP narrative.	Start up to begin immediately after construction and all BMP's are completed. Modular Wetlands Systems to be inspected and maintained as detailed under "Treatment Control BMPs" of this O&M Plan (see pages 8-10 of 10).	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
No	**N5. Title 22 CCR Compliance** If future occupants store hazardous materials, they must comply with all Title 22 CCR regulations.	N/A	N/A
No	**N6. Local Industrial Permit Compliance** Statewide IGP (only applicable if not exempt through NEC).	N/A	N/A
Yes	**N7. Spill Contingency Plan** Spill contingency plans apply to those facilities having bulk liquid storage in tanks or drums. A spillage control plan will be established following the guidelines and to handle smaller potential spills. Each user may need to update or revise spillage control plan to reflect onsite use of liquids, if any.	Inspection and maintenance will start when construction is complete. Daily inspection and maintenance throughout the project site.	Specially trained disposal company for recycled wastes.
No	**N8. Underground Storage Tank Compliance** Not applicable. There will be no underground storage tanks on-site.	N/A	N/A
No	**N9. Hazardous Materials Disclosure Compliance** Site will be in compliance with ordinances typically enforced by respective fire protection agency for the management of hazardous materials. The Orange County, Health care agencies, and/or other appropriate agencies (i.e. Department of Toxics Substances Control is typically responsible for enforcing hazardous materials and hazardous waste handling and disposal regulations.	Inspection and maintenance as necessary	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**N10. Uniform Fire Code Implementation** Site will be in compliance with article 80 of the Uniform Fire Code enforced by fire protection agency.	Inspection and maintenance as necessary	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Yes	**N11. Common Area Litter Control** Employees, gardeners, and the property manager will help keep the site free of trash and other debris. It will be the owner's responsibility for having the site inspected weekly and cleaned as necessary.	The site shall be inspected weekly with ongoing maintenance.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Yes	**N12. Employee Training** The owner will prepare guidelines for the tenant and their employees discussing both structural and non-structural BMP's and how to implement them. See Educational Materials and Attachment E in this report.	Start up to begin immediately after construction is completed. The owner will check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants. Employees shall be trained to clean up spills and participate in ongoing maintenance. The project site will have annual employee training and new hires within 1 month.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**N13. Housekeeping of Loading Docks** Employees and the property manager will help keep the loading docks free of trash and other debris. It will be the owner's responsibility for having the loading docks inspected weekly and cleaned as necessary.	Loading/unloading docks will be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers. On-going.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Yes	**N14. Common Area Catch Basin Inspection** The owner/maintenance contractor will be responsible for cleaning the catch basins on-site on a regular basis prior to the storm season, no later than October 1st of each year.	Maintenance to begin upon completion of storm drain system. Catch basins and storm drain system will be cleaned at least twice a year and prior to October 1.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Yes	**N15. Street Sweeping Private Streets and Parking Lots** The owner/maintenance contractor will have the private drive swept. Hosing or watering of the site will not be permitted as a method of cleaning.	Start up upon completion of the paving. Parking lots and drive isles will be swept or vacuumed at least quarterly, October 1, January 1, April 1 and July 1 and as necessary. If there is any trash or debris in between the routine sweeping it will be swept or vacuumed immediately.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
No	**N16. Retail Gasoline Outlet** Site is not a retail gasoline outlet.	N/A	N/A

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Structural Source Control BMPs			
Yes	**S1. Provide Storm Drain System Stenciling and Signage** All storm drain inlets and catch basins shall have stenciling or labeling such as "No Dumping – Drains to Ocean" and/or other graphical icons to alert the public to the destination of pollutants discharged into stormwater. The County or City can be contacted to determine specific requirements for placards types and methods of application	Implementation will begin when construction is complete. In addition, legibility of stencils and signs must be maintained/repaired immediately. The owner/ or maintenance contractor shall inspect signage for legibility at least twice a year.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
No	**S2. Design Outdoor Hazardous Material Storage Areas to Reduce Pollutant Introduction** N/A		
Yes	**S3. Design Trash Enclosures to Reduce Pollutant Introduction** Trash/Waste/Recycle storage areas will be incorporated on the site. The trash enclosure areas will be paved with an impervious surface to mitigate spills. The trash container lids will remain closed. Canopy provided over enclosure to prevent windblown debris and to prevent contact with rainfall. In addition, storm water runoff from adjoining roofs and pavement must be diverted around the trash area and signs should be posted informing users that only trash and recyclable waste are to be discarded in these bins.	Start up to begin immediately after construction is completed. Weekly inspection, cleaning and sweeping of trash area by property owner. Trash to be removed weekly or more as needed.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Yes	**S4. Use Efficient Irrigation Systems and Landscape Design** Irrigation of the landscaping shall be implemented as indicated on the approved landscape drawings and be consistent with the City's Water Conservation Ordinance. The irrigation system shall have rain shutoff controls as well as a programmable timer. Short irrigation cycles should be used to meet with the plant/landscaping needs.	System shall be inspected (by the owner/ or maintenance contractor) once a month to check for over watering, broken sprinkler heads or lines, and excessive runoff onto paved areas.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
No	**S5. Protect Slopes and Channels** N/A		

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**S6. Loading Dock Areas** Loading/unloading docks will be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers.	Weekly inspection, cleaning and sweeping of trash; immediate clean up of spills is required. Keep docks property maintained.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
No	**S7. Maintenance Bays and Docks** N/A		
No	**S8. Vehicle Wash Areas** N/A		
No	**S9. Outdoor Processing Areas** N/A		
No	**S10. Equipment Wash Areas** N/A		
No	**S11. Fueling Areas** N/A		
No	**S12. Site Design and Landscape Planning (Hillside Landscaping)** N/A		
No	**S13. Wash Water Controls for Food Preparation Areas** N/A		
No	**S14. Community Car Wash Racks** N/A		

BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Low Impact Development BMPs		
Treatment Control BMP BIO-7: Proprietary Biotreatment	Description of BMP: The Modular Wetlands will be utilized as bioretention treatment of storm water runoff from the project site. Runoff passes through the system horizontally, with planted material at the surface. Start-up date: When installation is completed. Maintenance Schedule: Pollutant loading varies greatly from site to site and no two sites are the same. Therefore, the first year requires inspection monthly during the wet-season and every other month during the dry season in order to observe and record the amount of pollutant loading the system is receiving. Then a site-specific inspection and maintenance frequency can be established. complete.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX

BMP Name and BMP Implementation,	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation &
Pre-Treatment/Gross Solids Removal BMPs		
Pre-Treatment and Trash Amendment Connector Pipe Screen (CPS)	Description of BMP: CPS devices will need to be inspected. Inspect the inflow of the catch basin where the CPS is located. Check for any obstructions to inflow of the CB and remove if any. Remove the manhole cover to estimate the amount and types of debris found in the CB. Look for any visual signs of damage that may compromise the CB to function properly. Inspect for any standing water as well as for large amounts of sediment and debris surrounding the CPS device. If standing water and high sediment volume is found, remove water, sediment and debris by vacuum truck or by other debris removal methods. Start-up date: When storm drain system is complete. Maintenance Schedule: Routine inspection and maintenance intervals for all CPS devices are twice per year for inspections and once per year for maintenance service. CPS devices may require more frequent maintenance service if the device is located in a high debris loading drainage area. In such cases, the CPS device may require more frequent inspection and maintenance service, which could range from twice per year to monthly inspection and maintenance service depending on pollutant load conditions. CPS devices shall be maintained late summer/early fall prior to the start of the rainy season.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX
Sump Pump	Description of BMP: 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. Start-up date: When storm drain system is complete. Maintenance Schedule: Semi-annually (October 1st and February 1st) through maintenance service contract with the vendor or equally qualified contractor.	**Owner** Name: Mike Moshayedi Title: [TITLE HERE] Company: Centurion Plaza LLC Tel: (949) XXX-XXXX

Required Permits

See attachments for the operation, and maintenance of the BMPs. Permit for connection to sanitary sewer will be required.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

Recordkeeping

All records must be maintained for at least five (5) years and must be made available for review upon request.

Maintenance Funding Mechanism

See Attachment E of WQMP report for *"Covenant and Agreement Regarding O & M Plan to Fund and Maintain Water Quality BMPs, Consent to Inspect, and Indemnification."*

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed
BIO-7: Proprietary Biotreatment	
Connector Pipe Screen (CPS)	
Sump Pump	

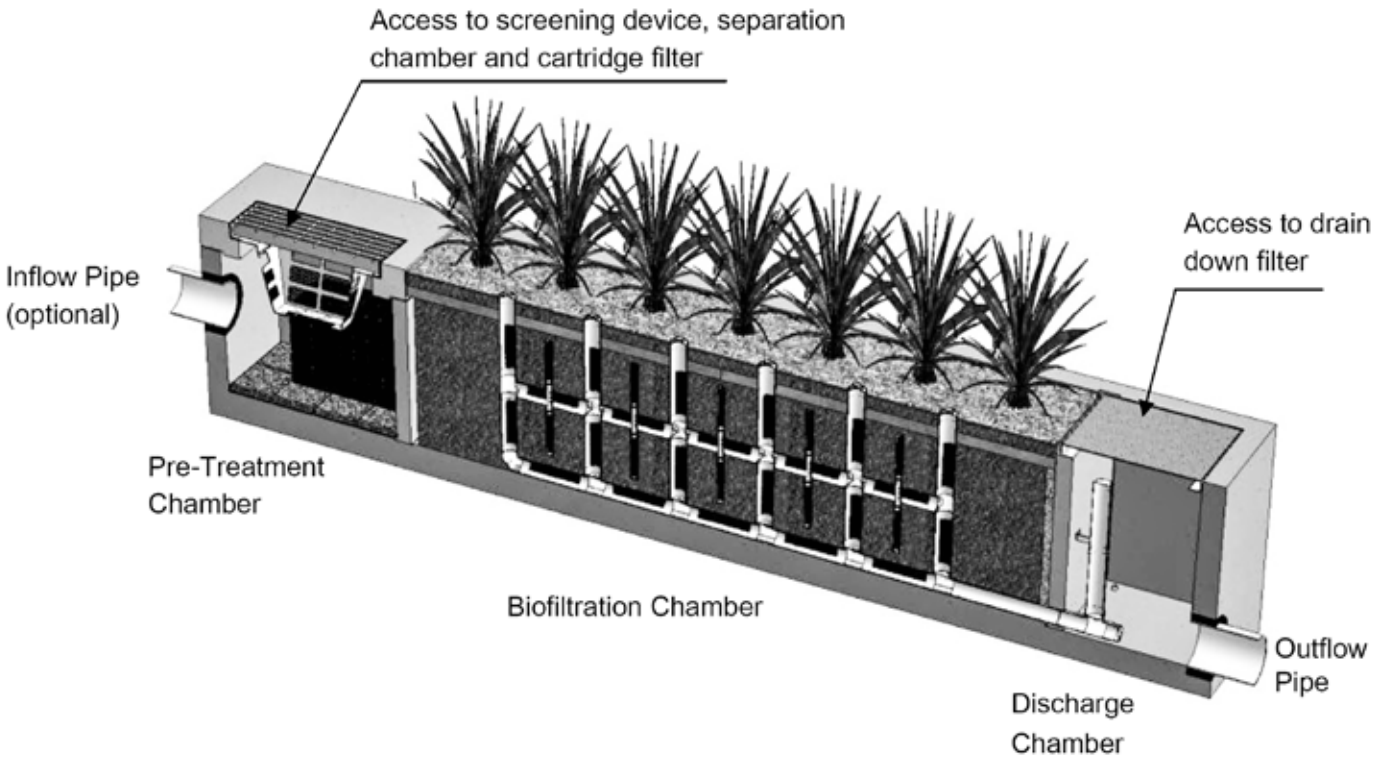
CONTECH®
ENGINEERED SOLUTIONS

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.

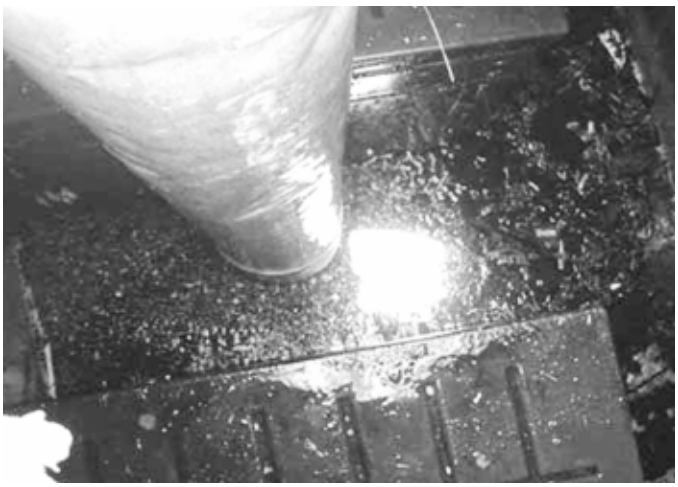
Maintenance Procedure Illustration

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.

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Inspection Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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 _____

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 _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

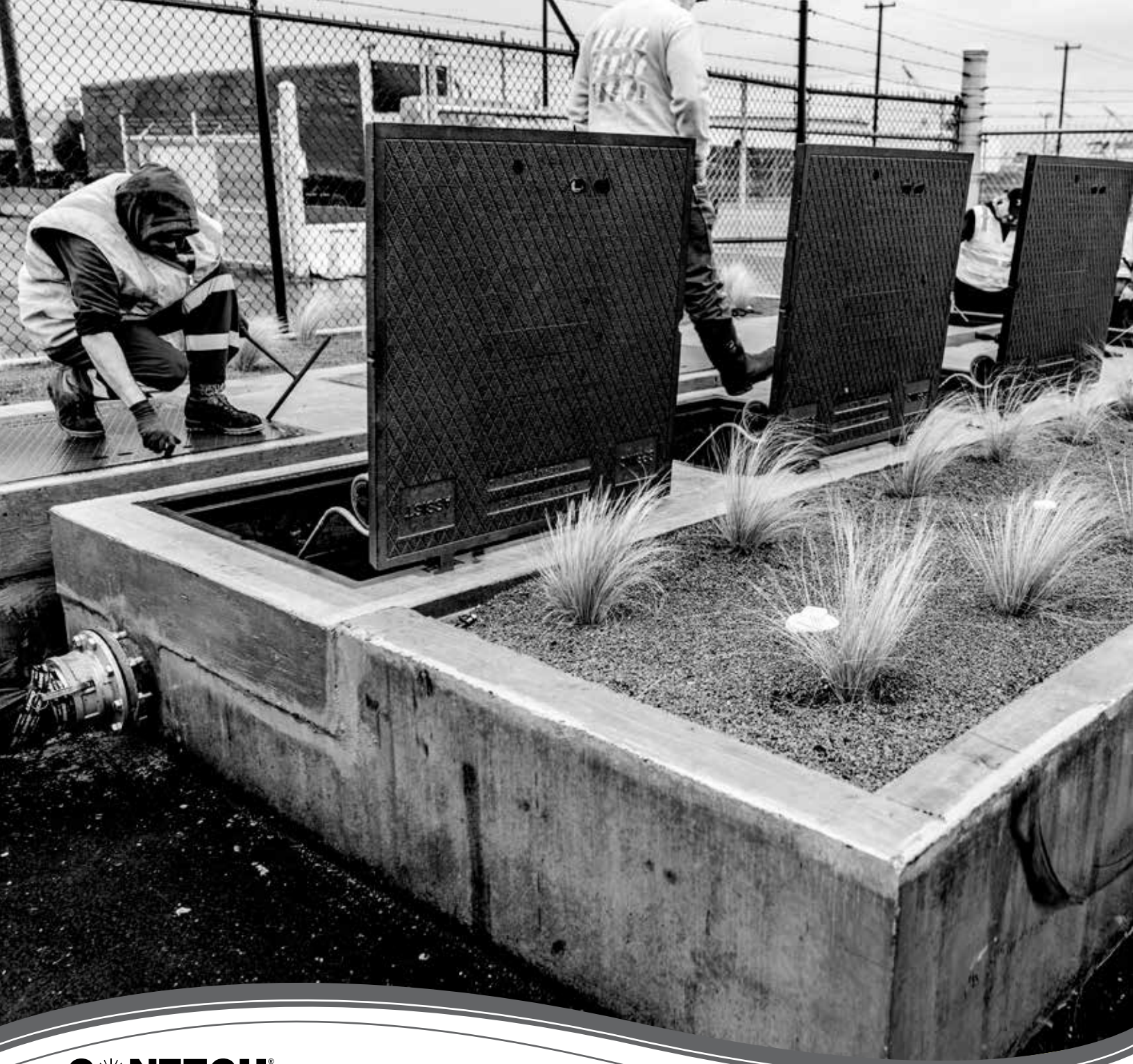
For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

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:



CONTECH®
ENGINEERED SOLUTIONS

800-338-1122

WWW.CONTECHES.COM

CONTECH ENGINEERED SOLUTIONS LLC PROVIDES SITE SOLUTIONS FOR THE CIVIL ENGINEERING INDUSTRY. CONTECH'S PORTFOLIO INCLUDES BRIDGES, DRAINAGE, SANITARY SEWER, STORMWATER AND EARTH STABILIZATION PRODUCTS. FOR INFORMATION ON OTHER CONTECH DIVISION OFFERINGS, VISIT CONTECHES.COM OR CALL 800-338-1122.

SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

Modular Wetlands Maintenance Guide 08/22

Bio Clean

A Forterra Company

Hydra Connector Pipe Screen

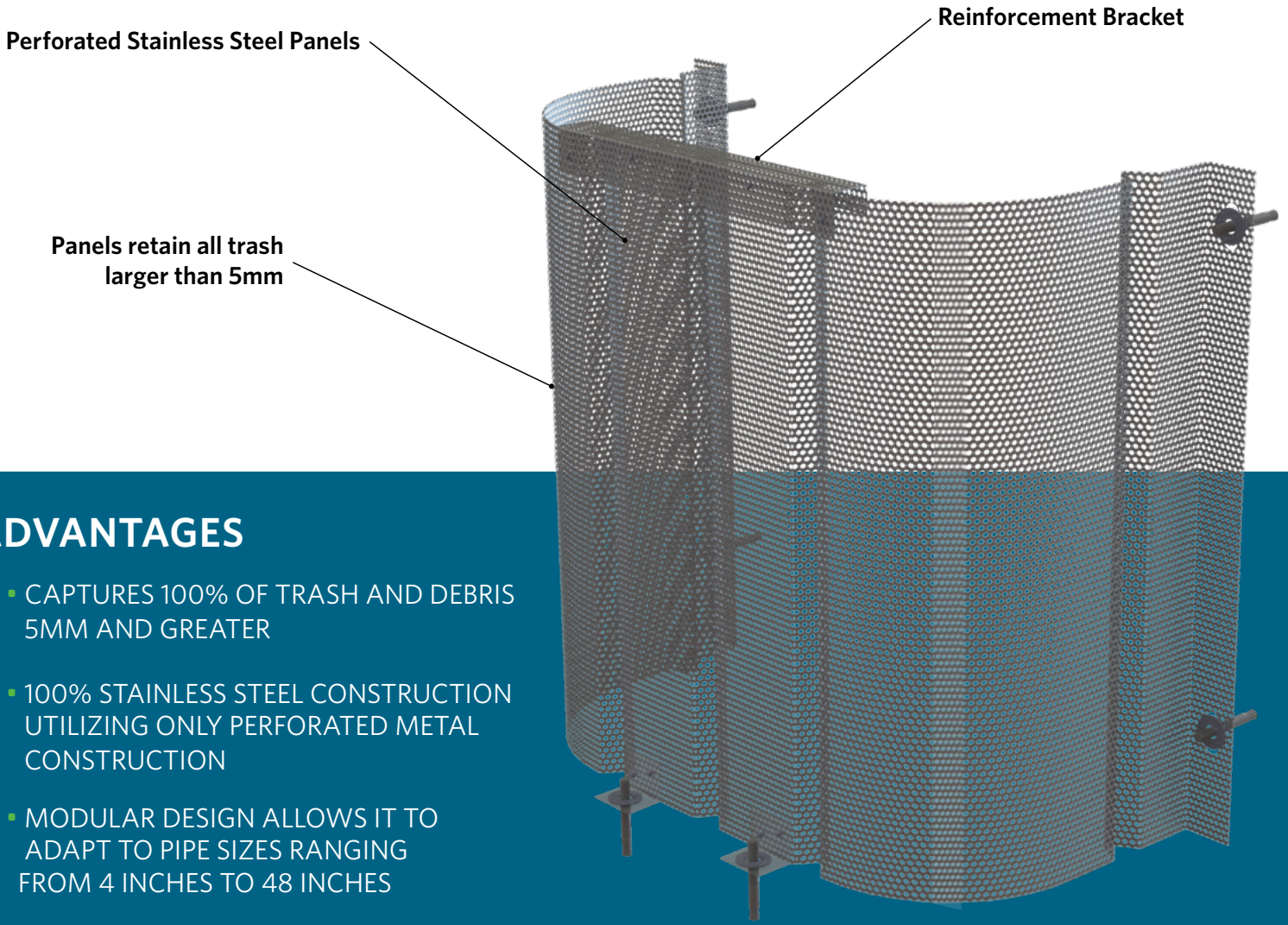
A Stormwater Trash Capture Solution

OVERVIEW

The Hydra Connector Pipe Screen (Hydra CPS) is designed to utilize existing catch basins, allowing them to efficiently capture 100% of trash and debris.

The Hydra CPS technology can be retrofitted into any curb or drop inlet to help municipalities meet current stormwater regulations and comply with their NPDES or MS4 permit. Hydra CPS devices can be used for new site developments as the first line of defense to prevent trash and debris from reaching downstream stormwater BMPs where they can cause clogging and unnecessary maintenance burdens.

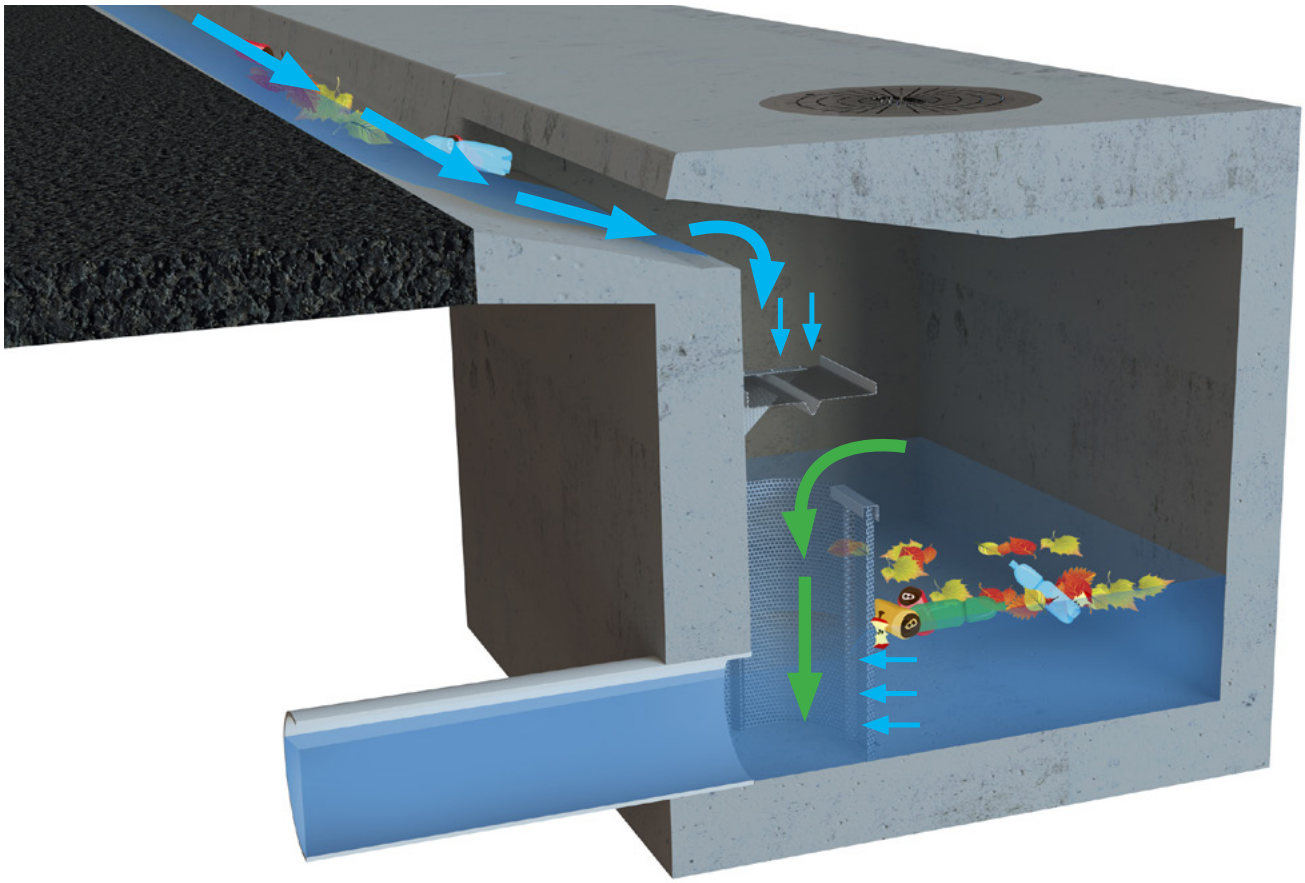
Constructed from 100% 304 perforated stainless steel, the system is feasible, effective, and built to last. An innovative curved design with multiple cross supports ensures the device can withstand several hundred pounds of pressure, far exceeding the 60-plus pound requirement by the County of Los Angeles. Its modular design makes it easy to insert through a 24-inch diameter manhole and assemble inside the basin within minutes. The center piece comes in different lengths allowing it to be used with outlet pipe sizes up to 48 inches or greater. For catch basins with pipes exiting in the corner, the system can easily be adapted to an 'L' shape using a single corner piece and a single center piece.



ADVANTAGES

- CAPTURES 100% OF TRASH AND DEBRIS 5MM AND GREATER
- 100% STAINLESS STEEL CONSTRUCTION UTILIZING ONLY PERFORATED METAL CONSTRUCTION
- MODULAR DESIGN ALLOWS IT TO ADAPT TO PIPE SIZES RANGING FROM 4 INCHES TO 48 INCHES
- MODULAR DESIGN ALLOWS FOR DESIGN FLEXIBILITY

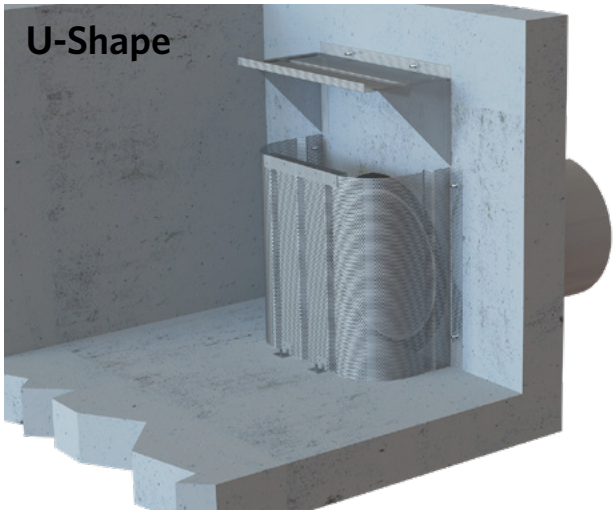
OPERATION

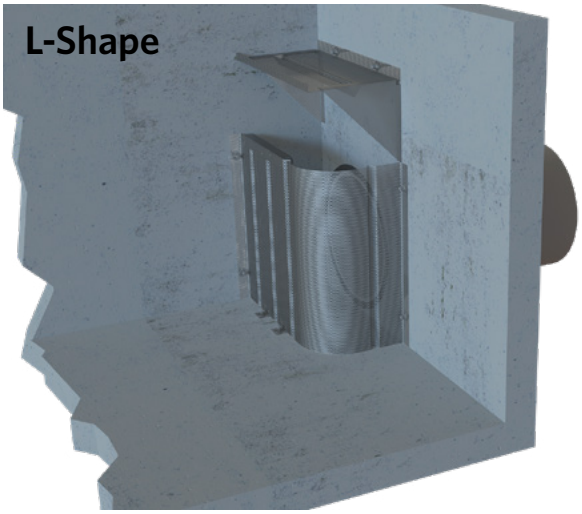


Treated flows enter the basin and are passed through the Hydra CPS which retains all trash and debris down to 5 mms in size.

High flows are allowed to bypass over the top of the Hydra CPS during intense storm events.

CONFIGURATIONS





INSTALLATION

The modular design of the system makes installation fast and easy. Rounded end pieces and center sections fit through any standard manhole. The system is assembled using self-tapping screws and concrete drive pins.

MAINTENANCE

The Hydra CPS makes any catch basin a Full Trash Capture device. Maintenance of the catch basin can be performed using a standard vacuum truck or removed by hand.

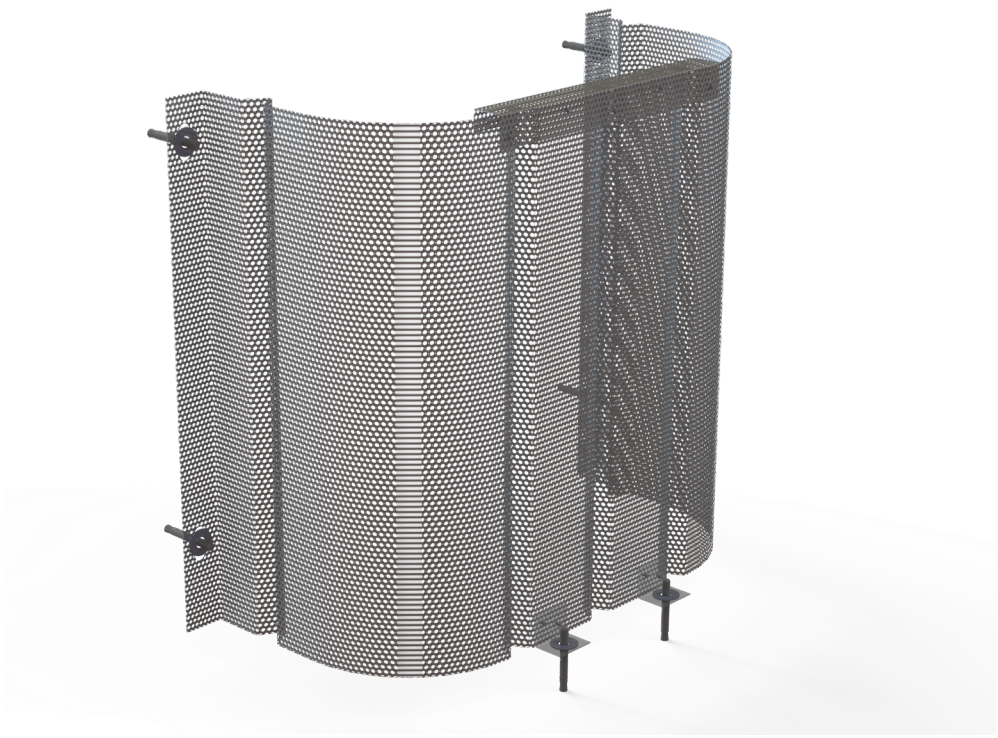
Bio Clean
A Forterra Company
5796 Armada Drive Suite 250
Carlsbad, CA 92008
855.566.3938
stormwater@forterrabp.com
biocleanenvironmental.com

Bio Clean
A Forterra Company

Hydra Connector Pipe Screen (CPS)
Operation & Maintenance (O&M)

Note

CPS devices should be maintained by individuals who are trained in proper disposal procedures, confined space entry and traffic safety regulations. When servicing a Hydra CPS device be sure to follow all safety and traffic control protocols as well as wearing all proper personal protection equipment such as gloves, safety glasses, hard-hat, safety vest and work boots.



Visual Inspection

1. Begin by inspecting the inflow of the catch basin where the Hydra CPS device is located. Check for any obstructions to inflow of the CB unit. If any large obstructions are found, have them removed. Once the inflow inspection is completed, remove the man-hole cover for further inspection. (Note: Confined Space Entry Procedures may apply if trained personnel intend to enter the interior space of any Catch Basin. Please follow all applicable confined space entry procedures)

2. Remove the manhole cover and visually estimate the amount and types of debris found in the CB unit. Look for any visual signs of damage that may compromise the CB unit to function properly. Inspect for any standing water in the CB unit as well as for large amounts of sediment and debris surrounding the CPS device. If standing water and high sediment volume is found, remove water, sediment and debris by vacuum truck or by other debris removal methods.

Cleaning Procedures and Frequencies

1. Like all other storm water BMP's, Hydra CPS devices require periodic maintenance.

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A Forterra Company

Routine inspection and maintenance intervals for all CPS devices are typically twice per year for inspections and once per year for maintenance service. Hydra CPS devices may require more frequent maintenance service if the device is located in a high debris loading drainage area, such as certain downtown areas, retail/restaurant, or residential areas where a significant amount of vegetation/foliage is located. In such cases, Modular CPS devices may require more frequent inspection and maintenance service, which could range from twice per year to monthly inspection and maintenance service, depending on pollutant load conditions.

2. To begin Hydra CPS cleaning procedures, conduct a visual inspection of the CPS device and the surrounding area to ensure a safe working environment. Setup appropriate barriers and signage as necessary to establish a work zone surrounding the catch basin. Once the work zone has been established, remove the manhole cover from the catch basin.

3. Once the manhole cover is removed from the basin the Modular CPS is ready for servicing. All debris can be removed by either a vacuum truck or manually removing sediment and debris by hand.

4. Hydra CPS devices shall be cleaned using a pressure washer as may be necessary if any materials are found to cause occlusion or clogging of the screen.

Disposal

1. All trash and debris removed from the Hydra CPS unit shall be disposed of in accordance with local, state and federal regulation.

2. Solid waste disposal can be coordinated with local landfills. Liquids may need to be disposed of by wastewater treatment plant, municipal vacuum truck decant facility or approved facility.

For maintenance services please contact Bio Clean at:

760-433-7640

info@biocleanenvironmental.com

PSI Pacific Southwest Industries

ENGINEERED - PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS - PACKAGED LIFT STATIONS

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.

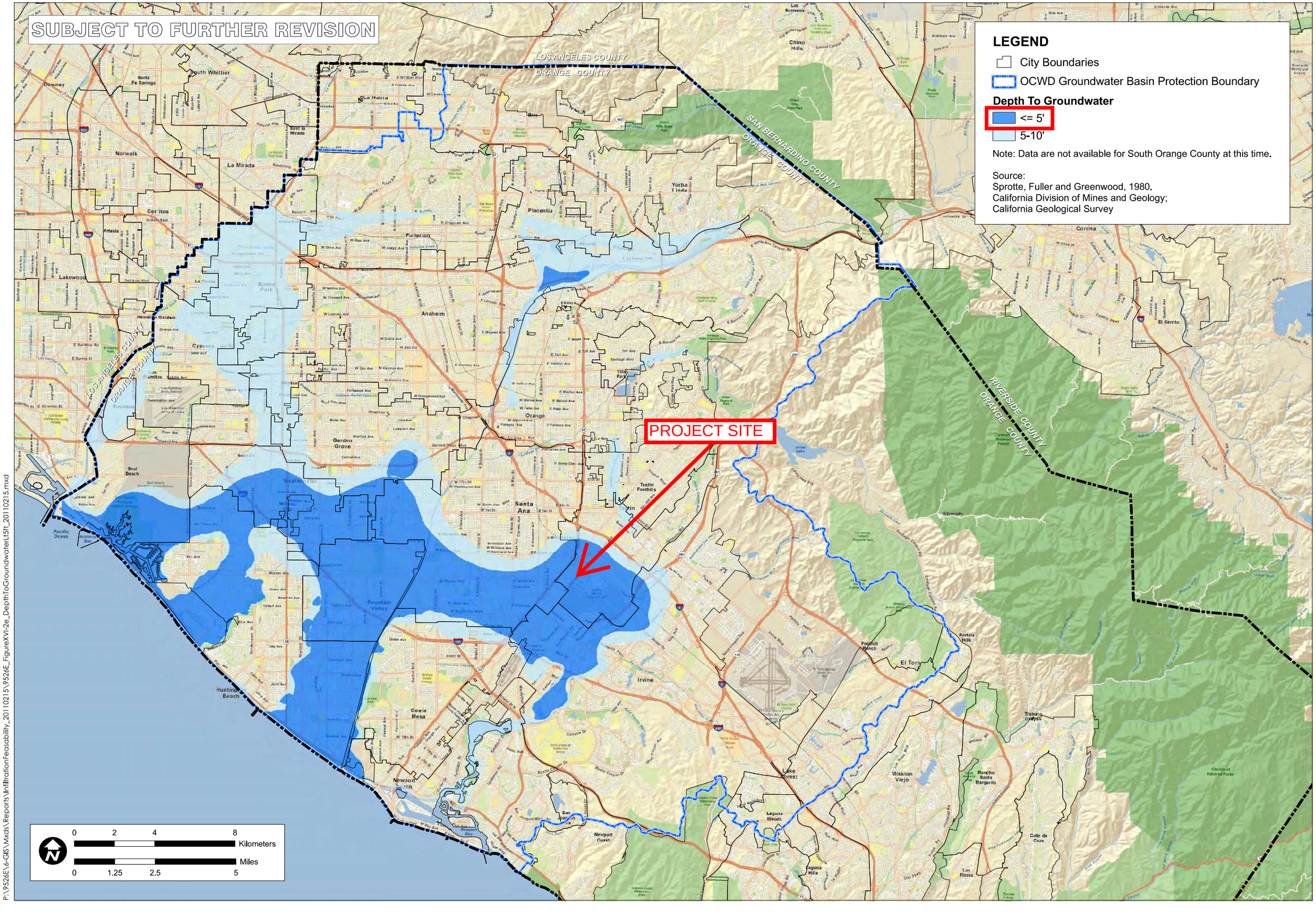
PSI recommends that preventive maintenance and service be performed by a qualified technician.

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

P O Box 520 Lake Elsinore, CA 92531 – 18541 Collier Ave., Lake Elsinore, CA 92530
(800) 358-9095 (909) 674-2144 fax (909) 674-9444 CSL #583052
www.psipumps.com Email: info@psipumps.com

ATTACHMENT C
INFILTRATION FEASIBILITY

SUBJECT TO FURTHER REVISION



LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Depth To Groundwater

- <= 5'
- 5-10'

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

TITLE
NORTH ORANGE COUNTY
MAPPED SHALLOW GROUNDWATER

ORANGE COUNTY
INFILTRATION STUDY

CA

JOB
ORANGE CO.

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2e

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SUBJECT TO FURTHER REVISION

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Plume Protection Boundaries

- North Basin Groundwater Protection Project
- South Basin Groundwater Protection Project
- El Toro Marine Base
- Tustin Marine Air Base
- Approximate Selenium Contamination Area

Note: Individual contamination sites are not plotted.
See State Water Resources Control Board Geotracker database (http://geotracker.waterboards.ca.gov),
Department of Toxic Substance Control Envirostor database (http://www.envirostor.dtsc.ca.gov) and other applicable sources for current listing of active contaminated sites.

Groundwater basin and plume protection boundaries for South Orange County are not shown on this exhibit at this time

0 2 4 8 Kilometers

0 1.25 2.5 5 Miles

TITLE
NORTH ORANGE COUNTY GROUNDWATER PROTECTION AREAS

ORANGE COUNTY INFILTRATION STUDY

JOB
ORANGE CO. CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2f

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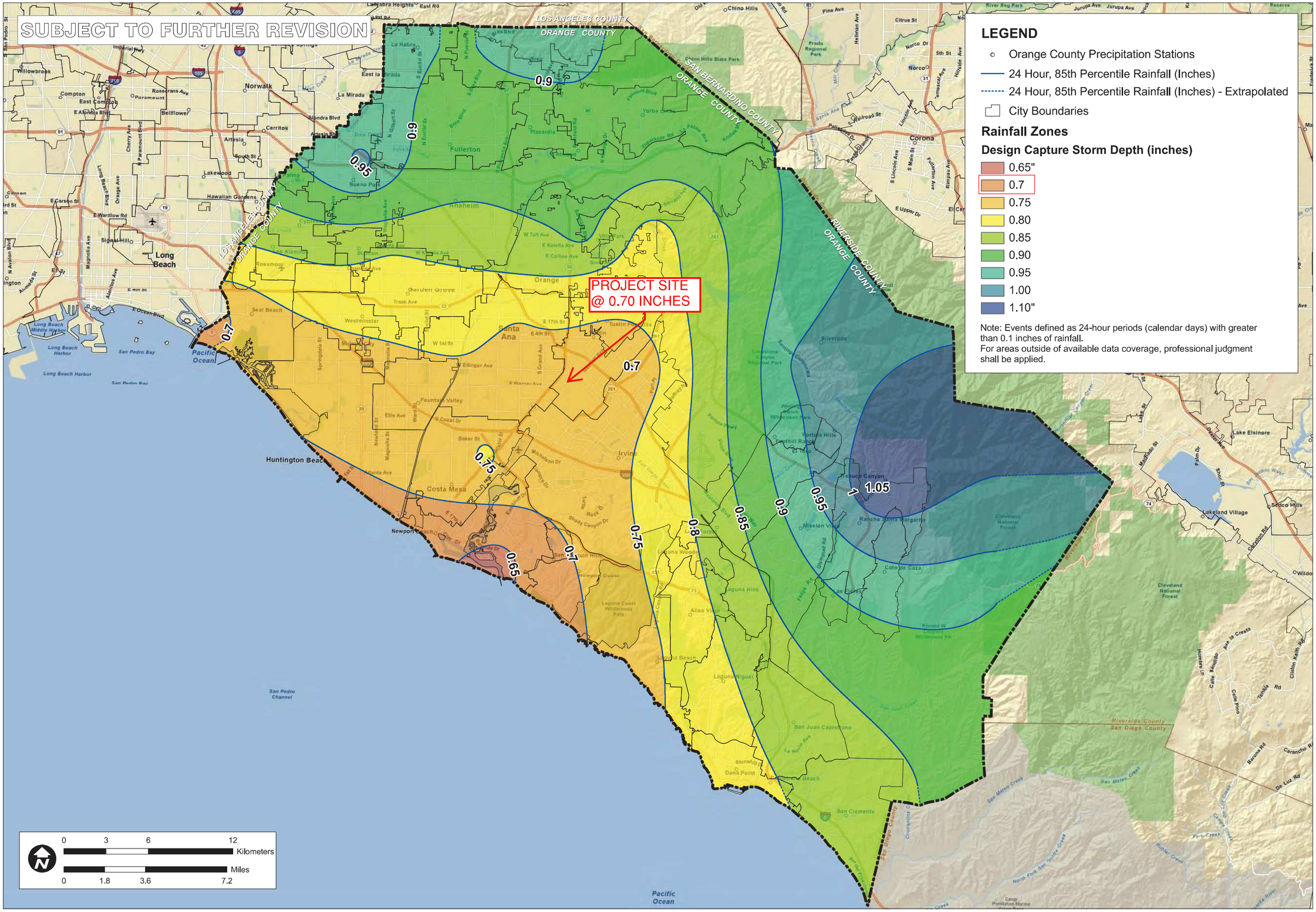
ATTACHMENT D
Q-BMP CALCULATIONS

SUBJECT TO FURTHER REVISION



LEGEND

- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

Rainfall Zones

Design Capture Storm Depth (inches)

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.

TITLE: RAINFALL ZONES

JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT — ORANGE CO. — CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-1

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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=	0.70	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.70	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.06	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.863	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	4,515	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	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 a proprietary biofiltration unit.

Worksheet B: Simple Design Capture Volume Sizing Method

DMA B

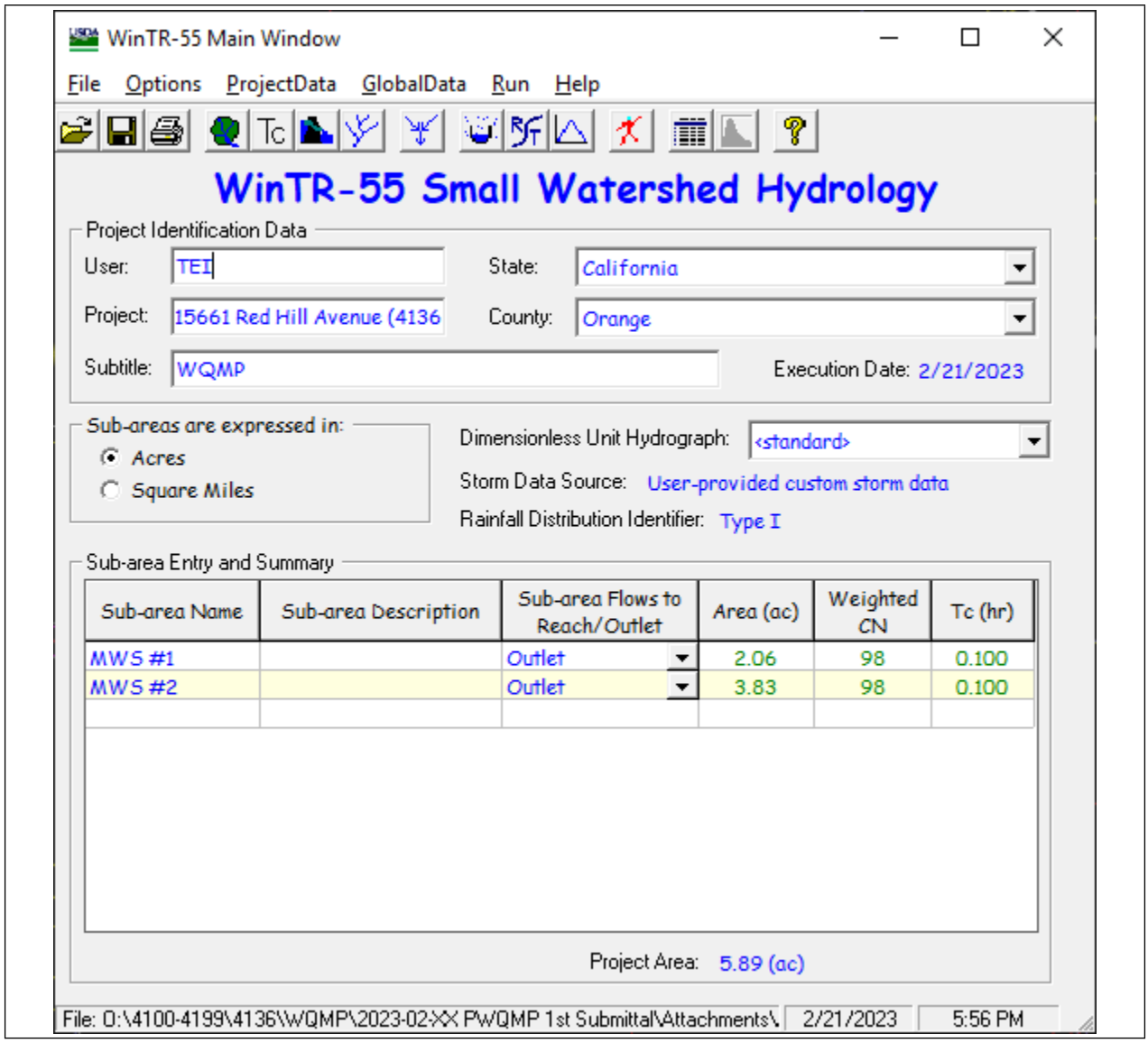
Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.70	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	N/A	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.70	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.83	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.863	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	8,394	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N/A*	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N/A*	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	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 two proprietary biofiltration units.

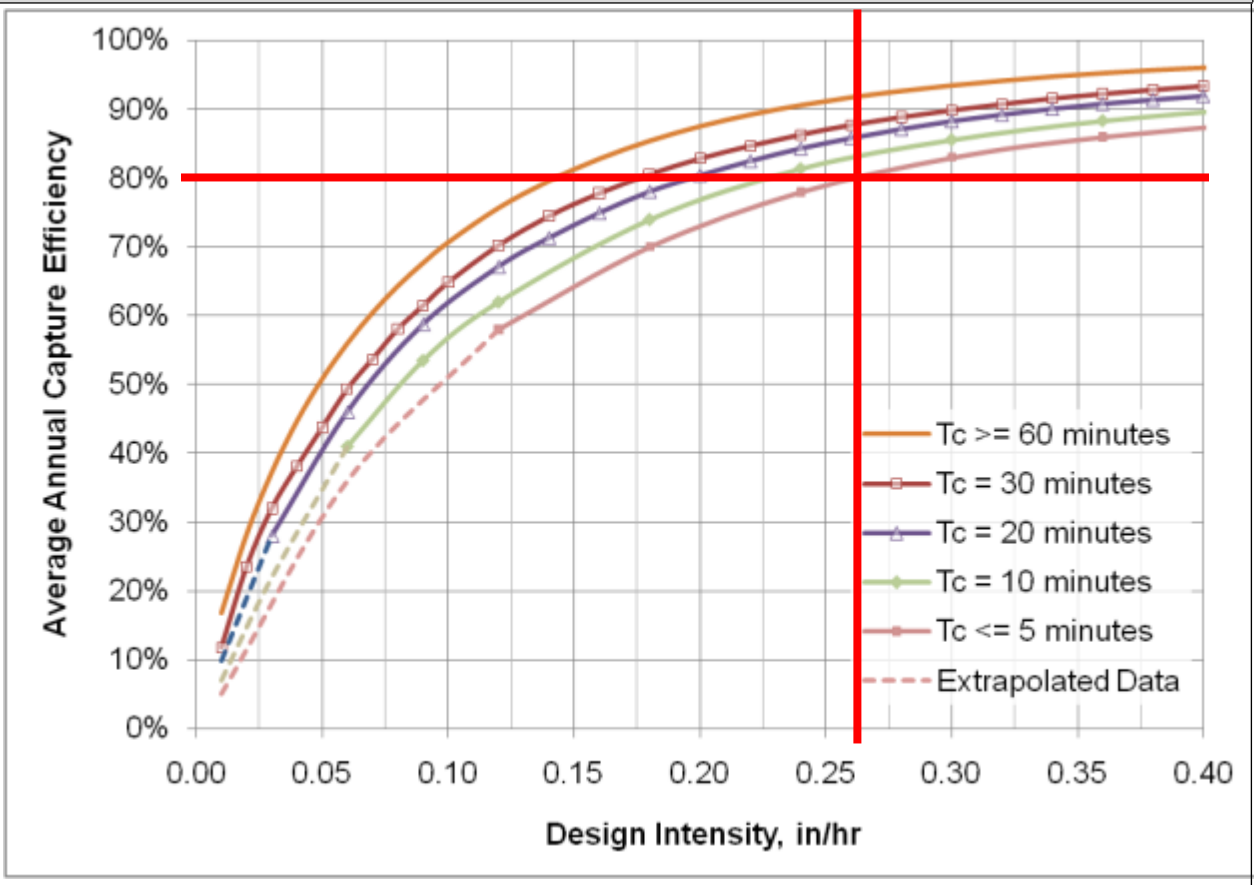
Worksheet D: Capture Efficiency Method for Flow-Based BMPs

DMA 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=	0.263	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}=	0.263	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.06	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.863	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.466	cfs
Supporting Calculations				
Describe system: MWS #1: Model: MWS-L-8-16-V @ 3.5' HGL QTY: 1 Treatment Rate: 0.476 cfs each Total Treatment Rate: 0.476 cfs > SQDF Sump pump: Minimum flowrate = 0.476 cfs = 213.6 gpm Provided flowrate = 230 gpm > SQDF				
Provide time of concentration assumptions:				


WinTR-55 Main Window
File Options ProjectData GlobalData Run Help
WinTR-55 Small Watershed Hydrology
Project Identification Data
User: TEI
State: California
Project: 15661 Red Hill Avenue (4136
County: Orange
Subtitle: WQMP
Execution Date: 2/21/2023
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 #1
Outlet
2.06
98
0.100
MWS #2
Outlet
3.83
98
0.100
Project Area: 5.89 (ac)
File: O:\4100-4199\4136\WQMP\2023-02-XX PWQMP 1st Submittal\Attachments\
2/21/2023
5:56 PM

Graphical Operations

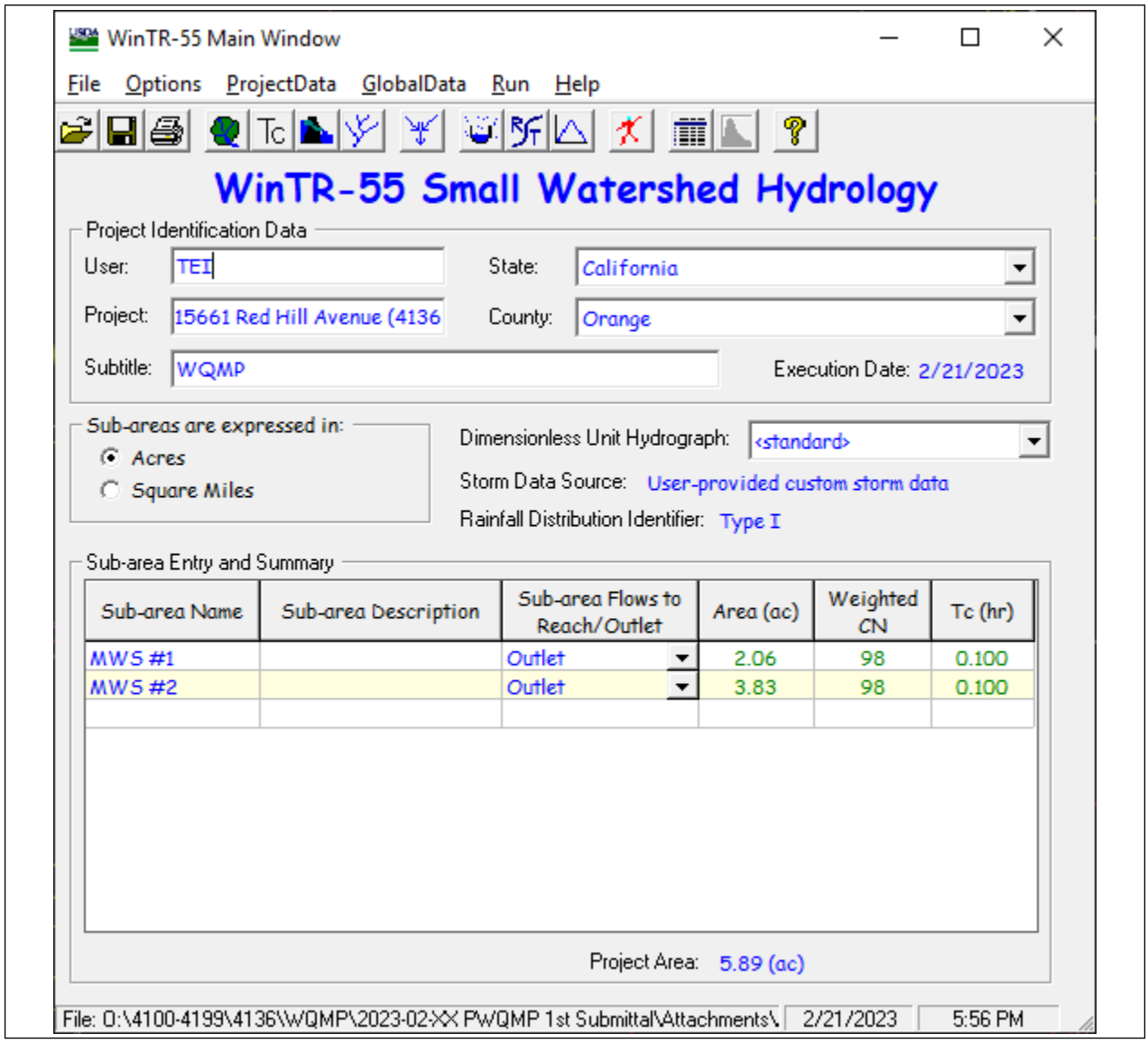


Provide supporting graphical operations. See Example III.7.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

DMA 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=	0.263	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}=	0.263	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.83	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.863	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.867	cfs
Supporting Calculations				
Describe system: MWS #1: Model: MWS-L-8-16-V @ 3.4' HGL QTY: 2 Treatment Rate: 0.476 cfs each Total Treatment Rate: 0.952 cfs > SQDF Sump pump: Minimum flowrate = 0.952 cfs = 427.3 gpm Provided flowrate = 440 gpm > SQDF				
Provide time of concentration assumptions:				


WinTR-55 Main Window
File Options ProjectData GlobalData Run Help
WinTR-55 Small Watershed Hydrology
Project Identification Data
User: TEI
State: California
Project: 15661 Red Hill Avenue (4136
County: Orange
Subtitle: WQMP
Execution Date: 2/21/2023
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 #1
Outlet
2.06
98
0.100
MWS #2
Outlet
3.83
98
0.100
Project Area: 5.89 (ac)
File: O:\4100-4199\4136\WQMP\2023-02-XX PWQMP 1st Submittal\Attachments\
2/21/2023
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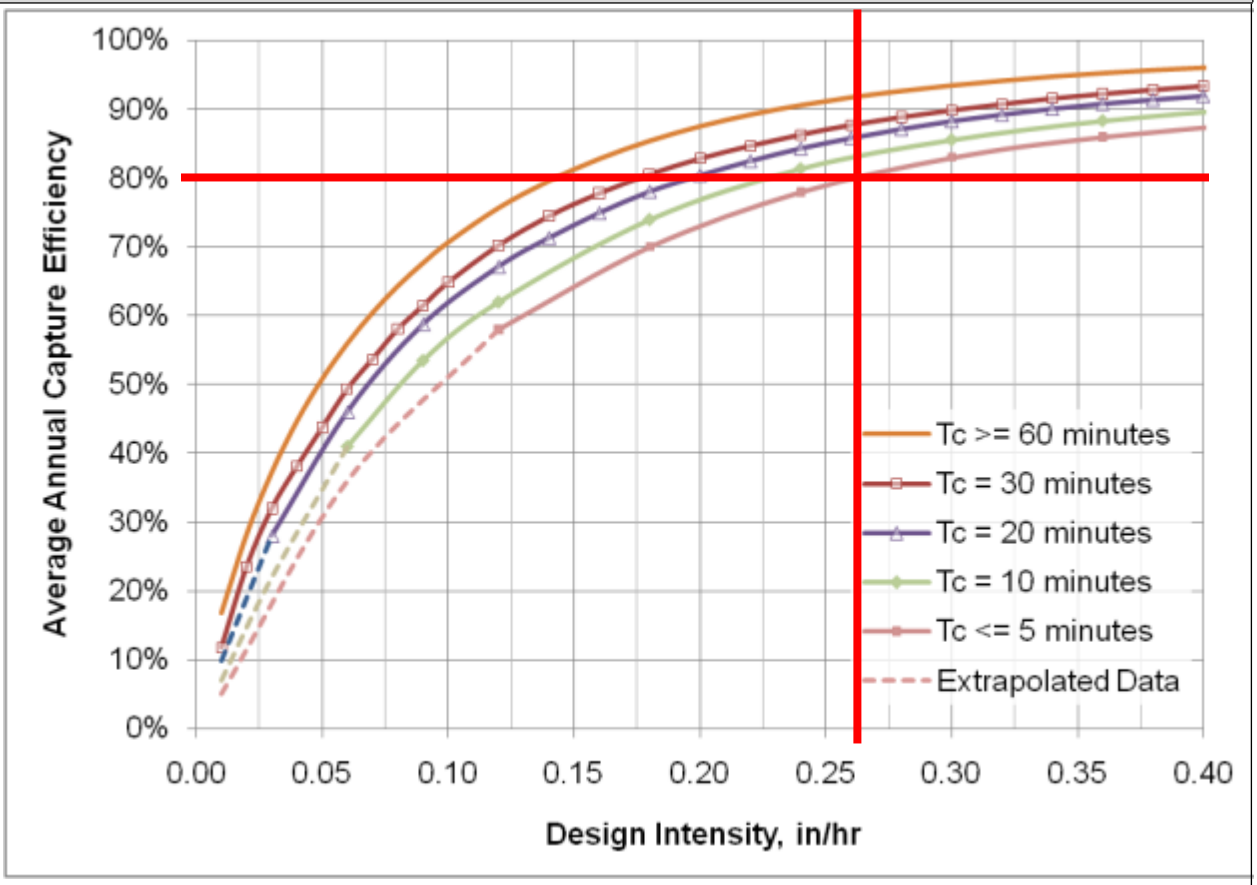
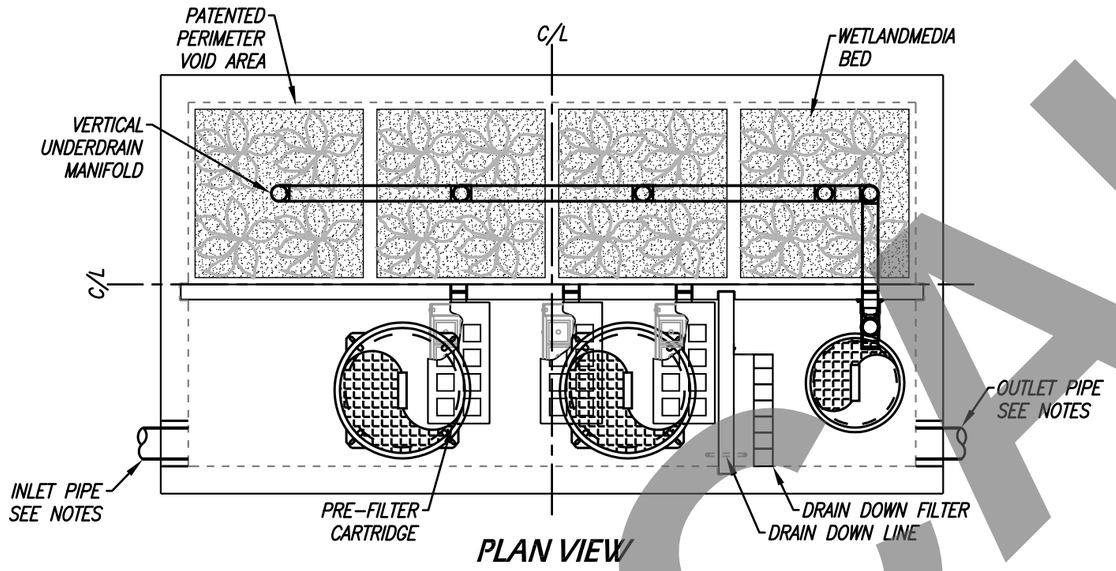
Graphical Operations

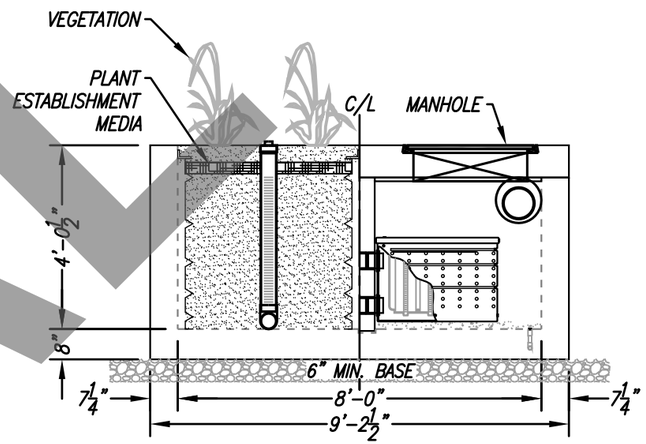


Provide supporting graphical operations. See Example III.7.

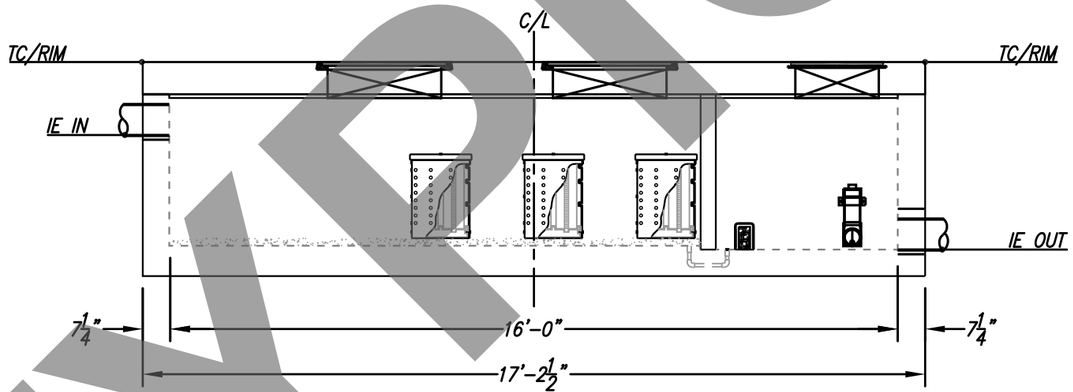
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	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:			



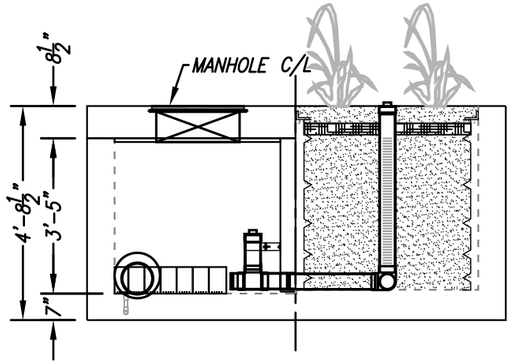
PLAN VIEW



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

MODULAR WETLANDS
www.ModularWetlands.com | (855) 5MOD-WET

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

WASHINGTON STATE DEPARTMENT OF ECOLOGY

July 2017

GENERAL USE LEVEL DESIGNATION FOR BASIC, ENHANCED, AND PHOSPHORUS TREATMENT

For the

MWS-Linear Modular Wetland

Ecology's Decision:

Based on Modular Wetland Systems, Inc. application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Basic treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

2. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Phosphorus treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

3. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Enhanced treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

4. Ecology approves the MWS - Linear Modular Wetland Stormwater Treatment System units for Basic, Phosphorus, and Enhanced treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:

   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
   - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
   - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

5. These use level designations have no expiration date but may be revoked or amended by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use:

Applicants shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the MWS – Linear Modular Wetland Stormwater Treatment System units, in accordance with Modular Wetland Systems, Inc. applicable manuals and documents and the Ecology Decision.
2. Each site plan must undergo Modular Wetland Systems, Inc. review and approval before site installation. This ensures that site grading and slope are appropriate for use of a MWS – Linear Modular Wetland Stormwater Treatment System unit.
3. MWS – Linear Modular Wetland Stormwater Treatment System media shall conform to the specifications submitted to, and approved by, Ecology.
4. The applicant tested the MWS – Linear Modular Wetland Stormwater Treatment System with an external bypass weir. This weir limited the depth of water flowing through the media, and therefore the active treatment area, to below the root zone of the plants. This GULD applies to MWS – Linear Modular Wetland Stormwater Treatment Systems whether plants are included in the final product or not.
5. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

   - Typically, Modular Wetland Systems, Inc. designs MWS - Linear Modular Wetland systems for a target prefilter media life of 6 to 12 months.
   - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
   - Owners/operators must inspect MWS - Linear Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific

maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
    - Standing water remains in the vault between rain events, or
    - Bypass occurs during storms smaller than the design storm.
    - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
    - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6. Discharges from the MWS - Linear Modular Wetland Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant:	Modular Wetland Systems, Inc.
Applicant's Address:	*PO. Box 869* *Oceanside, CA 92054*

Application Documents:

- *Original Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011
- *Quality Assurance Project Plan*: Modular Wetland system – Linear Treatment System performance Monitoring Project, draft, January 2011.
- *Revised Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011
- *Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014*
- *Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014.*

Applicant's Use Level Request:

General use level designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The MWS – Linear Modular wetland is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 50-percent of Total Phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 30-percent of dissolved Copper from stormwater with influent concentrations between 0.005 and 0.020 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 60-percent of dissolved Zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/l.

Ecology Recommendations:

- Modular Wetland Systems, Inc. has shown Ecology, through laboratory and field-testing, that the MWS - Linear Modular Wetland Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Total phosphorus, and Enhanced treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The MWS-Linear Modular wetland has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

Field Testing

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).
- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Modular Wetland Systems, Inc. should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Modular Wetland Systems, Inc. should use these data to establish required maintenance cycles.
2. Modular Wetland Systems, Inc. should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Modular Wetland Systems, Inc. will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at http://www.modularwetlands.com/

Contact Information:

Applicant: Zach Kent
BioClean A Forterra Company.
398 Vi9a El Centro
Oceanside, CA 92058
zach.kent@forterrabp.com

Applicant website: http://www.modularwetlands.com/

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Revision History

Date	**Revision**
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment
December 2015	Updated GULD to document the acceptance of MWS-Linear Modular Wetland installations with or without the inclusion of plants
July 2017	Revised Manufacturer Contact Information (name, address, and email)

PACKAGE DUPLEX PUMP LIFT STATION - MANUFACTURED BY PACIFIC SOUTHWEST INDUSTRIES
RUSTIN LOGISTICS CENTER RIVERSIDE, CA.

Furnish and install complete pre-packaged duplex Lift Station model #PSI-THI101822 as manufactured by Pacific Southwest Industries (national phone # 800-358-9095)

This pre-packaged Lift Station shall incorporate a quick removal system manufactured by the pump manufacturer. The pump(s) shall be guided to the discharge base elbow by a single or double guide rail and shall be stainless steel and shall extend from the discharge base elbow to the upper guide bracket mounted on 1-5/8" x 1-5/8" channel strut just below the basin cover. Stainless steel lifting chain or cable shall be supplied and properly installed to remove the pump from the wet well. The internal discharge piping shall be completely pre-plumbed with pressure rated schedule 40 or 80 PVC pipe as indicated and extend 12" beyond the wet well and valve vault side wall for contractor connection to the force main piping. The pump(s) discharge piping shall have a check and ball valve installed on each pump discharge. The Lift Station shall include control panel and level control floats. The control panel shall be suitable for surface mounting or free standing on a leg kit if the site conditions require it.

PUMPS:
Each Tsurumi non-clog B series pump(s) shall be designed to pump wastewater, sewage or effluent containing solids without damage during operation. The pump(s) shall be designed so that the shaft power required (BHP)/(kW) shall not exceed the motor rated output throughout the entire operating range of the pump performance curve.

MATERIALS OF CONSTRUCTION:
Construction of major parts of the pumping unit(s) including casing, impeller, and discharge elbow shall be manufactured from gray cast iron, ASTM A48 CLASS 35. Unit(s) shall have a field adjustable and/or replaceable, cast-iron shield type wear plate or wear rings. Internal and external surfaces coming into contact with the pumpage shall be protected by a fused polymer coating. All exposed fasteners shall be stainless steel. All units shall be furnished with a discharge elbow with 150 lb. (10 Kg. /Cm2) flat face flange and NPT companion flange, impellers shall be of the solids handling design equipped with back pump out vanes and shall be slip fit to the shaft and key driven. The pump casing shall incorporate an air relief valve.

MECHANICAL SEAL:
All units shall be furnished with a dual inside mechanical shaft seal located completely out of the pumpage, running in a separate oil filled chamber and further protected by an exclusionary oil seal located between the bottom seal faces and the fluid being pumped. The oil chamber shall be fitted with a device that shall provide positive lubrication of the top mechanical seal, (down to one third of the standard oil level). The device shall not consume any additional electrical power. Mechanical seals shall be rated to preclude the incursion of water up to 42.6 PSI (98.4 Ft.). Units shall have silicon carbide mechanical seal faces.

MOTOR:
Motor(s) shall be air filled, copper wound, class F insulated with built in thermal protection for each winding. Motor shaft shall be 420 or 403 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. On units up to 10 Hp (75 kW), the bottom bearing shall be a single row, double shielded, C3, deep groove type ball bearing. On units 15 Hp. (11 kW), the bottom bearing shall be two row, double shielded, C3 deep groove type ball bearings. The top bearing on all units shall be single row, double shielded, C3, deep groove type ball bearings. Motor housing and bearing housing shall be gray cast iron, ASTM A48 CLASS 30. Motors shall be D.O.L. or Star-delta start (15 Hp.), shall be suitable for across the line start or variable speed applications, utilizing a properly sized variable frequency drive.

POWER CABLE AND CABLE ENTRANCE:
The pump power cable shall be suitable for submersible pump applications. Units up to 5 Hp. shall be supplied with a cable entrance that incorporates built in strain relief, a one-piece, three-way mechanical compression seal with a fatigue reducing cable boot. On units 7.5 Hp. and above, the cable entrance shall incorporate built in strain relief, and combination three-way mechanical compression sealing with a fatigue reducing/thermal expansion rubber boot. The power cable shall be field replaceable utilizing standard submersible pump cable. The cable entrance assembly on all units shall contain an anti-wicking block to eliminate water incursion into the motor due to capillary wicking should the power cable be accidentally damaged.

QUICK REMOVAL SYSTEM:
The pumping unit(s) shall be equipped with quick removal system (QRS). The construction shall be such that the pump(s) will automatically connect to the discharge piping when lowered into place on the discharge connector. There shall be no need for personnel to enter the wet well to accomplish installation or removal of the pump(s). The pumping unit(s) shall be fitted with stainless steel lifting chain(s) of sufficient length and strength to permit the raising and lowering of the unit(s). The chain(s) shall be fastened at the top of the structure near the access opening. The need for a protective coating shall not be required. A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connection with a bracket to connect with the discharge connection. Sealing of the pumping unit to the discharge connection shall be accomplished by a single linear downward motion of the pump with the entire weight of the pumping unit guided by a pawl, thereby wedging the pumping unit tightly against the discharge connector. No portion of the pump shall bear directly on the floor of the sump nor shall a rotary motion of the pump be required for sealing. All fasteners coming into contact with the pumpage shall be stainless steel. Two corrosion resistant guide pipes shall be furnished and installed for each pump to permit raising and lowering of the pump.

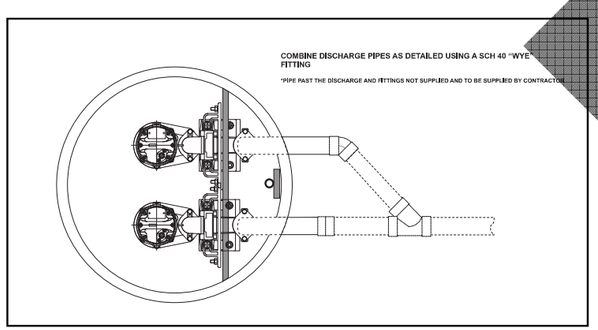
FIBERGLASS WET WELL:
The fiberglass wet well with an anti-flotation flange shall have the proper diameter and depth below the lowest inlet to promote proper cycling while maintaining the rim at grade. The fiberglass wet well shall be manufactured using a process that is filament wound and or chopped spray. The wet well shall be constructed with a anti flotation flange. Lifting lugs shall be required for those wet wells 48 inches in diameter and larger for setting of the wet well. The laminate shall have a Barco hardness of at least 90% of the resin manufactures minimum specified hardness for cured resin on both the interior and exterior surfaces. The minimum wall thickness of the wet well shall not be less than 1/4". Stainless steel studs will be encapsulated in the bottom of the wet well to allow the mounting of the quick removal system. The top rim flange will be a minimum of 2" wide to allow for the installation of the pedestrian rated aluminum cover to the rim flange or shall be rimless if the cover is specified for H20 off street locations. The wet well shall be provided with "unseal" fittings that can be installed in the field to insure proper elevation of the inlet, vent, and electrical on the side of the wet well. The wet well will house 2 - swing check valves, and 2 – shut off valves.

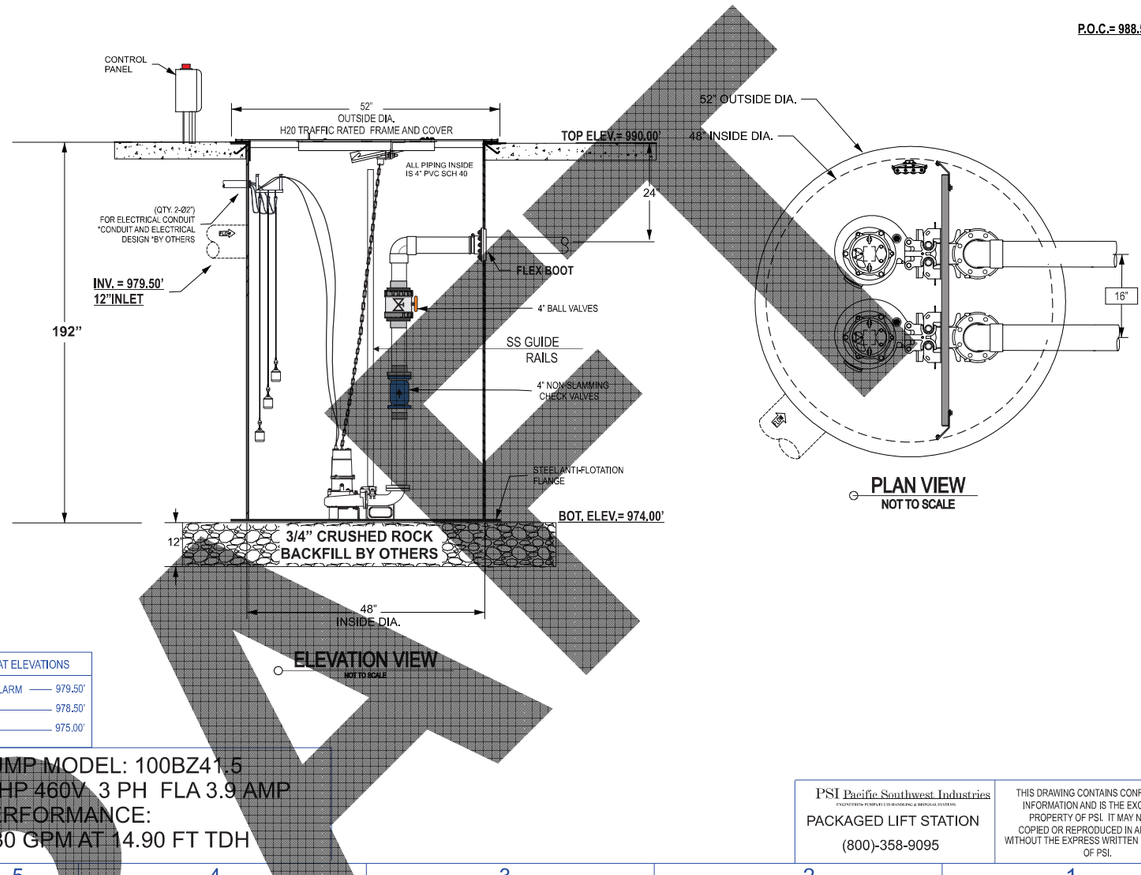
COVER(s)
The wet well cover shall always be gasketed and bolted to the rim flange of the fiber glass tank using 7/16" stainless steel hex head bolts unless the cover is to be in a H20 off street location. The type of material to be used for the cover shall be as indicated on this plan sheet.

DUPLEX ALTERNATING CONTROL PANEL:
The duplex control panel, as a minimum, shall include the appropriate enclosure type for the environment it is to be installed in and should include the following: Motor starters, motor circuit protectors or variable frequency drives (VFD), pump run indicator(s), operation selector switch(es), high water alarm and light, silence switch, dry contact for alarm, numbered terminals for all incoming power, pump motor(s) and level controls. The control panel shall be UL listed 508 or 913.

The following options marked "x" shall be included and specific for this site.

NEMA 4X _X_ NEMA 3R ___ LEG KIT ___ ETM's ___ SEAL FAIL ___ THERMAL CUTOUTS ___ PHASE LOSS MONITOR ___ SOFT START ___ GENSET HOOKUP ___ DOOR IN DOOR DEAD FRONT ___ THROUGH DOOR MAIN DISCONNECT ___ TRANSDUCER OPERATED ___ FLOAT BACKUP ___ CURRENT CENSOR ___ AUTO DIALER ___ REDUNDANT OFF ___ INTRINSICALLY SAFE ___ SMART RELAY WHICH INCLUDES EXERCISER, RUN COUNT, ALARM COUNT AND FLOAT POSITION _X_

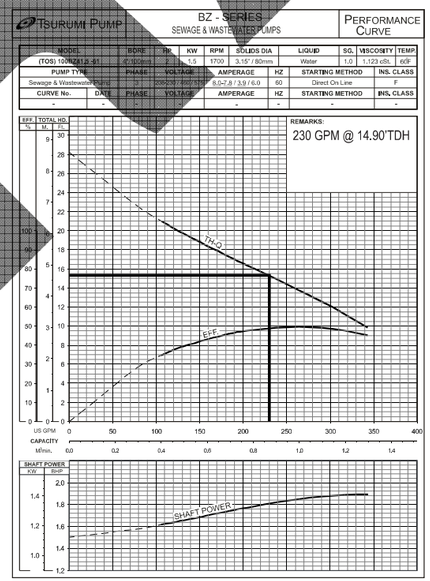




FLOAT ELEVATIONS	
LAG/ALARM	979.50'
ON	978.50'
OFF	975.00'

PUMP MODEL: 100BZ41.5
2 HP 460V 3 PH FLA 3.9 AMP
PERFORMANCE:
230 GPM AT 14.90 FT TDH

PSI Pacific Southwest Industries
PACKAGED LIFT STATION
(800)-358-9095



LIFT STATION PROFILE & CALCULATIONS					
6" SCH 40 = 6.06 SCH 80 = 5.76					
6" PVC PIPE	(QTY)	20.14	x	1 FT	20.14 FT
6" PVC 90 ELBOW	(QTY)	1	x	16 FT	16 FT
6" PVC 45 BEND	(QTY)	1	x	7.7 FT	7.7 FT
6" PVC TEE	(QTY)	0	x	33 FT	0 FT
6" BALL VALVE	(QTY)	1	x	3.5 FT	3.5 FT
6" CHECK VALVE	(QTY)	1	x	39 FT	39 FT
TOTAL EQUIVALENT LENGTH					86.34 FT
FRICTION LOSS PER 100 FT 6" PVC	230 GPM		0.4 FT	PER 100 FT	
FRICTION LOSS 6"	86.34	/	100	x 0.4 FT	0.36 FT
TOTAL DYNAMIC HEAD					
6" FRICTION LOSS					0.36 FT
STATIC HEAD				+	14.54 FT
PERFORMANCE	230 GPM	@	14.90	FT TDH THROUGH 6" PVC LINE	

HAZEN-WILLIAMS EQUATION/HEAD LOSS IN WATER PIPE	
$(f) = 0.2083\ (100 / c)^{1.852}\ q^{1.852} / dh^{4.8655}$	
c=	140 HDPE / PVC
q=	230 GPM
dh=	6" SCH 40 = 6.06
FRICTION LOSS PER 100 FT f=	0.41
Velocity (ft/s) =	2.56

LIFT STATION DETAILS

NOTE: VERIFY ALL ELEVATIONS PRIOR TO FABRICATION. OTHERS TO VERIFY ALL INLET/OUTLET ORIENTATIONS PRIOR TO FABRICATION AND INSTALLATION. *ALL PIPE OPENINGS AND SEALING SHALL BE COMPLETED IN FIELD BY OTHERS.

PSI Pacific Southwest Industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
18541 COLLIER. , LAKE ELSINORE, CA 92530 PH: 800 358-9095

No.	Date	Description

LIFT STATION DETAILS
RUSTIN LOGISTICS CENTER
RIVERSIDE CA

Date: 10/18/2022
Drawn by: EM
Checked by:
Scale: NTS
Sheet No. 1 OF 1

LSD-1

14451 MYFORD ROAD TUSTIN, CA PUMP #61
PACKAGE STORM WATER LIFT STATION

SCOPE OF SUPPLY:

Furnish and install complete pre-packaged storm water pump lift station model **#PSI-THI010621-P61** as manufactured by Pacific Southwest Industries, (national phone# 800-358-9095), No exceptions shall be taken to this specification without engineers approval.
NOTE: Due to the specific nature of this pump station/ equipment and its operational sequence, any contractor not intending to purchase and supply as specified, by model number, must provide full submittals for review and approval prior to ordering, no exceptions. send full submittals to, www.submittalapproval.com, allow one week for a response.

The pre-packaged Lift Station shall incorporate a quick removal system manufactured by the pump manufacturer. The pump(s) shall be guided to the discharge base elbow by stainless steel guide rails. The rails shall extend from the discharge base elbow to the upper guide bracket mounted on fiberglass channel just below the basin cover. Stainless steel lifting chain or cable shall be supplied and properly installed to remove the pump from the wet well. The internal discharge piping shall be completely pre-plumbed in PVC pipe and extend 12" beyond the wet well side wall for contractor connection to the force main piping. The pump(s) discharge pipe shall have a check and ball valve installed on each discharge line. The Lift Station shall include three liquid level controls on a removable float tree and a control panel suitable for surface mounting. The pump(s), quick removal system and the level sensors shall be housed in a fiberglass wet well (basin) and shall be of sufficient length to maintain the rim of the wet well at grade.

PUMPS:
Each Tsurumi non clog model #100BZ42.2 shall be capable of delivering 440 G.P.M. at 13.68 Feet TDH. The pump(s) shall be designed to pump wastewater, sewage or effluent containing solids without damage during operation. The pump(s) shall be designed so that the shaft power required (BHP)/(kW) shall not exceed the motor rated output throughout the entire operating range of the pump performance curve.

MATERIALS OF CONSTRUCTION:
Construction of major parts of the pumping unit(s) including casing, impeller, and discharge elbow shall be manufactured from gray cast iron, ASTM A48 CLASS 35. Unit(s) shall have a field adjustable and/or replaceable, cast iron shield type wear plate or wear rings. Internal and external surfaces coming into contact with the pumpage shall be protected by a fused polymer coating. All exposed fasteners shall be stainless steel. All units shall be furnished with a discharge elbow with 150 lb. (10 Kg./Cm2) flat face flange and NPT companion flange. impellers shall be of the solids handling design equipped with back pump out vanes and shall be slip fit to the shaft and key driven. The pump casing shall incorporate an air relief valve.

MECHANICAL SEAL:
All units shall be furnished with a dual inside mechanical shaft seal located completely out of the pumpage, running in a separate oil filled chamber and further protected by an exclusionary oil seal located between the bottom seal faces and the fluid being pumped. The oil chamber shall be fitted with a device that shall provide positive lubrication of the top mechanical seal, (down to one third of the standard oil level). The device shall not consume any additional electrical power. Mechanical seals shall be rated to preclude the incursion of water up to 42.6 PSI (98.4 Ft.). Units shall have silicon carbide mechanical seal faces.

MOTOR:
The pump motor(s) shall be 3 HP, 2.2 kW, 460V, 60 Hz. 3 Phase and shall be NEMA MG-1, Design Type B equivalent. Motor(s) shall be rated at 4.6 full load amps. Motors shall have a 1.15 service factor and shall be rated for 20 starts per hour. Motor(s) shall be air filled, copper wound, class F insulated with built in thermal protection for each winding. Motor shaft shall be 420 or 403 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. On units up to 10 Hp (75 kW), the bottom bearing shall be a single row, double shielded, C3, deep groove type ball bearing. On units 15 Hp, (11 kW), the bottom bearing shall be two row, double shielded, C3 deep groove type ball bearings. The top bearing on all units shall be single row, double shielded, C3, deep groove type ball bearings. Motor housing and bearing housing shall be gray cast iron, ASTM A48 CLASS 30. Motors shall be D.O.L. or Star-delta start (15 Hp.), shall be suitable for across the line start or variable speed applications, utilizing a properly sized variable frequency drive.

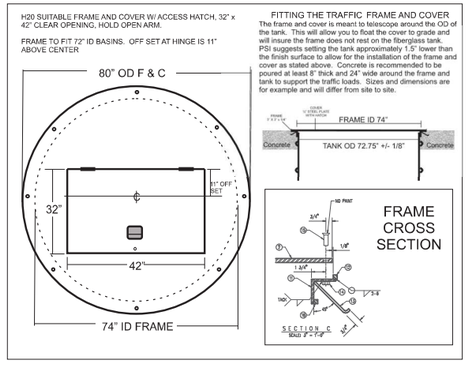
POWER CABLE AND CABLE ENTRANCE:
The pump power cable shall be suitable for submersible pump applications. Units up to 5 Hp. shall be supplied with a cable entrance that incorporates built in strain relief, a one piece, three way mechanical compression seal with a fatigue reducing cable boot. On units 7.5 Hp. and above, the cable entrance shall incorporate built in strain relief, and combination three way mechanical compression sealing with a fatigue reducing/thermal expansion rubber boot. The power cable shall be field replaceable utilizing standard submersible pump cable. The cable entrance assembly on all units shall contain an anti-wicking block to eliminate water incursion into the motor due to capillary wicking should the power cable be accidentally damaged.

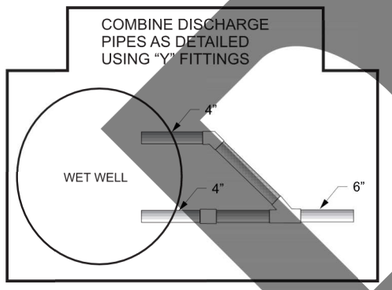
DUPLEX ALTERNATING CONTROL PANEL:
The control panel shall have a NEMA 4X door -in -door dead front lockable fiberglass enclosure suitable for wall mounting. A motor circuit protector shall be provided for each pump and magnetic starter with three leg overload protection for each pump. A Smart relay shall be provided with automatic load selector to alternate pumps on each successive cycle of operation, exercise timers, elapsed time meters, and cycle counter. The starter shall have auxiliary contacts to operate both pumps in an override condition. The control circuit shall not be affected in the event that either pump trips the pump circuit breaker. H.O.A. switches and run lights shall be supplied for each pump. A terminal strip shall be provided to terminate all incoming power, pumps, level sensors and remote alarm wiring. A 100VA control transformer shall be provided to supply reduced voltage to the control circuit. The control panel shall offer a high water alarm light, top mounted for 360 degree visibility. An external push button shall be provided to silence the audible alarm. U.L. 508 listed shop.

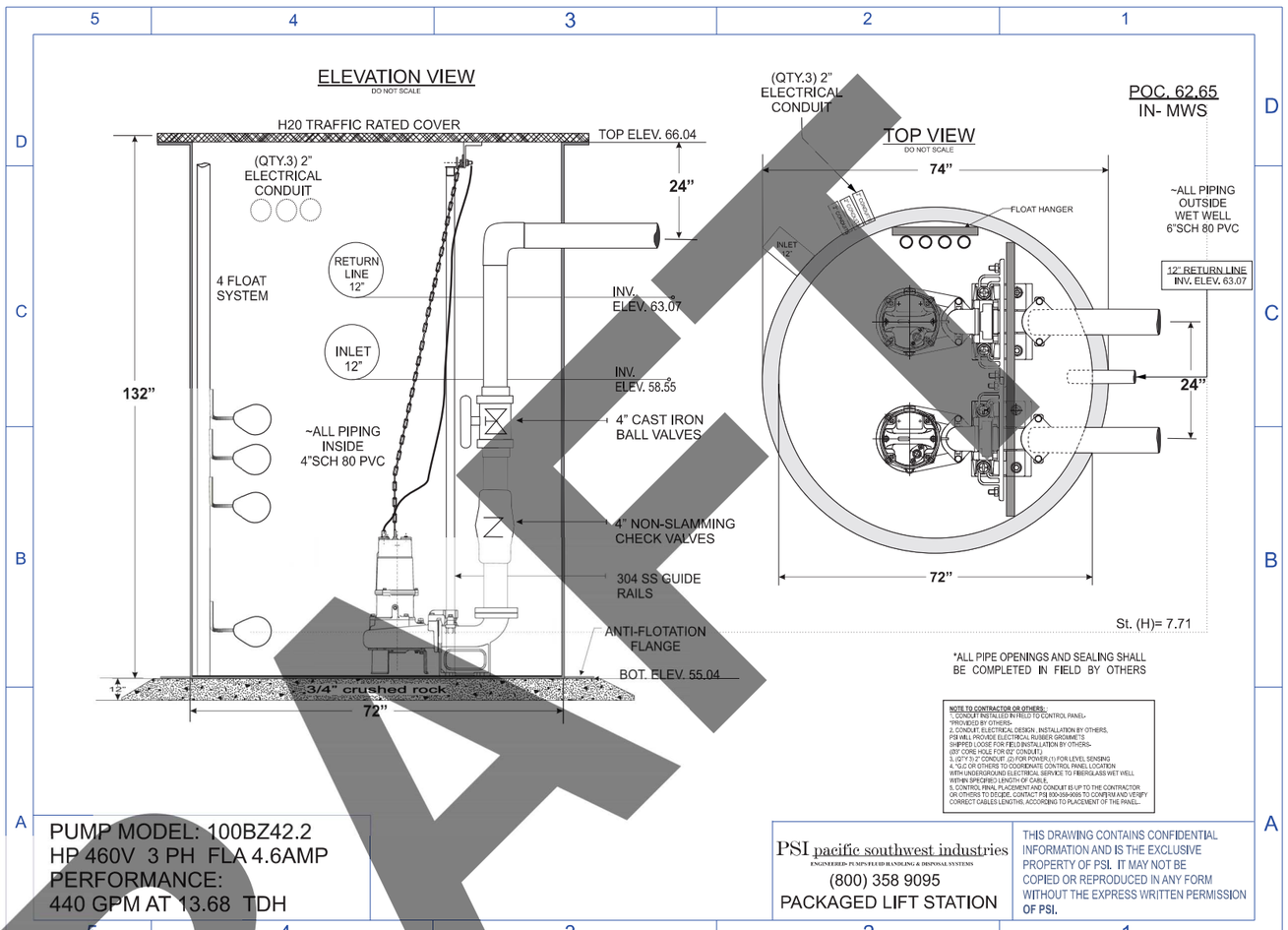
A dry, non-powered contact shall be supplied in the main control panel to interface with the owners computerized security system. This contact is to normally open. The contact will close when the high level alarm float is activated or upon power loss.

FIBERGLASS WET WELL:
The fiberglass wet well shall be suitable direct burial installation. The wet well shall be no less than 72 inches in diameter and will be 132 inches in length. The laminate shall have a barcol hardness of a least 90% of the resin manufactures minimum specified hardness for cured resin on both the interior and exterior surfaces. The minimum wall thickness of the wet well shall not be less than 3/16". The wet well manufacturer shall encapsulate a steel base plate with stainless steel studs for the mounting of the quick removal system. The wet well will be provided with 2-12" inlet fitting for field installation by the contractor at the elevation and location as indicated on the plans. All other penetrations shall be sealed by using "Uniseal" fitting or "Flex boot" fittings.

STEEL H20 SUITABLE FRAME AND COVER:
The cover of the wet well shall be no less than ½" thick and shall be suitable for H-20 traffic loads. The cover shall be solid with no penetrations through the top and shall be secured to the rim of the wet well with steel hardware. The cover is to be suspended in a Class A bed of concrete a minimum of 6" thick and to extended a minimum of 18" past the frame. The covers will be supplied with enamel primer paint.

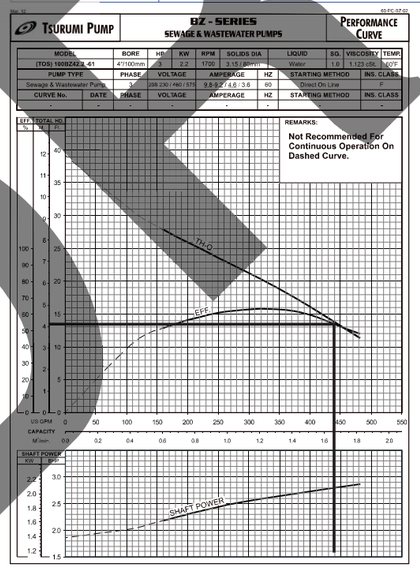






NOTE TO CONTRACTOR OR OTHERS:
1. CONDUIT INSTALLED IN FIELD TO CONTROL PANEL-*PROVIDED BY OTHERS-
2. CONDUIT, ELECTRICAL DESIGN , INSTALLATION BY OTHERS, PSI WILL PROVIDE ELECTRICAL RUBBER GROMMETS SHIPPED LOOSE FOR FIELD INSTALLATION BY OTHERS-(QTY CORE HOLE FOR (QTY CONDUIT)
3. (QTY 3) 2" CONDUIT, (2) FOR POWER (1) FOR LEVEL SENSING
4. *3J/C OR OTHERS TO COORDINATE CONTROL PANEL LOCATION WITH UNDERGROUND ELECTRICAL SERVICE TO FIBERGLASS WET WELL WITHIN SPECIFIED LENGTH OF CABLE.
5. CONTROL PANAL PLACEMENT AND CONDUIT IS UP TO THE CONTRACTOR OR OTHERS TO DECIDE. CONTACT PSI 800-358-9095 TO CONFIRM AND VERIFY CORRECT CABLES LENGTHS, ACCORDING TO PLACEMENT OF THE PANEL.

PUMP MODEL: 100BZ42.2
HP 460V 3 PH FLA 4.6AMP
PERFORMANCE:
440 GPM AT 13.68 TDH



Hazen-Williams Equation
Head Loss in Water Pipe

$f = 0.2083\ (100 / c)^{1.852}\ q^{1.852} / d_h^{4.8655}$

c = 150 HDPE/PVC

q = 440 GPM

dh = 3.83 for 4" SCH80

FRICTION LOSS PER 100 FT

11.24 FT

---

c = 150 HDPE/PVC

q = 440 GPM

dh = 5.76 for 6" SCH80

FRICTION LOSS PER 100 FT

1.54 FT

STORM LIFT STATION PROFILE & CALCULATIONS

EQUIVALENT PIPE RUN CALCULATION

6" SCH 80 PVC PIPE		20.0 FT
6" PVC SCH 80 90 ELBOW (0)	X 16 FT	0.0 FT
6" PVC SCH 80 45 BEND (1)	X 7.7 FT	7.7 FT
TOTAL EQUIVALENT LENGTH		27.7 FT
FRICTION LOSS PER 100 FT 6" PVC @ 440 GPM		1.54 FT PER 100 FT
FRICTION LOSS 6"	27.7/100 X 1.54 FT =	.93 FT
4" PVC SCH 80 PIPE		11.0 FT
4" PVC SCH 80 90 ELBOW (1)	X 10 FT	10.0 FT
4" CHECK VALVE (1)	X 26 FT	26.0 FT
4" BALL VALVE (1)	X 2.3 FT	2.3 FT
TOTAL EQUIVALENT LENGTH		49.3 FT
FRICTION LOSS PER 100 FT 4" PVC @ 440 GPM		11.24 FT PER 100 FT
FRICTION LOSS 4"	49.3/100X 11.24 FT =	5.54 FT
FRICTION LOSS .43 + 5.54		5.97 FT
STATIC HEAD		7.71 FT
TOTAL DEVELOPED HEAD		13.68 FT
PERFORMANCE 440 GPM @ 13.68 FT TDH THRU 6" PVC LINE		

PSI pacific southwest industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
(800) 358 9095
PACKAGED LIFT STATION

MWS- STORM WATER LIFT STATION DETAILS

NOTE: VERIFY ALL ELEVATIONS PRIOR TO FABRICATION. OTHERS TO VERIFY ALL INLET/OUTLET ORIENTATIONS PRIOR TO FABRICATION AND INSTALLATION. *ALL PIPE OPENINGS AND SEALING SHALL BE COMPLETED IN FIELD BY OTHERS.

PSI pacific southwest industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
18541 COLLIER AVE., LAKE ELSINORE, CA 92530 PH: 800 358-9095

No.	Date	Description

LIFT STATION DETAILS
14451 MYFORD ROAD
TUSTIN, CA

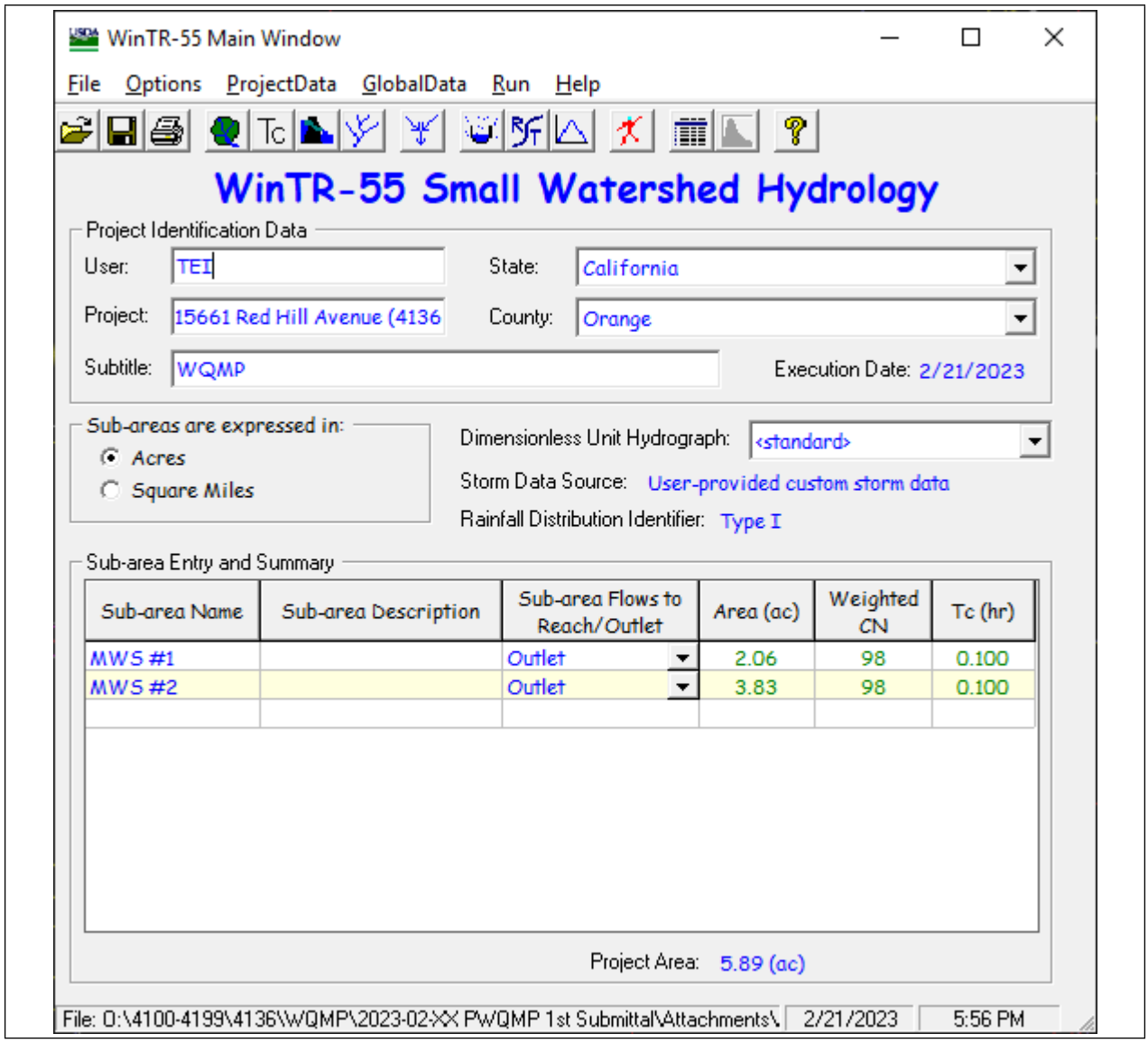
Date: 01/06/21 Scale: NTS
Drawn by: CB Sheet No. 1 OF 1
Checked by: OR

LSD-1

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

CB #1/CPS #1

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=	0.263	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}=	0.263	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.86	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.863	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.421	cfs
Supporting Calculations				
Describe system: CPS #1: Model: Hydra CPS U 4.7 (18" Height) QTY: 1 Treatment Rate: 12.26 cfs each Total Treatment Rate: 12.26 cfs > SQDF				
Provide time of concentration assumptions:				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WinTR-55 Small Watershed Hydrology
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User: TEI
State: California
Project: 15661 Red Hill Avenue (4136
County: Orange
Subtitle: WQMP
Execution Date: 2/21/2023
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 #1
Outlet
2.06
98
0.100
MWS #2
Outlet
3.83
98
0.100
Project Area: 5.89 (ac)
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2/21/2023
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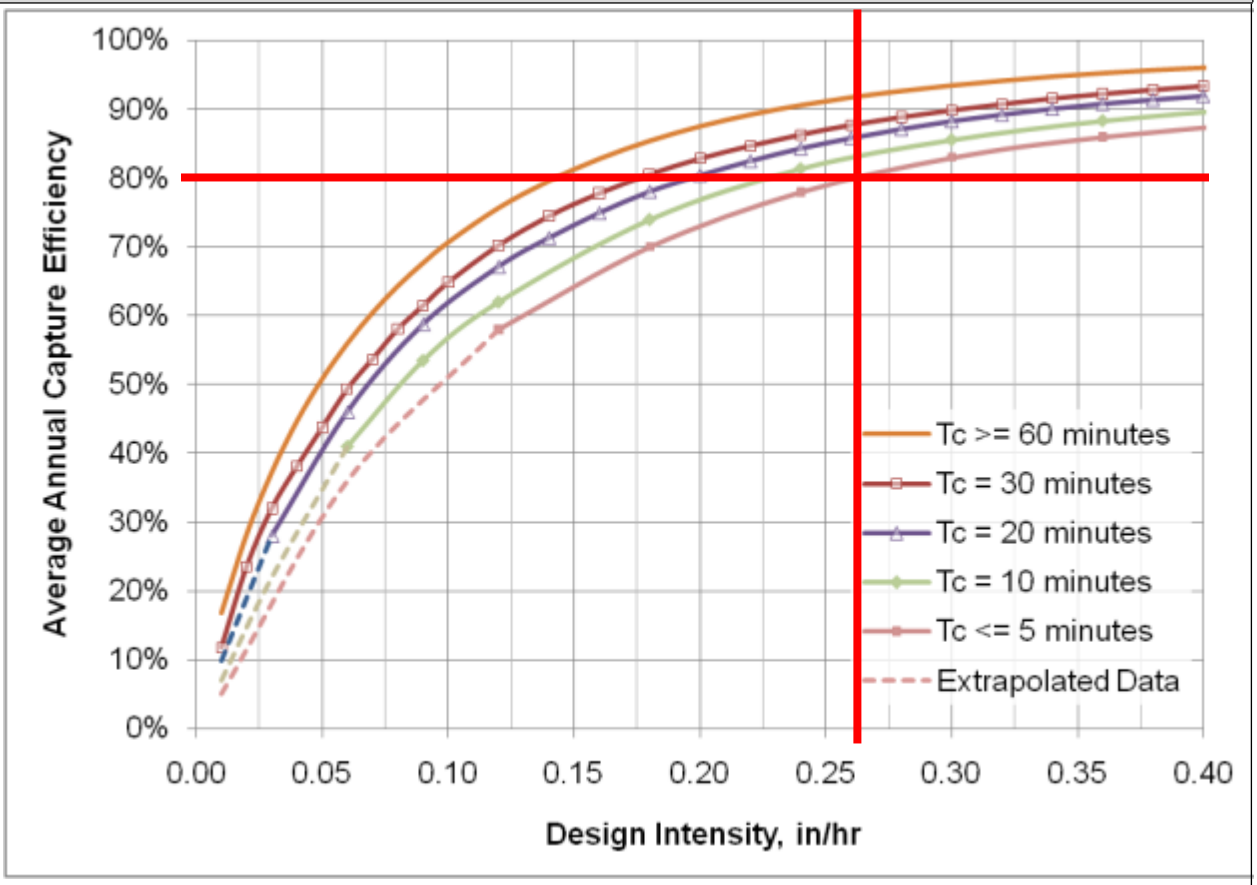
Graphical Operations

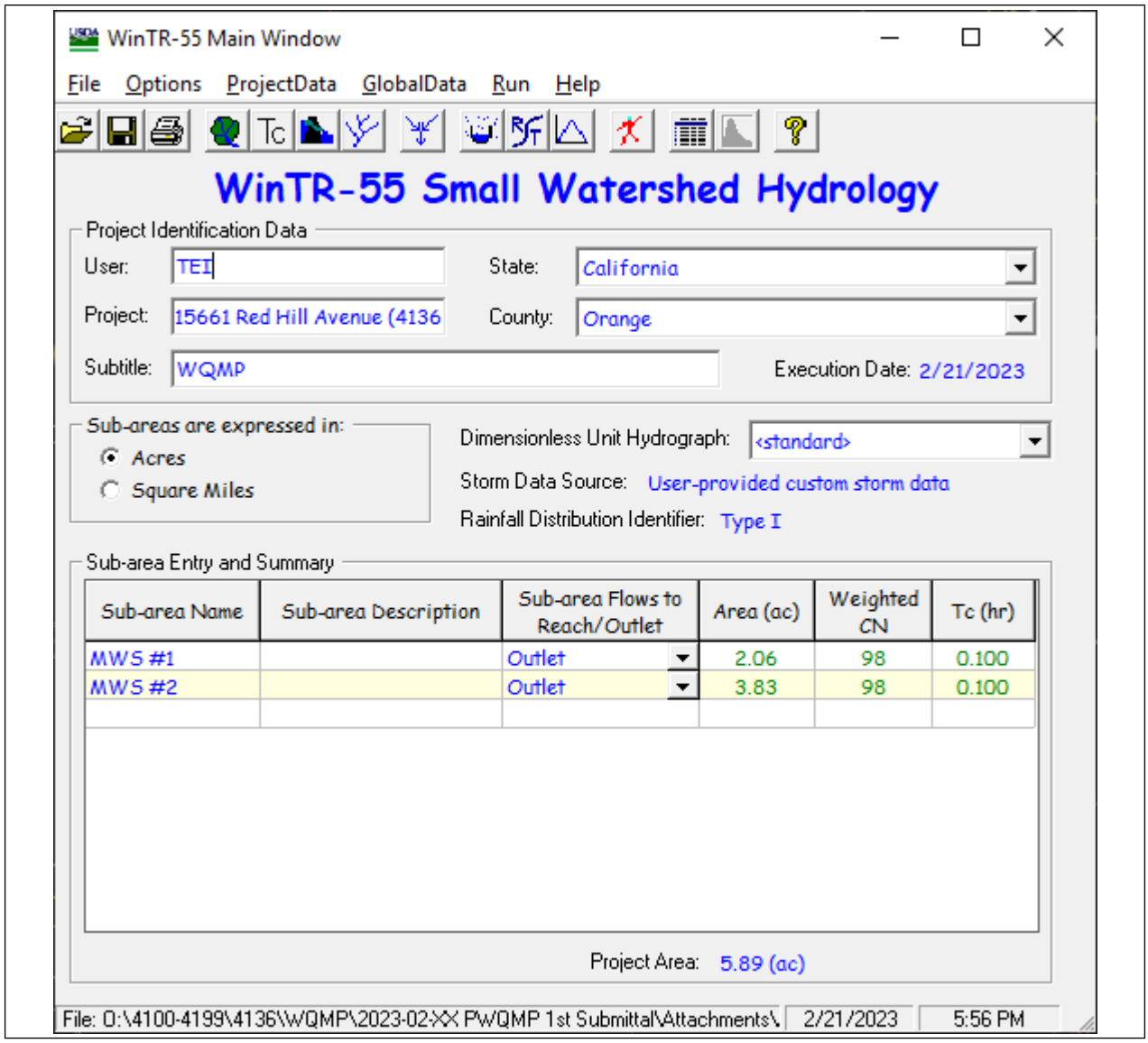


Provide supporting graphical operations. See Example III.7.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

CB #2/CPS #2

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=	0.263	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}=	0.263	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.30	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.863	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.068	cfs
Supporting Calculations				
Describe system: CPS #1: Model: Hydra CPS U 4.7 (18" Height) QTY: 1 Treatment Rate: 12.26 cfs each Total Treatment Rate: 12.26 cfs > SQDF				
Provide time of concentration assumptions:				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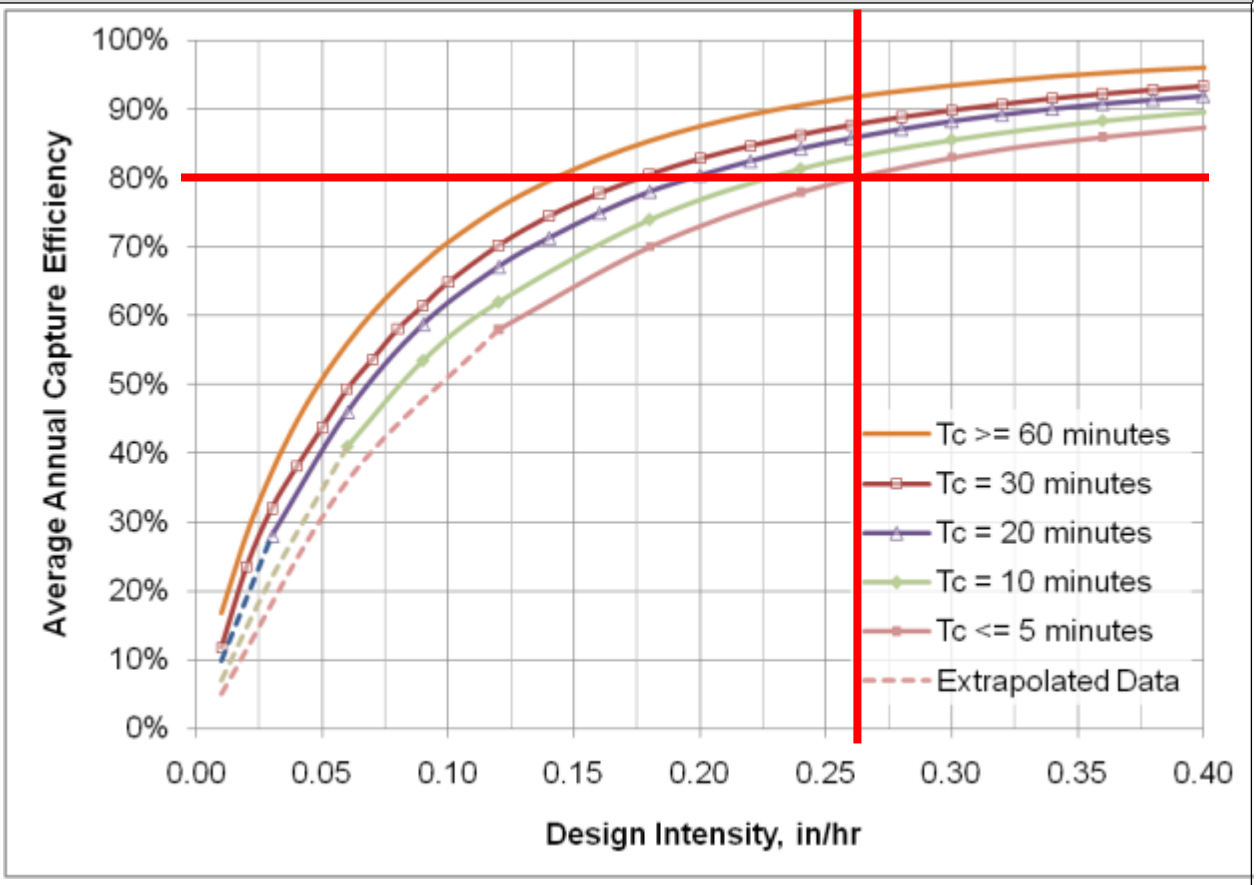
File Options ProjectData GlobalData Run Help
WinTR-55 Small Watershed Hydrology
Project Identification Data
User: TEI
State: California
Project: 15661 Red Hill Avenue (4136
County: Orange
Subtitle: WQMP
Execution Date: 2/21/2023
Sub-areas are expressed in:
Acres
Square Miles
Dimensionless Unit Hydrograph: <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 #1
Outlet
2.06
98
0.100
MWS #2
Outlet
3.83
98
0.100
Project Area: 5.89 (ac)
File: O:\4100-4199\4136\WQMP\2023-02-XX PWQMP 1st Submittal\Attachments\
2/21/2023
5:56 PM

Graphical Operations

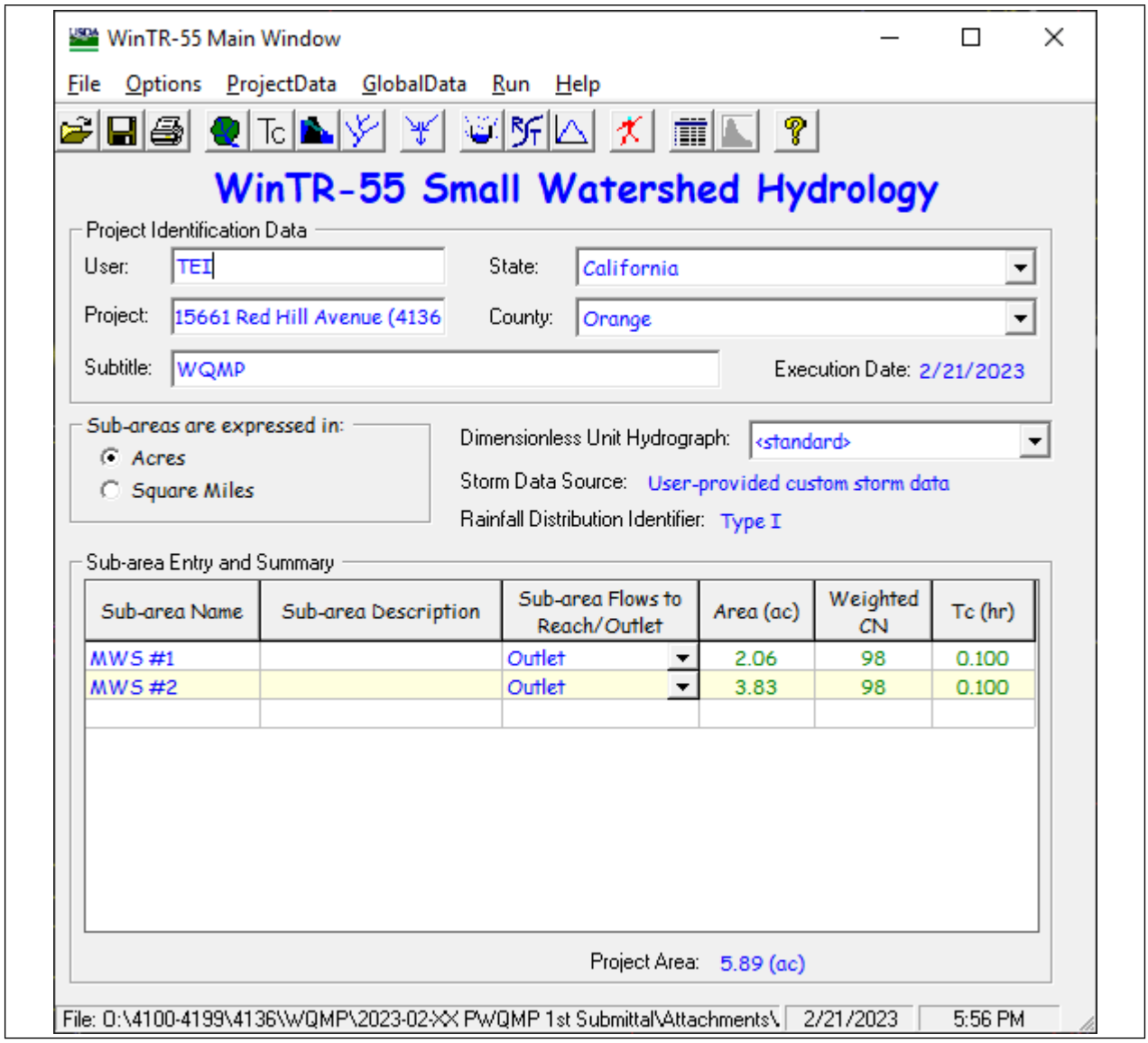


Provide supporting graphical operations. See Example III.7.

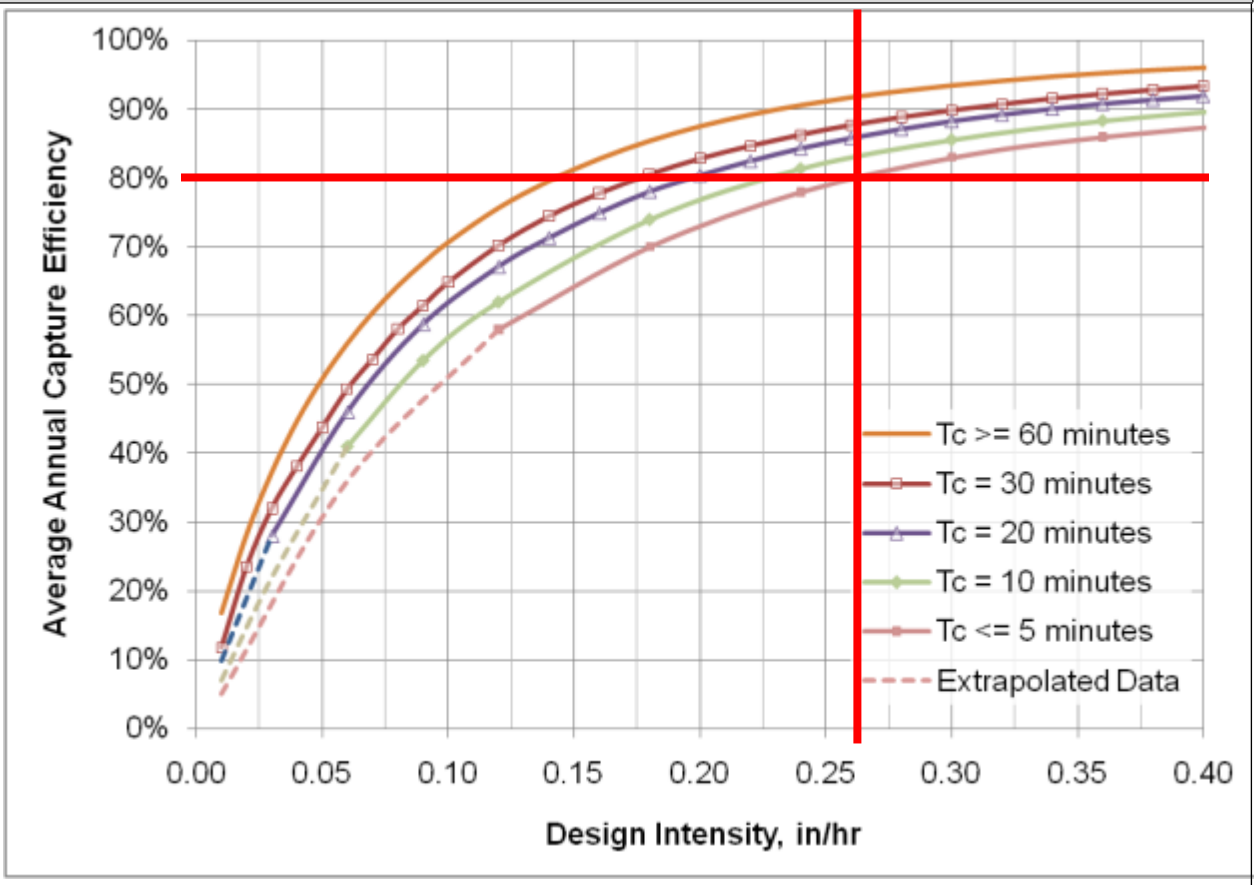
Worksheet D: Capture Efficiency Method for Flow-Based BMPs

CB #3/CPS #3

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=	0.263	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}=	0.263	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.37	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.863	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.310	cfs
Supporting Calculations				
Describe system: CPS #1: Model: Hydra CPS U 4.7 (18" Height) QTY: 1 Treatment Rate: 12.26 cfs each Total Treatment Rate: 12.26 cfs > SQDF				
Provide time of concentration assumptions:				


WinTR-55 Main Window
File Options ProjectData GlobalData Run Help
WinTR-55 Small Watershed Hydrology
Project Identification Data
User: TEI
State: California
Project: 15661 Red Hill Avenue (4136
County: Orange
Subtitle: WQMP
Execution Date: 2/21/2023
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 #1
Outlet
2.06
98
0.100
MWS #2
Outlet
3.83
98
0.100
Project Area: 5.89 (ac)
File: O:\4100-4199\4136\WQMP\2023-02-XX PWQMP 1st Submittal\Attachments\
2/21/2023
5:56 PM

Graphical Operations

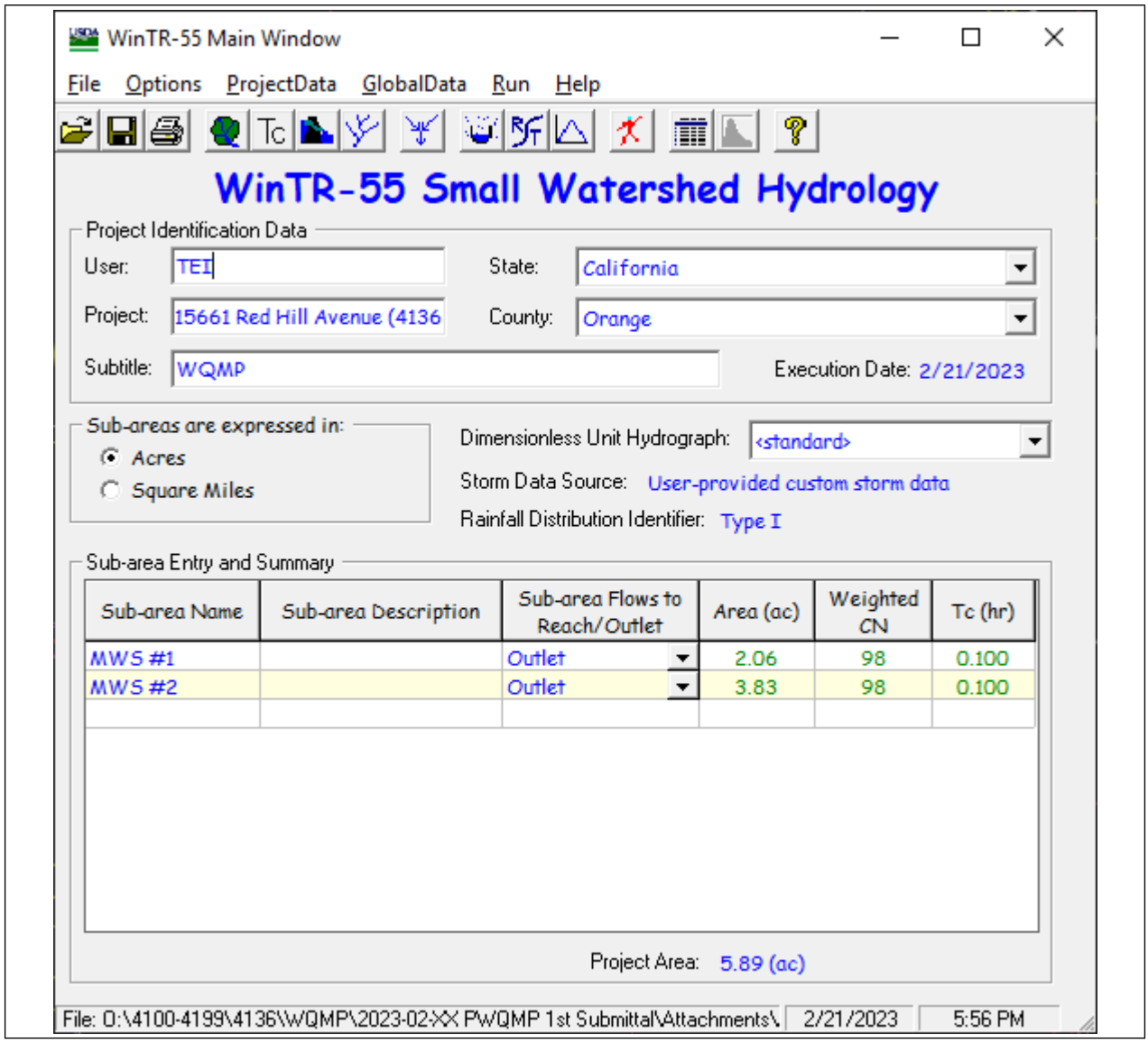


Provide supporting graphical operations. See Example III.7.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

CB #4/CPS #4

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=	0.263	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}=	0.263	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.53	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.863	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.346	Cfs
Supporting Calculations				
Describe system: CPS #1: Model: Hydra CPS U 4.7 (18" Height) QTY: 1 Treatment Rate: 12.26 cfs each Total Treatment Rate: 12.26 cfs > SQDF				
Provide time of concentration assumptions:				


WinTR-55 Main Window
File Options ProjectData GlobalData Run Help
WinTR-55 Small Watershed Hydrology
Project Identification Data
User: TEI
State: California
Project: 15661 Red Hill Avenue (4136
County: Orange
Subtitle: WQMP
Execution Date: 2/21/2023
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 #1
Outlet
2.06
98
0.100
MWS #2
Outlet
3.83
98
0.100
Project Area: 5.89 (ac)
File: O:\4100-4199\4136\WQMP\2023-02-XX PWQMP 1st Submittal\Attachments\
2/21/2023
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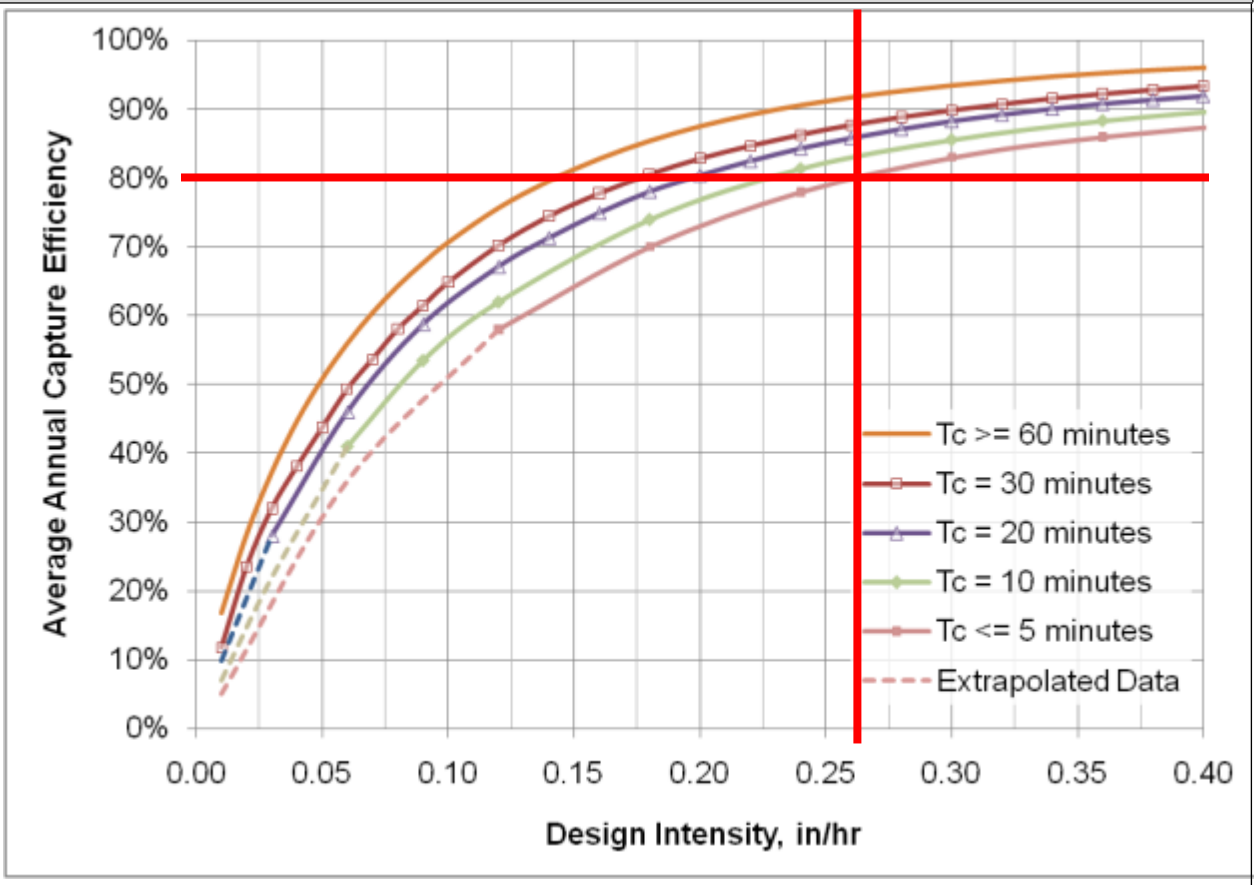
Graphical Operations

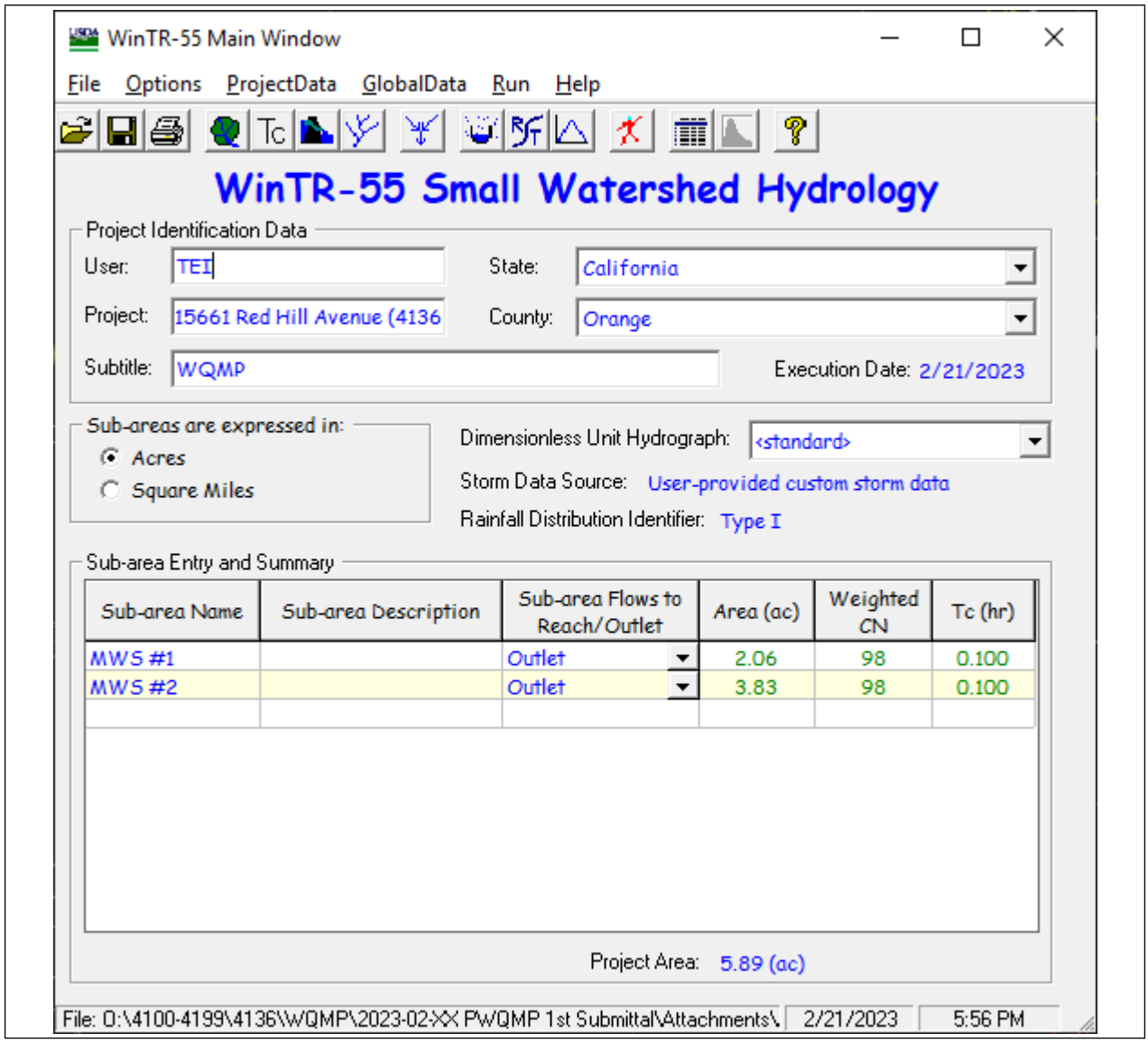


Provide supporting graphical operations. See Example III.7.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

CB #5/CPS #5

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=	0.263	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}=	0.263	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.47	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.95	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.863	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.106	Cfs
Supporting Calculations				
Describe system: CPS #1: Model: Hydra CPS U 4.7 (18" Height) QTY: 1 Treatment Rate: 12.26 cfs each Total Treatment Rate: 12.26 cfs > SQDF				
Provide time of concentration assumptions:				


WinTR-55 Main Window
File Options ProjectData GlobalData Run Help
WinTR-55 Small Watershed Hydrology
Project Identification Data
User: TEI
State: California
Project: 15661 Red Hill Avenue (4136
County: Orange
Subtitle: WQMP
Execution Date: 2/21/2023
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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)
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3.83
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Project Area: 5.89 (ac)
File: O:\4100-4199\4136\WQMP\2023-02-XX PWQMP 1st Submittal\Attachments\
2/21/2023
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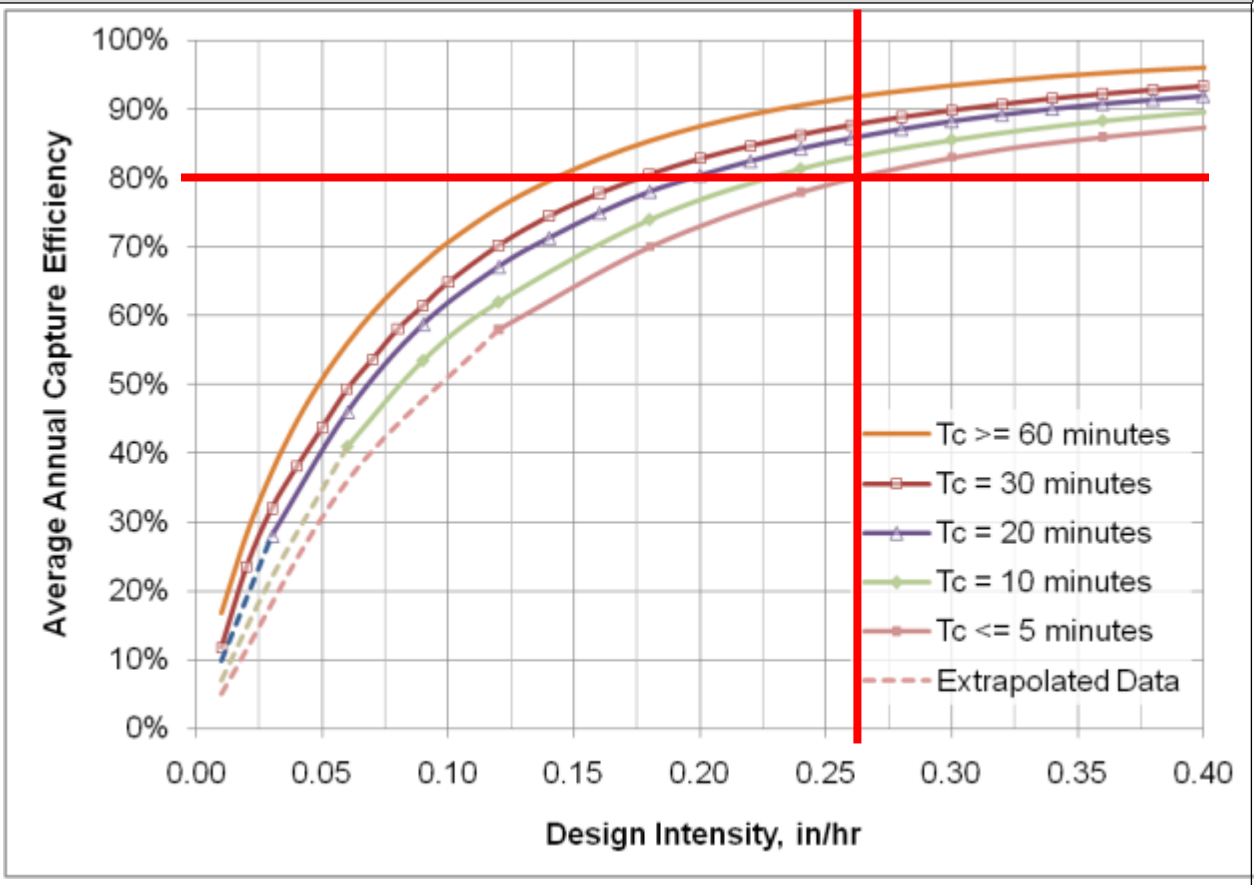
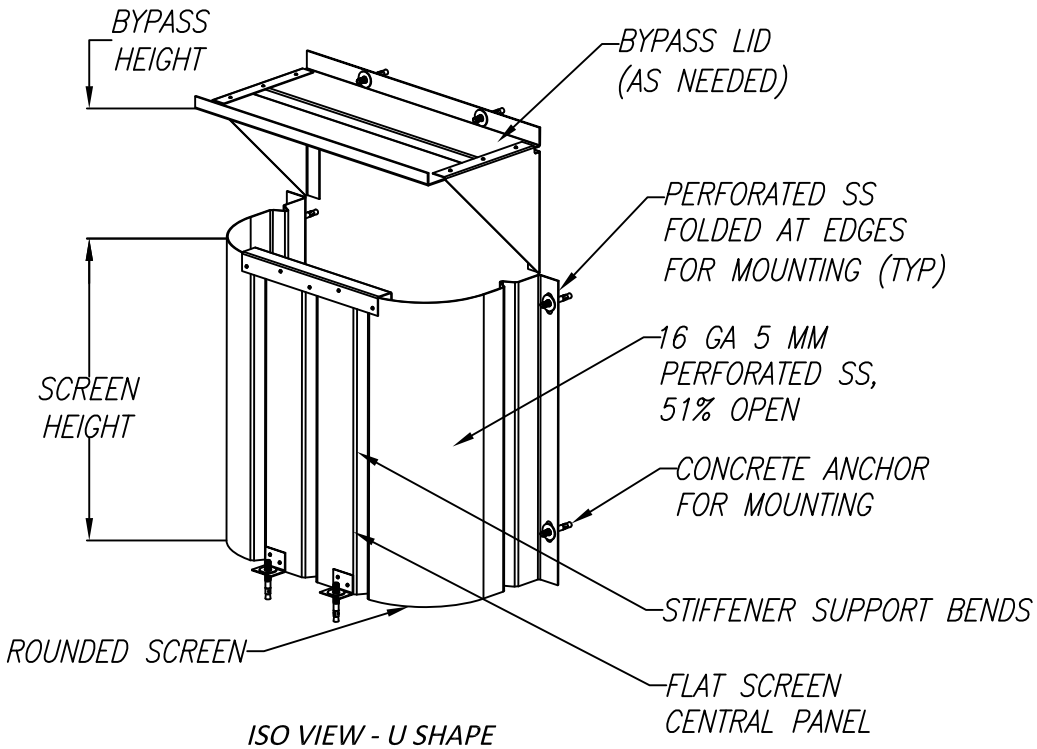
Graphical Operations



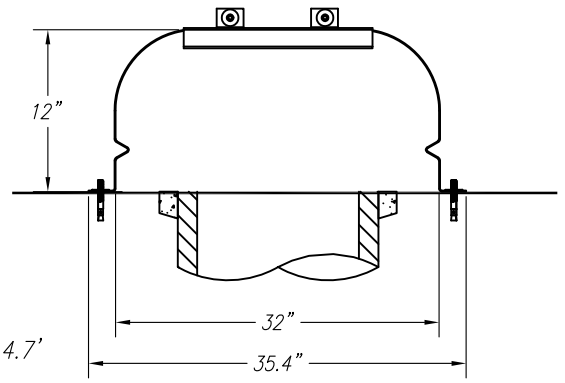
Provide supporting graphical operations. See Example III.7.

HYDRA CONNECTOR PIPE SCREEN (CPS)
U 4.7



ISO VIEW - U SHAPE

CPS U WITH 4.7 FT SCREEN LENGTH	
CPS HEIGHT (IN)	SCREEN FLOW (CFS)
12	6.67
18	12.26
24	18.88
30	26.40
36	34.71
NOTE: BYPASS FLOW RATES VARY WITH VAULT DEPTH AND BYPASS HEIGHT. CONTACT BIO CLEAN FOR ADDITIONAL INFORMATION.	



TOTAL SCREEN LENGTH ~ 4.7'
SPAN LENGTH = 32"
COMPATIBLE WITH PIPES UP TO ø24"

TOP SECTION VIEW - U SHAPE

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE.
3. THIS CPS UNIT IS DESIGNED FOR TREATMENT FLOWS THROUGH THE SCREEN. FLOWS GREATER THAN THE TREATMENT FLOW RATE WILL BYPASS OVER THE SCREEN.
4. A BYPASS LID IS REQUIRED WHEN THE OUTLET PIPE IS DIRECTLY BELOW THE CURB OPENING.
5. CPS IS COMPRISED OF 304 STAINLESS STEEL. THICKNESS IS 16 GAUGE. SCREEN PERFORATIONS ARE 5 MILLIMETERS IN DIAMETER. THE SCREEN AREA IS 51% OPEN SPACE.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO INSTALL THE CPS UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. POSITION THE CPS SO IT IS EVENLY SPACED AROUND THE CONNECTOR PIPE, ENSURING A MIN. OF 4" SPACING AWAY FROM ANY CORNERS. SCREEN BOTTOM SHALL BE FLUSH WITH THE CATCH BASIN FLOOR, OR WITH GAPS NO GREATER THAN 5 MM.
3. IF A BYPASS LID IS REQUIRED, VERIFY THE BYPASS HEIGHT NEEDED AND MARK THAT LOCATION ON THE WALL DIRECTLY ABOVE THE BASE UPRIGHTS. LIFT THE LID IN PLACE AND MARK THE HOLE LOCATIONS FOR THE LID MOUNTING BRACKETS. SECURE THE LID WITH STAINLESS STEEL NUTS.

WARRANTY: 3 YEAR MANUFACTURER'S		MEETS FULL CAPTURE REQUIREMENTS	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 1/17/2020	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

ATTACHMENT E
COVENANT AND AGREEMENT

[To Be Used for projects not involving land subdivisions]

RECORDING REQUESTED BY AND WHEN RECORDED MAIL TO:

Building Official
City of Tustin
300 Centennial Way
Tustin, CA 92780-3767

Space Above This Line For Recorder's Use Only

COVENANT AND AGREEMENT REGARDING O & M PLAN TO FUND AND MAINTAIN WATER QUALITY BMPS, CONSENT TO INSPECT, AND INDEMNIFICATION

This Agreement Regarding O&M Plan to Fund and Maintain Water Quality BMPs, Consent to Inspect, and Indemnification and Covenant Running With the Land ("Agreement") is made on this ___ day of _____, 20__, by and between The City of Tustin, a California municipal corporation ("Covenantee" or "City") and the undersigned property owner(s) ("Covenantor").

RECITALS

A. Covenantor is the owner of the following real property ("Property") [Provide Address, Legal Description and APN Number]):

Building 1: XXXXX Bell Avenue, Tustin, CA 92780
Building 2: XXXXX Red Hill Avenue, Tustin, CA 92780

APN: 430-233-19

Legal description and depiction of the Property provided in Exhibit A and B, attached herein.

B. The City is the owner of interests in that certain real property within the City of Tustin, County of Orange, State of California, containing storm drains, pipelines, and related appurtenances constituting the City's municipal separate storm sewer system (the City's "Storm Drain System").

C. Covenantor intends to develop, improve, and/or use the Property in such a way that approval of the City for such development, improvement, and/or use is required pursuant to the applicable laws.

D. As a condition for said approval by the City, City required Covenator, and Covenantor desires to, restrict the use of Property according to the conditions,

covenants, equitable servitudes, and restrictions contained herein for the express benefit of the City's Storm Drain System.

NOW, THEREFORE, incorporating the foregoing Recitals and in consideration thereof, in consideration of the covenants and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and expressly for the benefit of, and to bind, their successors in interest, the parties hereto agree as follows:

AGREEMENT

1. Operation and Maintenance ("O&M") Plan for Best Management Practices ("BMPs")

Covenantor, and each successive owner of an interest in all or any part of the Property ("Owner(s)") shall, throughout the period of their respective ownership, implement, and fund implementation of, the O&M Plan for the Property, which was approved by the City as part of the Water Quality Management Plan ("WQMP") required for development of the Property, and shall operate, inspect, maintain, repair, and replace the Best Management Practices ("BMPs") described in the O&M Plan for the Property, which includes:

a. Description of all post-construction BMPs (non-structural and structural),
b. Description of the Property owner's(s') responsibilities and required training of persons performing BMP implementation, operation, maintenance, and inspection,
c. Implementation frequency and operating schedule,
d. Inspection/maintenance frequency and schedule,
e. Specific BMP implementation, maintenance, and inspection activities,
f. Description of all permits required for the implementation, operation, and maintenance of BMPs,
g. Forms to be used in documenting implementation, operation, maintenance, and inspection of BMPs,
h. Recordkeeping requirements.

A copy of the approved O&M Plan is described in the current WQMP for the project, as it may be amended from time to time according to its terms, which is on file with the City of Tustin Community Development Department, and is incorporated herein by this reference.

2. Compliance with Tustin City Code and Consent to Inspect

Owners shall use and maintain the Property in full compliance with the provisions of the O&M Plan and the Tustin City Code section 4900 et seq., as it may be amended from time to time. Owners hereby consent to inspection of the Property by an inspector authorized by the City Manager, or his or her designee, for the purpose for verifying compliance with the provisions of this Agreement.

3. Indemnification

Owners agree to indemnify, defend, and hold harmless the City, its elected officers, employees, agents, and contractors from and against any and all liability, expense, including costs and legal fees, and claims of damage of any nature whatsoever including, but not limited to, death, bodily injury, personal injury, or property damage arising from or connected with the City inspection of the Property except where such liability, expense, or claim for damage results from the sole negligence or willful misconduct of the City its elected officers, employees, agents, or contractors.

4. Rights and Obligations Run With the Land

Unless terminated in accordance with Paragraph 5, below, or by law, the rights and obligations of the parties hereunder shall constitute covenants, benefits, burdens, conditions, equitable servitudes, and restrictions which run with the land in perpetuity and which shall be binding upon, and inure to the benefit of, each Owner during its respective period of ownership of all or any part of the Property. No Owner shall be bound by, or entitled to the benefit of, said rights and obligations, upon transfer by the Owner of its entire interest in the Property, in fee, to a successor in interest to the Property.

5. Termination of Agreement Upon Termination of WQMP

This Agreement and the conditions, covenants, equitable servitudes, and restrictions set forth herein shall terminate upon termination of the WQMP applicable to the Property in accordance with its terms. Upon termination of the WQMP applicable to the Property, the Owner may request that the City execute a recordable document approved by the City approving and acknowledging termination of this Agreement. A recorded document duly executed and acknowledged by the Director of Community Development of City, or his or her designee, approving termination of this Agreement shall be conclusive evidence of such termination.

6. Enforcement

The City may, but shall not be obligated to, enforce this Agreement by a proceeding at law or in equity against any person or persons violating or attempting to violate any condition, covenant, equitable servitude, or restriction provided for herein, either to restrain such violation or to recover damages.

7. Entire Agreement.

This Agreement constitutes the entire agreement and understanding between the parties with respect of the subject matter of this Agreement and supersedes all prior or contemporaneous agreements and understandings with respect to the subject matter hereof, whether oral or written.

8. Severability.

If any part of this Agreement is declared by a final decision of a court of competent jurisdiction to be invalid for any reason, such shall not affect the validity of the rest of the Agreement. The other parts of this Agreement shall remain in effect as if this Agreement had been executed without the invalid part. The parties declare that they intend and desire that the remaining parts of this Agreement continue to be effective without any part or parts that have been declared invalid.

9. Counterparts.

This Agreement may be executed in counterparts, each of which so executed shall, irrespective of the date of its execution and delivery, be deemed an original, and all such counterparts together shall constitute one and the same instrument.

10. Attorneys' Fees.

If any party files an action or brings any proceeding against the other arising from this Agreement, the prevailing party shall be entitled to recover as an element of its costs of suit, and not as damages, reasonable attorneys' fees and costs to be fixed by the court. A party not entitled to recover its costs shall not recover attorneys' fees. No sum for attorneys' fees shall be included in calculating the amount of a judgment for purposes of deciding whether a party is entitled to its costs or attorneys' fees.

11. Amendment.

No modification, amendment, addition to, or alteration of the terms of this Agreement whether written or verbal, shall be valid unless made in writing, formally approved and executed by the City and the current Owner(s) of the Property, and duly recorded.

12. Authority of Signatories to Agreement.

Each person executing this Agreement represents and warrants that he or she is duly authorized and has legal capacity to execute and deliver this Agreement on behalf of the parties for which execution is made. Each party represents and warrants to the other that the execution of this Agreement and the performance of such party's obligations hereunder have been duly authorized and that the agreement is a valid and legal agreement binding on such party and enforceable in accordance with its terms.

[*SIGNATURES ON FOLLOWING PAGE*]

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date set forth above.

"CITY" / "COVENANTEE"
CITY OF TUSTIN

_____
Dana L. Ogdon, AICP
Assistant Director of Community Development

ATTEST:

_____
Erica N. Yasuda, City Clerk

APPROVED AS TO FORM:

_____
David Kendig, City Attorney

"COVENANTOR"
Centurion Plaza LLC
Mike Moshayedi
Name of Covenantor

_____
Signature
[TITLE HERE]
Title

_____
Signature

_____
Title

[Signatures to be Notarized]

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of New York
County of _____)

On _____ before me, _____
(insert name and title of the officer)

personally appeared _____,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

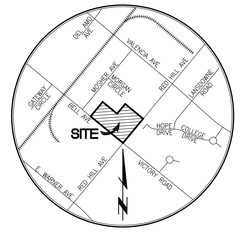
I certify under PENALTY OF PERJURY under the laws of the State of New York that the foregoing paragraph is true and correct.

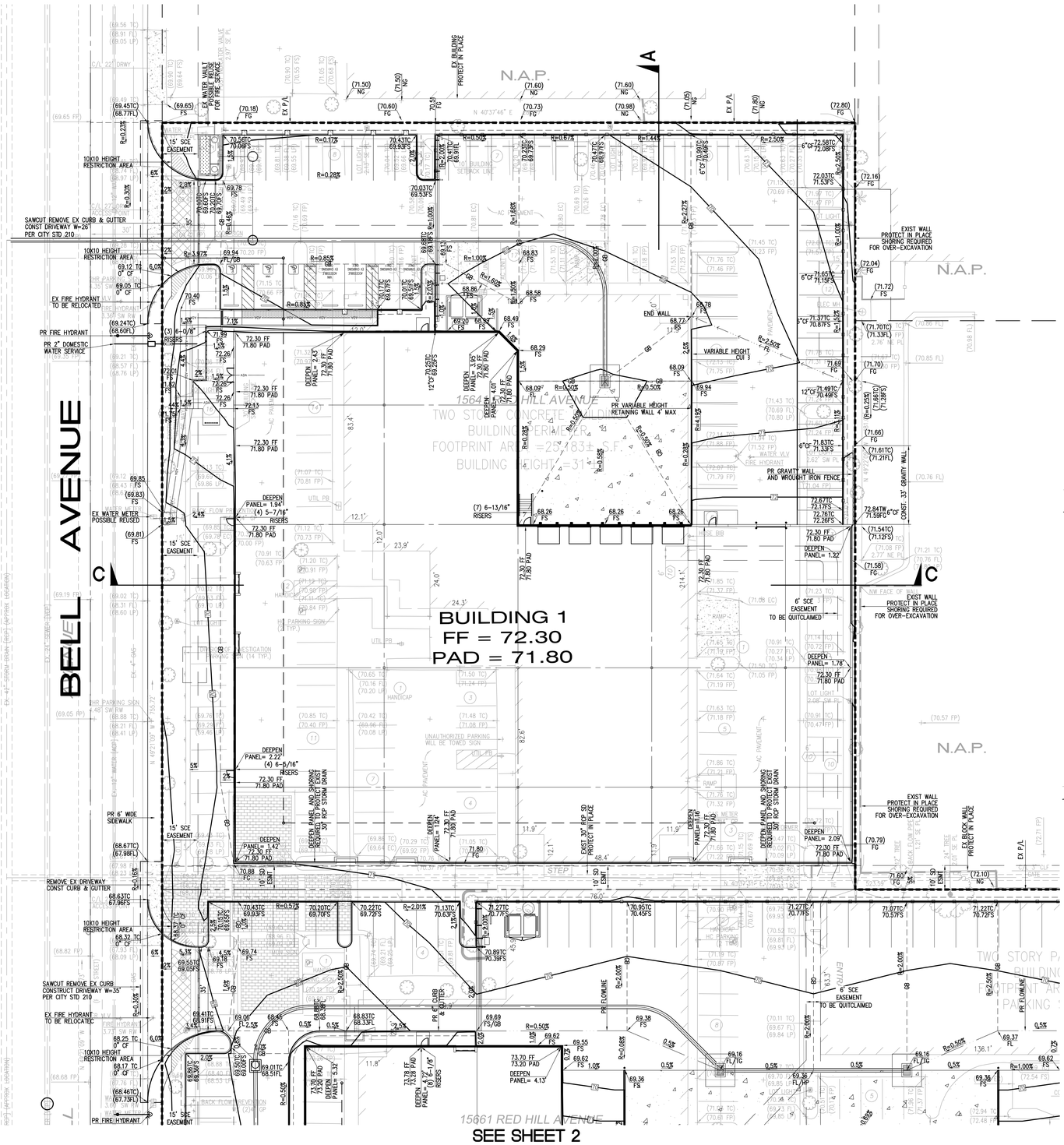
WITNESS my hand and official seal.

Signature _____**(Seal)**

ATTACHMENT F
CONDITIONS OF APPROVAL
(PROVIDED AT FWQMP)

ATTACHMENT G
GRADING PLANS
(for reference)





EARTHWORK BALANCE CALCULATIONS

8/17/2022

PROJECT: **Centurion Plaze** 15661 Red Hill Ave, Tustin, CA
JOB# 4136

K.	SITE AREA:	290,614	SF
L.	SUBSIDENCE FACTOR:	0.0	%
M.	SHRINKAGE FACTOR:	0.0	%
N.	SITE STRIPPING FACTOR:	0	
O.	OVEREXCAVATION:	-	CY
A.	CALCULATED CUT:	7,400	CY
B.	FOOTING AND ONSITE UTILITY SPOILS	1,800	CY
Ba.	OFFSITE SPOILS (STREET AND UTILITIES)	-	
C.	**TOTAL CUT: (A+B)**	**9,200**	CY
D.	CALCULATED FILL:	9,200	CY
E.	LIGHT PAVING FILL:	-	CY
F.	SUBSIDENCE: (LxK)/27=	-	CY
G.	SHRINKAGE: (M/100)C=	-	CY
H.	SITE STRIPPING	-	
I.	OVEREXCAVATION SHRINKAGE	-	CY
J.	**TOTAL FILL: (D+E+F+G+H)=**	**9,200**	CY
Q.	**TOTAL (IMPORT) OR EXPORT:**	**-**	CY

VICINITY MAP
N.T.S.

SECTION "B - B"
SCALE HORZ: 1"= 20'
VERT: 1"= 4'

SECTION "C - C"
SCALE HORZ: 1"= 20'
VERT: 1"= 4'

SHEET INDEX

1. CONCEPTUAL GRADING PLAN BUILDING 1
2. CONCEPTUAL GRADING PLAN BUILDING 2
3. UTILITIES PLAN
4. STORM DRAIN PLAN
5. STORM DRAIN PROFILE

SECTION "A - A"
SCALE HORZ: 1"= 20'
VERT: 1"= 4'

SCALE: 1" = 20'

PREPARED FOR:

Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657

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

Last Update: 2/7/23
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CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

CONCEPTUAL GRADING PLAN
CENTURION PLAZA
15661 RED HILL AVENUE, TUSTIN, CA

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

Approved by Date ______

Public Works Director R.C.E. XXXXX

Sheet 1 of 5 Sheets

JN: 4136

SEE SHEET 1

BUILDING 2
FF = 73.70
PAD = 72.20

15661 RED HILL AVENUE
TWO STORY CONCRETE BUILDING
BUILDING PERIMETER
FOOTPRINT AREA =28,460± S.F.
BUILDING HEIGHT =37'±

15621 RED HILL AVENUE
TWO STORY CONCRETE BUILDING
BUILDING PERIMETER
FOOTPRINT AREA =18,348± S.F.
BUILDING HEIGHT =32'±

TWO STORY PARKING STRUCTURE
BUILDING PERIMETER
FOOTPRINT AREA =17,064± S.F.
PARKING STALLS = 114

BELL AVENUE

RED HILL AVENUE

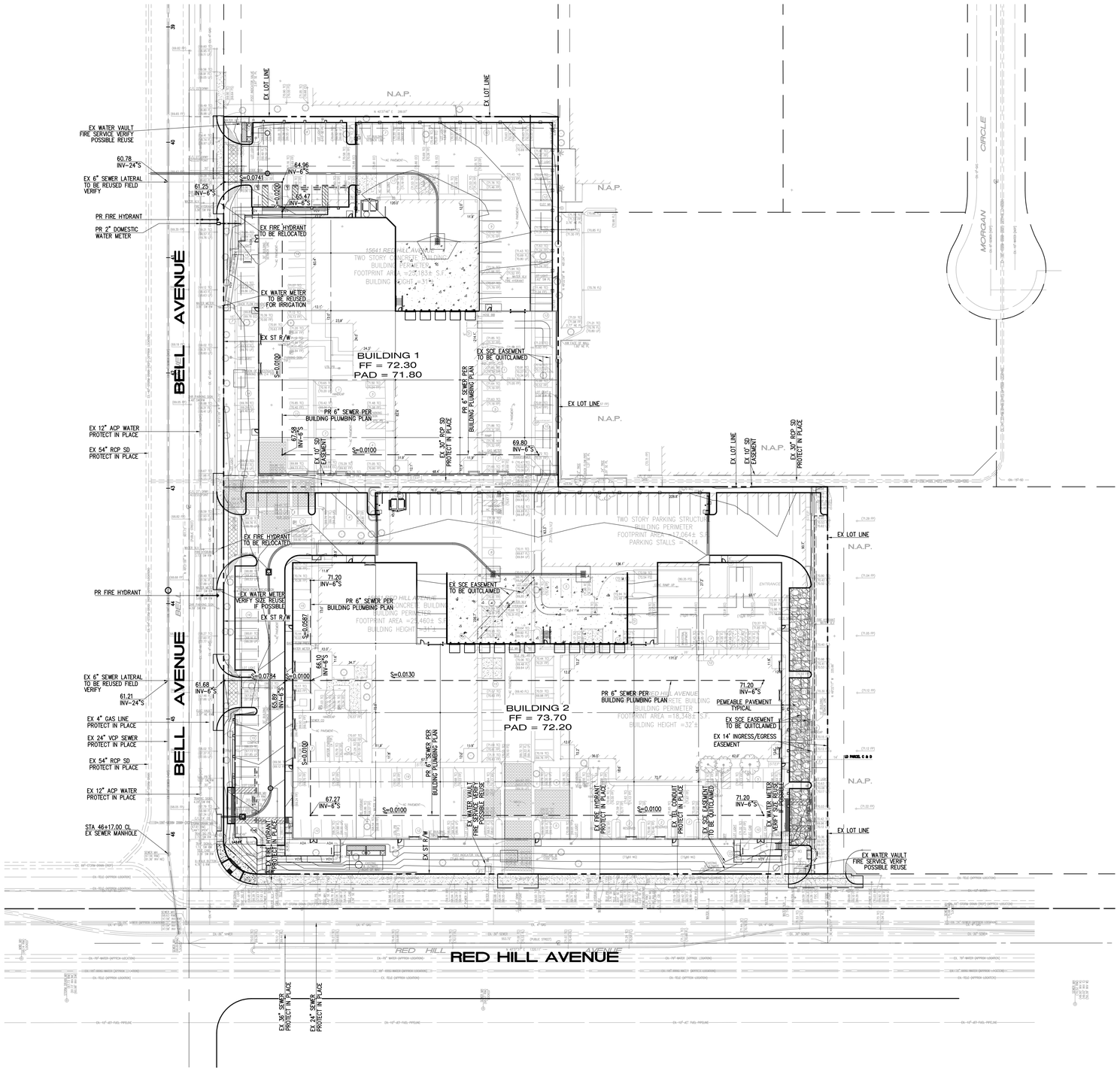
N.A.P.

WATERPROOFING AGAINST BUILDING
X" THICK PERMEABLE PAVEMENT
LAYER I: 2" THICK BEDDING COURSE (ASTM NO. 8 AGGREGATE)
LAYER II: 4" THICK OPEN-GRADED BASE (ASTM NO. 57 STONE)
LAYER III: STONE SUBBASE THICKNESS VARIES (ASTM NO. 2 STONE)
PAVER #3: 6" MIN.
12" MIN. VARIES
FLAT BOTTOM
NATIVE SOIL
CURB/EDGE RESTRAINT

SITE DESIGN BMP
PERMEABLE PAVEMENT - SECTION
N.T.S.

0 10 20 40 60
SCALE: 1" = 20'

PREPARED FOR:	CITY OF TUSTIN PUBLIC WORKS DEPARTMENT
Centurion Plaza LLC 36 Deep Sea Newport Coast, CA 92657	CONCEPTUAL GRADING PLAN CENTURION PLAZA 15661 RED HILL AVENUE, TUSTIN, CA
Thienes Engineering, Inc. CIVIL ENGINEERING • LAND SURVEYING 14349 FIRESTONE BOULEVARD LA MIRADA, CALIFORNIA 90638 PH:(714)521-4811 FAX:(714)521-4173 Last Update: 2/22/23 D:\4100-4199\4136\4136GDP01-02.dwg	Designed by ____ Date ____ Checked by ____ Date ____ Approved by ____ Date ____ Designed by ____ Date ____ Checked by ____ Date ____ Public Works Director ____ R.C.E. XXXXX Sheet 2 of 5 Sheets JN: 4136



0 10 20 40 60

SCALE: 1" = 20'

PREPARED FOR:

Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657

CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

CONCEPTUAL UTILITY PLAN

CENTURION PLAZA
15661 RED HILL AVENUE, TUSTIN, CA

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

Last Update: 2/7/23
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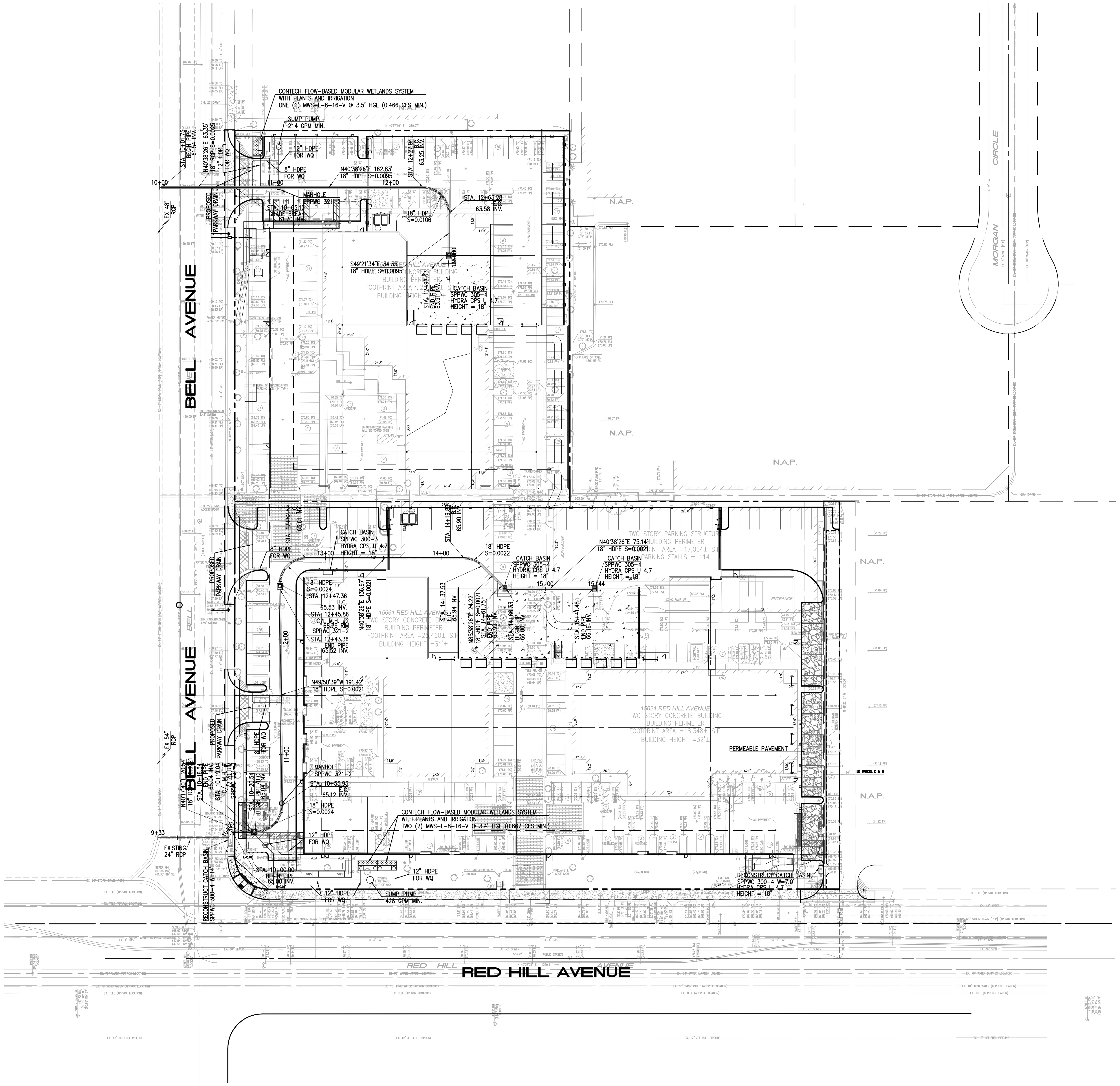
Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director R.C.E. XXXXX

Sheet 3 of 5 Sheets

JN: 4136



0 20 40 80 120

SCALE:1"=40'

PREPARED FOR:

Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657

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

Last Update: 2/22/23
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CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

CONCEPTUAL STORM DRAIN PLAN

CENTURION PLAZA
15661 RED HILL AVENUE, TUSTIN, CA

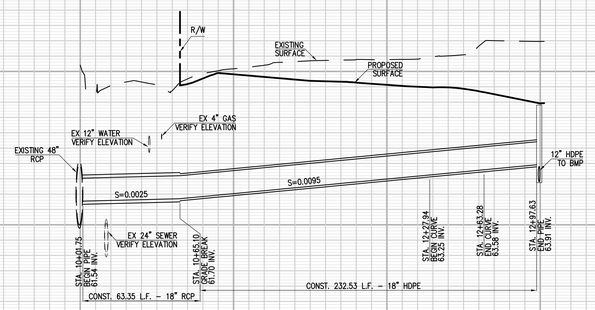
Designed by ____________
Date ____________
Checked by ____________
Date ____________
Designed by ____________
Date ____________
Checked by ____________
Date ____________

Approved by Date ____________

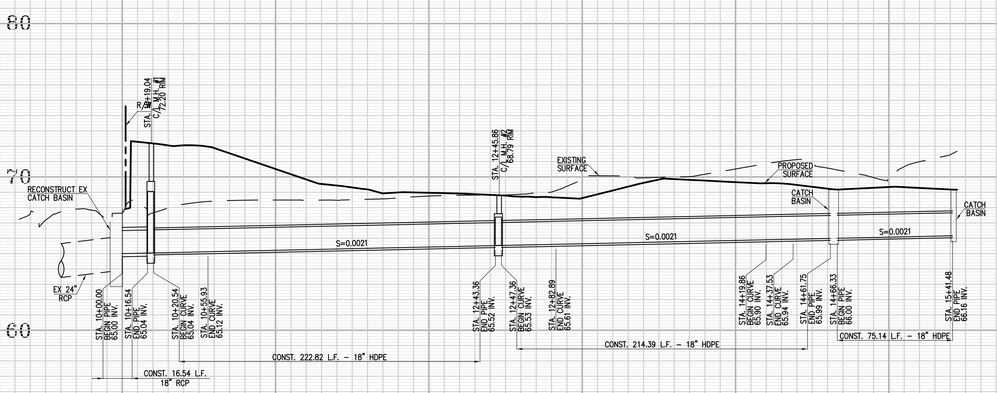
Public Works Director R.C.E. XXXXX

Sheet 4 of 5 Sheets

JN: 4136



LINE A



LINE B

PROFILE SCALE:
HORIZ. - 1" = 40'
VERT. - 1" = 4'

*CONTRACTOR TO VERIFY LOCATION AND INVERT ELEVATIONS OF EXISTING UTILITIES AND DRAINAGE SYSTEMS AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO ANY CONSTRUCTION.

PREPARED FOR:

Centurion Plaza LLC
36 Deep Sea
Newport Coast, CA 92657

CITY OF TUSTIN
PUBLIC WORKS DEPARTMENT

CONCEPTUAL STORM DRAIN PROFILES
CENTURION PLAZA
15661 RED HILL AVENUE, TUSTIN, CA

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

Last Update: 2/7/23
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Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____
Approved by _____ Date _____
Public Works Director R.C.E. XXXXX

Sheet 5 of 5 Sheets

JN: 4136

ATTACHMENT H
HCOC CALCULATIONS

2 year, 24-hr Storm Event			
	Flow Rate (cfs)	Volume (ac-ft)	Time of Concentration (min)
Pre-Development	8.89	0.8011	10.38
Post-Development	9.76	0.7998	7.47
Difference	0.87	-0.0013	-2.91
Difference (as % of pre-developed)	9.79%	-0.16%	-28.07%

```
**************************************************************************
          NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                AND LOW LOSS FRACTION ESTIMATIONS
==========================================================================
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                          Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRADA, CA 90638
                               714-521-4811

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB NO 4136
  2 YEAR 24 HOUR
  LOSS RATES
==========================================================================
*** 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          6.18       10.00       69.(AMC II)     0.250       0.801

    TOTAL AREA (Acres) =      6.18

                                  _
    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.025

                                  _
    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.199
==========================================================================
```

```
******************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
        (c) Copyright 1983-2016 Advanced Engineering Software (aes)
            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

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO 4136                                                      *
* EXISTING CONDITION                                                   *
* 2 YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: W:\4136\X100-2.DAT
  TIME/DATE OF STUDY: 08:43 02/21/2023
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =     70.53  DOWNSTREAM(FEET) =     69.55

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.352
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.580
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.62      0.25      0.100    50    9.35
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.87
  TOTAL AREA(ACRES) =      0.62   PEAK FLOW RATE(CFS) =      0.87
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.6  TC(MIN.) =      9.35
  EFFECTIVE AREA(ACRES) =      0.62  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       0.87
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
******************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO 4136                                                      *
* EXISTING CONDITION                                                   *
* 2 YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: W:\4136\X110-2.DAT
  TIME/DATE OF STUDY: 12:51 02/22/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   316.00
  ELEVATION DATA: UPSTREAM(FEET) =     71.47  DOWNSTREAM(FEET) =     69.75

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.621
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.656
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.71      0.25     0.100    50    8.62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.04
  TOTAL AREA(ACRES) =      0.71   PEAK FLOW RATE(CFS) =      1.04

******************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  91
------------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
==========================================================================
  UPSTREAM NODE ELEVATION(FEET) =     69.75
  DOWNSTREAM NODE ELEVATION(FEET) =     69.12
  CHANNEL LENGTH THRU SUBAREA(FEET) =   255.00
  "V" GUTTER WIDTH(FEET) =   2.50   GUTTER HIKE(FEET) =  0.170
  PAVEMENT LIP(FEET) =  0.013   MANNING'S N = .0150
```

```
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   0.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.366
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                C        1.57      0.25     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.98
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.24
  AVERAGE FLOW DEPTH(FEET) =   0.32   FLOOD WIDTH(FEET) =   16.68
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.44   Tc(MIN.) =   12.06
  SUBAREA AREA(ACRES) =    1.57       SUBAREA RUNOFF(CFS) =    1.89
  EFFECTIVE AREA(ACRES) =    2.28     AREA-AVERAGED Fm(INCH/HR) =   0.03
  AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       2.75

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.35   FLOOD WIDTH(FEET) =   19.53
  FLOW VELOCITY(FEET/SEC.) =   1.30   DEPTH*VELOCITY(FT*FT/SEC) =   0.46
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =     571.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     69.12
  DOWNSTREAM NODE ELEVATION(FEET) =     67.66
  CHANNEL LENGTH THRU SUBAREA(FEET) =   250.00
  "V" GUTTER WIDTH(FEET) =   2.50   GUTTER HIKE(FEET) =  0.170
  PAVEMENT LIP(FEET) =  0.013   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   0.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.241
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                C        0.46      0.25     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.00
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.90
  AVERAGE FLOW DEPTH(FEET) =   0.32   FLOOD WIDTH(FEET) =   16.55
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.20   Tc(MIN.) =   14.26
  SUBAREA AREA(ACRES) =    0.46       SUBAREA RUNOFF(CFS) =    0.50
  EFFECTIVE AREA(ACRES) =    2.74     AREA-AVERAGED Fm(INCH/HR) =   0.03
  AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        2.7         PEAK FLOW RATE(CFS) =       3.00

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.32   FLOOD WIDTH(FEET) =   16.55
  FLOW VELOCITY(FEET/SEC.) =   1.89   DEPTH*VELOCITY(FT*FT/SEC) =   0.61
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    113.00 =     821.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.10  DOWNSTREAM(FEET) =    65.00
  FLOW LENGTH(FEET) =    20.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.15
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.00
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   14.34
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    122.00 =     841.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.34
```

```
  RAINFALL INTENSITY(INCH/HR) =   1.24
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.74
  TOTAL STREAM AREA(ACRES) =       2.74
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.00

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   292.00
  ELEVATION DATA: UPSTREAM(FEET) =     71.06  DOWNSTREAM(FEET) =     69.29

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.713
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.646
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  APARTMENTS                 C        1.16      0.25     0.200    50    8.71
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.67
  TOTAL AREA(ACRES) =      1.16   PEAK FLOW RATE(CFS) =      1.67

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     69.29
  DOWNSTREAM NODE ELEVATION(FEET) =     67.58
  CHANNEL LENGTH THRU SUBAREA(FEET) =   248.00
  "V" GUTTER WIDTH(FEET) =   2.50   GUTTER HIKE(FEET) =  0.170
  PAVEMENT LIP(FEET) =  0.013   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   0.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.453
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.71      0.25     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.12
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.95
  AVERAGE FLOW DEPTH(FEET) =   0.29   FLOOD WIDTH(FEET) =   13.21
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.12   Tc(MIN.) =   10.83
  SUBAREA AREA(ACRES) =    0.71       SUBAREA RUNOFF(CFS) =    0.91
  EFFECTIVE AREA(ACRES) =    1.87     AREA-AVERAGED Fm(INCH/HR) =   0.04
  AREA-AVERAGED Fp(INCH/HR) =   0.25  AREA-AVERAGED Ap =   0.16
  TOTAL AREA(ACRES) =        1.9         PEAK FLOW RATE(CFS) =       2.38

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.30   FLOOD WIDTH(FEET) =   14.08
  FLOW VELOCITY(FEET/SEC.) =   1.97   DEPTH*VELOCITY(FT*FT/SEC) =   0.59
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     540.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.20  DOWNSTREAM(FEET) =    65.00
  FLOW LENGTH(FEET) =    20.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.07
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.38
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   10.89
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =     560.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
```

```
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.89
  RAINFALL INTENSITY(INCH/HR) =   1.45
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.16
  EFFECTIVE STREAM AREA(ACRES) =       1.87
  TOTAL STREAM AREA(ACRES) =       1.87
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.38

  ** CONFLUENCE DATA **
   STREAM       Q      Tc    Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        3.00   14.34    1.237  0.25( 0.03) 0.10       2.7     110.00
      2        2.38   10.89    1.448  0.25( 0.04) 0.16       1.9     120.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc    Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        5.05   10.89    1.448  0.25( 0.03) 0.13       4.0     120.00
      2        5.02   14.34    1.237  0.25( 0.03) 0.13       4.6     110.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.05    Tc(MIN.) =    10.89
  EFFECTIVE AREA(ACRES) =       3.95   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.13
  TOTAL AREA(ACRES) =        4.6
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    122.00 =     841.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.89
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.448
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "GRASS"                    C        0.34      0.25     1.000    72
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    0.34      SUBAREA RUNOFF(CFS) =    0.37
  EFFECTIVE AREA(ACRES) =      4.29   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        4.9       PEAK FLOW RATE(CFS) =       5.40
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.9  TC(MIN.) =     10.89
  EFFECTIVE AREA(ACRES) =      4.29  AREA-AVERAGED Fm(INCH/HR)=  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.198
  PEAK FLOW RATE(CFS)   =       5.40

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc    Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        5.40   10.89    1.448  0.25( 0.05) 0.20       4.3     120.00
      2        5.30   14.34    1.237  0.25( 0.05) 0.19       4.9     110.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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******************************************************************************
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                          Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRADA, CA 90638
                               714-521-4811

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO 4136                                                      *
* EXISTING CONDITION                                                   *
* 2 YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: W:\4136\X130-2.DAT
  TIME/DATE OF STUDY: 07:12 02/22/2023
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    131.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   236.00
  ELEVATION DATA: UPSTREAM(FEET) =     71.25  DOWNSTREAM(FEET) =     69.39

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.124
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.051
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.58      0.25      0.100    86    7.12
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.62
  TOTAL AREA(ACRES) =      0.58   PEAK FLOW RATE(CFS) =      2.62
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.6  TC(MIN.) =       7.12
  EFFECTIVE AREA(ACRES) =      0.58  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       2.62
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==========================================================================
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                          Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRADA, CA 90638
                               714-521-4811

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB NO 4136
  EXISTING CONDITION
  2 YEAR STORM EVENT
--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    6.16
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.025
    LOW LOSS FRACTION = 0.199
    TIME OF CONCENTRATION(MIN.) =  9.35
    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) =     0.80
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.25

**************************************************************************
  TIME     VOLUME        Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.10      0.0009      0.14  Q         .         .         .         .
  0.26      0.0028      0.14  Q         .         .         .         .
  0.42      0.0046      0.14  Q         .         .         .         .
  0.57      0.0065      0.14  Q         .         .         .         .
  0.73      0.0083      0.15  Q         .         .         .         .
  0.88      0.0102      0.15  Q         .         .         .         .
  1.04      0.0121      0.15  Q         .         .         .         .
  1.20      0.0140      0.15  Q         .         .         .         .
```

1.35	0.0159	0.15	Q	.	.	.	.
1.51	0.0178	0.15	Q	.	.	.	.
1.66	0.0198	0.15	Q	.	.	.	.
1.82	0.0217	0.15	Q	.	.	.	.
1.97	0.0237	0.15	Q	.	.	.	.
2.13	0.0257	0.15	Q	.	.	.	.
2.29	0.0277	0.16	Q	.	.	.	.
2.44	0.0297	0.16	Q	.	.	.	.
2.60	0.0317	0.16	Q	.	.	.	.
2.75	0.0337	0.16	Q	.	.	.	.
2.91	0.0358	0.16	Q	.	.	.	.
3.07	0.0379	0.16	Q	.	.	.	.
3.22	0.0400	0.16	Q	.	.	.	.
3.38	0.0421	0.16	Q	.	.	.	.
3.53	0.0442	0.16	Q	.	.	.	.
3.69	0.0463	0.17	Q	.	.	.	.
3.84	0.0485	0.17	Q	.	.	.	.
4.00	0.0506	0.17	Q	.	.	.	.
4.16	0.0528	0.17	Q	.	.	.	.
4.31	0.0550	0.17	Q	.	.	.	.
4.47	0.0572	0.17	Q	.	.	.	.
4.62	0.0595	0.17	Q	.	.	.	.
4.78	0.0617	0.18	Q	.	.	.	.
4.94	0.0640	0.18	Q	.	.	.	.
5.09	0.0663	0.18	Q	.	.	.	.
5.25	0.0686	0.18	Q	.	.	.	.
5.40	0.0709	0.18	Q	.	.	.	.
5.56	0.0733	0.18	Q	.	.	.	.
5.71	0.0757	0.19	Q	.	.	.	.
5.87	0.0781	0.19	Q	.	.	.	.
6.03	0.0805	0.19	Q	.	.	.	.
6.18	0.0830	0.19	Q	.	.	.	.
6.34	0.0854	0.19	Q	.	.	.	.
6.49	0.0879	0.20	Q	.	.	.	.
6.65	0.0905	0.20	Q	.	.	.	.
6.81	0.0930	0.20	Q	.	.	.	.
6.96	0.0956	0.20	Q	.	.	.	.
7.12	0.0982	0.20	Q	.	.	.	.
7.27	0.1008	0.21	Q	.	.	.	.
7.43	0.1035	0.21	Q	.	.	.	.
7.58	0.1062	0.21	Q	.	.	.	.
7.74	0.1089	0.21	Q	.	.	.	.
7.90	0.1117	0.21	Q	.	.	.	.
8.05	0.1145	0.22	Q	.	.	.	.
8.21	0.1173	0.22	Q	.	.	.	.
8.36	0.1201	0.22	Q	.	.	.	.
8.52	0.1230	0.23	Q	.	.	.	.
8.68	0.1260	0.23	Q	.	.	.	.
8.83	0.1289	0.23	Q	.	.	.	.
8.99	0.1319	0.24	Q	.	.	.	.
9.14	0.1350	0.24	Q	.	.	.	.
9.30	0.1381	0.24	Q	.	.	.	.
9.45	0.1412	0.24	Q	.	.	.	.
9.61	0.1444	0.25	Q	.	.	.	.
9.77	0.1476	0.25	.Q	.	.	.	.
9.92	0.1509	0.26	.Q	.	.	.	.

10.08	0.1542	0.26	.Q . . . .
10.23	0.1576	0.27	.Q . . . .
10.39	0.1611	0.27	.Q . . . .
10.55	0.1646	0.28	.Q . . . .
10.70	0.1681	0.28	.Q . . . .
10.86	0.1718	0.29	.Q . . . .
11.01	0.1755	0.29	.Q . . . .
11.17	0.1792	0.30	.Q . . . .
11.32	0.1831	0.30	.Q . . . .
11.48	0.1870	0.31	.Q . . . .
11.64	0.1910	0.31	.Q . . . .
11.79	0.1951	0.32	.Q . . . .
11.95	0.1993	0.33	.Q . . . .
12.10	0.2038	0.37	.Q . . . .
12.26	0.2089	0.42	.Q . . . .
12.42	0.2144	0.43	.Q . . . .
12.57	0.2199	0.44	.Q . . . .
12.73	0.2256	0.45	.Q . . . .
12.88	0.2315	0.46	.Q . . . .
13.04	0.2375	0.48	.Q . . . .
13.20	0.2437	0.48	.Q . . . .
13.35	0.2500	0.50	. Q . . . .
13.51	0.2566	0.51	. Q . . . .
13.66	0.2634	0.54	. Q . . . .
13.82	0.2704	0.55	. Q . . . .
13.97	0.2777	0.58	. Q . . . .
14.13	0.2854	0.61	. Q . . . .
14.29	0.2937	0.68	. Q . . . .
14.44	0.3026	0.70	. Q . . . .
14.60	0.3120	0.76	. Q . . . .
14.75	0.3221	0.80	. Q . . . .
14.91	0.3329	0.88	. Q . . . .
15.07	0.3446	0.93	. Q . . . .
15.22	0.3573	1.06	. Q . . . .
15.38	0.3715	1.14	. Q . . . .
15.53	0.3864	1.17	. Q . . . .
15.69	0.4025	1.34	. Q . . . .
15.84	0.4240	2.01	. Q . . . .
16.00	0.4549	2.79	. .Q . . . .
16.16	0.5284	8.63	. . . . Q .
16.31	0.5942	1.59	. Q . . . .
16.47	0.6119	1.16	. Q . . . .
16.62	0.6257	0.99	. Q . . . .
16.78	0.6375	0.84	. Q . . . .
16.93	0.6476	0.73	. Q . . . .
17.09	0.6565	0.65	. Q . . . .
17.25	0.6643	0.57	. Q . . . .
17.40	0.6714	0.53	. Q . . . .
17.56	0.6779	0.49	.Q . . . .
17.71	0.6841	0.47	.Q . . . .
17.87	0.6900	0.44	.Q . . . .
18.03	0.6955	0.42	.Q . . . .
18.18	0.7004	0.33	.Q . . . .
18.34	0.7046	0.32	.Q . . . .
18.49	0.7086	0.30	.Q . . . .
18.65	0.7124	0.29	.Q . . . .

18.81	0.7161	0.28	.Q	.	.	.	.
18.96	0.7197	0.27	.Q	.	.	.	.
19.12	0.7232	0.26	.Q	.	.	.	.
19.27	0.7265	0.25	.Q	.	.	.	.
19.43	0.7297	0.25	Q	.	.	.	.
19.58	0.7329	0.24	Q	.	.	.	.
19.74	0.7359	0.23	Q	.	.	.	.
19.90	0.7389	0.23	Q	.	.	.	.
20.05	0.7418	0.22	Q	.	.	.	.
20.21	0.7446	0.22	Q	.	.	.	.
20.36	0.7474	0.21	Q	.	.	.	.
20.52	0.7500	0.21	Q	.	.	.	.
20.67	0.7527	0.20	Q	.	.	.	.
20.83	0.7553	0.20	Q	.	.	.	.
20.99	0.7578	0.19	Q	.	.	.	.
21.14	0.7603	0.19	Q	.	.	.	.
21.30	0.7627	0.19	Q	.	.	.	.
21.45	0.7651	0.18	Q	.	.	.	.
21.61	0.7674	0.18	Q	.	.	.	.
21.77	0.7697	0.18	Q	.	.	.	.
21.92	0.7720	0.17	Q	.	.	.	.
22.08	0.7742	0.17	Q	.	.	.	.
22.23	0.7764	0.17	Q	.	.	.	.
22.39	0.7785	0.17	Q	.	.	.	.
22.55	0.7806	0.16	Q	.	.	.	.
22.70	0.7827	0.16	Q	.	.	.	.
22.86	0.7848	0.16	Q	.	.	.	.
23.01	0.7868	0.16	Q	.	.	.	.
23.17	0.7888	0.15	Q	.	.	.	.
23.32	0.7908	0.15	Q	.	.	.	.
23.48	0.7927	0.15	Q	.	.	.	.
23.64	0.7946	0.15	Q	.	.	.	.
23.79	0.7965	0.15	Q	.	.	.	.
23.95	0.7984	0.14	Q	.	.	.	.
24.10	0.8002	0.14	Q	.	.	.	.
24.26	0.8011	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%	1449.2
10%	112.2
20%	28.1
30%	18.7
40%	9.4
50%	9.4
60%	9.4
70%	9.4
80%	9.4
90%	9.4

```
******************************************************************************
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                          Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRADA, CA 90638
                               714-521-4811

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO 4136                                                      *
* PROPOSED CONDITION                                                   *
* 2 YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: W:\4136\P100-2.DAT
  TIME/DATE OF STUDY: 08:45 02/21/2023
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   199.00
  ELEVATION DATA: UPSTREAM(FEET) =     70.06  DOWNSTREAM(FEET) =     67.91

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.247
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.992
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        1.86      0.25      0.100    50    6.25
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.29
  TOTAL AREA(ACRES) =      1.86   PEAK FLOW RATE(CFS) =      3.29
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.9  TC(MIN.) =      6.25
  EFFECTIVE AREA(ACRES) =      1.86  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       3.29
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
************************************************************************
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                          Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRADA, CA 90638
                               714-521-4811

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO 4136                                                      *
* PROPOSED CONDITION                                                   *
* 2 YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: W:\4136\P110-2.DAT
  TIME/DATE OF STUDY: 10:56 02/22/2023
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   200.00
  ELEVATION DATA: UPSTREAM(FEET) =     71.38  DOWNSTREAM(FEET) =     69.16

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.226
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.996
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        1.37      0.25      0.100    50    6.23
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.43
  TOTAL AREA(ACRES) =      1.37   PEAK FLOW RATE(CFS) =      2.43

************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    66.16  DOWNSTREAM(FEET) =    35.99
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   2.6 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.55
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.43
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    6.29
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =     275.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.29
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.984
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.53      0.25     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.53      SUBAREA RUNOFF(CFS) =    2.70
  EFFECTIVE AREA(ACRES) =      2.90   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        2.9       PEAK FLOW RATE(CFS) =       5.11

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.99  DOWNSTREAM(FEET) =    65.65
  FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.76
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.11
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =    6.82
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    113.00 =     395.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.82
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.894
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.47      0.25     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.47      SUBAREA RUNOFF(CFS) =    0.79
  EFFECTIVE AREA(ACRES) =      3.37   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.4       PEAK FLOW RATE(CFS) =       5.67

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    114.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.65  DOWNSTREAM(FEET) =    65.04
  FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.70
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.67
  PIPE TRAVEL TIME(MIN.) =   1.13    Tc(MIN.) =    7.95
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =     645.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.95
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.735
```

```
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL GOOD COVER
  "GRASS"                     C        0.30      0.25     1.000    56
  NATURAL GOOD COVER
  "GRASS"                     C        0.33      0.25     1.000    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    0.63      SUBAREA RUNOFF(CFS) =    0.84
  EFFECTIVE AREA(ACRES) =      4.00   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.24
  TOTAL AREA(ACRES) =        4.0       PEAK FLOW RATE(CFS) =       6.03
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      7.95
  EFFECTIVE AREA(ACRES) =      4.00  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.242
  PEAK FLOW RATE(CFS)   =       6.03
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
******************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO 4136                                                      *
* PROPOSED CONDITION                                                   *
* 2 YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: W:\4136\P120-2.DAT
  TIME/DATE OF STUDY: 11:06 02/22/2023
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   324.00
  ELEVATION DATA: UPSTREAM(FEET) =     71.38  DOWNSTREAM(FEET) =     69.45

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.552
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.663
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.30      0.25     0.100    50    8.55
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.44
  TOTAL AREA(ACRES) =      0.30   PEAK FLOW RATE(CFS) =      0.44
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.3  TC(MIN.) =      8.55
  EFFECTIVE AREA(ACRES) =      0.30  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       0.44
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==========================================================================
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                          Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRADA, CA 90638
                               714-521-4811

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB NO 4136
  PROPOSED CONDITION
  2  YEAR STORM EVENT
--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    6.16
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.025
    LOW LOSS FRACTION = 0.199
    TIME OF CONCENTRATION(MIN.) =  6.25
    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) =     0.80
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.25

**************************************************************************
  TIME     VOLUME        Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.06      0.0004      0.14  Q         .         .         .         .
  0.17      0.0016      0.14  Q         .         .         .         .
  0.27      0.0028      0.14  Q         .         .         .         .
  0.38      0.0041      0.14  Q         .         .         .         .
  0.48      0.0053      0.14  Q         .         .         .         .
  0.58      0.0065      0.14  Q         .         .         .         .
  0.69      0.0078      0.15  Q         .         .         .         .
  0.79      0.0090      0.15  Q         .         .         .         .
```

0.90	0.0103	0.15	Q	.	.	.	.
1.00	0.0116	0.15	Q	.	.	.	.
1.10	0.0128	0.15	Q	.	.	.	.
1.21	0.0141	0.15	Q	.	.	.	.
1.31	0.0154	0.15	Q	.	.	.	.
1.42	0.0167	0.15	Q	.	.	.	.
1.52	0.0180	0.15	Q	.	.	.	.
1.62	0.0193	0.15	Q	.	.	.	.
1.73	0.0206	0.15	Q	.	.	.	.
1.83	0.0219	0.15	Q	.	.	.	.
1.94	0.0232	0.15	Q	.	.	.	.
2.04	0.0245	0.15	Q	.	.	.	.
2.15	0.0259	0.15	Q	.	.	.	.
2.25	0.0272	0.16	Q	.	.	.	.
2.35	0.0285	0.16	Q	.	.	.	.
2.46	0.0299	0.16	Q	.	.	.	.
2.56	0.0312	0.16	Q	.	.	.	.
2.67	0.0326	0.16	Q	.	.	.	.
2.77	0.0340	0.16	Q	.	.	.	.
2.88	0.0353	0.16	Q	.	.	.	.
2.98	0.0367	0.16	Q	.	.	.	.
3.08	0.0381	0.16	Q	.	.	.	.
3.19	0.0395	0.16	Q	.	.	.	.
3.29	0.0409	0.16	Q	.	.	.	.
3.40	0.0423	0.16	Q	.	.	.	.
3.50	0.0437	0.16	Q	.	.	.	.
3.60	0.0452	0.17	Q	.	.	.	.
3.71	0.0466	0.17	Q	.	.	.	.
3.81	0.0480	0.17	Q	.	.	.	.
3.92	0.0495	0.17	Q	.	.	.	.
4.02	0.0509	0.17	Q	.	.	.	.
4.12	0.0524	0.17	Q	.	.	.	.
4.23	0.0539	0.17	Q	.	.	.	.
4.33	0.0554	0.17	Q	.	.	.	.
4.44	0.0568	0.17	Q	.	.	.	.
4.54	0.0583	0.17	Q	.	.	.	.
4.65	0.0598	0.18	Q	.	.	.	.
4.75	0.0613	0.18	Q	.	.	.	.
4.85	0.0629	0.18	Q	.	.	.	.
4.96	0.0644	0.18	Q	.	.	.	.
5.06	0.0659	0.18	Q	.	.	.	.
5.17	0.0675	0.18	Q	.	.	.	.
5.27	0.0690	0.18	Q	.	.	.	.
5.38	0.0706	0.18	Q	.	.	.	.
5.48	0.0722	0.18	Q	.	.	.	.
5.58	0.0738	0.18	Q	.	.	.	.
5.69	0.0754	0.19	Q	.	.	.	.
5.79	0.0770	0.19	Q	.	.	.	.
5.90	0.0786	0.19	Q	.	.	.	.
6.00	0.0802	0.19	Q	.	.	.	.
6.10	0.0819	0.19	Q	.	.	.	.
6.21	0.0835	0.19	Q	.	.	.	.
6.31	0.0852	0.19	Q	.	.	.	.
6.42	0.0868	0.19	Q	.	.	.	.
6.52	0.0885	0.20	Q	.	.	.	.
6.62	0.0902	0.20	Q	.	.	.	.

6.73	0.0919	0.20	Q	.	.	.	.
6.83	0.0936	0.20	Q	.	.	.	.
6.94	0.0954	0.20	Q	.	.	.	.
7.04	0.0971	0.20	Q	.	.	.	.
7.15	0.0988	0.20	Q	.	.	.	.
7.25	0.1006	0.21	Q	.	.	.	.
7.35	0.1024	0.21	Q	.	.	.	.
7.46	0.1042	0.21	Q	.	.	.	.
7.56	0.1060	0.21	Q	.	.	.	.
7.67	0.1078	0.21	Q	.	.	.	.
7.77	0.1096	0.21	Q	.	.	.	.
7.88	0.1115	0.22	Q	.	.	.	.
7.98	0.1134	0.22	Q	.	.	.	.
8.08	0.1152	0.22	Q	.	.	.	.
8.19	0.1171	0.22	Q	.	.	.	.
8.29	0.1190	0.22	Q	.	.	.	.
8.40	0.1210	0.22	Q	.	.	.	.
8.50	0.1229	0.23	Q	.	.	.	.
8.60	0.1249	0.23	Q	.	.	.	.
8.71	0.1268	0.23	Q	.	.	.	.
8.81	0.1288	0.23	Q	.	.	.	.
8.92	0.1308	0.23	Q	.	.	.	.
9.02	0.1329	0.24	Q	.	.	.	.
9.12	0.1349	0.24	Q	.	.	.	.
9.23	0.1370	0.24	Q	.	.	.	.
9.33	0.1391	0.24	Q	.	.	.	.
9.44	0.1412	0.25	Q	.	.	.	.
9.54	0.1433	0.25	Q	.	.	.	.
9.65	0.1455	0.25	Q	.	.	.	.
9.75	0.1476	0.25	Q	.	.	.	.
9.85	0.1498	0.26	Q	.	.	.	.
9.96	0.1520	0.26	Q	.	.	.	.
10.06	0.1543	0.26	Q	.	.	.	.
10.17	0.1565	0.26	Q	.	.	.	.
10.27	0.1588	0.27	Q	.	.	.	.
10.38	0.1611	0.27	Q	.	.	.	.
10.48	0.1635	0.27	Q	.	.	.	.
10.58	0.1659	0.28	Q	.	.	.	.
10.69	0.1683	0.28	Q	.	.	.	.
10.79	0.1707	0.28	Q	.	.	.	.
10.90	0.1731	0.29	Q	.	.	.	.
11.00	0.1756	0.29	Q	.	.	.	.
11.10	0.1781	0.30	Q	.	.	.	.
11.21	0.1807	0.30	Q	.	.	.	.
11.31	0.1833	0.30	Q	.	.	.	.
11.42	0.1859	0.31	Q	.	.	.	.
11.52	0.1886	0.31	Q	.	.	.	.
11.62	0.1913	0.31	Q	.	.	.	.
11.73	0.1940	0.32	Q	.	.	.	.
11.83	0.1968	0.32	Q	.	.	.	.
11.94	0.1996	0.33	Q	.	.	.	.
12.04	0.2025	0.33	Q	.	.	.	.
12.15	0.2057	0.42	Q	.	.	.	.
12.25	0.2093	0.42	Q	.	.	.	.
12.35	0.2129	0.43	Q	.	.	.	.
12.46	0.2166	0.43	Q	.	.	.	.

12.56	0.2204	0.44	Q	.	.	.	.
12.67	0.2242	0.45	Q	.	.	.	.
12.77	0.2281	0.46	Q	.	.	.	.
12.88	0.2321	0.46	Q	.	.	.	.
12.98	0.2361	0.47	Q	.	.	.	.
13.08	0.2402	0.48	Q	.	.	.	.
13.19	0.2444	0.49	Q	.	.	.	.
13.29	0.2486	0.50	Q	.	.	.	.
13.40	0.2530	0.51	.Q	.	.	.	.
13.50	0.2574	0.52	.Q	.	.	.	.
13.60	0.2619	0.53	.Q	.	.	.	.
13.71	0.2666	0.54	.Q	.	.	.	.
13.81	0.2713	0.56	.Q	.	.	.	.
13.92	0.2762	0.57	.Q	.	.	.	.
14.02	0.2813	0.60	.Q	.	.	.	.
14.12	0.2866	0.64	.Q	.	.	.	.
14.23	0.2922	0.67	.Q	.	.	.	.
14.33	0.2981	0.69	.Q	.	.	.	.
14.44	0.3042	0.73	.Q	.	.	.	.
14.54	0.3105	0.75	.Q	.	.	.	.
14.65	0.3171	0.79	.Q	.	.	.	.
14.75	0.3240	0.81	.Q	.	.	.	.
14.85	0.3313	0.87	.Q	.	.	.	.
14.96	0.3389	0.90	.Q	.	.	.	.
15.06	0.3470	0.98	.Q	.	.	.	.
15.17	0.3556	1.02	. Q	.	.	.	.
15.27	0.3648	1.12	. Q	.	.	.	.
15.38	0.3747	1.18	. Q	.	.	.	.
15.48	0.3848	1.14	. Q	.	.	.	.
15.58	0.3951	1.24	. Q	.	.	.	.
15.69	0.4070	1.52	. Q	.	.	.	.
15.79	0.4211	1.77	. Q	.	.	.	.
15.90	0.4399	2.58	. Q	.	.	.	.
16.00	0.4663	3.56	. Q	.	.	.	.
16.10	0.5288	10.96	.	.	.Q	.	.
16.21	0.5849	2.08	. Q	.	.	.	.
16.31	0.5998	1.37	. Q	.	.	.	.
16.42	0.6106	1.14	. Q	.	.	.	.
16.52	0.6201	1.07	. Q	.	.	.	.
16.62	0.6287	0.94	.Q	.	.	.	.
16.73	0.6364	0.84	.Q	.	.	.	.
16.83	0.6433	0.77	.Q	.	.	.	.
16.94	0.6496	0.71	.Q	.	.	.	.
17.04	0.6555	0.66	.Q	.	.	.	.
17.15	0.6608	0.59	.Q	.	.	.	.
17.25	0.6658	0.55	.Q	.	.	.	.
17.35	0.6704	0.53	.Q	.	.	.	.
17.46	0.6748	0.50	.Q	.	.	.	.
17.56	0.6791	0.48	Q	.	.	.	.
17.67	0.6832	0.47	Q	.	.	.	.
17.77	0.6871	0.45	Q	.	.	.	.
17.88	0.6910	0.44	Q	.	.	.	.
17.98	0.6947	0.42	Q	.	.	.	.
18.08	0.6981	0.38	Q	.	.	.	.
18.19	0.7012	0.33	Q	.	.	.	.
18.29	0.7040	0.32	Q	.	.	.	.

18.40	0.7067	0.31	Q	.	.	.	.
18.50	0.7093	0.30	Q	.	.	.	.
18.60	0.7118	0.29	Q	.	.	.	.
18.71	0.7143	0.29	Q	.	.	.	.
18.81	0.7168	0.28	Q	.	.	.	.
18.92	0.7191	0.27	Q	.	.	.	.
19.02	0.7215	0.27	Q	.	.	.	.
19.12	0.7237	0.26	Q	.	.	.	.
19.23	0.7259	0.25	Q	.	.	.	.
19.33	0.7281	0.25	Q	.	.	.	.
19.44	0.7302	0.24	Q	.	.	.	.
19.54	0.7323	0.24	Q	.	.	.	.
19.65	0.7344	0.24	Q	.	.	.	.
19.75	0.7364	0.23	Q	.	.	.	.
19.85	0.7384	0.23	Q	.	.	.	.
19.96	0.7403	0.22	Q	.	.	.	.
20.06	0.7422	0.22	Q	.	.	.	.
20.17	0.7441	0.22	Q	.	.	.	.
20.27	0.7459	0.21	Q	.	.	.	.
20.38	0.7478	0.21	Q	.	.	.	.
20.48	0.7495	0.21	Q	.	.	.	.
20.58	0.7513	0.20	Q	.	.	.	.
20.69	0.7531	0.20	Q	.	.	.	.
20.79	0.7548	0.20	Q	.	.	.	.
20.90	0.7565	0.20	Q	.	.	.	.
21.00	0.7581	0.19	Q	.	.	.	.
21.10	0.7598	0.19	Q	.	.	.	.
21.21	0.7614	0.19	Q	.	.	.	.
21.31	0.7630	0.19	Q	.	.	.	.
21.42	0.7646	0.18	Q	.	.	.	.
21.52	0.7662	0.18	Q	.	.	.	.
21.62	0.7677	0.18	Q	.	.	.	.
21.73	0.7692	0.18	Q	.	.	.	.
21.83	0.7708	0.17	Q	.	.	.	.
21.94	0.7722	0.17	Q	.	.	.	.
22.04	0.7737	0.17	Q	.	.	.	.
22.15	0.7752	0.17	Q	.	.	.	.
22.25	0.7766	0.17	Q	.	.	.	.
22.35	0.7781	0.17	Q	.	.	.	.
22.46	0.7795	0.16	Q	.	.	.	.
22.56	0.7809	0.16	Q	.	.	.	.
22.67	0.7823	0.16	Q	.	.	.	.
22.77	0.7836	0.16	Q	.	.	.	.
22.88	0.7850	0.16	Q	.	.	.	.
22.98	0.7864	0.16	Q	.	.	.	.
23.08	0.7877	0.15	Q	.	.	.	.
23.19	0.7890	0.15	Q	.	.	.	.
23.29	0.7903	0.15	Q	.	.	.	.
23.40	0.7916	0.15	Q	.	.	.	.
23.50	0.7929	0.15	Q	.	.	.	.
23.60	0.7942	0.15	Q	.	.	.	.
23.71	0.7955	0.15	Q	.	.	.	.
23.81	0.7967	0.15	Q	.	.	.	.
23.92	0.7980	0.14	Q	.	.	.	.
24.02	0.7992	0.14	Q	.	.	.	.
24.12	0.7998	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%	1443.8
10%	75.0
20%	18.8
30%	12.5
40%	6.2
50%	6.2
60%	6.2
70%	6.2
80%	6.2
90%	6.2